Appendix B

Quarterly Testing Report No.4

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Quarterly Testing Report No. 4

January 2013

Indirect Potable Reuse/Reservoir Augmentation Demonstration Project
Advanced Water Purification Facility

THE CITY OF SAN DIEGO

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

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Abbreviations and Acronyms

Ace-K	acesulfame potassium
ADI	acceptable daily intake
ALCR	air liquid conversion ratio
ANSI	American National Standards Institute
AWP	advanced water purification
AWP Facility	advanced water purification facility
Basin Plan	Water Quality Control Plan for the San Diego Basin
Bay- Delta	Sacramento San Joaquin Bay Delta
BCM	bromochloromethane
BDCM	bromodichloromethane
C	Celsius
CAL	critical alert level
CCL3	Contaminant Candidate List 3
CCP	critical control point
CB	chlorinated backwashes
CDPH	California Department of Public Health
CEC	constituent of emerging concern
CIP	clean in place
City	City of San Diego
CLP	Contract Laboratory Program
CLP's	critical limit parameters
cm	centimeter
CSM	Colorado School of Mines
CTR	California Toxic Rule
CWA	Clean Water Act
DBCM	dibromochloromethane
DCS	distributed control system
DEET	N,N-diethyl-meta-toluamide
DBP	disinfection byproduct
DEA	Deethylatrazine
Demonstration Project	Water Purification Demonstration Project
DL	method detection limit
DLR	CDPH detection limit for reporting
DO	dissolved oxygen
DP	distribution panel
DP	differential pressure
DWEL	Drinking Water Equivalent Level
DWR	California Department of Water Resources
EDR	electrodialysis reversal
EED	electrical energy dose
EEO	electrical energy per order
EG	ethylene glycol
ENR	Engineering News Record
EPA	U. S. Environmental Protection Agency
ERD	energy recovery device

ERI	Energy Recovery, Inc.
ft^2	square feet
FWR	feedwater recovery
gfd	gallons per square foot per day
gpm	gallons per minute
H_2O_2	hydrogen peroxide
HAAs	Haloacetic Acids
HMI	human machine interface
HP	horsepower
HVAC	heating, ventilating, and air conditioning
I&C	instrumentation and controls
IAP	Independent Advisory Panel
IAW	imported raw aqueduct water
in^2	square inches
IPR	indirect potable reuse
IPR/RA	indirect potable reuse/reservoir augmentation
IRWM	Integrated Regional Water Management
KV	kilovolts
KVA	kilovolts amperes
kW	kilowatt
kWh	kilowatt hours
kWh/d	kilowatt hours per day
kWh/yr	kilowatt hours per year
L	liter
LDC	Laboratory Data Consultants, Inc.
LPHO	low pressure high output
LRV	log removal value
LRL	laboratory reporting level
LSI	Langelier Saturation Index
m	meter
MC	maintenance cleans
MCC	motor control center
MCL	maximum contaminant level
MDA	minimum detectable activity
MDL	method detection limit
MF	microfiltration
MG	million gallons
mg/L	milligrams per liter
mg/L-N	milligrams per liter as nitrogen
mg/L-P	milligrams per liter as phosphorus
mgd	million gallons per day
mL	milliliters
mL/min	milliliters per minute
min	minute
mJ/cm^2	millijoules per square centimeter
MPN	most probable number
mV	millivolt
µg/L	micrograms per liter

µg/L-P	P micrograms per liter as phosphorus
µS/cm	microsiemens per centimeter
N/A	not applicable
NE	Nautilus Environmental Laboratories
North City	North City Water Reclamation Plant
ND	not detectable or not quantifiable
NDBA	N-Nitrosodi-n-butylamine
NDEA	N-Nitrosodiethylamine
NDMA	N-Nitrosodimethylamine
NDPA	N-Nitrosodi-n-propylamine
ng/L	nanograms per liter
NL	notification level
NMEA	N-Nitrosomethylethylamine
NMOR	N-Nitrosomorpholine
NOP	net operating pressure
NPDES	National Pollution Discharge Elimination System
NPIP	N-Nitrosopiperidine
NPYR	N-Nitrosopyrrolidine
NR	not reported
NR&C	Natural Resources and Culture Committee
NTU	Nephelometric Turbidity Units
OCWD	Orange County Water District
O&M	operation and maintenance
ORP	oxidation reduction potential
PDC	power distribution cabinet
PDT	Pressure Decay Testing
PLC	programmable logic controller
Point Loma	Point Loma Wastewater Treatment Plant
ppb	parts per billion
PPCPs	pharmaceuticals and personal care products
ppm	parts per million
ppt	parts per trillion
psi	pounds per square inch
PVC	polyvinyl chloride
PVDF	polyvinylidene fluoride
Q1	Quarter 1
Q2	Quarter 2
Q3	Quarter 3
Q4	Quarter 4
QA/QC	quality assurance/quality control
RA	Reservoir Augmentation
RA	re-analyzed
Regional Board	San Diego Regional Water Quality Control Board
RL	reporting level
RO	reverse osmosis
RPD	relative percent difference
RWQCB	Regional Water Quality Control Board
SDG&E	San Diego Gas & Electric

SDI	silt density index
SDWA	Safe Drinking Water Act
SIP	State Board Policy for Implementation of Toxics Standards for Inland Surface Water, Enclosed Bays, and Estuaries of California
South Bay	South Bay Water Reclamation Plant
State Board/SWRCB	State Water Resources Control Board
STD	standard deviation
T&M Plan	Plan Testing and Monitoring Plan
TCEP	tris (2-chloroethyl) phosphate
TCPP	tris (1-chlor 2 propyl) phosphate
TDI	tolerable daily intake
TDS	total dissolved solids
THMs	trihalomethanes
Title 22	Title 22 of California Code of Regulations
TKN	Total Kjeldahl Nitrogen
TMP	transmembrane pressure
TOC	total organic carbon
TU	toxic unit
UCMR	Unregulated Contaminant Monitoring Rule
UF	ultrafiltration
UV	ultraviolet
UV/AOP	ultraviolet light disinfection and advanced oxidation
UV254	UV 254 Absorbance
UVT	ultraviolet light transmittance
VOC	volatile organic compound
Water Authority	San Diego County Water Authority
WET	Whole Effluent Toxicity
WSE	water surface elevation

Glossary

Advanced Oxidation: A set of chemical treatment processes designed to destroy organic material through the breakdown of their molecular structure. The advanced oxidation process used at the AWP Facility employs ultraviolet light and hydrogen peroxide, which break down into natural elements, such as carbon, hydrogen and nitrogen.

Advanced Water Purification Facility (AWP Facility): A facility that produces purified water by utilizing advanced treatment technologies: membrane filtration (microfiltration [MF] or ultrafiltration [UF]), reverse osmosis (RO), disinfection, and advanced oxidation.

Advanced Water Purification (AWP) Facility Study: One element of the multi-faceted Demonstration Project. The AWP Facility Study included two primary elements: (1) the design, installation, and operation of a one million gallon per day (mgd) Demonstration Facility located at North City and (2) a conceptual design and cost estimate for a potential Full-Scale Facility.

Advanced Water Purification (AWP) Facility Study Report: Final report documenting the observations and findings of the AWP Facility Study.

Analyte: a chemical substance that is the subject of chemical analysis.

Backwash: The process of reversing the direction of flow through a filtration system in order to remove contaminants that had been filtered out in a water purification process, e.g. membrane filtration. The backwash process is necessary in order to maintain the treatment capacity of membrane filtration.

Bacteriophage: Viruses present among coliform bacteria. Have a high presence in wastewater.

Ballast: An electronic device on the UV system designed to generate a constant UV intensity and maximize UV lamp life.

Blending: Mixing or combining one water source with another such as purified water with raw water sources.

California Groundwater Recharge Reuse Draft Regulations: The November 21, 2011 Groundwater Recharge Reuse Draft Regulations, which are used as a guidance document for the conceptual design of the Full-scale Facility since regulations for reservoir augmentation with purified water do not yet exist. Also referred to as the draft groundwater recharge regulations.

Clean in place: The in situ chemical cleaning of membranes that consists of soaking membranes in one or more chemical solutions (typically acid and caustic solutions) to remove accumulated foulants and restore permeability.

Concentrate: A continuous waste stream, typically containing concentrated dissolved solids, from the membrane process.

Constituent: In water, a constituent is a dissolved chemical element or compound or a suspended material that is carried in the water.

Constituents of Emerging Concerns (CECs): CECs are not regulated and include commonly used pharmaceuticals, personal care products, flame retardants and unregulated pesticides.

Contaminant: An organic or inorganic substance found in the water. Some contaminants have a health effect in people consuming the water, and thus is regulated in drinking water. Not all contaminants are unsafe. Iron and manganese are contaminants, but in excess simply causing staining. See Maximum Contaminant Level.

Critical alert limit: Measurement of a critical limit parameter that requires urgent corrective action in order for the corresponding critical control point to function as intended.

Critical control point: A point or step within the AWP Facility process train at which critical limit parameters can be monitored in order for corrective actions to be taken should critical alert limits be exceeded.

Critical limit parameter: A parameter that indicates whether or not a control measure is within the alert limit or critical alert limit for the corresponding critical control point.

Demonstration Facility: The one-mgd advanced water purification facility that was designed, installed, and operated as part of the City's Water Purification Demonstration Project.

Detection limit for the purposes of reporting (DLR): The DLR is a parameter that is set by regulation for each reportable analyte. It is not laboratory specific and it is independent of the analytical method used (in cases where several methods are approved). The DLR cannot be changed by the laboratory. It is expected that a laboratory can achieve a reporting limit (RL) that is lower than or equal to the DLR set by the California Department of Public Health (CDPH).

Disinfection: The removal, deactivation or destroying of microorganisms present in a water supply that may be harmful to humans. Commonly used disinfectants include chlorine (and its derivatives), ultraviolet (UV) light, and ozone. Chlorine and its derivatives are used to disinfect drinking water because they provide residual disinfection that protects the water as it goes through the pipes to homes and businesses.

Disinfection byproduct: A compound that is formed through the reaction of a disinfectant (chlorine, ozone, chlorine dioxide) with organic or inorganic material present in the water. Some disinfection byproducts have been found to be harmful to human health and are regulated by the EPA or under consideration for future regulation.

1, 4- Dioxane: A chemical contaminant primarily used as an industrial stabilizer to enhance performance of solvents in manufacturing processes. Commonly used in food and food additives or in personal care products such as cosmetics, deodorants, soaps and shampoos. Currently there is not a federal or state MCL; however, the CDPH has established a notification level of 1 ppb. CDPH also specifies in the 2011 Draft Groundwater Recharge Reuse Regulations that AOP systems required for direct injection applications can be designed to achieve 0.5 log

removal of 1,4-Dioxane. Alternatively, AOP sizing can be based on demonstrated log removals of select indicator compounds from different functional groups.

Drinking water: Water that meets federal drinking water standards as well as state and local water quality standards so that it is safe for human consumption. Water treatment facilities that produce drinking water require a state permit. Also referred to as potable water.

Drought: A defined period of time when rainfall and runoff in a geographic area are much less than average.

EEO-electrical energy per order: The amount of energy required to destroy 1 log order (i.e. 90%) of a given contaminant per 1000 gallons of water treated. EEO values are both reactor and water quality specific and used to baseline differences in reactor configurations and UV lamp intensities to establish comparative removals of a given constituent such as NDMA and 1,4-Dioxane.

EED -electrical energy dose: The amount of energy (kWh) dosed per 1000 gallons of water treated.

Effluent: The water leaving a water or wastewater treatment process or facility. If effluent has been treated to a high enough standard, it may be considered to be recycled water and can be used for beneficial purposes.

Endocrine disrupting compounds (EDCs): A chemical substance or mixture that alters the normal hormone functions in humans and animals. These chemicals can come from pharmaceuticals and personal care products such as detergent and synthetic hormones. They may also come from some industrial wastes and pesticides. EDCs are also contained in natural agricultural products such as soybeans, alfalfa, and natural hormones in animals.

Environmental Impact Statement / Environmental Impact Report (EIS/EIR): Detailed analysis of impacts of a project on all aspects of the natural and human environment. An EIS is required by the federal National Environmental Policy Act (NEPA) for federal permitting or use of federal funds. An EIR is required by the California Environmental Quality Act (CEQA) for local projects.

Filtrate: A continuous stream of water that passes through a filter.

Filtration: A process that separates small particles from water by using a porous barrier to trap the particles and allow the water to pass through.

Flux: The unit rate at which water passes through the membrane expressed as flow per unit of membrane area (e.g., gallons per square foot per day (gfd)).

Fouling: The accumulation of contaminants on the membrane surface, within membrane pores, or media surface that inhibits the passage of water.

Full-Scale Facility: The proposed AWP Facility for the full scale IPR/RA project. The Full Scale

Facility will have a capacity of 18 mgd and annual average purified water production of 15 mgd.

Groundwater recharge: Naturally or artificially adding water back into a groundwater basin.

Hydrogen peroxide: Chemical added in the UV disinfection/advanced oxidation step.

Imported water: A water source that originates in one hydrologic region and is transferred to another hydrologic region. In San Diego's case, water is imported from Northern California or the Colorado River and travels to this region in large above ground aqueducts or underground pipelines.

Imported raw aqueduct water: The imported raw water conveyed to the City's three Drinking Water Treatment Plants. For the AWP Facility Project, imported raw aqueduct water specifically refers to the imported water that was sampled per the Testing and Monitoring Plan. Imported raw aqueduct water was sampled at the Miramar Water Treatment Plant.

Indicator Compounds or Indicator Organisms: A common method to evaluate water or wastewater quality using representative chemicals or organisms that are characteristic of a larger group of related chemicals or organisms. Coliform bacteria are common indicator organisms, and trihalomethanes, benzene, and NDMA are examples of indicator compounds.

Indirect potable reuse (IPR): The process of blending purified water into a natural water source (groundwater basin or reservoir) that can be used as a source of drinking water.

Influent: Flow entering a process.

Inorganic chemicals: Inorganic chemicals are substances that do not contain both carbon and hydrogen. Generally, inorganic chemicals are minerals. Most minerals are not a cause for concern in water. Water contains many natural minerals from the rocks the water has come into contact with on its journey to the water treatment plant. Nutrients, such as phosphorus and nitrogen, and metals, such as calcium, iron, sodium, potassium, and zinc, are inorganic chemicals. Some inorganic chemicals, when they are too abundant, are considered contaminants in water.

Integrity monitoring: Performance evaluation of a treatment process in order to verify that the process meets its intended treatment performance on a continuous basis.

Laboratory reporting level (LRL) or Reporting Level (RL): The lowest concentration at which an analyte can be quantified and reported with an acceptable degree of accuracy. Laboratory reporting levels can vary based on the analytical method used, the laboratory, and the concentration being tested.

Maximum Contaminant Level (MCL): The highest allowable amount of a contaminant in water, established by the U.S. Environmental Protection Agency as a regulatory standard.

Membrane filtration: A type of filter used to separate particles from the water. Membrane filters are characterized by the pore openings size from the largest to the smallest pore size:

microfiltration, ultrafiltration, and nanofiltration. Membrane filters remove suspended solids, bacteria, protozoa, and other material from water.

Method detection limit (MDL) or Detection Limit (DL): The lowest concentration at which an analyte can be detected in a sample and reported with greater than 99 percent certainty using a particular analytical method.

Microfiltration (MF): A low pressure membrane filtration process where tiny, hollow straw like membranes separate small suspended particles, bacteria and other materials out of the water. MF provides the most efficient preparation of water for reverse osmosis. MF is used in commercial industries to process food, fruit juices and soda beverages; in computer chip manufacturing; and to sterilize medicines that cannot be heated.

Micron: Equal to one millionth of a meter or 1/25,400 of one inch. The eye can see particles only to about 40 microns. Used to describe the size of bacteria.

National Pollutant Discharge Elimination System (NPDES): A federal permit authorized by the Clean Water Act, Title IV, which is required for discharge of pollutants to navigable waters of the United States, and includes any discharge to surface waters: lakes, streams, rivers, bays, the ocean, wetlands, storm sewer, or tributary to any surface water body.

NDMA-N-Nitrosodimethylamine: A semi-volatile, yellow, oily liquid of low viscosity that has been extensively used in industry for several decades (USEPA, 2001). NDMA is found at low levels in numerous items of human consumption including cured meat, fish, beer, and tobacco smoke. Currently there is not a federal or state MCL; however, the CDPH has established a notification level of 10 ng/L. Until revision of the Draft Groundwater Recharge Reuse Regulations in 2011 CDPH required that AOP systems required for direct injection applications be designed to achieve 0.5 log removal of 1,4-Dioxane and 1.2 log removal of NDMA.

Non detectable and non quantifiable (ND): Laboratory sample results of a constituent reported as less than the reporting limit (RL) and detection limit (DL).

Non-potable water: Water that is not suitable for drinking because it has not been treated to drinking water standards.

North City Water Reclamation Plant (North City): Wastewater treatment plant that produces recycled water through a series of processes: primary treatment (screening and sedimentation), secondary treatment (aeration and clarification), and tertiary treatment (filtration and disinfection).

Organic chemicals: Chemicals that contain both carbon and hydrogen. There are millions of organic compounds, both naturally occurring and man-made. Naturally occurring organic compounds include amino acids (the building blocks of proteins), sugars, fats, hormones, and vitamins. All living matter is made up of natural organic chemicals. Synthetic (manmade) organic chemicals have been developed because they exhibit features that are valuable to us. These synthetic organic chemicals include herbicides, insecticides, pharmaceuticals, food coloring and flavors, personal care products, dyes, paints, adhesives, detergents, polymers, and plastics.

Osmotic pressure: The amount of pressure that must be applied to stop the natural osmosis driven flow of water across a semi-permeable membrane.

Oxidation: A treatment step often used in disinfection, where chlorine, hydrogen peroxide, ozone, or another oxidizing agent is added to water to produce a chemical reaction that removes or aids in removal of harmful substances.

Pathogens: Disease causing organisms. The general groupings of pathogens are viruses, bacteria, protozoa, and fungi.

Permeate: A continuous stream of water that passes through membrane. Typically used for water that passes through a reverse osmosis membrane (i.e., reverse osmosis permeate). Also referred to as filtrate or product.

Personal care product: Products that can be found in wastewater such as shampoos, fragrances, soap, and deodorant.

Pharmaceutically active compound: Hormone based compounds found within EDC's. Examples of these compounds include antibiotics, anti epileptic medications, heart medications, pain medications, and cancer medications, along with veterinary drugs and feed additives used for livestock.

Phenolic Compounds: A class of aromatic organic compounds commonly used in the manufacture of plastics, cosmetics, and antiseptics, and as preservatives for wood and rubber. Several of these compounds are regulated for surface water (11 compounds), drinking water (1 compound), and air (5 compounds), based on observed toxicity. Phenolic compounds are commonly found in bottled water and are sometimes classified as endocrine disrupting compounds.

Point Loma Wastewater Treatment Plant (Point Loma): Advanced primary wastewater treatment plant that discharges treated wastewater into the Pacific Ocean.

Potable water: See drinking water.

Purified water: Recycled water that has been treated to an advanced level beyond tertiary treatment, so that it can be added to water supplies ultimately used for drinking water. The treatment includes membrane filtration with microfiltration (MF) or ultrafiltration (UF), reverse osmosis (RO), and advanced oxidation that consists of disinfection with ultraviolet light (UV) and hydrogen peroxide (H2O2). Purified water may be discharged into a groundwater basin or surface water reservoir that supplies water to a drinking water treatment facility.

Quarterly Testing Reports: Four quarterly testing reports were prepared to summarize the testing data collected at the Demonstration Facility. Quarterly Testing Report No. 4 includes all of the data collected at the Demonstration Facility and is included as an appendix to the AWP Facility Project Report.

Raw water: Water that has not been treated for use. Examples of raw water are water in the Colorado River aqueduct, the State Water Project aqueduct, open reservoirs (whether filled with imported water or runoff), rivers, naturally occurring lakes and some well water.

Reactor: A vessel or tank where physical or chemical treatment processes occur**.**

Reclaimed water: See recycled water.

Recovery: Also called Feedwater Recovery is the volumetric percent of feed water that is converted to filtrate or permeate.

Recycled water: Treatment of wastewater beyond secondary treatment using tertiary filtration and chlorination. Water treated to this tertiary level is considered to be recycled water, which is suitable for many beneficial uses including irrigation or industrial processes. Recycled water meets treatment and reliability criteria established by Title 22, Chapter 4, of the California Code of Regulations.

Reservoir: A manmade lake or tank used to collect and store water.

Reservoir augmentation (RA): The process of adding purified water to a surface water reservoir. The purified water undergoes advanced treatment (membrane filtration, reverse osmosis and UV disinfection/advanced oxidation). The purified water is then blended with untreated water in a reservoir. The blended water is then treated and disinfected at a conventional drinking water treatment plant and is distributed into the drinking water delivery system. Also known as surface water augmentation.

Reverse osmosis (RO): A high pressure membrane process that forces water through the molecular structure of several sheets of thin plastic membranes to filter out minerals and contaminants, including salts, viruses, pesticides, and other materials. The RO membranes are like microscopic strainers bacteria and viruses as well as inorganic and most organic molecules cannot pass through the membranes.

Scaling: The precipitation or crystallization of salts on a surface (e.g., on the feed side of a membrane).

Specific flux: Flux per unit pressure (gfd/psi). This value is temperature corrected due to the impact of temperature on viscosity. (See definition of flux).

Spiking: A process in which a known quantity of a given constituent is added to the feed of a treatment system to test the robustness of the treatment process when ambient concentrations of the target constituent(s) is very low.

Stage: A group of membrane units operating in series. In a two stage configuration, concentrate from the first stage travels to the second where more water is produced.

Storage: Water held in a reservoir for later use.

Surface water: Water located on the Earth's surface, in a river, stream, lake, pond or surface water reservoir.

Surrogate Compounds or Surrogate Parameters: A common method used to evaluate water quality using a compound or parameter viewed as representative of a non-related class of chemicals or organisms. Surrogates are used when the analytes of interest are more difficult to quantify and measure through standard laboratory practices. Examples of surrogate parameters include turbidity, conductivity, UV254, and total organic carbon.

Tertiary effluent prior to chlorination: Tertiary effluent prior to chlorination is wastewater that has undergone primary treatment, secondary treatment, and tertiary filtration, but has not been disinfected with chlorine. This is the feed water to the AWP Facility. Sometimes referred to as recycled water even though it has not been disinfected.

Testing and Monitoring Plan (T&M Plan): This plan was prepared as part of the AWP Facility Project to outline the testing and monitoring that was conducted at the Demonstration Facility. The plan was reviewed and commented on by the Independent Advisory Panel (IAP), the California Department of Public Health (CDPH), and the San Diego Regional Water Quality Control Board (Regional Board).

Total dissolved solids (TDS): The concentration of mineral salts dissolved in water. Salinity may be measured by weight (TDS) or by electrical conductivity. Salinity and TDS are both measures of the amount of salt dissolved in water, and the terms are often used interchangeably. Generally, salinity is used when referring to water with a lot of salt (e.g., seawater), whereas TDS is used to refer to water with little salt (e.g., freshwater).

Total Organic Carbon (TOC): TOC has no health effects. However, TOC provides a medium for the formation of disinfection by-products. These by-products include trihalomethanes (THMs) and haloacetic acids (HAAS). Drinking water containing these by-products in excess of the MCL may lead to adverse health effects, liver or kidney problems, or nervous system effects, and may lead to an increased risk of cancer.

Transmembrane pressure: The difference in pressure from the feed (or feed concentrate average) to the permeate across the membrane.

Turbidity: A measure of suspended solids in water; cloudiness.

Ultrafiltration (UF): A membrane filtration process with pore openings that fall between reverse osmosis (RO) and microfiltration (MF). Also used to characterize the size of particles removed.

Ultraviolet (UV) disinfection and advanced oxidation: During ultraviolet disinfection, water is exposed to ultraviolet (UV) light, just like instruments in medical and dental offices, to provide disinfection. Additionally, ultraviolet light combined with hydrogen peroxide creates an advanced oxidation reaction that eliminates any remaining compounds in water by breaking them down into harmless compounds.

Vessel Array: Physical arrangement of pressure vessels in a reverse osmosis (RO) system. For

example, a 10 by 5 by 3 vessel array indicates a three stage RO system with 18 total vessels: stage one has 10 vessels, stage two has 5 vessels, and stage three has 3 vessels.

Wastewater: Untreated water collected in the sewer system from residences and businesses (e.g., from bathtubs, showers, bathroom sinks, clothes washers, toilets, kitchen sinks, dishwashers, and industrial processes). It consists of mostly water with some impurities. Also known as sewage.

Water Purification Demonstration Project (Demonstration Project): The second phase of the City of San Diego's Water Reuse Program. During this phase the Demonstration Facility will operate for approximately one year and will produce one million gallons of purified water per day. A study of the San Vicente Reservoir is being conducted to test the key functions of reservoir augmentation and to determine the viability of a full-scale project. No purified water was sent to the reservoir during the demonstration phase.

Water Purification Demonstration Project (Demonstration Project) Report: Final report documenting the findings of the Demonstration Project.

Water purification process: The process of using water purification technology on recycled water to produce a water supply that can be used for reservoir augmentation and ultimately for drinking water purposes. The process of water purification starts with recycled water, which has already been treated to produce a supply of water safe enough for irrigation and industrial purposes. This recycled water is further treated with water purification technology. The resulting purified water can be used to augment local reservoir supplies, which would be treated once more at a potable water treatment plant to produce drinking water.

Water purification technology: The technology used for purifying treated wastewater, including membrane filtration with microfiltration (MF) or ultrafiltration (UF), reverse osmosis (RO), and ultraviolet (UV) disinfection and advanced oxidation.

Water reuse: The planned use of recycled water that would otherwise return to the natural hydrologic (water) system for a specific beneficial purpose.

Water Quality Sampling Terminology

Field Duplicate: A portion of the collected sample volume is analyzed identically to evaluate laboratory precision, reproducibility of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

Blind Duplicate: Same as field duplicate, however the laboratory is not provided the sample location prior to analysis.

Split Sample: A portion of the collected sample volume is analyzed by a separate laboratory with overlapping capabilities utilizing identical analytical methods to evaluate laboratory accuracy, reproducibility of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

Field Blank: A sample of analyte free water (laboratory provided) is poured into the container in the field, preserved and shipped to the laboratory with field samples. The purpose is to assess contamination from field conditions during sampling.

Travel Blank: A clean sample of a matrix that is transported from the laboratory to the sampling site and transported back to the laboratory without having been exposed to sampling procedures. Typically, analyzed only for volatile compounds. The purpose is to aassess contamination introduced during shipping and field handling procedures.

Grab Sample: An individual sample collected at a selected time.

Composite Sample: Consists of grab samples of the same volume, taken from one source over a specific period at regulated times (i.e. time weighted) or at irregular intervals in irregular volumes that proportion the flow (i.e. flow weighted).

Water Measurement Terms

Milligrams per liter (mg/L) also known as parts per million (ppm): A measurement describing the amount of a substance (such as a mineral, chemical or contaminant) in a liter of water; a unit used to measure water concentrations (parts of something per million parts of water). One part per million is equal to one milligram per liter. (This term is becoming obsolete as instruments measure smaller particles.) This is equivalent to one drop of water diluted into 50 liters (roughly the fuel tank capacity of a compact car) or about thirty seconds out of a year.

Micrograms per liter (ug/L) also known as parts per billion (ppb): A frequently used measurement for water concentration (parts of something per billion parts of water). One part per billion is equivalent to one second of time in 32 years or one drop of water in a typical backyard swimming pool (a typical residential swimming pool is 30 feet by 15 feet with an average depth of 6 feet or 60 cubic meters). One thousand parts per billion is equal to one part per million.

Nanograms per liter (ng/L) also known as parts per trillion (ppt): A very high level of measurement for water concentration (parts of a constituent per trillion parts of water). This is equivalent to one drop of water diluted into 20 London Olympics swimming pools (2,500 cubic meters times 20 = 50,000 cubic meters) or about three seconds out of every 100,000 years.

Million gallons per day (mgd): This term is used to describe the flow of water treated and distributed from a treatment plant.

Acre foot (AF): A unit of water commonly used in the water industry to measure large volumes of water. It equals the volume of water required to cover one acre to a depth of one foot. An acre foot is 325,851 gallons and is considered enough water to meet the needs of two families of four with a house and yard for one year.

Executive Summary

In June 2011, the City of San Diego began operation of a three-step Advanced Water Purification (AWP) Facility to produce water suitable for indirect potable reuse from tertiary effluent (pre-chlorination) produced at the North City Water Reclamation Plant (North City). The Demonstration Facility is located at 4949 Eastgate Mall Road San Diego, CA 92121. A flow diagram of the Demonstration Facility processes and sampling locations (designated as S1 through S10) is provided in **Figure ES-1**. The Demonstration Facility was designed with a 1 million gallon per day (mgd) production capacity and consists of the following unit processes: parallel membrane filtration processes (microfiltration [MF] and ultrafiltration [UF]); parallel-two stage and three-stage reverse osmosis (RO) processes; and ultraviolet (UV) light disinfection and advanced oxidation (UV/AOP).

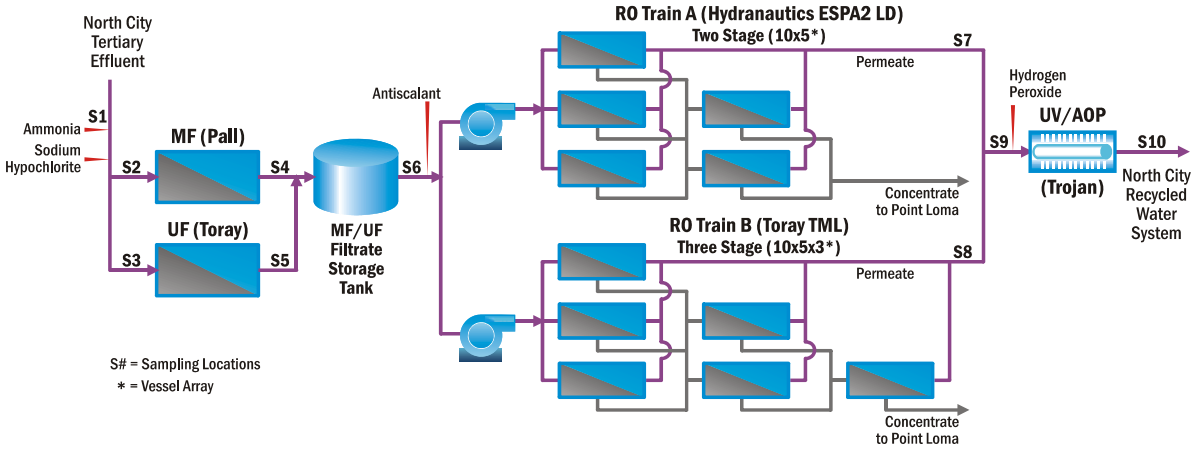

Figure ES-1 Demonstration Facility Processes

Specific objectives of the testing and monitoring program for the Demonstration Facility included:

- Demonstrate to the California Department of Public Health (CDPH) and the Regional Water Quality Control Board (RWQCB) that the proposed water purification processes will produce a final product water that meets public health and surface water augmentation criteria.
- Implement a monitoring plan for Constituents of Emerging Concern (CECs) tailored to the North City tertiary water characteristics and current recommendations of the State Water Resources Control Board (State Board).
- Demonstrate integrity monitoring techniques and performance reliability measures for the water purification processes, which can be implemented at the potential Full-Scale Facility.
- Monitor and collect operational performance and maintenance requirements of the Demonstration Facility equipment.

- Evaluate the degradation and by-product formation of nitrosamines and 1,4-dioxane by UV/AOP and compare alternative chloramines application conditions to mitigate N-Nitrosodimethlyamine (NDMA) formation.

The above objectives were met by operating the Demonstration Facility on a continuous basis for a 13.5-month period beginning in mid-June 2011 through the end of July 2012. During this time a testing and monitoring plan was implemented that specified water quality goals, materials and methods, process evaluation procedures and quality control measures. The Final Testing and Monitoring Plan (CDM Smith / MWH 2011) was reviewed and commented on by the Demonstration Project's Independent Advisory Panel (IAP), the CDPH, and the San Diego RWQCB. The operation and testing results associated with the Demonstration Facility were reported on a quarterly basis. The start and completion date for each testing period are shown in **Table ES-1**.

Table ES-1 Summary of Demonstration Facility Testing Periods

Testing Period	Testing Quarter	Test Period Start	Test Period End	Report Date
Testing Period 1	Q1	6/16/2011	10/31/2011	December 2011
Testing Period 2	Q2	11/1/2011	2/10/2012	March 2012
Testing Period 3	Q3	2/11/2012	5/14/2012	June 2012
Testing Period 4	Q4	5/15/2012	7/31/2012	September 2012

Operational Performance Monitoring

The subsections below summarize the cumulative operational performance results collected for each water purification process.

Microfiltration and Ultrafiltration Systems

Based on the similarities in operational performance and water quality performance, both MF and UF are suitable systems for membrane filtration in a Full-Scale Facility. The results of the testing showed the following:

- **Recovery:** The MF system operated at a recovery of 93 percent and experienced minimal fouling (reduction in performance). The UF system operated at 95 percent recovery and minimal fouling was observed during the Testing Periods 1 and 2; however, an increased rate of fouling was observed during the Testing Period 3. The UF system's higher recovery (i.e., less backwash waste) of 95 percent may have contributed to the increased rate of fouling.

- **Chemical Cleaning:** Two chemical cleanings were conducted on both the MF and UF systems during Testing Periods 1 through 3. These were effective at restoring the performance to the level observed when the membranes were new, which maintains efficient operations. Increased fouling of the UF system was observed during Testing Period 4.. The shorter cleaning cycle observed on the UF compared to the MF system may be due to smaller membrane pore size, which could result in

more fouling by trace organic constituent or differences in membrane cleaning procedures based on manufacturers' recommendations.

- **Energy Use:** The MF and UF system pressures and resulting energy consumption were essentially equal.

- **Water Quality:** Both the MF and UF systems consistently produced water with similar concentrations for key water quality parameters including turbidity (<0.1 NTU), total organic carbon (6.5 mg/L), and UV 254 absorbance (0.17 cm-1). Pathogen testing showed that both the MF and UF as the first step in the purification process removed bacteria to undetectable concentrations, demonstrating greater than 99.9 percent removal of coliform bacteria. Removal of measured viruses (bacteriophage) was greater for the UF system as attributed to the smaller pore size of the UF membranes compared to the MF membranes. The MF and UF systems achieved composite virus removals (Somatic plus Male Specific) greater than 99.8 percent and 99.97 percent, respectively. **Section 2.2** of this report provides additional information regarding bacteriophage removal performance of the MF and UF systems.

Reverse Osmosis Systems

Two reverse osmosis configurations were tested: Train A, a two-stage configuration; and Train B, a three-stage configuration. The different configurations were tested to compare hydraulic conditions and potential operating advantages of one configuration over the other.

- **Recovery:** During Testing Periods 1 and 2 both Trains A and B were operated at 80 percent recovery. During this time both systems operated with little to no fouling with membrane cleaning cycles (time between required cleaning) exceeding six months. Due to the successful operation at 80 percent recovery, the recovery of both systems was increased to 85 percent during Testing Period 3, which is desirable to maximize water production at the Full-Scale Facility. Train A operated for three months with little fouling under 85 percent recovery conditions; however, due to an issue with the concentrate flow meter Train B was operated at a higher recovery than anticipated (i.e. 87 to 89 percent), which lead to scaling and the need to clean after 0.6 months of operation. Upon resolving the issue, Train B was operated for a short period of time prior to the end of the testing period at 85 percent recovery with moderate fouling/scaling observed .

- **Chemical Cleanings:** Two chemical cleanings were performed for Trains A and B during Testing Periods 1 and 2. For Train A, the cleanings had little effect on the operating conditions as buildup was likely not present in significant quantities. Assessment of the Train B membrane performance before and after the cleanings showed that they were partially effective at restoring the operation to that observed when the membranes were new. Train B was cleaned (third stage only) successfully during Testing Period 3.

- **Energy Use:** The power monitors on the RO system Train A (two-stage) and Train B (three stage) showed that the three-stage configuration required on average 10 percent more energy than the two-stage configuration under similar operating conditions. The overall average energy reduction resulting from the energy recovery devices was determined to be 8 percent for Train A and 5 percent for Train B during operation at 80 percent recovery. However, the boost pressure was observed to decrease significantly when the recovery was increased to 85 percent due to the reduction of concentrate flow available. The ERD performance observed at the Demonstration Facility under the 85% FWR condition does not represent what could be achieved at the potential Full-Scale Facility.

- **Water Quality:** Both systems consistently produced water with nearly identical water quality characteristics. Nitrate rejection was better than expected for Train A, and lower than expected in Train B, resulting in identical total nitrogen concentrations from both trains.

UV/AOP System

The UV disinfection and advanced oxidation system, which includes ultraviolet light and hydrogen peroxide, was operated to achieve a target 1.2- log (94 percent) removal of NDMA as defined in the 2008 CDPH Groundwater Replenishment Reuse Draft Regulations, and 0.5-log (68 percent) removal of 1,4-Dioxane as defined in the 2008 and 2011 CDPH Groundwater Replenishment Reuse Draft Regulations. The average power level required to achieve the target NDMA removal, was approximately 68 percent, which corresponded to an average power of 12.5 kW. The target power required to achieve the target removal increased as runtime increased, attributed to a decrease in temperature during winter operation, as well a correction factor in the control system that accommodates for reduced efficiency with lamp age. The target power also increased slightly when the target chloramine dose to prevent bio-fouling on the RO membranes was increased (i.e. 1.5 mg/L to 3 mg/L) as this caused the ultraviolet light transmittance (UVT) of the RO permeate to decrease.

The average electrical energy per order (EEO) value was 0.19 kWh/1000 gallons/log removal. For the Full-Scale Facility, multiple UV vessels in series will likely be used, which may improve efficiency and further reduce the EEO. The UV intensity values measured in the Testing Period 1 were very close to values measured in Testing Period 4 at 100 percent reactor power, which indicates that lamp aging was not significant over this time period.

Water Quality Monitoring

In general two categories of parameters were monitored over the testing period: (1) contaminants selected based on regulatory considerations for the potential Full-Scale Facility and (2) non-regulated contaminants.

Regulatory Relevance of Water Quality Results

Table ES-2 provides a summary of water quality monitoring results for all contaminants monitored based on regulatory considerations for the potential Full-

Scale Facility. Overall the results showed the purified water quality consistently met or exceeded the specified requirements for guidelines. As indicated all microbial constituents (coliform and viruses) measured in the purified water were non-detect in all samples analyzed over the testing period.

Table ES- 2 Water Quality Monitoring Results of Regulated Constituents

Regulation and Guideline Group	Number of Constituents / Parameters	Total Number of Tests[1]	Purified Water Results
Primary Drinking Water MCL [2]	90	1781	√ Meets all
Secondary Drinking Water MCL [3]	18	1290	√ Meets all
Microbial [4]	4	1547	√ Non-Detect
CDPH Notification Level [5]	30	716	√ Below all
CDPH Groundwater Replenishment [6]	142	2244	√ Meets all
Reservoir Limits [7]	143	4404	√ Meets all
Total Number of Constituents / Parameters[8]	231[8]	7,523[8]	----------

Notes:
[1] The total number of tests represents the approximate number of tests conducted at all sample locations shown in Figure ES-1 and the Imported Raw Aqueduct Water.
[2] Maximum Contaminant Levels and Regulatory Dates for Drinking Water U.S. EPA VS. California November 2008.
[3] California Code of Regulation: Title 22, Division 4, Environmental Health Chapter 15. Domestic Water Quality and Monitoring Regulations Article 16. Secondary Water Standards. Purified water met all Federal and State Secondary MCLs with the exception of pH and corrosivity. The potential Full Scale Facility would include post treatment to meet these requirements.
[4] EPA Total Coliform Rule (published 29 June 1989/effective 31 December 1990). Samples from the Demonstration Facility were analyzed for the following microbial contaminants: Total coliform, Fecal Coliform, and Viruses (Somatic and Male Specific Bacteriophage).
[5] Drinking Water Notification Levels and Response Levels: An Overview. California Department of Public Health Drinking Water Program Last Update: December 14, 2010.
[6] CDPH Groundwater Replenishment Reuse DRAFT Regulation 2011. Purified water meets all numerical water quality requirements for indirect potable reuse via groundwater replenishment.
[7] EPA Numeric Criteria for Priority Pollutants Toxic Pollutants for the State of California Rule. San Diego Regional Water Quality Control Board San Diego Basin Plan Numeric objectives; note some objectives have not been defined.
[8] Because some contaminants and parameters are in multiple regulations / guidelines the total of unique parameters is less than the sum.

Non-Regulated Water Quality Results

These constituents are grouped into two main categories: those included in the 2012 EPA Unregulated Contaminant Monitoring Rule (UCMR3) and other CECs, such as pharmaceutical compounds and personal care products. Of the 111 non-regulated constituents sampled for at the Demonstration Facility, only six were found to be quantifiably detected at low levels in the purified water at any time, including three constituents from the UCMR3 list and three CECs.

Three UCMR3 list constituents, bromochloromethane, hexavalent chromium, and strontium, were quantifiable detected in the purified water. The first two of these constituents can be considered disinfection byproducts and may have been formed at

low levels within the treatment processes. The third constituent is a naturally occurring metal used as a dietary supplement and in manufacturing.

Only three CECs were detected at quantifiable concentrations in the purified water. These compounds were iohexal (contrasting agent used in x-ray), acesulfame-k (widely used artificial sweetener), and triclosan (antibacterial agent).

Section 3.6.2 and **Table 45** of this report provide a detailed discussion and summary of the results for these six constituents.

Quality Control

Several quality control (QC) procedures related to data analysis, lab testing, field sampling, sample handling and storage, and data validation were employed during the testing period. The results of this program showed the data set generated during the testing program is of high quality in terms of accuracy, precision, completeness, representativeness, and comparability.

Integrity & Critical Control Point Monitoring

The integrity and reliability of the individual water purification processes were evaluated closely during the testing period. Overall the results of the integrity monitoring plan showed the methods, frequency of testing, and response procedures were useful in verifying the integrity and reliability of the water purification processes. The findings indicate that the development of a similar monitoring and response plan during the design phase of the potential Full-Scale Facility that provides sufficient features and assurances that a foreseeable malfunction could be promptly identified and an appropriate response can be applied that would aid in assuring continuous production of high quality purified water. Results of integrity monitoring at Demonstration Facility are discussed below.

- **MF and UF.** Online continuous filtrate turbidity monitoring and daily pressure decay testing (PDT) were used. Turbidity monitoring results showed both systems achieve filtrate turbidities of less than 0.1 NTU on a consistent basis. The pressure decay rates were less than 0.1 pounds per square inch (psi) / 5 minutes. The fact that the pressure decay rates did not change over the testing period indicates no fibers were broken and the systems remained intact.

- **RO.** Prior to membrane installation, pressure or vacuum decay testing confirmed there were no defects in the membranes or membrane glue lines of each element that would inhibit performance. Post installation of the elements into the pressure vessels, conductivity probing was used to determine that there were no leaks in the interconnectors or end-caps and that the RO systems were intact and ready for operation. Lastly, during the operation the integrity of the RO systems were verified to be intact by conducting online continuous monitoring of permeate conductivity and total organic carbon.

- **UV/AOP.** Online power monitoring was done on a continuous basis. Verification and confirmation of the hydrogen peroxide dosing was also conducted. Results of

the testing detected several occurrences of changes in power resulting from ballast failures. The UV/AOP control system automatically responded by increasing the reactor power level to prevent a loss in treatment performance. The system alarms also notified the operations staff allowing them to identify and replace the faulty ballasts in a timely manner. Additionally, during a short period of the testing period air entrapment in the hydrogen peroxide dosing system resulted in the loss of peroxide dose. Again, the automatic control systems detected and signaled the operations staff via alarm. Lessons learned from the Demonstration Facility were used to identify design features for consideration at the potential Full-Scale Facility to prevent or reduce such occurrences.

UV/AOP Challenge Testing

The overall water quality goals established for the Demonstration Facility included the assessment of the ability of the UV/AOP system to achieve target removal values of two specific contaminants (NDMA and 1,4 Dioxane) based on the 2008 and 2011 Groundwater Replenishment Reuse Draft Regulations, respectively. Because these contaminants were not present in the Demonstration Facility influent or RO permeate it was necessary to dose laboratory prepared solutions of these contaminants to the influent of the UV/AOP system in order to demonstrate the target removals. The major conclusions associated with the testing follow:

- The UV/AOP system achieved 1.5-log removal (96.8 percent) of NDMA under the design flow (1 mgd), UVT (97 percent) and peroxide dose (3 mg/L) conditions. This exceeded the log-removal goal of 1.2-log removal (93.7 percent) based on the 2008 Groundwater Recharge Reuse Draft Regulations.

- The average EEO for NDMA was determined to be 0.19 kW-h/1000 gallons/order.

- The UV/AOP system achieved 0.6-log removal (74.9 percent) of 1,4-Dioxane under the design conditions. This exceeded the log-removal goal of 0.5 (68.7 percent) based on 2011 Groundwater Recharge Reuse Draft Regulations.

Chemical and Power Usage

Chemical and power usage of the Demonstration Facility was tracked closely to assess ways to to improve operational efficiency and provide a basis for estimating operation and maintenance (O&M) costs for the potential Full-Scale Facility.

Chemical usage included chemicals used on a continuous basis as part of the purification process as well as chemicals required for periodic cleaning of the membrane systems. The amount of process chemicals required during the testing period was in close agreement with what was anticipated based on the design conditions. In general, the MF and UF systems required a greater volume of cleaning chemicals per cleaning event than that required for the RO systems mainly due to differences in the configuration of the cleaning systems, and the type and concentration of chemicals used based recommendations from the membrane manufacturers.

Power usage of the AWP equipment was also closely monitored. **Figure ES-2** provides the breakdown of power usage for the individual AWP equipment based on typical daily power totals taken when the Demonstration Facility was operating at full production capacity over a 24 hour period. The breakdown includes power required for the feed pump, which was used to supply tertiary effluent prior to chlorination to the MF and UF systems.

The power required for the feed pump is higher than what would be required for a full-scale facility due to specific operational requirements associated with the Demonstration Facility as further discussed in this report. The higher use of power required for the UF system, compared to the MF system, was largely attributed to differences in the size and efficiency of the air compressors equipped on the systems.

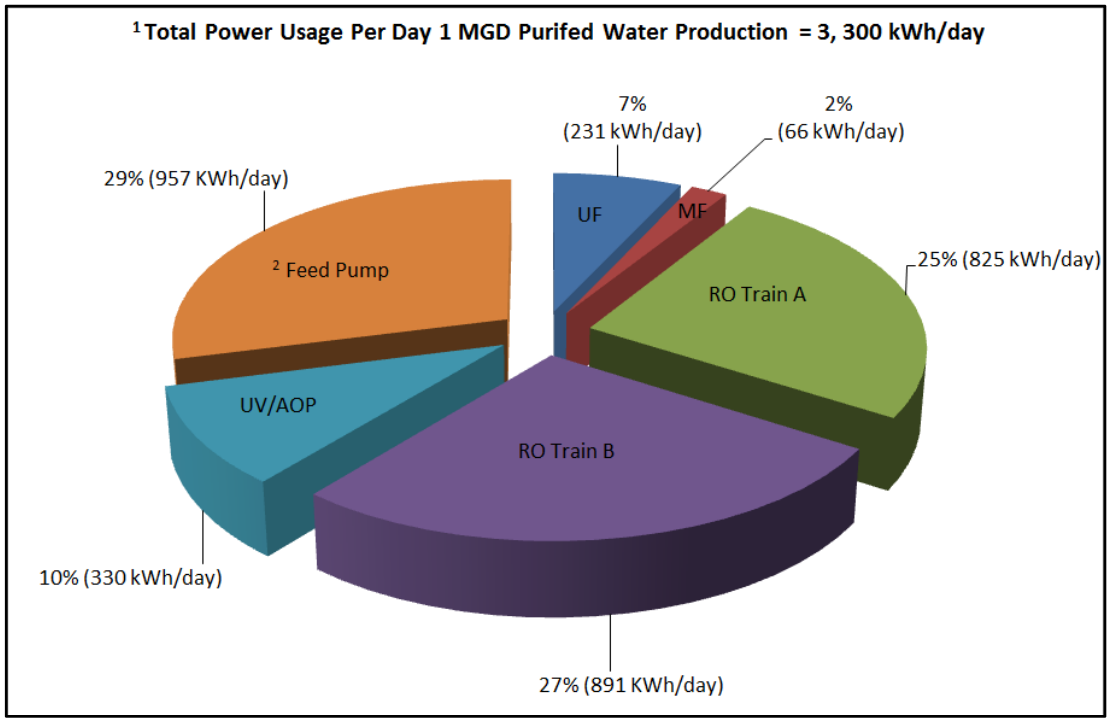

Figure ES-2 Demonstration Facility Process Power Usage

It seems the UF system air compressor was oversized and the design could be optimized for the Full-Scale Facility. The higher power use of RO Train B compared to RO Train A is largely attributed to difference in the membrane configuration (i.e. 3 Stage vs. 2 Stage) and membrane characteristics of the two systems. Train B was equipped with membranes designed for high rejection and low fouling requiring higher feed pressure, while Train A was equipped with membranes designed for energy savings, requiring lower feed pressure.

Note: [1] The total power usage per day is equivalent to 3.3 kWh/1000 gallons of purified water produced and 1,100 kWh per acre-foot of purified water produced. [2] The amount of power required for the Feed Pump is not representative (higher) of a full-scale facility due to specific operational requirements of the Demonstration Facility. Typically, the power usage for feed pumps used at full-scale facilities is accounted for in the MF or UF system power usage. Daily power usage shown does not include parasitic loads (e.g. lights, air conditioning, and ancillary equipment), which were measured to be between 3 to 5% of the equipment power usage.

Section 1
Introduction

1.1 Summary of Progress to Date

The following report provides the final progress update on the operations, testing, and monitoring component of the City of San Diego Demonstration Advanced Water Purification Facility (AWP Facility) located at 4949 Eastgate Mall Road San Diego, CA 92121. Full time operation of the AWP Facility began on June 16, 2011 which coincided with the beginning of the testing and monitoring period. Testing and monitoring was completed on July 31, 2012, representing a duration of approximately 13.5 months. Results were presented in quarterly reports over this period as summarized below. **Tables 1 and 2** respectively, provide a detailed summary of the overall AWP Facility operation schedule and quarterly monitoring periods.

- **Testing Period 1 Quarter 1 (Q1)** began on 6/16/2011 and was completed on 10/31/2011. The testing report was prepared in December 2011.
- **Testing Period 2 Quarter 2 (Q2)** began on 11/1/2011 with completion on 2/10/2012. The testing report was prepared in March 2012
- **Testing Period 3 Quarter 3 (Q3)** began on 2/11/2012 with completion on 5/14/2012. The testing report was prepared in June 2012.
- **Testing Period 4 Quarter 4 (Q4)** began on 5/15/2012 with completion on 7/31/2012. Progress for Q4 is the main focus of the current report.

During each testing period operational and water quality performance information was collected on each AWP unit process including the:

- Pall Microfiltration (MF) System,
- Toray Ultrafiltration (UF) System,
- Hydranautics ESPA2 LD Reverse Osmosis (RO) System (Train A),
- Toray TML RO System (Train B), and
- Trojan Phox Ultraviolet (UV) disinfection and advanced oxidation system (UV/AOP).

Each testing report presented the cumulative results of specific quarterly testing events, as well as routine water quality and operational data, plus the data from previous quarters. Observations included in each quarterly report focused on the most recent quarter. This current testing report (Q4) includes data collected for the entire 13.5 month start-up and testing period.

The collection of operational and water quality data of various constituents groups reported in the Q1, Q2 and Q3 Testing Reports continued during the Q4 Testing Period. The previous Testing Reports also presented the initial monthly sampling events for constituents of emerging concern (CECs), which were conducted in August, September, October and November 2011. Based on the results of the initial characterization, a select group of CECs were monitored weekly for four weeks during the Q3 testing period. A final set of CEC samples were collected conducted in tandem with the fourth quarterly sampling event conducted on 5/1/12. Results of all sampling events for the previous and current testing period are summarized in this report.

As reported in the Q1 Testing Report, prior to the initial quarterly sampling event a spiking experiment was conducted on the UV/AOP system to confirm the system was achieving the target log removal of N-Nitrosodimethylamine (NDMA). During this testing period a second spiking experiment was conducted to demonstrate the UV/AOP system achieved the target log removal of 1,4-dioxane and assess the impact of peroxide dose and electrical energy dose on removal. Results for both spiking experiments are presented and discussed in detail in this report.

During the current testing period, integrity monitoring of the various unit processes continued. This included daily pressure decay testing of the MF and UF membranes, along with online monitoring of MF/UF turbidity, RO conductivity, Total Organic Carbon (TOC), and UV/AOP power draw. Critical limit parameters and acceptable values were identified and monitored for each unit process to ensure the systems were meeting their designed treatment goals on a consistent basis. If any of the integrity monitoring indicated that unit processes were not meeting their designed treatment goals, then they were shut down for troubleshooting and repair.

Third party validation of water quality results was performed during the previous testing period. The purpose of the validation was to assess the quality of the data and review laboratory procedures to identify possible procedural alterations to be implemented for subsequent sampling events. A technical memorandum summarizing the extensive reports provided by the third party laboratory that conducted the data validation is provided in this report. Results of quality control (QC) sampling for all testing periods are summarized and assessed in this report.

1.2 Report Organization

The progress report is organized as follows:

- Executive Summary
- Section 1 Introduction
- Section 2 Operational Performance Monitoring of AWP Facility Unit Processes
- Section 3 Water Quality Monitoring Results

- Section 4 Integrity Monitoring
- Section 5 AWP Facility Chemical and Power Consumption
- Section 6 Maintenance and Equipment Issues
- Section 7 Summary and Conclusions
- Tables and Figures
- Appendix A: Final Report: Toxicity Testing Results for the City of San Diego Water Purification Demonstration Project.
- Appendix B: Quality Control Sample Results and CEC Data Review Letter prepared by Andy Eaton, Ph.D.
- Appendix C: Technical Memorandum: Summary of Third Party Data Validation of AWP Facility Quarterly Sampling Event Results.
- Appendix D: Expert Report: In review of Data for City of San Diego AWP Facility prepared by Shane Snyder, Ph.D.

Section 2
Operational Performance Monitoring of Water Purification Processes

2.1 Summary of Operations

The subsections below summarize the operational performance results collected between 6/16/11 through 7/31/12 for each water purification process. The feedwater for the purification processes was North City Water Reclamation Plant (North City) tertiary effluent (prior to chlorination). In general, the feedwater quality observed throughout the testing period was high quality in terms of general parameters that can impact operational performance of the purification processes including: turbidity, TOC, nutrients (nitrogen and phosphorus), and scale forming species. During the testing period, each process was operated continuously with minimal offline time due to routine maintenance, cleaning (membrane systems) and unscheduled minor repairs. Based on comparison of actual time to run hours (i.e. online time) the AWP Facility produced purified water greater than 87% of the time during this period.

Sections 2.2 and 2.3, respectively, compare microfiltration (MF) to ultrafiltration (UF) system performance and RO Train A to RO Train B performance.

2.1.1 Microfiltration System

The Pall Aria MF system was operated for over 8700 run hours (12 months) during the Q1 through Q4 testing periods. Membrane fouling was assessed by monitoring the temperature corrected specific flux under constant flux operation. **Figure 1** presents operational performance data including specific flux, flux, transmembrane pressure (TMP) and temperature based on daily operational readings. These parameters are plotted versus run hours; the plot also includes dates at each 1,000 run hour interval. The MF system was operated under the same steady state operating conditions throughout the testing periods. This included: target instantaneous flux = 29 gallons per square foot-day (gfd); average feedwater recovery = 93%; backwash interval = 19 minutes or production interval of 10,000 gallons; backwash duration = 96 seconds and target feedwater chloramine dose of 3 mg/L. Performance results collected during each testing period are discussed below.

Q1 Testing Period. Operational data collected on the MF system during the first testing period showed an initial overall fouling rate (percent decline in temperature corrected specific flux per month) of approximately 14% with the majority of the decline occurring between run hours 750 to 1300. A full clean in place (CIP) was conducted at run hour 2227 and was effective at restoring the temperature corrected (20 Deg C) specific flux to ~8 gallons per square foot of membrane per day (gfd)/pounds per square inch (psi). Post cleaning, the specific flux dropped steadily during the initial 120 run hours becoming steady at a value of ~5.8 gfd/psi for the remainder of the testing period.

Q2 Testing Period. During the Q2 testing period the temperature corrected specific flux remained steady at ~5.5 gfd/psi with little to no decline for approximately 2,175 hours (3.2 months) of operation.

Q3 Testing Period. During the Q3 testing period the MF system was operated for approximately 2,069 hours (Run hour 4996 to 7065) with minimal downtime. The only non-scheduled downtime occurred at run hour 6998 when the AWP Facility was shut down due to a pipe break which occurred on the downstream RO system. The AWP Facility was offline for approximately 3.5 days to make necessary repairs.

Beginning at run hour 4996 the temperature corrected specific flux remained steady at ~5.2 gfd/psi for approximately 580 hours of operation. At this time, the specific flux began to decline steadily reaching a value of 3.3 gfd/psi after 663 hours of operation. A full CIP was conducted at run hour 6239 and was effective at restoring the temperature corrected (20 Deg C) specific flux to a value close (~7.5 gfd/psi) to that achieved after the initial CIP conducted during Q1. Post cleaning, the specific flux dropped steadily as expected becoming steady at a value of ~5.6 gfd/psi for the remainder of the testing period.

Q4 Testing Period. During the Q4 testing period the MF system was operated for approximately 1643 hours (Run hour 7066 to 8709) with minimal downtime. Over this time period the temperature corrected specific flux dropped from a value of ~5.3 gfd/psi to ~4.3 gfd/psi, representing a decrease in specific flux of about 19%. A CIP was not necessary during this testing period. The overall fouling rate (% decrease in specific flux per month) starting after the completion of the last CIP (conducted during Q3) through the end of the Q4 testing period was about 12% per month. Assuming a linear fouling rate, it is projected the MF system could operate approximately 6 months before cleaning (i.e. specific flux reaches 2-3 gfd/psi) under the current operating conditions .

2.1.2 Ultrafiltration System

The Toray UF system was operated for over 8600 run hours (11.9 months) during the Q1 to Q4 testing periods. Membrane fouling was assessed by monitoring the temperature corrected specific flux under constant flux operation. **Figure 2** presents operational performance data including specific flux, flux, TMP and temperature based on daily operational readings. These parameters are plotted versus run hours; the plot also includes dates at each 1,000 run hour interval. The UF system was operated under the same steady state operating conditions throughout the testing periods. This included: target instantaneous flux = 30 gfd; average feedwater recovery = 95%; backwash frequency = 30 minutes; backwash duration = 195 seconds and target feedwater chloramine dose of 3 mg/L. Performance results collected during each testing period are discussed below.

Q1 Testing Period. Operational data collected on the UF system during the first testing period showed an initial overall fouling rate (% decline in temperature corrected specific flux per month) of approximately 25% with the majority of the

decline occurring during run hours 750 to 1400. A full CIP conducted at run hour 1729 effectively restored the specific flux to ~8.8 gfd/psi. Post cleaning the specific flux decline was gradual (~1 gfd/psi) over 1,158 run hours.

Q2 Testing Period. During the Q2 testing period the temperature corrected specific flux declined gradually to a value of ~5.5 gfd/psi between run hours 2872 to 4984 hours, representing an overall fouling rate of ~8% per month following the CIP conducted during the Q1 testing period. However, it was observed that the rate of specific flux decline increased during the latter part of the testing period starting at around run hour 4504.

During the Q2 testing period, the North City operations staff reported the introduction of a continuous low dose of ferric chloride in the influent of the tertiary filters beginning on 12/8/11 to meet the California Department of Public Health (CDPH) requirement for recycled water used in cooling towers. On 2/6/12 the North City operations staff reported the short-term use of polymer addition at the aeration basin effluent prior to secondary clarification to reduce tertiary filter effluent turbidity. Based on operational data collected to date it does not appear the use of these chemicals impacted the MF or UF system performance.

Q3 Testing Period. During the Q3 testing period the UF system was operated for approximately 2,004 hours (Run hour 4984 to 6989) with minimal downtime. The only non-scheduled downtime occurred at run hour 6923 due to the aforementioned AWP Facility shut down to repair the damaged RO permeate piping.

The steady decline in specific flux observed towards the end of the Q2 testing period continued from run hour 4984 to 5585 to a value of ~2.8 gfd/psi. At this time, a full CIP was conducted and was effective at restoring the temperature corrected (20 Deg C) specific flux to a value close (~8.3 gfd/psi) to that achieved after the initial CIP conducted during Q1. Post cleaning, the specific flux dropped steadily at a rate faster than expected for the next 716 hours of operation to a value of ~3.9 gfd/psi at run hour 6301. At this time the decline in specific flux was observed to be steady with a slight increase for ~593 hours of operation. However, for the remainder of the testing period the decline was steady to a final value of 3.5 gfd/psi at run hour 6989.

Q4 Testing period. During the current testing period the UF system was operated for approximately 1618 hours (Run hour 6990 to 8608) with minimal downtime.

The steady decline in specific flux observed towards the end of the Q3 testing period continued from run hour 6990 to 7360 to a value of ~1.9 gfd/psi. At this time, a full CIP was conducted. Based on discussions with Toray the cleaning protocol was modified from that used previously. During the previous cleanings the target pH during the citric acid step was 3, however a target of 1.5 was recommended by Toray as a possible way to extend time between cleanings. It is expected the lower pH would dissolve a larger amount of inorganic material that may have precipitated on the membranes therefore extending the time between cleanings. The CIP was effective

at restoring the temperature corrected (20 Deg C) specific flux to a value (~9.6 gfd/psi), which was higher than that achieved from previous cleanings. Post cleaning, the specific flux dropped consistently for the remainder of the testing period to a value of~5.4 gfd/psi at run hour 6806. The overall fouling rate starting after the completion of the CIP through the end of the testing period was about 26% per month. Assuming a linear fouling rate, it is projected the UF system could operate approximately 3 months between cleaning events (i.e. specific flux reaches 2-3 gfd/psi) under the current operating conditions.

2.1.3 Reverse Osmosis System

During the Q1 through Q4 testing period the RO systems (Trains A and B) were operated using combined filtrate from the membrane filtration systems for approximately 8,500 hours (11.8 months) of runtime. The RO trains were operated under similar operating conditions for the entire testing period as shown in **Table 3**. Each RO train was also equipped with an energy recovery device (ERD) by Energy Recovery, Inc. (ERI) that was designed to transfer pressure from the concentrate to the feed of the last stage. The RO trains were designed without the use of cartridge filtration as pre-treatment. RO Train A was configured as a two-stage system and utilized model ESPA2 LD membranes manufactured by Hydranautics. Likewise, RO Train B was configured as a three stage system and utilized model TML membranes manufactured by Toray. Operational performance data collected for both RO Trains during each testing period is discussed in the subsections below.

2.1.3.1 RO Train A

Operational performance parameters including net operating pressure (NOP), flux, specific flux and feedwater temperature for the RO Train A are illustrated in **Figure 3**. Membrane fouling was assessed by monitoring the decline in temperature corrected specific flux, or permeability, under constant flux operation. These parameters are plotted versus run hours; the plot also includes dates at each 1,000 run hour interval. Operational performance observed during each testing period is summarized below.

Q1 Testing Period. During the initial operation period, a decrease in the specific flux was observed prior to becoming level around run hour 900 (5 weeks). Since this decrease was predominantly in the first stage elements, it was believed that it may have been related to organic fouling or to biological regrowth. To prevent further fouling, the target feedwater concentration of chloramines was increased from 1.5 to 3.0 mg/L. Following this adjustment, the membranes operated with little to no decrease in specific flux for around 1,345 hours of operation. A full Chemical cleaning was performed on Train A on 10/14/11 (run hour 2,245). The membranes were cleaned in accordance to the manufacturer's protocol using caustic soda followed by citric acid. A summary of cleaning results for both RO Systems is provided in **Table 4**. Comparison of the specific flux measured pre and post cleaning for the 10/14/11 Train A cleaning indicates the cleaning had no effect on restoring the average membrane specific flux. These results suggest that the decrease in specific flux observed during the initial operation may have been related to conditioning of the

membranes rather than entirely from membrane fouling. It is also possible that the cleaning procedures chosen were not sufficient to entirely remove the foulant layers.

Q2 Testing Period. The corresponding run hours for the Q2 Testing period began at 2,618 and ended at 4,764 hours. During this time the temperature corrected specific flux remained steady at ~0.13 gfd/psi with little decline for approximately 2,146 hours of operation. The overall fouling rate from the previous CIP to the end of the Q3 testing period was less than 2% per month. The net operating pressure increased over the testing period due to the decrease in feedwater temperature.

The calculated efficiency of the RO Train A Turbocharger from Q1 and Q2 operation was determined to be far below optimal conditions. After several discussions with the manufacturer, a representative from the RO skid supplier (Enaqua) installed a complete set of new bearings on the device on 12/5/11 (run hour ~3,512). Upon review of performance pre and post replacement of the bearings technicians from ERI confirmed there was a hydraulic issue with the ERD and agreed to repair the unit. On 1/10/12 (run hour ~4097), a representative from Enaqua removed the device for return to ERI and installed necessary piping to allow the RO system to be operated while the device was being repaired.

Q3 Testing Period. The corresponding run hours for the Q3 Testing period began at run hour 4764 and ended at run hour 6805. The only unscheduled downtime occurred at run hour 6737 due to the aforementioned AWP Facility shut down required to repair the damaged RO permeate piping.

During the first 1,500 hours of Q3 operation the system was operated under the same target operating conditions as the previous testing periods, which were: average flux = 11.8 gfd; feedwater recovery = 80%, antiscalant dose = 3 mg/L; and chloramines dose = 3 mg/L. During this period, the temperature corrected specific flux remained steady at ~0.13 gfd/psi with little to no decline. A goal during this testing period was to assess the performance of the RO systems at an increased feedwater recovery (FWR). Prior to increasing the FWR, a full CIP was conducted to try and restore the specific flux so an accurate assessment of the impact of FWR on fouling/scaling could be made.

Due to the ineffectiveness of the CIP conducted during the Q1 testing period the cleaning protocol was modified to change the order of cleaning chemicals. During Q1 caustic was followed by citric acid. However, during this testing period citric acid was followed by caustic. In addition, the chemical soak and recirculation times were extended. Data collected before and after the cleaning showed the specific flux was restored by about 15% with all of the increase observed after the caustic cleaning, suggesting that the majority of the fouling was related to organic material. Though there was no observed increase in specific flux after the acid cleaning it is believed the acid may have removed inorganic foulants which may have coated or complexed with organic foulants allowing for effective removal of the organic foulants by the caustic.

Following completion of the CIP, the system was operated under the same target operating conditions as stated above with the exception that the FWR was increased to 85% at run hour 6314. The FWR was increased by manually adjusting the valve located on the concentrate piping to reduce the concentrate flow. The permeate flow set point was held constant to the design flow rate and not impacted by increasing the FWR. The system operated with little to no fouling as measured by the decline in overall specific flux for the remainder of the testing period.

Performance monitoring of the TurboCharger (Energy Recovery Inc. - ERI) energy recovery device (ERD) continued during the testing period. **Figure 6** presents values of Stage 1 concentrate pressure before and after the TurboCharger along with the calculated boost pressure. The unit was repaired and reinstalled at run hour 5015. Comparison of performance data pre and post repair showed that the average boost pressure increased from 8.9 to 22.9 psi as a result of the repair. It was also observed during this testing period that the average boost pressure dropped significantly (22.9 psi to 11.8 psi) when the recovery FWR increased to 85%. The drop in boost pressure would be expected with an increase in FWR as the concentrate flow into the Turbocharger is reduced.

Q4 Testing Period. The corresponding run hours for the Q4 Testing period began at run hour 6805 and ended at run hour 8458, representing 1653 hours (2.3 months) of online time. During this time system operation continued at a target feedwater recovery of 85%. The system operated for 2144 hours (3 months) during the period following the previous cleaning (conducted during Q3) to the end of the current reporting period The average fouling rate was about 2% per month as measured by the decline in temperature corrected specific flux.

Figure 4 presents values of specific flux for Stage 1 and Stage 2, respectively. As shown the values for Stage 1 were consistent over the testing period with little to no decline after the initial conditioning period, indicating minimal fouling occurred. The values for Stage 2 show a downward trend suggesting some scaling occurred. **Figure 5** shows values of differential pressure (DP) measured across Stage 1 and Stage 2. It was observed during the Q2 testing period that Stage 1 DP values were increasing slightly with runtime. During the current and previous testing periods the values remained fairly consistent indicating that membrane element feed channels are not plugging.

Performance monitoring of the TurboCharger (Energy Recovery Inc. - ERI) energy recovery device (ERD) continued during the testing period. **Figure 6** presents values of Stage 1 concentrate pressure before and after the TurboCharger along with the calculated boost pressure. The average boost pressure observed during the current reporting period was similar (~12 psi) to that observed during the Q3 testing period during operation at 85% recovery.

2.1.3.2 RO Train B

Operational performance parameters including net operating pressure (NOP), flux, specific flux and feedwater temperature for the RO Train A are illustrated in **Figure 7.** Membrane fouling was assessed by monitoring the decline in temperature corrected specific flux, or permeability, under constant flux operation. These parameters are plotted versus run hours, the plot also includes dates at each 1,000 run hour interval. Operational performance observed during each testing period is summarized below.

Q1 Testing Period. The target operating conditions for the Q1 Testing period were: average flux = 11.6 gfd; feedwater recovery= 80%, antiscalant dose = 3 mg/L; chloramines dose = 1.5 to 3 mg/L. During the initial 160 hours (1 week) of operation, the specific flux (gfd/psi @25 °C) of the new Toray TML membranes declined steadily from an initial value of 0.15 to 0.13. The specific flux further declined slightly over the next 740 run hours to ~0.12 gfd/psi. The target feed concentration of chloramines was increased from 1.5 to 3.0 mg/L (same modification as Train A) at run hour 941. The specific flux remained steady with little or no decline for the next 1,126 hours (1.6 months) of operation.

A full chemical cleaning was performed on Train B at run hour 2,027. The membranes were cleaned in accordance with the manufacturer's protocol using both caustic soda and citric acid. Assessment of the membrane performance before and after the cleaning showed the cleaning restored the specific flux by about 18% signifying the cleaning was effective. Post cleaning, the specific flux remained steady with little to no decline for the remaining 551 run hours of the testing period.

Q2 Testing Period. The corresponding run hours for the Q2 Testing period began at 2595 and ended at 4772 hours. During this time the system was operated with the same target operating conditions as the previous testing period. The temperature corrected specific flux remained steady at ~0.12 gfd/psi with little decline for approximately 2,177 hours (3 months) of operation. The overall fouling rate from the previous CIP to the end of the Q2 testing period was less than ~3% per month. As shown the net operating pressure increased over the testing period due to the decrease in feedwater temperature.

Monitoring of the TurboCharger (Energy Recovery Inc.) energy recovery device during Q2 showed the average pressure boost was 25.4 psi, which was similar to the average boost pressure observed during the previous testing period (e.g. 22.6 psi).

Q3 Testing Period. The corresponding run hours for the Q3 Testing period began at run hour 4772 and ended at run hour 6787. The only unscheduled downtime occurred at run hour 6721 due to the aforementioned AWP Facility shut down required to repair the damaged RO permeate piping.

During the first 1,525 hours of Q3 operation the system was operated under the same target operating conditions as the previous testing periods. The temperature corrected specific flux remained steady at ~0.11 gfd/psi with little to no decline. At this time a

full CIP was conducted. Due to the ineffectiveness of the CIP conducted on the RO systems during the Q1 testing period the cleaning protocol was modified as described above for RO Train A. Data collected before and after the cleaning showed the specific flux was restored by about 17%. The specific flux increased by 8% after the acid cleaning and an additional 9% after the caustic cleaning.

Following completion of the CIP the system was operated under the same target operating conditions as above with the exception that the FWR was increased to 85% at run hour 6391. During the initial 396 hours (2.3 weeks) of operation, little to no fouling was observed as measured by the decline in overall specific flux.

However, comparison of values of normalized specific flux for Stage 1, Stage 2 and Stage 3 indicated increasing the FWR to 85% resulted in the Stage 3 normalized specific flux to decline at a much faster rate than Stage 1 and Stage 2. In addition, over this time the permeate conductivity of Stage 3 increased by about 158%. These observations signify that scaling of the Stage 3 membranes occurred.

Monitoring of the TurboCharger (Energy Recovery, Inc.) energy recovery device on the Train B RO system continued during this testing period. The average boost pressure during operation at a target FWR of 80% was 23.3 psi with a noticeable decrease at run hour 5022. The decrease is due to a manual adjustment made on the concentrate valve to decrease the concentrate flow in order to maintain the target FWR. Further adjustment was made to the concentrate valve at run hour 6391 to increase the target FWR to 85%. The average boost pressure measured during operation at 85% over the remainder of the testing period was only 6.4 psi. The reduced boost pressure at 85% FWR is attributed to the lower concentrate flow.

While the ERD could have been adapted to the higher FWR conditions using a nozzle valves, the City elected not to proceed with this modification during the testing period. If it is decided to incorporate ERD's into the design of the potential Full Scale Facility consideration should be given to the use of automatic control valves and auxiliary nozzle valves to optimize the performance of the ERD's over the expected range of concentrate flow, pressure and temperature.

Q4 Testing Period. The corresponding run hours for the Q4 Testing period began at run hour 6787 and ended at run hour 8435, representing 1648 (2.3 months) of online time. During this time system operation continued at a target FWR of 85%. The decrease in the third stage specific flux observed at the end of the previous reporting period continued for the initial 938 hours (1.3 months) of operation. At run hour 7311 the third stage specific flux had dropped by 40% of the initial value observed at the start of 85% FWR operation. This drastic drop in specific flux indicated the third stage had undergone significant scaling. At this time a CIP was conducted on the third stage membranes. Results of the cleaning show the cleaning was effective at restoring the specific flux. Following the CIP the Train B was restarted at a target FWR of 80%.

Because Train B scaled at a much faster rate than Train A during operation at 85%, an investigation was undertaken to identify the possible cause. The investigation included verification of the accuracy of the flow transmitters equipped on the RO skids as well as verifying the FWR of the systems based on sulfate values measured in the feed, permeate and concentrate. The flow transmitters equipped on both RO skids were checked against measurements using an ultrasonic flow meter provided by Toray. Comparing results showed the flow transmitters were within acceptable agreement with the ultrasonic flow meter with the exception of the concentrate flow transmitter on Train B, which read 22% higher than the flow measured by the ultrasonic meter. Based on this information, recovery calculations were revised to use the permeate and feed flowmeters rather than the concentrate. In addition, sulfate mass balance calculations were performed, confirming the accuracy of the revised recovery calculations. It was therefore determined that Train B had operated at FWR between 87 and 89% instead of the targeted 85% FWR during the time the scaling was observed. In order to rectify the issue the scale factor on the concentrate flow meter was adjusted to accommodate for the measured discrepancy. The FWR was returned to 85% FWR at run hour 7942. During the following 493 hours (3 weeks) the overall specific flux declined by about 9.9% and the third stage by 25%. Because a limited amount of run time was conducted on Train B at 85% recovery it is recommended further operation be conducted to further assess the fouling rate at this recovery.

Lastly, it was confirmed that prior to changing the FWR to 85%, Train B operated at a FWR between 79 to 81% (target 80%) based on flow measurements recorded from the magmeter located on the feed pump and permeate flow transmitters equipped on the RO skid.

Figure 8 presents values of specific flux for Stage 1, Stage 2 and Stage 3, respectively. As shown the specific flux of the third stage declined much faster than Stage 1 and Stage 2 during the initial 85% FWR operating period. This decline is attributed to the aforementioned scaling event. During operation following the completion of the CIP the specific flux for Stage 1, Stage 2 and Stage 3 remained fairly constant with no significant decline observed. **Figure 9** presents values of differential pressure (DP) measured for each Stage. Overall the DP values were consistent with that expected due to hydraulic losses and indicate no plugging of the membrane feed channels occurred over the previous or current testing period. The lower DP values observed in Stage 3 during the operation at 87 to 89% FWR (Run hour 6391) is attributed to a reduction in flow to the stage as the membranes scaled.

Monitoring of the TurboCharger (Energy Recovery Inc.) energy recovery device on the Train B RO system continued during this testing period. **Figure 10** presents values of Stage 2 concentrate pressure before and after the TurboCharger along with the calculated boost pressure. As the FWR is increased the concentrate flow from Stage 2 is decreased therefore providing less flow through the ERD resulting in lower boost pressure. The average boost pressure measured during the testing period changed during operation at different FWR conditions as provided below.

- Run hour 6391 to 7311 – The average boost pressure measured during this time period was 7 psi, FWR 87 to 89%.

- Run hour 7329 to 7920 – The average boost pressure measured during this time period was 16 psi, FWR 80%.

- Run hour 7942 to 8435 – The average boost pressure measured during this time period was 12 psi, FWR 85%.

2.1.4 UV Disinfection and Advanced Oxidation

During the Q1 through Q4 testing period the UV/AOP system was operated using permeate from the RO systems for approximately 8,500 hours (11.8 months) of runtime. During normal operation, the system was operated to achieve a target log removal of NDMA and 1,4-dioxane of 1.2 (93.7%) and 0.5 (68.4%), respectively. The target hydrogen peroxide dose applied to the UV/AOP feedwater was held constant at 3 mg/L. The ultraviolet light transmittance (UVT) at the 254 nanometer wavelength measured in the feed ranged from approximately 97 % to 98.5 %, which was determined to be impacted by the chloramine residual concentration. The Trojan control system adjusted the reactor power to maintain the target log removals using an algorithm, which takes into account feed flow, temperature, UVT, and lamp age**.** **Section 2.1.4.1** presents operational UV/AOP performance results collected during each testing period. **Sections 2.1.4.2 and 2.1.4.4**, respectively, provide results from an evaluation of potential UV/AOP by-products and challenge experiments conducted on the UV/AOP system to demonstrate target removals of NDMA and 1,4-dioxane.

2.1.4.1 Operational Performance Results

Operational data for the UV/AOP system collected during the Q1 through Q4 testing period are presented in **Figures 11 and 12.**

Q1 Testing Period. Operational data collection on the UV/AOP system during the Q1 Testing period showed the ultraviolet transmittance (UVT) measured at the 254 nanometer wavelength in the feedwater decreased from 98.5% to 97.7% (run hour 916) due to the increased chloramines dose required to reduce biofouling of the RO membranes. The Trojan algorithm changes the applied power required to achieve a target log removal based on changes in inlet flow, temperature, and UVT. Therefore, when the UVT decreased the required power increased. The average reactor power level required to achieve the target NDMA removal following the drop in UVT was 67% of the maximum reactor power level (i.e. 100%) corresponding to an average present power of 12.5 kW. Based on the average inlet flow the electrical energy dose (EED) was 0.303 kWh/1000 gallons. On four occasions the reactor power increased to 100% due to ballast failures. The faulty ballasts were sent to Trojan for autopsy to determine the cause(s) of failure. Upon analysis Trojan reported three of the failures were due to blown primary fuses, which commonly result from power surges, and the fourth was due to an output failure. It is also not uncommon in the ballast industry to have a bad batch of ballasts due to defective components. Trojan noted that

installation of a transient voltage surge suppressor (TVSS) on the system may be a good idea if ballasts continue to fail in the future due to blown fuses.

The average electrical energy per order (EEO) value recorded at the Trojan HMI over the operating period was 0.260 kilowatt-hours (kW-h)/1000 gallons/ log removal. The EEO values and NDMA performance of the UV/AOP were confirmed by conducting a spiking experiment as described in **Section 2.1.4.4** which showed the unit was performing more efficiently than predicted (e.g. Average EEO was determined to be 0.188 kW-h/1000 gallons/log removal).

Q2 Testing Period. Operational data collected on the UV/AOP system during the Q2 testing period started at run hour 2,595. Overall the performance of the UV/AOP system during this testing period was similar to the previous testing period. However, a slight trend of increasing reactor power level required to achieve the target 1.2-log removal of NDMA was observed. The increase in power is likely due to the lower feedwater temperature of ~4 degrees Celsius (C) observed during the this testing period. In addition to the aforementioned factors that impact the applied power level (i.e. inlet flow, temperature and UVT) the Trojan control system also increases power with time to accommodate for lamp aging. The average reactor power level required to achieve the target NDMA removal was 71% of the maximum power level, which corresponds to an average present power of 13.0 kilowatts (kW). Based on the average inlet flow the EED was 0.317 kWh/1000 gallons. In addition, no ballast failures occurred during this testing period.

Q3 Testing Period. Operational data collected on the UV/AOP system during the Q3 testing period started at run hour 4793 and ended 6841. The reactor operated for ~2,048 hours. There were two periods of unscheduled downtime. The first occurred around run hour 6602 when the reactor was taken offline for approximately 1 to 2 hours to replace a single faulty ballast and lamp. The operations team immediately contacted Trojan to send replacement parts. The faulty parts were sent back to Trojan for autopsy (ballast only) to determine the cause of failure. The second shutdown occurred at run hour 6775 due to the aforementioned AWP Facility shut down required to repair the damaged RO permeate piping.

Starting around run hour 6263 the UVT analyzer alarmed on a frequent basis due to low flow. When these alarms occurred the UV control system automatically increased the UV power to 100%. It was determined the cause of the low flow was air entrapped in the UV inlet piping. After several attempts to remove the air by adjusting the air relief valves located upstream and downstream of the UV reactor the problem was resolved by partially closing the butterfly valve located on the UV outlet pipe to increase the backpressure in the line and installing a bubble trap upfront of the UVT analyzer.

Q4 Testing Period. Operational data collected on the UV/AOP system during the current testing period started at run hour 6841 and ended at 8549. The reactor operated for ~1,708 hours. Overall the performance of the UV/AOP system during

this testing period was similar to the previous testing periods. However, a slight trend of decreasing reactor power level required to achieve the target 1.2-log removal of NDMA was observed. As previously mentioned, the Trojan control system adjusts power based on feed temperature. The average feedwater temperature during the current testing period was ~3.3 degrees Celsius (C) higher than that observed during Q2 and Q3, which would account for the reduction in the reactor power requirement. The average reactor power level required to achieve the target NDMA removal during this testing period under normal operating conditions was 68% of the maximum power level which corresponds to an average present power of 12.5 kilowatts (kW). The EED based on the average inlet flow was of 0.303 kWh/1000 gallons. These values are in close agreement with those measured during the Q1 Testing Period suggesting the lamp ageing factor built into the Trojan control system did not have a significant impact on the EED during the Q1 to Q4 Test Period.

The UV intensity sensor equipped on the system was checked against a reference sensor during each testing period. This was done by stopping flow to the system and increasing the power to 100%. Readings of UV intensity were taken with the duty sensor. The system was then shutoff and the reference sensor was installed and the procedure was repeated. Comparison of UV intensity measurements from both sensors are provided in **Table 5**. Results showed close agreement (i.e. < 5% difference) throughout the testing period. Also, the UV intensity values measured in the Q1 testing period were very close to values measured in the Q4 testing period giving a gross indication that lamp aging was not significant over this time period. However, it is important to keep in mind the intensity sensor is only positioned at one lamp. A comprehensive assessment of lamp aging would require several lamps be sent to Trojan for analysis.

During the current testing period there were several occurrences of peroxide pump failures caused by air entrained in the dosing pumps. The first occurrence happened around run hour 7052 when the duty pump lost flow confirmation and auto switched to the standby pump. After the switch over occurred, the second pump lost flow confirmation causing the system to go into critical alarm and shut off. The system was re-started, however the pumps continued to lose flow confirmation on several occasions over the next few days. At this time, the operations team contacted Trojan to trouble shoot the issue. Several adjustments were made to the peroxide dosing system which seemed to remedy the issue. First, the degasification interval and duration (user set points) were adjusted to allow the dosing system to purge air on a more frequent basis and for a longer time period per purge. Second, a valve on the discharge side of the peroxide pumps which allows air to return to the peroxide storage tank was opened. It should also be noted that on several of the pump failure occurrences the feed flow to the UV was at reduced flow as only one RO system was in operation. Because the peroxide dose is flow paced the dose rate would be lowered automatically which may have increased the likelihood of air entrapment.

A ballast failure also occurred during this testing period, which makes a total of six ballast failures during the Q1 through Q4 testing period. Based on discussions with

Trojan, it was suggested a power monitoring study be employed to assess if the failures could be a result of power surges. In addition, it was recommended the air filters on the power distribution cabinet (PDC), which houses the ballasts, be changed on a monthly basis to prevent the cabinet temperature from getting to a level that could damage the ballasts. At the time of this report the power study was underway. In addition, the operations team initially began changing the PDC filters on a monthly basis. However, due to the amount of debris discovered on the filters over this time period, a more frequent maintenance schedule was implemented (i.e. every 2 weeks). Lastly, Trojan also sent the failed ballasts to the ballast manufacturer to determine the possible cause (s) of the failures. The initial findings were that there does not seem to be a common cause for the ballast failures. It is expected the manufacturer will provide further details as they become available.

2.1.4.2 UV/AOP By-product Evaluation

The T&M Plan takes into consideration input from the IAP, CDPH, and the RWQCB. CDPH reviewed the 2010 IAP report and suggested that the demonstration program evaluate by-products from advanced oxidation of NDMA, 1,4-dioxane, and other organic constituents present in the RO permeate. Based on information found in peer reviewed literature and past pilot testing conducted at North City, the project team recommended taking grab samples from the RO permeate (UV/AOP influent) and UV/AOP product water and measuring formaldehyde on a weekly basis during the initial eight weeks of the routine sampling period. Three additional sample sets were taken later in the testing period.

Results of the formaldehyde analyses are provided in **Table 6**. The average concentration (µg/L) in the influent (n=11) was 4.1 ± 2.5 while the product (n=11) was 9.7±2.9. While the results showed an apparent increase in concentration across the UV/AOP process, the relative change in concentration does not appear to be of health concern. The concentration measured in the UV/AOP product is nearly 10 times lower than the CDPH Notification Level (NL) of 100 µg/L. Interestingly, the concentrations of NDMA and 1,4-dioxane measured in RO permeate, which can serve as pre-cursors to formaldehyde formation, were below or near below their RL of 2 ng/L and 0.5 µg/L, respectively. During subsequent testing periods additional samples of formaldehyde were taken and analyzed as part of the overall water quality QC plan. Results from analysis conducted by a second commercial lab showed the concentration of formaldehyde in the UV/AOP product to be higher than those reported by the original lab that conducted the analysis but still lower than the NL. This is further discussed in **Section 3.5.1.2.**

2.1.4.3 Chloramine and Nitrosamines Investigation

The T&M Plan outlined specific measures to evaluate different chloramine dosing alternatives during the testing period. While chloramine dosing is required to control organic and biological fouling of the membrane components (i.e. MF, UF, and RO membranes) of the overall purification process, past studies have shown the combination of chloramines and organic pre-cursors present in wastewater are

common pathways for the formation of nitrogenous disinfection by products (DBPs) such as nitrosamines. Chloramines can be created by either sequential addition of ammonia (aqueous ammonia) or chlorine (sodium hypochlorite) directly into the feedwater or by a side stream process that pre-forms chloramines prior to application to the feedwater. The latter method has been shown to reduce the formation of some DBPs.

The T&M Plan was designed to evaluate both chloramine dosing methods with the initial condition to be sequential addition. As discussed in **Section 3.1,** routine water quality monitoring included sampling of nitrosamines on a monthly basis from various locations in the purification process including tertiary effluent (prior to chlorination), RO feed, RO permeate and UV/AOP product water. Results of nitrosamine monitoring presented in **Table 18** showed the average concentration (n=10) of NDMA measured in the tertiary effluent was 4.2 ng/L and ranged from <RL (RL=2 ng/L) to 20 ng/L. Slightly lower concentrations were measured in the RO feed with the average concentration (n=14) of 3.5 ng/L ranging from <2 ng/L to 17 ng/L. These results show that NDMA formation was not occurring under the sequential addition of chloramines.

Results also showed the RO system achieved greater 43% removal of NDMA based on average concentration in the RO permeate of <2 ng/L. All NDMA results in the UV/AOP product water were < 2 ng/L with the exception of the sample collected on 1/3/12, for which the reported result was 5.5 ng/L. Results for other nitrosamines (i.e. NDEA, NDBA, NDPA, NMEA, NMOR, NPIP, NPYR) were similar in concentration in the tertiary water and RO feed throughout the testing period further indicating nitrogenous DBP formation was not occurring. These results did not warrant the need for testing the pre-formed chloramine application and therefore sequential chloramination was continued for the remainder of the testing period.

It should be noted routine sampling results showed that both NDMA and NDEA had occasional positive hits at locations downstream of locations where no detectable levels had been observed. For NDEA, this occurred on 12/1/11, 1/3/12, and 4/23/12, where low levels of NDEA were measured in the UV/AOP product (levels were 2.5, 2.9, and 4.9 ng/L, respectively), but had been below quantifiable levels in the upstream RO product. Similarly, a 6.1 ng/L NDEA level was measured in the Train B RO permeate on 11/2/11 when no NDEA was detected in either the upstream RO feed or the downstream combined RO permeate. For NDMA, a 5.5 ng/L result was found in the UV/AOP product on 1/3/12 when concentrations had been below quantifiable levels in both the RO product and RO feed. These positive results represent the challenge of reliably monitoring nitrosamine concentrations at such low concentrations with an analytical reporting level of only 2 ng/L. It is unlikely that these results suggest that either NDMA or NDEA was formed or introduced downstream of the RO membranes or within the UV/AOP, and the vast majority of the 15 NDEA and NDMA samples were below quantifiable levels in the UV/AOP product. Similarly, all results were below the CDPH notification level of 10 ng/L for both constituents.

2.1.4.4 UV/AOP Challenge Experiments

During the course of the Q1 through Q4 testing period several challenge experiments were conducted to demonstrate the performance and efficiency of the UV/AOP system to reduce NDMA and 1, 4-Dioxane. The design criterion for the UV/AOP was based on a 1.2 log removal of NDMA and 0.5 log removal of 1,4-dioxane at a system flow rate of 1 MGD. Because the concentration of the target compounds in the North City tertiary effluent and subsequently the RO permeate were too low (i.e. <RL) to demonstrate the required log removals it was necessary to spike laboratory prepared solutions containing adequate concentrations of these compounds spiked into the UV inlet. During all spiking experiments the UV/AOP product water was sent to sewer to avoid possible contamination of the recycled water. During Q1 a spiking experiment was conducted to assess the removal of NDMA, during Q3 (and repeated during Q4) spiking experiments were conducted to assess the removal of 1,4-dioxane. Details and results of each experiment are discussed in the subsections below.

2.1.4.4.1 NDMA Spiking Experiment

Objectives and Test Procedure. NDMA was spiked upstream of the UV/AOP to demonstrate the system could achieve the target removal under the aforementioned design conditions. During this experiment the reactor power was varied between the minimum and maximum settings. The reactor was operated at the design flow rate of 1 MGD and UV transmittance (UVT) of approximately 97%. In addition, the chloramines residual present in the UV/AOP feedwater was ~ 3 mg/L. The log removal of NDMA was determined for each set point. In addition 1,4-dioxane was measured in the UV/AOP feed and product to assess removal of inherent concentrations present.

The testing equipment required to conduct the spiking experiments, shown in **Figure 13**, was comprised of the following:

- Chemical Storage tank and cover– 30 gallon black polyethylene
- Chemical Storage tank mixing rod
- Chemical dosing pump
- Hydrogen Peroxide monitoring kit
- Piping and valving to make the connections between the components

1 L of NDMA stock spiking solution prepared by a certified laboratory experienced with preparing spiking solutions.

For each sample run, three individual 1.0 L influent grab samples were taken from the influent sample port and three product grab samples were taken from the product sample port. Samples were collected in UV proof (amber glass) bottles with

preservative. Samples were sent to MWH Labs for analyses using EPA method 521 (NDMA) and 525 (1,4-dioxane). All samples were analyzed for NDMA and one (1) influent and one (1) product were analyzed from each run for 1,4-dioxane.

Concurrent to sampling, the feed UVT, product H_2O_2 concentration, feed flow, temperature, target reactor power, actual reactor power, target LRV, actual LRV EEO, and lamp hours were recorded. Documentation of the number of lamps in service was also recorded.

Control – The test plan included two runs in which the UV unit was in the off position. Samples were collected from the influent and product with and without peroxide.

- Test 1 consisted of operating the UV unit at the manufacturer's recommended power setting (approximately 64%) to achieve 1.2 log removal of NDMA at 695 gpm. The H_2O_2 was dosed at 3 mg/L. Three sets of influent and product samples were collected approximately 5 minutes apart.

- Test 2 increased the UV power setting to a target of 80% of the maximum output of the UV unit and the H_2O_2 was dosed at 3 mg/L. Three influent and three product samples were collected approximately 5 minutes apart.

- In Test 3 the UV power setting was approximately 60% (minimum power setting). Three influent and three product samples were collected approximately 5 minutes apart.

- Test 4 increased the UV power settings to 100% (maximum power setting). Three influent and three product samples were collected approximately 5 minutes apart.

A total of twenty-nine (29) NDMA and eight (8) 1,4-dioxane samples were collected and analyzed as part of this spiking experiment including samples measured in the UV/AOP influent, UV/AOP product and control samples. The spiking experiment lasted approximately four (4) hours. The first hour was used to set-up and verify that the testing and dosing apparatus were operating correctly and to give the system time to reach equilibrium. During the spiking experiment the UV/AOP product was directed to sewer. Any remaining volume in the mixing tank at the conclusion of the experiment was run through the UV unit to completely destroy any remaining chemical. Following completion of the experiment the UV/AOP product was diverted to sewer for another hour to ensure the system was completely flushed before putting the product back into the North City recycled water system.

Results. Table 7 provides analytical results of NDMA and 1,4-dioxane of samples collected during the spiking experiment. Results include measurements of the batch, control samples and three (3) influent and three (3) product samples for each power set point condition. The average influent and product concentration of NDMA (ng/L) based on results from all test conditions ranged from 737 to 847 and 5.3 to 29, respectively. The analytical data also show that the inherent feed concentration and

product concentration of 1,4-dioxane sampled during each run was non-detect (ND). Control samples yielded results as expected showing similar values of influent and product NDMA concentrations with lamps off and peroxide dosing of 0 mg/L (Control 1) and lamps off and target peroxide dose of 3 mg/L (Control 2).

The analytical lab data was used to calculate the average NDMA log removal for each reactor power set point as presented in **Figure 14**. Results indicate the Trojan system achieved between 1.5 to 2.1 log removal of NDMA over the span of power settings (minimum 60% to maximum 100%) tested. The figure also presents the average target NDMA log removal recorded from the Trojan HMI for each test condition. For each power set point (100% power setting the exception) the NDMA log removal based on measured values was higher than that predicted by the Trojan algorithm.

Using the calculated NDMA log removal values, feed flow, and power measured during each test condition, values of electrical energy per order (kWh/1000 gallons/log removal) were calculated for each test condition as presented in **Table 8**. The calculated EEO values ranged from 0.176 to 0.205 over the range of power settings tested. Results showed the calculated EEO for the 64% power set point (0.188) was lower than the average EE/0 value (0.26) displayed on the Trojan system during the operating period as presented in **Section 2.1.4.1**. The data suggest the Trojan system is operating more efficiently than predicted.

The project team consulted with Trojan regarding the discrepancy of the EEO values calculated based on spiking results compared to the values calculated by the UV/AOP system algorithm. In response, Trojan compared the EEO models of the AWPF system to the UV/AOP system used at the Orange County Water District (OCWD) Groundwater Replenishment System. Trojan reported the AWP Facility system control algorithms are more complicated than OCWD's because the program structure allows for model parameters to be modified to control the system based on alternate contaminants. Furthermore, the OCWD system model does not have peroxide control so it only determines the UV dose needed for NDMA removal.

Trojan concluded that because the AWP Facility system calculates higher EEO values than the OCWD system the AWP Facility system may achieve higher than intended NDMA log reductions. Lastly, Trojan compared the two models based on a 95% feedwater UVT and showed the AWP Facility model calculated an EEO of 0.31 while the OCWD model predicted an EEO of 0.22.

2.1.4.4.2 1,4-Dioxane Spiking Experiment

Objectives and Test Procedure. During the Q3 Testing Period a second spiking experiment was conducted on the UV/AOP. The objectives of this experiment included:

1. Demonstrate the UV/AOP reactor is achieving minimum 0.5-log removal of 1,4-dioxane under the target reactor conditions to achieve 1.2-log removal of NDMA.

2. Determine EEO of the UV/AOP reactor with respect to 1,4-dioxane.

3. Assess the impact of hydrogen peroxide dose on 1,4-dioxane removal by the UV/AOP.

4. Assess the removal of 1,4-dioxane under UV dose conditions lower than the target conditions demonstrated to achieve >1.2-log removal of NDMA.

5. Gather information on the removal of select surrogate compounds by the UV/AOP process.

The experiment included four different operating conditions (Run 1 to 4) which varied in terms of target peroxide concentration, influent flow and UV reactor power. Details are provided in **Table 9**. A summary of the test conditions follow.

- Test 1 consisted of operating the UV unit at the manufacturer's recommended power setting (approximately 64%) to achieve 1.2 log removal of NDMA at 695 gpm. The H_2O_2 was dosed at 1.5 mg/L. One influent and three product samples were collected for both NDMA and 1,4-dioxane at approximately 5 minute intervals.

- Test 2 increased the H_2O_2 dose to 3 mg/L with the same flow and UV settings as Run 1. One influent and three product samples (1,4-dioxane only) were collected at approximately 5 minute intervals.

- Test 3 increased the H_2O_2 dose to 6 mg/L with the same flow and UV settings as Run 1 and Run 2. One influent and three product samples (1,4-dioxane only) were collected at approximately 5 minute intervals.

- Test 4 decreased the UV power settings to 60% (minimum power setting). The influent flow was increased by approximately 20% to further lower the UV dose. The H_2O_2 dose was set to 3 mg/L. One influent and three product samples were collected for both NDMA and 1,4-dioxane at approximately 5 minute intervals.

The target feedwater concentrations for NDMA and 1,4-dioxane were 1,000 ng/L and 20 µg/L, respectively. It was necessary to repeat the experiment during the current testing period because it was discovered that the solvent (methanol) originally used by the lab to prepare the spiking solution significantly increased the free radical demand and therefore would reduce the removal of 1,4-dioxane. Specifically, during the original experiment 1 L of methanol was used to prepare the stock solution resulting in a much greater concentration (>60X) than the spiked amount of 1,4-dioxane. During the repeated experiment the spiking solution was prepared with a solvent of DI water mixed with only 5 mL of methanol per 1 L. Though the target compounds are highly soluble in distilled water alone, the small volume of methanol was used to serve as a wetting agent and prevent the compounds from sticking to the surface of the glass container used to prepare the spiking solution.

Results. **Table 10** summarizes the results for 1,4-dioxane and NDMA measured in the batch samples, control samples, and the UV/AOP influent and product samples for the four test conditions. **Figure 15** plots average log removal values of 1,4-dioxane and NDMA versus target peroxide dose (mg/L) for Test 2 and Test 4, in which the peroxide dose was held constant at 3 mg/L but the EED was reduced (Test 4) by lowering the reactor power level and increasing the feed flow rate. As expected, the log removal of 1,4-dioxane was reduced under the lower EED conditions due to the reduced amount of free hydroxyl radical production. The average log removal of 1,4-dioxane and NDMA were 0.6 and 1.6, respectively for Test 2 but reduced to 0.39 and 1.3, respectively for Test 4.

Average values of 1,4-dioxane EEO (kWh/1000 gallons/log reduction) were 0.50 (range=0.45 to 0.58) to 0.57 (range=0.34 to 0.70) for Test 2 and Test 4, respectively. Such results are in general agreement with EEO values determined from spiking studies conducted on the full-scale AOP system located the OCWD's Groundwater Replenishment System which ranged from 0.27 to 0.58 kWh/1000 gallons/ log removal of 1,4 Dioxane (2009 WaterReuse California Section meeting, San Diego CA). **Table 11** provides calculated values of EED (kWh/1000 gallon) for the four test conditions. EED values for Tests 1, 2, and 3 were similar (i.e. 0.302 to 0.312) but approximately 27% lower for Test 4 (i.e. 0.225).

Figure 16 plots log removal of 1,4-dioxane versus target peroxide dose for Tests 1 to 3. The results show a linear relationship between log removal and peroxide dose (R^2 = 0.99). Based on this relationship, a predicted target dose of 2.3 mg/L would be required to achieve 0.5 log removal of 1,4-dioxane. The significance of these results is that it may be possible to optimize the peroxide dose to reduce O&M costs of the UV/AOP, however the overall results show it is a balance between electrical energy and peroxide dose to determine the optimal operating conditions to meet the target removal.

2.2 Comparison of MF and UF System Performance

The MF and UF systems were operated side by side for similar runtimes to compare operational and water quality performance.

A summary of operational performance of the membrane filtration systems is provided in **Table 12**.

Operating Period 1 is defined as the operational time period between the completion of the first and second chemical cleanings. During this time, the MF system operated for 5.5 months and the UF system for 5.7 months with similar fouling rates of 11 % (average decline in specific flux per month). During this time the UF system operated with a slightly lower average TMP (4.6 psi vs. 5.0 psi); however, the UF system required a higher average feed pressure (16 psi vs. 15 psi), due to a higher permeate backpressure from the longer discharge piping between the UF system and the break tank. Backpressure on the UF averaged 11.3 psi, but averaged 8.5 psi for the MF system, located immediately adjacent to the break tank. The differences in feed

pressure should therefore not be considered representative of the two systems, but are rather the result of the unique flow configuration of the intermediate piping downstream of each system.

Operational Period 2 is defined as the operational period following the completion of the second chemical cleaning. The MF system operated for over 3.4 months with a calculated fouling rate of 12% and did not require a third cleaning through the end of the current testing period. In comparison, the UF system only operated for 2 months before requiring cleaning. During this time the fouling rate for the UF was 38%, which was significantly greater (> 3 times) than that observed on the MF system over a similar time period.

Operational Period 3 (UF only) is defined as the operational period following the completion of the third chemical cleaning. The UF system operated for 1.7 months with a lower fouling rate (26% vs. 38%) and much lower average TMP (2.7 vs. 6.8) than observed during Operational Period 2. The decrease in fouling is attributed to the lower target pH (1.5 vs. 3) used during the third cleaning as opposed to the target pH of the second cleaning.

On-site water quality monitoring of the membrane filtration systems showed that both consistently produced filtrate with similar average concentrations for turbidity (<0.1 NTU), Total Organic Carbon (6.5 mg/L), and UV 254 Absorbance (0.17 cm-1). Pathogen testing showed that both the MF and UF as the first step in the purification process removed bacteria to undetectable concentrations, demonstrating greater than 3-log (99.9 percent) removal of coliform bacteria. Removal of measured viruses (bacteriophage) was greater for the UF system, but exceeded 97 percent for both the MF and UF.

The MF and UF systems achieved concentrations of Total and Fecal Coliforms that were consistently non-detect (ND) in the filtrate from both systems; however, it was observed that the UF system achieved a slightly higher log removal of bacteriophage than the MF system, which is attributable to the smaller pore size in the UF membranes. The average log removal for Somatic (n=21) and Male Specific (n=20) Bacteriophage for the MF system were greater than 3.0 and 1.1, respectively. The average log removal of Somatic (n=21) and Male Specific Bacteriophage (n=20) for the UF system were calculated as greater than 3.7 and 2.2, respectively. No quantifiable hits of either Somatic or Male Specific Bacteriophage were recorded in the UF product, suggesting that higher log removal values may have been observed had concentrations in the feed been higher. **Section 3.15** provides further discussion of microbial monitoring results based on samples collected before and after each purification process.

2.3 Comparison of RO System Train A and Train B Operation

A comparison of operational performance of RO System Trains A and B is provided in **Table 13**. The Table is organized by operational periods as discussed below.

Operating Period 1: is defined as the operational time period between the completion of the first and second chemical cleaning. During this time the systems operated for 5.6 months (Train A) and 5.9 months (Train B) with similar fouling rates of 1.4 % and 1.6 % (average decline in specific flux per month), respectively at a target feedwater recovery of 80%. During this time, Train B operated with a higher feed pressure (e.g., 139 psi vs. 133 psi) and NOP (e.g., 104 psi vs. 98 psi). The higher pressure required for Train B is attributed to the difference in membrane type and configuration (three stages vs. two stages), as the permeabilities (specific flux) were found to be similar for both membranes and were nearly identical for the first stage elements **(see Table 13).**

Operational Period 2: is defined as the operational period following the completion of the second chemical cleaning, which was conducted at run hour 6,265 for Train A and run hour 6,297 for Train B. During this time the target feedwater recovery for both systems was 85%. Following the second cleaning Train A operated for 2,144 run hours (3 months) with little fouling (2.1 % per month). However, Train B only operated for 920 run hours (1.3 months) due to the aforementioned issue with the concentrate flow meter which led to the system being operated above the target recovery (i.e. .87 to 89%). During this time fouling rate was 15% based on the decline in the overall specific flux, however the Stage 3 fouling rate was 40%. At this time the third stage was cleaned.

Operational Period 3 (Train B only): is defined as the operational period following the cleaning of the third stage membranes. During this period the system was operated with a target recovery of 80% during which time the issue with the concentrate flow meter was investigated and resolved. During this period the system operated for 591 run hours with a modest fouling rate of 2.1%.

Operational Period 4 (Train B only): is defined as the operational period during which the system was operated at 85% recovery upon resolving the aforementioned issue with the concentrate flow meter. During this time the system operated for 493 run hours (0.7 months) with a measured fouling rate of 9.9%. Because a limited amount of run time was conducted on Train B at 85% recovery it is recommended further operation be conducted to further assess the fouling rate at this recovery.

Comparison of the power consumption monitored from RO Train A (2-Stage configuration) and Train B (3-Stage configuration) during operation at 85 percent recovery shows that the RO Train B required on average 19% more energy than RO Train A. The basis for this determination follows:

- Train A – Based on the average power consumption (67,000 kWh) and permeate flow (344 gpm) monitored over 2,144 hours of operation at 85% recovery, the average power consumption per treated flow (kWh/MG) was calculated as 1,514.

- Train B – Based on power consumption (18,500 kWh) and permeate flow (347 gpm) monitored over 493 hours of operation at 85% recovery, the average power consumption per treated flow (kWh/MG) was calculated as 1,802.

Table 14 presents water quality data of the RO System Trains A and B for several key water quality parameters. The two types of membranes were projected to differ on some water quality parameters, but both systems consistently produced permeate with similar water quality characteristics. Software projections for both membranes under-predicted the Total Dissolved Solids (TDS) and chloride rejection, with the Hydranautics ESPA2 elements (Train A) closer to projections for TDS and the Toray TML20 elements (Train B) closer for chlorides. Nitrate rejection was significantly under-predicted for the ESPA2 elements, projecting a nitrate concentration of 1.4 mg/L-N in the product, but the measured average concentration was much lower, at 0.41 mg/L-N. In contrast, the TML20 software over projected the nitrate rejection, predicting a nitrate of 0.22 mg/L-N, but the measured average concentration was 0.45 mg/L-N. Overall, there was very little difference between the permeate produced by the two RO membranes tested, in spite of the initial projections that had suggested much higher nitrogen removal with the TML20 elements.

Section 3
Water Quality Monitoring Results

An extensive water quality monitoring plan was implemented for the Water Purification Demonstration Project. The detailed water quality monitoring plan including sample locations, laboratory methods, and sampling frequencies is provided in the Final T&M Plan. For thorough water quality analysis, several different laboratories were selected to conduct analysis of samples collected during the testing. The labs utilized over the testing period were: MWH Laboratories, Weck Laboratories, Biovir Laboratories, and the AQWATEC, Laboratory at the Colorado School of Mines. In addition, Laboratory Data Consultants, Inc. (LDC) was selected to perform data validation of the laboratory analyses. Multiple laboratories were selected for specific analysis performed by labs that specialize in that area, increasing accuracy and lowering detection levels. The Final T&M Plan provides specific information on the credentials and the types of analysis each lab conducted over the testing period as well as information on an Onsite Lab used during the testing period to analyze general process parameters. The overall water quality monitoring plan included the following seven categories.

- *Routine Water Quality Monitoring*. This category included nutrients (nitrogen and phosphorus); volatile organic compounds (Trihalomethanes, Methylene Chloride, 1,2-Dichloroethane); nitrosamines; 1,4-Dioxane; and TOC. Sampling frequencies ranged from bi-weekly to monthly depending on the specific parameter.

- *Microbial Monitoring*. This category included initial daily followed by weekly sampling for Total Coliform and Fecal Coliform and initial weekly followed by monthly sampling for Somatic and Male Specific Bacteriophage.

- *Basin Plan Objectives Monitoring*. This category consisted of parameters with Basin Plan numeric objectives not addressed in other sampling categories: Total Dissolved Solids (TDS), Chloride, Sulfate, Sodium, Iron, Manganese, Boron, Color, Fluoride, Phenolic compounds, pH, Temperature, Dissolved Oxygen, and Turbidity. Sampling frequencies ranged from daily to bi-monthly.

- *Quarterly Monitoring*. This category consisted of (1) compounds with Federal and State drinking water maximum contaminant levels (MCLs); (2) compounds included on U.S. EPA's priority pollutant list; (3) compounds with current CDPH Notification Levels (NLs); (4) compounds on the US EPA's current Unregulated Contaminant Monitoring Rule (UCMR3) list; (5) compounds recommended by the IAP (lithium, benzo(k)fluoranthene, and hexavalent chromium). Samples were collected quarterly.

- *Constituents of Emerging Concern (CECs).* During the Q1 and Q2 Testing Periods, an initial characterization study was conducted based on four monthly sampling

events for 92 CECs, including pesticides, herbicides, pharmaceuticals, and ingredients in personal care products representing a wide range of chemical and physical properties. The initial characterization study included monitoring of health-based and performance-based indicators recommended by the State Water Resources Control Board's (SWRCB) expert panel on CEC monitoring for groundwater recharge projects that utilize RO/AOP. The complete report produced by the expert panel can be found online at the following website: **http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/recycledwater_cec.shtml.** Thirty CECs were selected for monitoring as potential treatment performance indicators based on occurrence in the RO feed water as measured during the initial characterization study or CECs recommended by the IAP. Weekly samples were collected over a period of four weeks.

- *Whole Effluent Toxicity Testing*. This program, conducted during the Q2 Testing Period, consisted of acute and chronic toxicity assays for a blend of UV/AOP product and Lake Murray water (local reservoir primarily holding imported water) and a control sample. The chronic test organisms were Ceriodaphnia dubia (water flea), Pimephales promelas (fathead minnow) and Selenastrum capricornutum (green algae). The test organisms used for the acute testing were Ceriodaphnia dubia and Pimephales promelas.

- *Quality Assurance/Quality Control (QA/QC) Testing*. A QA/QC Plan was developed for the project consisting of the collection and analysis of field duplicates, blind duplicates, travel blanks, field blanks, and split samples. In addition, third-party validations were performed by Laboratory Data Consultants, Inc. (LDC) using United States Environmental Protection Agency USEPA Level IV guidelines to assess data quality and review laboratory and sample handling procedures by WECK and MWH Labs.

There was some overlap for parameters in the different categories. For example, some of the constituents included in the routine monitoring category were also assessed as part of the quarterly monitoring category. The subsections below present the results for each constituent category. **Section 3.6** summarizes the water quality results for both regulatory relevant and non-regulated constituents measured of the purified water and compares the results to the proposed demonstration goals as outlined in the Final T&M Plan. As noted in the Final T&M Plan, the goals for each parameter were established based on the anticipated regulatory requirements using the best available information at that time and may be subject to change.

3.1 Routine Water Quality Monitoring

This section provides the cumulative results of routine sampling and analysis, conducted from 8/1/11 to 7/31/12. Samples were collected at various locations throughout the purification process as identified in the general AWP Facility Process Schematic provided in **Figure 17.** As shown, ammonia hydroxide and sodium hypochlorite were added upstream of the MF and UF system to achieve a target

residual of 3 mg/L chloramines as a means of controlling biological fouling of the membrane systems.

During the Q1 Testing period, all samples were collected as grab samples; however beginning with the Q2 Testing period, 24-hour composite samples were collected (when appropriate or feasible) or by grab samples. In general, composite samples are more representative than grab samples as they capture changes in feed water quality and/or treatment performance over a given time period. The tables referenced in this section are organized by parameter, sample date, sample type (grab or composite), sample location and include statistical parameters (i.e. average, number of samples (n), maximum, minimum and standard deviation). Sample results reported as equal to or greater than the laboratory reporting level (RL) are considered to be measured concentrations. Sample results less than the RL but greater than the method detection limit (DL) were detected but not quantifiable and are noted as less than the RL value (i.e., <RL). Sample results reported as less than the DL are considered to be below levels of detection and are noted as <DL. For purposes of calculating statistical parameters, results reported below the RL were considered as 50% of the RL value and for values reported below the DL a value of 50% of the DL was used.

Based on comments from the Project's Independent Advisory Panel (IAP) as outlined in the February 2, 2012 memorandum: *Recommendation from IAP: Draft Memorandum: Findings and Recommendations of the Advanced Water Purification Facility Subcommittee, February 2, 2012*, efforts were made during the Q3 and current testing period to time sequence all sample collection. The purpose was to allow tracking of process performance in parallel with the hydraulic detention time of each reactor to monitor changes in approximately the same slug of water (i.e., plug flow) as it passes through each treatment processes.

A brief summary of the results is provided below for each constituent or constituent group monitored routinely.

3.1.1 Nitrogen and Phosphorus

Table 15 provides the results for various forms of nitrogen and Total Phosphorus from samples collected at various locations throughout the purification process during the previous and current testing periods. The majority of samples collected were 24 hour composites. The specific parameters evaluated are: Ammonia, Total Kjeldahl Nitrogen (TKN), Nitrate+Nitrite, Nitrite, Total Nitrogen, and Total Phosphorus. Total Nitrogen values were calculated by summing the concentrations of nitrate-N + nitrite-N and TKN (organically bound nitrogen + ammonia). Individual nitrate concentrations were calculated by subtracting measured concentrations of nitrite-N from measured concentrations of (nitrate-+nitrite as N). The following convention was followed for the calculations:

- If nitrite as N was below the DL of 0.010 mg/L no subtraction was done. In this case, nitrate-N was determined to be the same value as the nitrate-N + nitrite concentration.

- If nitrite as N was between the DL and the RL (0.10 mg/L) and was 10% or greater of the nitrate-N + nitrite concentration, the result was subtracted from the nitrate-N + nitrite to calculate a value for nitrate-N.

A discussion of the nutrient results to date for different parameters is provided below.

- **Ammonia –** During the previous testing periods, the average ammonia concentration (n=71) in the UV/AOP product water using grab and composite samples was 0.20 ±0.09 mg/L-N. Similar values were measured during the current testing period using composite samples with the average ammonia concentration (n=22) measured in the UV/AOP product of 0.23 ±0.04 mg/L-N. Results of ammonia samples collected during the testing period before and after each purification process indicate the RO and the UV/AOP achieved an average (n=23) removal of 77% and 50%, respectively. It should be noted that the test method for ammonia does not distinguish between free ammonia and ammonia complexes, such as monochloramine and dichloramine, which have different removal rates in both the RO and UV/AOP.

- **Total Nitrogen** - The average value of total nitrogen (n=74) reported during the previous testing periods for the UV/AOP product water using grab and composite samples was 0.80 ±0.17 mg/L-N. Slightly higher values were reported for the current testing period using composite samples with the average value of total nitrogen (n=22) of 1.10 ±0.28 mg/L-N. The total nitrogen concentration in the sample collected on 5/31/12 was 2.2 mg/L-N (predominantly TKN). The cumulative average (n=96) total nitrogen concentration from all testing periods in the UV/AOP product water was 0.87 ±0.23 mg/L-N. The demonstration goal for total nitrogen based on anticipated CDPH requirements is 5 mg/L-N.

- **Nitrate –** During the previous testing periods the average nitrate concentration (n=74) in the UV/AOP product was 0.65 ±0.11 mg/L-N. Slightly higher values were reported for the current testing period with the average nitrate concentration (n=22) of 0.99 ±0.14 mg/L-N. The average concentration (n=96) of nitrate based on cumulative results of all testing periods was 0.73 ± 0.19 mg/L-N. It was also observed over all testing periods that both RO systems achieved similar rejection of nitrate even though the Toray membranes were projected to reject more nitrate than the Hydranautics membranes The average nitrate rejection (%) for Hydranautics ESPA 2 and Toray TML (n=23) based on the total number of results from all testing periods is 96.6% and 96.3%, respectively. It was also observed that the concentration of nitrate in the RO permeate is consistently slightly lower (average 26% lower) than values measured in the UV/AOP product water. This is attributed to the oxidization of ammonia to nitrate that occurs across the UV/AOP process.

- **Total Phosphorus –** During the previous testing periods, the average value of total phosphorus (n=66) measured in the UV/AOP product water based on grab and composite samples was 19 µg/L-P (0.019 mg/L-P). During the previous

testing period, four results reported in the UV/AOP product water were higher than expected: 3/8/12, (420 µg/L-P); 3/15/12 (140 µg/L-P); 3/22/12 (140 µg/L-P); and 4/16/12 (120 µg/L-P). These results were from sampling events when samples were only taken from the UV/AOP product water. Therefore, during the current reporting period additional samples were taken at sample locations upstream (i.e. tertiary effluent prior to chlorination and RO permeate) of the UV/AOP product water. Results showed the average (n=10) concentration of total phosphorus in the tertiary effluent and RO permeate was 1,385 µg/L and <10 µg/L, respectively. These results represent an average removal of total phosphorus by the RO system of > 99.3 %. During the current testing period the average concentration (n=22) of total phosphorus measured in the UV/AOP product water was <10 µg/L-P (0.010 mg/L-P). The average concentration (n=88) of total phosphorus based on cumulative results of all testing periods based on grab and composite samples was 16 ±50 µg/L-P (0.016±0.050 mg/L-P).

3.1.2 Disinfection By-products, Methylene Chloride, 1,2-Dichloroethane, and Naphthalene

Table 16 presents results for volatile organic compounds (VOCs) including Trihalomethanes (THMs), Methylene Chloride, 1,2-Dichlorethane and Napthalene. Results for THMs include Total THMs along with individual compounds (*Dibromochloromethane, Chloroform, Bromoform and Bromodichloromethane,*). **Table 17** presents results for Haloacetic Acids (HAAs). Results for HAAs include Total HAA5, along with individual compounds (*Dibromoacetic acid, Trichloroacetic acid, Dichloroacetic acid, Monobromoacetic acid, Monochloroacetic acid*).

A discussion of the results for the various parameters listed above is provided below.

- **Total THMs –** The average (n=9) concentration of Total THMs (TTHMs) measured in the UV/AOP product water during the previous testing periods was below the RL (2 µg/L). All samples (n=3) analyzed during the current testing period were below the RL or DL (0.6 µg/L) in the UV/AOP product water making the cumulative average of all testing periods <2 µg/L. Note: Because THMs are volatile and require a short holding time, all samples were collected as grab samples. The demonstration goal for TTHM's is <80 µg/L based on the drinking water maximum contaminant level (MCL) which is anticipated to be the CDPH limit for surface water augmentation using purified water.

- **Bromoform –** All samples (n=12) analyzed in the RO permeate and UV/AOP product during the previous t testing periods and the current testing period were less than the DL (0.19 µg/L). The anticipated regulatory limit presented in the Final T&M Plan is based on the California Toxic Rule (CTR) criterion of 4.3 µg/L.

- **Dibromochloromethane (DBCM) -** All samples (n=9) analyzed in the UV/AOP product water during the previous testing periods were less than the DL=0.2 µg/L. During the current reporting period three additional monthly samples were

analyzed from the UV/AOP product. The calculated average concentration for the current reporting period is 0.14 µg/L. Two of the sample results were less than the DL. However, the third result from the 6/4/12 sampling was 0.6 µg/L. This result is questionable because results for samples collected on the same day in the tertiary effluent and RO permeate were 0.6 µg/L and <RL (0.5 µg/L), respectively. The cumulative average for this compound for all testing periods is less than the RL (0.5 µg/L), which meets the demonstration goal for DBCM of <RL (0.5 µg/L). The anticipated regulatory limit presented in the Final T&M Plan is based on the CTR criterion of 0.401 µg/L.

- **Bromodichloromethane (BDCM) –** All samples (n=9) analyzed in the UV/AOP product water during previous testing periods were less than the RL (0.5 µg/L) with the exception of samples collected on 8/1/11 (0.71 µg/L) and 3/6/12 (0.56 µg/L). During the current testing period three additional monthly samples were collected from the UV/AOP product water. Two of the sample results were less than the RL. However, the third result (sampling date 6/4/12) was 0.85 µg/L. This result is questionable because results for samples collected on the same day in the tertiary effluent and RO permeate were both lower in concentration (i.e. 0.78 µg/L and 0.66 µg/L, respectively) than the UV/AOP product water). The cumulative average of 0.33 µg/L (n=12) for this compound for all testing periods is less than the RL (0.5 µg/L), which meets the demonstration goal of less than 0.56 µg/L. The anticipated regulatory limit presented in the Final T&M Plan is based on the CTR criterion of 0.56 µg/L.

- **Methylene Chloride –** All monthly samples (n=3) analyzed during the current testing period from the UV/AOP product were below the RL (0.5 µg/L) or DL (0.14). The average (n=12) concentration in the UV/AOP product water based on cumulative results from all testing periods is less than the RL, which is below the demonstration goal of <4.7 µg/L. The anticipated regulatory limit presented in the Final T&M Plan is based on the CTR criterion of 4.7 µg/L.

- **1,2-Dichloroethane -** All monthly samples (n=12) analyzed in the UV/AOP product during all testing periods were below the DL of 0.12 µg/L, which is below the demonstration goal for this parameter of <0.38 µg/L. The anticipated regulatory limit presented in the Final T&M Plan is based on the CTR criterion of 0.38 µg/L.

- **Naphthalene –** All samples (n=3) analyzed in the RO feed and RO permeate during the previous and current reporting period were below the DL. This compound was monitored based on recommendation from the IAP for the purpose of assessing removal by the RO system. Because all samples were below the DL, removal rate by RO could not be determined.

- **HAA5, Total -** All monthly samples (n=12) analyzed in the UV/AOP product during all testing periods were below the DL (1 µg/L) in both the RO permeate and UV/AOP product water, which is below the demonstration goal for HAA5,

Total of <60 µg/L. The anticipated regulatory limit (60 µg/L) presented in the Final T&M Plan is based on the drinking water MCL which is anticipated to be the CDPH limit for surface water augmentation using recycled water.

3.1.3 Nitrosamines & 1,4-Dioxane

Tables 18 and 19 provide results for nitrosamines and 1,4-Dioxane, respectively, sampled at various locations throughout the AWP Facility. Because nitrosamines form in the presence of chloramines, all samples were collected as grab samples. All samples of 1,4-Dioxane during the previous and current testing period were collected as composites. Results are presented for NDMA and the seven other nitrosamine compounds listed below:

- N-Nitrosodiethylamine (NDEA)
- N-Nitrosodi-n-butylamine (NDBA)
- N-Nitrosodi-n-propylamine (NDPA)
- N-Nitrosomethylethylamine (NMEA)
- N-Nitrosomorpholine (NMOR)
- N-Nitrosopiperidine (NPIP)
- N-Nitrosopyrrolidine (NPYR)

A discussion of the results to date compared to the proposed demonstration goals is provided below.

- **Nitrosamines -** All routine samples (n=15) collected during all testing periods show that the concentrations of all the nitrosamines in the RO permeate were below the RL or DL. The majority of samples analyzed in the UV/AOP product water were also below the RL or DL with the exception of one sample with NDMA reported at a value of 5.5 ng/L (sample date 1/3/12). It was observed that the concentration of NDMA in the RO permeate on the same day was reported at the RL of 2 ng/L. The lab reanalyzed the UV/AOP product sample and reported the result as ND; however, the result is considered inconclusive as the sample was past the holding time required for the analytical method. On three occasions (12/1/11, 1/3/12, 4/23/12), the concentration of NDEA was also reported to be above the RL in the UV/AOP product water with concentrations measured in the RO permeate on the same day below the RL. All results for NDMA, NDEA, and NDPA measured in the UV/AOP product water were below the current CDPH drinking water Notification Levels (NL) of 10 ng/L for each chemical. It is not clear how NL-based requirements might be applied in permits for surface water augmentation projects at this time. The treatment performance goal for NDMA was 1.2 log

removal across AOP. Additional information on removal of nitrosamines is provided in **Section 2.1.4**.

- **1,4-Dioxane -** All monthly samples (n=12) collected in the RO permeate during all testing periods were below the RL of 0.5 µg/L. All samples (n=12) collected in the UV/AOP product water were below the DL of 0.040 µg/L. The average (n=11) concentration of 1,4 Dioxane measured in the RO feed water based on cumulative results from all testing periods was less than 2 µg/L. The treatment performance goal was to achieve 0.5-log removal across the AOP. This goal was demonstrated during the current reporting period by conducting challenge testing on the UV/AOP system as presented in **Section 2.1**. While CDPH has established a NL of 1 µg/L for 1,4-Dioxane, it is not clear how NL based requirements might be applied in permits for surface water augmentation projects at this time.

3.1.4 Total Organic Carbon (TOC)

Table 20 provides the results for TOC sampled at various sample locations throughout the purification process. The majority of samples collected during the current testing periods were collected as composites. Results from all testing periods (n=97) show the average TOC concentration measured in the UV/AOP product water is below the RL of 0.3 mg/L. The demonstration goal for TOC is 0.5 mg/L based on the anticipated CDPH requirement for use of recycled water for surface augmentation. The results of TOC measured before and after the RO systems show an average (n=12) removal of greater than 97.4%.

It should be noted on one occasion during the Q2 testing period (1/12/12), the TOC result for the sample collected in the UV/AOP product was reported at 1.4 mg/L. The laboratory reanalyzed the sample and confirmed the original result. However, the online TOC measured in the RO product (**see Section 4.2.1.**2) was consistently below 0.07 mg/L on the day of the sampling event, and the lab reported values in the UV/AOP product water before and after this result were consistently below the RL. Statistical analysis of the entire set of lab results for TOC measured in the UV/AOP product identified the result of 1.4 mg/L to be an outlier and is not considered representative of the TOC concentration consistently reported in the UV/AOP product water. It is likely that the high TOC value is the result of a contaminated sample or mislabeled sample bottle.

It should be noted TOC values measured online in the RO permeate throughout the testing period were much lower (**i.e. ranged from 0.02 to 0.08 mg/L**) than lab results, which were reported below the labs quantifiable limit of 0.3 mg/L. Based on discussion with the manufacturer of the online TOC analyzer, GE Power and Water, online analyzers can detect lower amounts of organics due to the fact there are no organic interferences in the measurement system. In addition, during the collection of field samples for laboratory analysis, samples can be contaminated with organics from the several sources including the sample vials themselves and carbon dioxide from the atmosphere. The operating specifications for the online analyzer used during

the demonstration project had an operating range of 0.03 µg/L to 50 mg/L with accuracy of ±2% or 0.5 µg/L, whichever is greater.

3.1.5 Microbial Monitoring

Tables 21 and 22 present results for Coliform (Total and Fecal) and naturally occurring Bacteriophage (Somatic and Male Specific), respectively, measured before and after each AWP Facility unit process. Results for total and fecal coliform samples (n=12) collected weekly during this testing period were <DL for all samples collected in the MF filtrate, UF filtrate, RO feed, RO permeate (Trains A and B) and UV/AOP product water. The cumulative number of samples collected during all testing periods from each sampling location was 85. Of these, all results were ≤DL for total and fecal coliform with the exception of 3 total coliform results reported at low concentrations: UF filtrate (2.2 MPN/100 mL, 3.6 MPN/100 mL) and RO feed (5.1 MPN/100 mL). These results are attributed to bacterial growth which occurred in the sample lines located on the filtrate/permeate side of the membranes. Upon flushing and disinfection of the lines no further detections occurred. Overall the results showed that both the MF and UF, as the first step in the purification process, removed bacteria to undetectable concentrations, demonstrating greater than 3 log (99.9 percent) removal of coliform bacteria.

The results of monthly sampling for Somatic (n=21) and Male Specific Bacteriophage (n=20) collected for each sample location for the current and previous testing periods are discussed below. EPA Method 1602 (DL=1 pfu/100 mL) was used to analyze all tertiary effluent samples while a more sensitive method, EPA Method 1601 (Present or Absent per L), was used for MF filtrate, UF filtrate, RO Permeate, and UV/AOP product. Duplicate samples were collected for these locations so that in the event detection occurred using EPA Method 1601, the laboratory could perform the analysis using EPA Method 1602. As noted in **Table 22** the samples for Somatic Bacteriophage using EPA 1601 on 5/29/12 were analyzed past the recommended hold time due to laboratory issues and therefore no bacteriophage results are presented for this sampling date. A follow up sampling was conducted on 6/18/12, however because this reduced the overall number of sample results collected during the testing period an additional sampling was conducted on 9/10/12.

Overall the results showed that both the MF and UF, as the first step in the purification process, achieved high removal of bacteriophage. The MF and UF systems achieved composite virus removals (Somatic plus Male Specific) greater than 99.8 percent and 99.97 percent, respectively. The higher removal by the UF is attributed to the smaller pore size. All bacteriophage results for the purified water were Absent. A summary of results measured over the testing period for each sampling location is below.

- **Tertiary Effluent –** During this testing period, Somatic Bacteriophage concentrations ranged from 578 to 1500 pfu/100 mL; and Male Specific Bacteriophage concentrations ranged from 4 to 9 pfu/100 mL. These results are

comparable to data collected during the prior testing periods. Somatic Bacteriophage ranged from 99 to > 3000 pfu/100 mL and Male Specific Bacteriophage ranged from > 1 to 67 pfu/100 mL.

- **UF Filtrate –** All samples of Somatic and Male Specific Bacteriophage collected during the current testing period were reported as Absence per L using EPA Method 1601 with the exception of the sample collected on 6/18/12 where the Somatic Bacteriophage was reported as Present per L. The sample was then run using EPA Method 1602 and the result was <1 pfu/100 mL. During the prior testing periods all Male Specific Bacteriophage were reported as Absence per L. For Somatic Bacteriophage, 2 samples were reported as Present per L. The samples were then run using EPA Method 1602 and the results were <1 pfu/100 mL.

- **MF Filtrate –** Somatic and Male Specific Bacteriophage collected during this testing period ranged from Absence per L to <1 pfu/100 mL. During the prior testing periods, Somatic Bacteriophage ranged from Absence per L to 10 pfu/100 mL and Male Specific Bacteriophage ranged from Absence per L to 11 pfu/100 mL. Note the higher concentration of bacteriophage in the MF filtrate compared to the UF filtrate is attributed to the difference in membrane pore size.

- **RO Permeate Trains A & B –** All samples of Somatic and Male Specific Bacteriophage during the current testing period were reported as Absence per L. During the prior testing periods, all bacteriophage samples were reported as Absence per L with the exception of the sample collected on 12/12/11 from Train A permeate. For this sample, the Male Specific Bacteriophage was reported as Present per L. The sample was then run using EPA Method 1602 and the result was <1 pfu/100 mL.

- **UV/AOP Product –** During the current and prior testing periods, all sample results for Somatic and Male Specific Bacteriophage were Absent per L.

- **Overall Log Removal Value (LRV) –** Based on sampling results , the average concentrations of Somatic (n=21) and Male Specific (20) Bacteriophage in the tertiary effluent compared to the UV/AOP product indicate the AWP Facility purification process achieved log reduction values (LRV's) greater than 4.2 and 2.2, respectively for removal of naturally occurring phage.

Overall the microbial monitoring results to date demonstrate the ability of the AWP Facility to provide a barrier to bacteria and pathogens.

3.1.6 Basin Plan Numeric Objectives

The Basin Plan Numeric Objectives are provided in **Table 23**. It should be noted that the nutrient requirements (including phosphorus and nitrogen) for the potential Full-Scale Facility have not been established at the time of this report. **Table 24** provides results for general parameters with Basin Plan Numeric Objectives not presented elsewhere in this report, including: total dissolved solids (TDS), chloride, sulfate,

sodium, iron, manganese, boron, color, fluoride and phenolic compounds. In general each of these parameters present in the RO feedwater were shown to be highly removed (>95%) by the RO systems with the exception of boron for which the average removal was only approximately 42% (similar rejection by both Train A and Train B membranes). The average concentration (229 µg/L) of boron measured in the purified water was 4 times lower than the Basin Plan Objective of 1,000 µg/L (1 mg/L).

All results collected during the Q1 through Q4 Testing Periods showed the purified water met the Basin Plan objectives with the exception of three occasions when phenolic compounds were reported above the Basin Plan Objective of 1 µg/L. The sample dates and reported results for the three occasions follow: 9/1/2011 (22 µg/L), 10/24/11 (1.9 µg/L) and 11/21/11 (2.6 µg/L). The 9/1/2011 (first sample analyzed during the Q1 Testing Period) result is considered an outlier as the sample was analyzed using method EPA 420.4 (RL=10 µg/L), which only measures total phenolics thereby making analyses prone to interferences. Subsequent samples were analyzed using method EPA 8270 which quantifies individual (14 total) phenolic compounds, with a RL of 1 µg/L. The 10/24/11 and 11/21/11 results for the purified water are also questionable as RO permeate composite samples collected on the same day were lower in concentration. The laboratory reanalyzed the samples and confirmed the results. It should also be noted, based on discussions with the laboratory that conducted the analysis, the 12/19/11 samples were re-extracted and reanalyzed past hold time due to the likelihood of lab contamination. All other results showed phenolic compounds (14 total) measured in the RO permeate and UV/AOP product during the previous and current testing periods were <1 µg/L in both the RO permeate and UV/AOP product water.

Table 25 presents on-site water quality measured in the UV/AOP product water for other constituents with Basin Plan numeric objectives including: pH, Dissolved Oxygen (DO), and Turbidity. To date, the results for DO and Turbidity meet Basin Plan objectives; the pH ranged from 5.2 to 6.5, which was within the expected range without chemical stabilization.

3.2 Quarterly Monitoring

During the current and previous testing periods, quarterly monitoring of various compound groups was conducted by collecting grab samples of the North City tertiary effluent, UV/AOP product water and imported raw aqueduct water (IAW). The specific compound groups evaluated on a quarterly basis are:

- Compounds with Federal and State Primary and Secondary Drinking Water Maximum Contaminant Levels;
- Compounds included on EPA's Priority Pollutant List as defined by the California Toxic Rule;
- Compounds with current CDPH NLs;

- Proposed Contaminants from EPA's Unregulated Contaminant Monitoring Rule (UCMR3) Assessment Monitoring (List 1 and List 2);
- Other Radionuclides (Cesium-137, Iodine-129, Iodine-131);
- Other Compounds: Lithium, benzo(k)fluoranthene, hexavalent chromium.

The results of the fourth quarter sampling event (5/1/12) for each compound group are summarized below. Note: Several compounds appear in multiple compound groups. The summary tables presented below also include data from the previous testing periods.

3.2.1 Federal and State Drinking Water MCLs

Tables 26 and 27, respectively, present results for compounds regulated under Federal and State Primary and Secondary drinking water standards. Consistent with results from the Q1, Q2, and Q3 Testing periods, the concentrations of constituents measured in the UV/AOP product water were all below MCLs for Federal and State Drinking Water Standards with the exception of pH (Federal Secondary MCL=6.5 to 8.5; there is no State MCL for pH) and corrosivity (Federal MCL= Non Corrosive; there is no State MCL for corrosivity). The AWP Facility does not include chemical stabilization as the product water is blended with tertiary recycled water for non-potable uses. Chemical stabilization at the potential Full Scale Facility would address pH and corrosivity.

3.2.2 EPA California Toxic Rule Priority Pollutants

Tables 28, 29 and 30 present results of compounds included on the EPA's Priority Pollutant list that were detected in samples collected in the NCWRP tertiary water, UV/AOP product water and IAW, respectively, during the testing periods. The EPA Priority Pollutant list (126 compounds) is provided in **Table 31** for reference. A summary of the results for each sample location follows:

- **Tertiary Effluent –** Samples analyzed showed only eight ccompounds were reported above the RL all of which were below their respective CTR criterion. During the previous testing periods a similar number of compounds were reported above the RL. A total of four results were reported above their respective CTR criterion during all testing periods. These results follow: BDCM at 1 µg/L (Q1) and 0.58 µg/L (Q2), DBCM at 0.65 µg/L (Q1), and NDMA at 2.9 ng/L (Q1).
- **UV/AOP Product Water –**Samples analyzed during the current testing period showed all compounds reported in the UV/AOP product water were at concentrations less than their RL or DL. Similar results were reported for the Q1, Q2 and Q3 Testing periods. Only one result was reported above the CTR criterion. The result was BDCM at 0.78 µg/L (CTR criterion of 0.56 µg/L) reported during the Q1 Testing period. All subsequent quarterly results for BDCM were reported as less than RL (0.5 µg/L). It was also observed the di-n-butyl phthalate results were

<DL (DL=0.24 µg/L) for all testing periods with the exception of the Q1 Testing Period with a reported results of 2.2. µg/L, which was still well below CTR criterion of 2700 µg/L. The higher value reported for Q1 may have resulted from UV light exposure to the PVC (polyvinyl chloride) piping located just downstream of the UV reactor. In general, phthalates are typically used as plasticizers and are primarily used as softening agents for PVC.

- **IAW –** Samples analyzed showed eight compounds were reported in the imported raw aqueduct water above their RLs. Of these, three compounds were reported above their CTR criterion: BDCM (19, 14, 10, and 10 µg/L), DBCM (21, 14, 14, and 15 µg/L), and bromoform (3.5, 2.9, 3.8, and 6.2 µg/L). BDCM and DBCM were reported above their criterion during all testing periods.

3.2.3 CDPH Notification Levels

Table 32 presents results of the 30 compounds with current CDPH notification levels (NLs). Overall similar results were seen for the previous testing periods. Results from the current testing period show all sample locations were below the NL's for all compounds with the exception of 1,4-Dioxane at 1.6 µg/L in the tertiary effluent, which was just above the NL of 1 µg/L. Ethylene glycol (EG) was also reported <RL (50 mg/L) in the tertiary effluent and UV/AOP product water. As noted, because the RL for EG was above the NL (14 mg/L) additional samples were collected (samples dates 8/13/12 and 8/15/12) in both the tertiary effluent and UV/AOP product water. The samples were analyzed using a more sensitive method (RL=1 mg/L). All results were <DL (DL=0.5 mg/L). The NL results also showed slightly higher concentrations of formaldehyde (Q1, Q2, Q3, Q4) were measured in the UV/AOP product water as compared to the tertiary effluent. All results were below the respective NL. Similar results were observed from analysis done as part of the routine sampling as discussed in **Section 2.1.4.3** and **Section 3.1.3**.

3.2.4 UCMR3 Compounds

Table 33 presents results of the 30 compounds proposed for the EPA's Unregulated Contaminant Monitoring Rule (UCMR3) Assessment Monitoring (List 1and List 2). EPA uses the UCMR Monitoring program to collect data for contaminants suspected to be present in drinking water, but that do not have health-based standards set under the Safe Drinking Water Act (SDWA). As shown, the reporting levels for many of these compounds are extremely low. Results from the current testing period show 27 of the compounds were <RL or <DL in the UV/AOP product water. The remaining three compounds that were found at concentrations above their RLs were bromochloromethane, hexavalent chromium and strontium. Similar results were seen for the previous testing periods with the exception of strontium which was reported <RL (0.3 µg/L) for the previous testing periods. The concentration of strontium reported in the UV/AOP product water during this testing period was 0.37 µg/L, which is just above the RL. Based on average the average concentration of quarterly sampling results values (n=4) measured in the tertiary water (443 µg/L) and the UV/AOP product water (<0.3 µg/L) the AWP achieved a high level and consistent

removal (>99.9%) of strontium during all testing periods. The average concentration of strontium measured in the IAW water was 403 µg/L. Additional information on strontium, bromochloromethane, and hexavalent chromium results is provided in **Section 3.6.2**.

3.2.5 Other Radionuclides

Radiation sources provide critical capabilities in the oil and gas, electrical power (utilities) construction, manufacturing, and food industries. They are used to treat millions of patients each year in diagnostic and therapeutic procedures and also are used in a variety of military applications. Radionuclides are commonly used for pharmaceutical research, fluorescent fixtures, wall tiles, luminous devices like exit signs, gauges and watches, electric arc welding for aircraft, petrochemical and food processing industries, test the integrity of pipe welds, nuclear power plants and propulsion systems, lighting rods, electric blanket thermostats, indicator lights in household appliances, sterilization of surgical instruments, treating cancerous tumors, biological and agricultural research, inspect airline luggage for explosives, gauge moisture content in soils, smoke detectors, analyze metal alloys, providing coloring and fluorescence in colored glazes and glassware, and more.

Radionuclides are regulated in drinking water to protect public health from potential harmful effects of radiation. Radionuclides are naturally occurring and thus commonly found in natural water supplies, particularly groundwater. Most radioactive contaminants are at levels that are low enough to not be considered a public health concern, but at higher levels long-term exposure to radionuclides in drinking water could increase the chances of developing cancer or cause toxic effects to the kidney. Radionuclides are unstable isotopes and elements that give off various types of radiation as they decay into more stable forms. Drinking water regulations are established for both Gross Alpha and Gross Beta, which represent the total measured quantity of alpha and beta radiation emitted by any radionuclides present in the water. Gross Alpha measures alpha radiation or alpha particles, which are released by large molecular weight unstable elements, such as Uranium and Radium isotopes. Gross Beta measures beta radiation or beta particles, released by numerous unstable isotopes, such as Cesium-137, Strontium-90, Tritium, and Iodine isotopes. In addition, maximum contaminant levels (MCLs) have been established for specific radionuclides, including Radium-226 and 228, Tritium, Strontium-90, and Uranium.

Measurements of radionuclides are presented in units different than other drinking water parameters. Radionuclides are commonly expressed in terms of radiation output (picocuries per liter or pCi/L) or millirems per year (a unit of ionizing radiation dose), rather than as a weight concentration, such as milligrams per liter (mg/L). In addition, sample results can often be negative and have ranges of values rather than definitive numbers, making the interpretation of the reported results seemingly more complex than other contaminants measured in water supplies. Because ambient radiation exists throughout the environment, sample values are reported in the positive when measured values are above, or negative when below the

ambient radiation in the location where testing is conducted. Radiochemical analyses of drinking water, as part of their methods, also include the determination of counting errors (CEs). CEs reflect the randomness of the natural decay of radionuclides and are a statistical expression of the variability in analytical procedures.

The California Department of Public Health (CDPH) requires measurement of Gross Beta and two specific beta emitters, Tritium and Strontium-90, in drinking water. In the event that the Gross Beta results exceed the federal standard of 4 millirems per year or the equivalent CDPH standard of 50 pCi/L, additional sampling is required for individual beta emitters, such as Cesium-137, Iodine-129, and Iodine-131. Although it was anticipated that the Gross Beta level of the purified water would be less than the Gross Beta MCL, the Testing & Monitoring Plan included quarterly monitoring of Cesium-137, Iodine-129, and Iodine-131 in the tertiary effluent, purified water, and raw imported aqueduct water to provide additional information about the purified water quality. **Table 34** presents the results for Cesium-137, Iodine-129, and Iodine-131 for Quarter 1 (Q1), Quarter 2 (Q2), Quarter 3 (Q3), Quarter 4 (Q4), and an additional sampling event on 7/9/12.

As shown in **Table 34**, the results are shown with the associated minimum detectable activity (MDA) and CEs reported by the laboratory that conducted the analysis. The MDA is defined as the smallest concentration of radioactivity in a sample that can be detected with a 5 percent probability of erroneously detecting radioactivity, when in fact none is present (Type I error) and also, a 5 percent probability of not detecting radioactivity, when in fact some is present (Type II error). Per American National Standards Institute (ANSI) Standard 13.30 (Performance Criteria for Radiobioassay), several factors affect the MDA, including the duration of the sample count, the volume of sample counted, the efficiency of the detector used, the background of the detector used, the decay during sample hold time and counting (for short-lived isotopes), and the measured radiation from the analysis. The MDA is a calculated value, which will vary for each analysis depending on the values of these factors.

Gross Beta measurements were conducted quarterly in the purified water and were less than 50 pCi/L. Consequently, individual measurements of Cesium-137, Iodine-129 and Iodine-131 were not required by regulation, but were measured anyway in accordance with the Testing & Monitoring Plan. Results from Q1, Q2, Q3 and Q4 show that Cesium-137, Iodine-129, and Iodine-131 were measured at or lower than the MDA in the purified water. If the Gross Beta did exceed 50 pCi/L, the EPA has published limits for individual beta emitting radionuclides:

http://www.epa.gov/superfund/health/contaminants/radiation/pdfs/att_d-clean.pdf

These limits are based on concentrations equivalent to an exposure of 4 millirem per year, which is the federal MCL for Gross Beta. The limits for Cesium-137, Iodine-129, and Iodine-131 are:

- Cesium-137 less than 200 pCi/L

- Iodine-129 less than 1 pCi/L
- Iodine-131 less than 3 pCi/L

The results from the quarterly sampling show that Cesium-137 was consistently below this limit in the purified water. However, the laboratory selected MDAs for Iodine-129 and Iodine-131 that were too high to confirm that the samples met the limits cited above. A fifth sampling event was conducted on 7/9/12 during which the lab targeted an MDA of less than 1 pCi/L for both Iodine-129 and Iodine-131. The results presented in Table 33 show the concentration of Iodine-129 in the purified water was below the 1 pCi/L limit and Iodine-131 was below the 3 pCi/L limit.

The Q1 and Q2 results for Cesium-137, Iodine-129, and Iodine I-131 were originally presented in Draft Quarterly Testing Report No. 2 and subsequently posted by the City on a public website. However, incorrect results were presented. The Q1 and Q2 results for Cesium-137, Iodine-129, and Iodine-131 presented in the Draft Quarterly Testing Report No. 2 (submitted to the City on 3/3/12) reflected a discrepancy that was discovered shortly after the City posted the Q1 and Q2 water quality results on the City's project website.

An example of the discrepancy between the correct data and the previously reported data is that the laboratory result of "U" reported for Iodine-131 was incorrectly converted to a value of 16 pCi/L. A result of "U" indicates that the radionuclide was not detected at a value greater than the MDA. In this example, the MDA was 16 pCi/L, meaning that if the radionuclide was present it would be at a value between 0 to less than 16 pCi/L (or negative due to background), but was not quantifiable based on the sensitivity of the test procedure. The correct Q1 and Q2 results are presented in **Table 34**, along with results from additional sampling.

3.2.6 Other Compounds

Table 35 presents results of the three other compounds included as part of the quarterly monitoring program: benzo(k)fluoranthene, hexavalent chromium, and lithium. Results from the current and previous testing periods show all the results were <RL or <DL for all compound and sample locations with the exception of lithium. Lithium was reported <RL or < DL in all UV/AOP four quarterly samples but ranged from 20 - 28 µg/L in the tertiary water and <RL to 21 µg/L in the IAW with two samples above the RL. Hexavalent chromium was also sampled as part of UCMR3 (see Section 3.2.4) and benzo(k)fluoranthene was sampled as part of the priority pollutants (Section 3.2.2).

3.3 Constituents of Emerging Concern (CEC)

3.3.1 Summary of Initial Characterization CEC Results

Table 36 presents the results of CEC samples collected monthly as part of an initial characterization period beginning in August 2011. Analyses were performed by MWH Laboratories using a liquid chromatography followed by tandem mass spectrometry (LC-MS-MS) method. The table provides the common use for each compound, sample location, sample date and reported result. Sample locations included: tertiary effluent (prior to chlorination), various locations in the AWP Facility (i.e. RO feed, RO permeate, and UV/AOP product), and imported raw aqueduct water. During this time, samples were collected for a target list of ninety-two (92) compounds, including those used in pesticides, herbicides, and pharmaceuticals and personal care products (PPCPs) representing a wide range of chemical and physical properties. Information used from the initial characterization period was intended to be used to 1) characterize the tertiary effluent, 2) identify appropriate AWP Facility performance indicator compounds to be monitored on an on-going basis, 3) assess AWP Facility unit process CEC removal performance and 4) compare AWP Facility product water quality to the City's imported raw drinking water.

Results shown in **Table 36** include three samples collected monthly during the Q1 testing period and the one monthly sample collected during the Q2 testing period. Results that were reported below the RL but above the DL are shown as <RL; for some analytes, the table indicates not reported (NR) due to QC concerns reported by the laboratory for two (2) of the 92 target compounds reducing the list to 90 compounds. Further information is provided in a brief letter provided by Dr. Andy Eaton from Eurofins Eaton Analytical Labs (formerly MWH Labs) that is located in **Appendix B**.

Results for six compounds that were re-analyzed (RA) due to discrepancies in results between several different dilutions in the original analytical runs are highlighted in yellow. The re-analyzed compounds were all from samples collected in the RO feed water on 8/15/11. Although the samples were past internal holding time, they were held refrigerated and most of the target analytes are stable for extended periods under these conditions. During the Q3 testing period the lab also investigated the results reported for the compound Deethylatrazine (DEA) from samples collected on 9/14/11. The original results of 160 ng/L and 78 ng/L, respectively reported in the UV/AOP product water and IAW were determined to be false positives and therefore the results were revised in **Table 36** as <DL (1.5 ng/L).

The results from the four month initial characterization period showed on average 41 of the 90 compounds analyzed in the tertiary water were above their RL. As expected, a similar number of compounds (average count above the RL per sampling event = 36) and concentrations were reported in the RO feed water. Of these, the majority were removed by the RO system (average count above the RL per sampling event = 3). All CECs were less than their RL or DL in the UV/AOP product water with the

exception of three results reported from the 9/14/11 sampling event. The compound name, common use, reported concentration and respective RL for each follow:

- Acesulfame-K (sugar substitute) reported at 50 ng/L (RL= 20 ng/L)
- Iohexal (contrasting agent) reported at 19 ng/L (RL= 10 ng/L)
- Triclosan (anti-microbial) reported at 19 ng/L (RL=10 ng/L).

Additional information on these three compounds is provided in **Section 3.6**. When assessing low level CEC results such as these it is important to keep in mind that analytical variability and influence of false positive / negative results become a more significant issue at minute levels. Technologies were not available to measure compounds at these low concentrations a decade ago, and there is still considerable debate about the significance of such low concentrations. As such, it is important that CEC monitoring be accompanied with robust QC sampling. The overall water quality QC sampling plan implemented during the testing periods is discussed in **Section 3.5**. As part of the CEC monitoring QC procedures several samples from each sampling location were sent to a second lab (Colorado School of Mines - CSM) for analysis during the initial characterization period. These samples were collected on the same date and time frame as samples analyzed by MWH laboratories. Results from the 41 compounds analyzed by CSM for samples collected during the initial characterization (sample date 8/15/11 and 11/8/11) are included in **Table 37**. The results showed all compounds measured in the RO permeate and UV/AOP product water were <DL with the exception of sulfamethoxazole, which was reported at the DL (1 ng/L). This compound is an antibiotic and was shown to be highly removed (99.9%) by the RO system. Overall the results from MWH and CSM laboratories were in agreement. Further discussion is provided in **Section 3.5.1.2**.

3.3.2 On-going CEC Characterization & Performance Indicators

3.3.2.1 Revised CEC Monitoring Plan

As presented in the Q2 Testing Report, the project team revised the CEC monitoring plan following completion of the four month initial characterization period presented in **Section 3.4.1**. Implementation of the revised CEC monitoring plan presented in **Table 38** began in concert with the third quarterly sampling event, which was conducted on 2/1/12. The compounds selected for monitoring were based on one or more of the following rationale:

- Toxicologically relevant and treatment performance indicator compounds recommended for monitoring by the State Water Resources Control Board (SWRCB) Expert Panel (*Monitoring Strategies for CECs in Recycled Water: Recommendations of a Science Advisory Panel, June 2010*).
- Potential treatment performance indicator compounds presented in **Table 39** that were selected based on occurrence in the RO feed water as measured during the initial characterization period.

- Additional potential treatment performance indicator compounds based on comments received from the IAP (NWRI Draft Memorandum: *Findings and Recommendations of the Advanced Water Purification Facility Subcommittee*, February 2, 2012).

3.3.2.2 Summary of Results

Results for CEC compounds measured by MWH Labs during the previous and current reporting period are presented in **Tables 40 and 41.** The tables are organized as Group A and Group B compounds, respectively.

Group A. This group contains a total of five compounds, four of which (Caffeine, 17 β-estradiol, NDMA and Triclosan) were the CECs recommended by the SWRCB expert panel based on toxicological relevance for monitoring groundwater recharge projects that use RO/AOP. This group also includes 1,4-Dioxane, which is currently presented as an option for evaluating AOP performance in the November 2011 Draft CDPH Groundwater Recharge Regulations. The Group A compounds were measured as part of the third and fourth quarterly sampling event at five sample locations: S1 (tertiary effluent), S6 (RO feed), S9 (RO permeate), S10 (UV/AOP product water) and imported raw aqueduct water.

Q3 results showed all compounds were below the RL or DL in the RO permeate and UV/AOP product water with the exception of Triclosan reported at 13 ng/L and 17 ng/L, respectively. It should be noted split samples taken from these locations and analyzed by the Colorado School of Mines (CSM) showed Tricolsan to be below the DL of 5 ng/L. Information regarding an investigation of discrepancies between CEC results reported by MWH Labs and CSM is discussed in **Section 3.5**. Triclosan is an antibacterial and antifungal agent used in a variety of consumer products, including toothpastes, deodorants, and soaps. Different DWELs have been developed for Triclosan ranging from 0.35 µg/L (350 ng/L)[1] to 2,600 µg/L (2,600,000 ng/L)[2], which are all significantly higher than the MWH Labs reported values in the RO permeate and UV/AOP product water. Note: DWELs are developed from tolerable daily intakes (TDIs) or acceptable daily intakes (ADIs), which describe a daily dose below which risks to public health are judged to be minimal, assuming repeated daily exposure over a lifetime through consumption of drinking water.

Q4 results for Group A compounds were below the RL or DL in the RO permeate and UV/AOP product water.

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[1] Environment Protection and Heritage Council, the National Health and Medical Research Council and the Natural Resource Management Ministerial Council, 2008, *Australian guidelines for water recycling augmentation of drinking water supplies*, March.

[2] Bruce, G. M.; Pleus, R. C.; Snyder, S. A. Toxicological relevance of pharmaceuticals in drinking water. *Environ. Sci. Technol.* **2010,** *44*, 5619–5626.

Group B. This group contains 37 compounds selected as potential performance indicator compounds for the RO and UV/AOP processes. Three of these compounds (Sucralose, NDMA, and DEET) were the CECs recommended by the SWRCB expert panel for performance of RO/AOP systems for groundwater recharge projects. These compounds were consistently detected in the RO feed of the AWP Facility water during the initial characterization period. Thirty additional compounds were also included in Group B based on their occurrence in pre RO/AOP waters during the initial characterization period. The four remaining compounds (Caffeine, Theobromine, Linuron and Estrone) were included based on recommendations from the IAP. The Group B compounds were measured weekly for four weeks at three sampling locations: S6 (RO feed), S9 (RO permeate), and S10 (UV/AOP product water). Results showed the average number of compounds (per sampling event) detected per location at concentrations above the RL to be: RO feed (33), RO permeate (3), UV/AOP product water (1).

3.3.3 Differential Removal of CEC Performance Indicator and Surrogate Compounds

Based on the results of the four weeks of CEC monitoring of the 37 compounds presented in **Table 41** a smaller group of CEC's were identified to serve as performance indicator compounds. The primary selection criterion was the consistency in the concentration detected in the RO feed water over the four week period. Comparison of weekly results for each of the 37 compounds showed 15 compounds had a relative percent difference (RPD) ≤ 35%. The RPD was calculated for each compound as the standard deviation divided by the average of the 4 results. The lower the RPD the less spread between the results. For example, if the results were all the same, the RPD would be zero.

Table 42 provides average (n=5) values measured in the RO feed, RO permeate and UV/AOP product water along with calculated values of differential removal (Δ Removal) of 16 selected performance indicator compounds for the RO and UV/AOP process. It should be noted that even though the NDMA results did not meet the RPD criteria (e.g. 47% vs. ≤ 35%) it has been recommended by the SWRCB expert panel as a performance indicator for RO/AOP for groundwater recharge projects and for CEC monitoring based on toxicological relevance. Furthermore, the concentration of NDMA in the RO feed was typically 10 X the DL (2 ng/L vs. 0.28 ng/L). Differential removal was calculated based on the average (n=5) concentrations measured in the feed and product of each unit process as follows:

- RO Removal = [RO Feed – RO Permeate] / [RO Feed]
- UV/AOP Removal = [UV/AOP Influent – UV/AOP Product] / [UV/AOP Influent]

For calculation purposes, for results reported below the RL, the value of the RL was used. For results reported below the DL, the value of the DL was used. The RO

process effectively removed all 16 compounds with differential removal (%) ranging from >65.5% to >99.9%. Differential removal values shown as greater than (>) indicate the average RO permeate or UV/AOP product concentrations were near or less than the RL or DL. As shown the average RO feed concentration of the various compounds ranged from 3 to 33,000 ng/L with only one compound (Acesulfame-K) with an average concentration above the RL in the RO permeate. Therefore, Acesulfame-K was the only selected performance indicator compound for which differential removal across the UV/AOP could be determined.

During the initial two weeks of the performance indicator sampling period, surrogate compounds including TOC, Conductivity, Monochloramines, and UV 254 Absorbance (UV 254) were monitored daily. **Table 43** provides the differential removal of surrogates measured for the RO and UV/AOP process. The average value of differential removal for surrogates measured for the RO and UV/AOP follow:

- RO Removal: TOC = 99.6%; UV 254 =88.8%; and Conductivity =99.0%
- UV/AOP Removal: UV 254 = 68.7%; Monochloramines = 72.8%.

It should be noted removal of UV 254 Absorbance and Monochloramines removal by the UV/AOP was observed to be similar irrespective of whether hydrogen peroxide was dosed or not. This suggests that removal of these surrogates was due to photolysis, particularly of the chloramines present in the RO permeate. This finding indicates that while removal of these surrogates is a good indication that photolysis is occurring; the results suggest they are not appropriate surrogates for AOP performance. As discussed in **Section 3.1.1**, nitrate results measured in the RO permeate and UV/AOP product water indicated that ammonia was oxidized to nitrate across the UV/AOP process. These results suggest ammonia may serve as a good UV/AOP surrogate for performance monitoring. Though lab results of ammonia measured in the RO permeate and UV/AOP during the testing period did not show consistent reduction across the UV/AOP an online ammonia analyzer may provide additional information about the possibility of ammonia as an AOP surrogate. Also, per IAP recommendation, UV Absorbance at the 228 nm wavelength was also measured in samples collected before and after the UV/AOP. Though the 228 nm wavelength is expected to provide a more sensitive measure of NDMA absorption results from field measurements showed a slight increase in UV 228 absorbance across the UV/AOP. It should be noted the NDMA concentrations in the RO permeate measured during the testing period was consistently <RL (2 ng/L).

During the current testing period the 37 Group B compounds were sampled again in concert with the Quarterly 4 sampling event conducted on 5/1/12. Results are included in **Table 40**. In addition to sampling the RO feed, RO permeate and UV/AOP, separate samples were also collected from the permeate of each RO system. The results showed both RO membranes achieved similar rejection of CECs (i.e. >99%).

3.4 Whole Effluent Toxicity (WET) Testing

3.4.1 Sampling and Test Procedure

WET testing was performed during the previous testing period utilizing both acute and chronic freshwater bioassays. All tests were performed by Nautilus Environmental (NE) Laboratories (San Diego, CA). Tests were conducted per EPA protocols: EPA/821/R-02/013 (2002) Chronic Manual and EPA/821/R-02/012 (2002) Acute Manual. The chronic test organisms included: *Ceriodaphnia dubia* (water flea), *Pimephales promelas* (fathead minnow) and *Selenastrum capricornutum* (green algae). The test organisms used for the acute testing included water flea and fathead minnow. A complete report provided by NE is provided in **Appendix A**.

The sample water was comprised of a blend of UV/AOP product water collected from the AWP Facility and raw aqueduct water collected from Lake Murray. The target total hardness of the blend was 50 mg/L resulting in a final blend of UV/AOP product water (67%) plus raw aqueduct water (33%). Prior to testing, the pH of the blended sample was raised to approximately 8.5 using sodium hydroxide. In addition, sodium thiosulfate was added to the sample to remove residual chlorine and hydrogen peroxide. Laboratory control water was EPA moderately hard mineral water (20% diluted). A reference control consisting of deionized water (67%) mixed with raw aqueduct water (33%) was also utilized.

3.4.2 Summary of Results

Overall, the results showed there was no toxicity observed in the sample for any of the acute and chronic tests performed. The laboratory did observe a statistically significant decrease (~7%) in the chronic fathead minnow growth endpoint for the sample as compared to the control sample. However, this observation was not deemed biologically relevant as it was outside of the acceptable range of sensitivity per the laboratory's Quality Control procedures. The statistical results of the UV/AOP sample follow:

- NOEC (No Observed Effect Concentration) values (% effluent) for all species and endpoints tested were reported as 100%.
- LOEC (Lowest Observed Effect Concentration) values (% effluent) for all species and endpoints tested were reported as >100%.
- Toxic Units (TU) were reported as 1.0 for all species and end points tested with the exception of the Water Flea 96-hr Acute survival TU = 0.41 and the Fathead minnow 96- hr acute survival TU=0.

3.5 Quality Assurance / Quality Control

As outlined in the Final T&M Plan, several QA/QC procedures were employed during the Q1 through Q4 testing period including data analysis, lab testing, field sampling procedures, sample handling and storage, and data validation. The overall purpose of the QA/QC program was to ensure that the water quality data are accurate and useful. Due to the significant number of variables which can impact water quality data, even the best water quality data will have errors, and it is the goal of the QA/QC program to measure and minimize these errors. Data quality is described by its accuracy, precision, completeness, representative ness, and comparability. The subsections below discuss the results of three main components of the overall QA/QC water quality program implemented during the Q1 through Q4 testing period including:

- QC Sample Collection
- Data Validation
- Sampling Procedures

3.5.1 QC Sample Collection

Field and laboratory QC samples were collected and analyzed as a quality check of sampling and analytical procedures throughout the testing period. QC sample types included:

- Field Duplicate. A portion of the collected sample volume is analyzed identically to evaluate laboratory precision, reproducibility of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.
- Blind Duplicate. Same as field duplicate, however the laboratory is not provided the sample location prior to analysis.
- Split Sample. A portion of the collected sample volume is analyzed by a separate laboratory with overlapping capabilities utilizing identical analytical methods to evaluate laboratory accuracy, reproducibility of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.
- Field Blank. A sample of analyte free water (laboratory provided) is poured into the container in the field, preserved and shipped to the laboratory with field samples. The purpose is to assess contamination from field conditions during sampling.
- Travel Blank: A clean sample of a matrix that is transported from the laboratory to the sampling site and transported back to the laboratory without having been exposed to sampling procedures. Typically, analyzed only for volatile compounds. The purpose is to assess contamination introduced during shipping and field handling procedures.

A summary of the QC samples collected during the Q1 through Q4 testing period is provided in **Table B-1 (Appendix B)**. For each entry, the following information is provided: sample date, QC sample type, the laboratory conducting the analysis, sample location and compounds analyzed. The results associated with QC samples are provided in **Appendix B**. A description of the results for each QC samples group is provided below.

3.5.1.1 Blind Duplicate Sample Results

During each testing period, quarterly blind duplicate samples were sent to WECK Labs for analysis for all compound groups (with the exception of CECs and UCMR3 compounds). Blind duplicate samples were sent to MWH Labs during each CEC sampling event. The specific sampling location associated with all blind duplicate samples was rotated quarterly. **Tables B-2** through **B-5 (Appendix B)** provides results for compounds detected in the original and duplicate samples for all quarterly sampling events. When comparing results the following general criteria were used to assess if the differences in results were acceptable.

1. If the result of the original sample was within two times the RL, then the difference in results between the two samples should be ± 0.5 RL or b) the relative percent difference (RPD) should be 50%, whichever is higher. For purposes of this report, RPD is defined as the difference in results divided by the average times 100%.

2. If the result of the original sample was less than two times the RL, then the difference in results between the two samples should be ± 0.5 RL or b) RPD of 20%, whichever higher.

Quarter 1 Sampling Event. Table B-2 compares the results of the original and blind duplicate (UV/AOP product water) samples collected during the Q1 quarterly sampling event conducted on 8/24/11. As shown, of the 40 compounds detected in both samples the results were in good agreement with the exception of six compounds for which the difference in results was outside the acceptance criteria. The table provides notes for each of the six compounds based on discussions with the laboratories. As indicated, the only compound that was recommended for further QC sampling was TOC. Results related to additional TOC sampling are discussed in **Section 3.5.1.2.**

Quarter 2 Sampling Event. Table B-3 compares the results of the original and blind duplicate samples (tertiary effluent) collected during the Q2 quarterly sampling event conducted on 11/8/11. As shown, of the 48 compounds detected in both samples the results were in good agreement with the exception of some of the radionuclides for which the acceptance criteria are considered not applicable because the results were analyzed with different MDAs and counting errors. QC samples for radionuclides were deemed acceptable if the difference in results was within the range of the counting errors. The table provides other notes for each compound that were just

outside the acceptable criteria based on discussions with the laboratories. As indicated, no compounds were recommended for further QC sampling.

Quarter 3 Sampling Event. Table B-4 compares the results of the original and blind duplicate samples (imported raw aqueduct water) collected during the Q3 quarterly sampling event conducted on 2/1/12. . As shown, the results for the 40 compounds reported above the RL in one or both samples were in good agreement. Comparison of radionuclide results included the counting errors as previously noted. The table provides other notes for each compound that were just outside the acceptable criteria based on discussions with the laboratories. As indicated, no compounds were recommended for further QC sampling.

Quarter 4 Sampling Event. Table B-5 compares the results of the original and blind duplicate samples (UV/AOP product water) collected during the Q4 quarterly sampling event conducted on 5/1/12. As shown, the results for the 19 compounds reported above the RL in one or both samples were in good agreement. The table provides other notes for each compound that was just outside the acceptable criteria based on discussions with the laboratories. As indicated, no compounds were recommended for further QC sampling.

CEC Sampling Events. Table B-6 compares the results of the original and blind duplicate samples collected during the four CEC sampling events (i.e. 9/14/11, 10/17/11, 11/8/11, 2/1/12, and 5/1/12). When comparing QC sample results, the general criteria presented above were slightly modified to make the maximum RPD for the Criteria 2 acceptance to be 40%. The higher degree of acceptable difference is justified based on the extremely low RLs, DLs and concentrations of CECs reported. Overall there was very good agreement between sample results for original and blind duplicate CEC samples. A summary of the results for each sampling event is provided below.

- Sampling Event 9/14/11. Of the 90 compounds for which results were reported in the RO permeate, only five were reported above the RL in the original or blind duplicate samples. Of these only two (Triclosan and Acesulfame-k) did not meet the general acceptance criteria (RPD of 106 to 109%). As noted in the table the difference warrants further QC sampling.

- Sampling Event 10/17/11. Of the 90 compounds for which results were reported in the tertiary effluent, 36 were reported above the RL in the original or blind duplicate samples. Of these, only two did not meet the general acceptance criteria (RPD's were below 90%); however, as noted in the table because the results were near the RL in one or more of the samples the difference was deemed acceptable.

- Sampling Event 11/08/11. Of the 90 compounds for which results were reported in the tertiary effluent, 37 were reported above the RL in the original or blind duplicate samples. Of these only two did not meet the general acceptance criteria (RPD's ≤70%); however, as noted in the table, the difference in results for

Acetaminophen was considered acceptable because the results were near the RL. However, the difference in results for Iopromide was just outside the acceptance criteria which did not warrant further QC sampling. A possible reason for the observed discrepancies is potential differences in the homogeneity of the samples.

- Sampling Event 2/1/12. Of the 38 compounds for which results were reported in the RO feed, 34 were reported above the RL in the original or blind duplicate samples. Of these only four did not meet the general acceptance criteria. The RPDs for these results ranged from 57% to 164%. Table B-6 provides additional information for each set of results that was outside the general acceptance criteria.

- Sampling Event 5/1/12. Of the 38 compounds for which results were reported in the UV/AOP product water, no results were reported above the RL in the original or blind duplicate samples.

3.5.1.2 Split Sample Results

Compounds Monitored Quarterly. During the Q1 Testing period, split samples of the UV/AOP product water were sent to MWH Labs for analysis for all compound groups being monitored by WECK Labs on a quarterly basis. **Table B-7 (Appendix B)** provides results for compounds that were detected in the original samples analyzed by WECK and the split samples analyzed by MWH. When comparing results the general criteria previously presented were used to assess if the difference in results were considered acceptable. As shown, of the 42 compounds detected in both samples, the results were in good agreement with the exception of 12 compounds for which the difference in results was outside the acceptance criteria. Of these, ten were reported by both laboratories to be below their RL or DL and were therefore deemed acceptable. In the Q2 Testing Report it was noted that these reported that differences suggest further QC sampling is required for TOC and Formaldehyde.

Results from split samples analyzed for TOC in the UV/AOP product water by both labs during the Q3 testing period were in agreement as <0.3 mg/L. However, the results differed for three sets of split samples analyzed for Formaldehyde (Method EPA 556) in the RO permeate and UV/AOP product water by both labs. WECK reported average (n=3) concentration of 2.7 µg/L in the RO permeate and 5.6 µg/L in the UV/AOP product water. However, MWH reported average (n=3) concentrations of 9.5 µg/L in the RO permeate and 70 µg/L in the UV/AOP product water. During the current reporting period both labs purchased and analyzed stock solutions of formaldehyde obtained from the same supplier and lot number to further investigate the discrepancies. Results of spiked stock solution at concentrations of 5 µg/L and 25 µg/L from analysis by both labs were within close agreement.

The variability observed by WECK labs in RO permeate over time is consistent with the difference in the results of the split samples, but the variability in the UV/AOP results is well outside of the variability observed by either lab in repeat analyses. It is therefore likely there is a matrix effect on the formaldehyde analysis due to the peroxide that one of the two labs is not dealing with properly. Additional analysis by

a different method might help to resolve the discrepancy. Finding these levels of formaldehyde in an AOP product is not unexpected because of the potential formation of aldehydes. Even if one uses the MWH results, they are below the CDPH notification level.

CECs: During the current and prior testing periods, split samples were sent to MWH Labs and CSM. Of the 90 CECs analyzed by MWH labs (results **shown in Table 36**), CSM analyzed 30 compounds in the split samples. **Table B-8 (Appendix B)** provides results from each lab along with RPD's. Results were compared for each compound and assigned one of the following QC categories.

- **Category 1** - comparison of lab results for the given compound showed consistent agreement (i.e., RPD's < 40% or ND);

- **Category 2** - comparison of lab results for the given compound showed consistent agreement for some results and discrepancies for others; possibly due to non-homogeneity in the samples and/or sample contamination.

- **Category 3** - comparison of lab results for the given compound showed consistent disagreement possibly due to systematic differences between laboratory analysis procedures.

- **Category 4** - Results could not be compared due to insufficient data.

Based on discussion with the labs a possible cause of the Category 2 discrepancies is the result of differences in the sample volumes used by labs. MWH Labs provides 40 mL vials for CEC collection compared to CSM, which provides 1 L bottles. Sample collection using 40 mL vials are much more sensitive to low level contamination. This may explain differences in results reported by the two labs for compounds such as DEET and Triclosan. To test this hypothesis, during the current reporting period UV/AOP product water samples and field blanks were collected in both 40 mL and 1 L bottles and analyzed by MWH Labs for a target list of 38 CECs (field blanks) and 27 CECs (UV/AOP product water). Results for the field blanks showed all compounds to be <RL in both the 1 L and 40 mL samples with 37 results <DL in the 1 L sample and 33 results less than the DL in the 40 mL sample. Results for the UV/AOP samples showed all compounds to be <RL in both the 1 L and 40 mL samples with all results also <DL in the 1 L sample and 24 results less than the DL in the 40 mL sample. While these results showed a higher number of detected compounds in the smaller sample size it was not conclusive. As a result additional field blank and UV/AOP samples were collected and analyzed during the current reporting period including samples collected in samples volumes 40 mL, 250 mL, 500 mL and 1 L. Samples were analyzed for only Triclosan and DEET and results were all <DL.

Therefore while earlier data suggest the possibility of field contamination impacting the samples due to the low sample volume, the subsequent test, which found no detects in field blanks is inconclusive. Both DEET and Triclosan are ubiquitous in the

environment and there is insufficient data to rule out possible field blank or laboratory contamination during one of the sampling periods.

To further investigate Category 3 discrepancies, MWH and CSM labs exchanged and analyzed standards for compounds analyzed using the same method by both labs. Of the standards analyzed results were in good agreement suggesting that differences in standards used by the labs are not the cause of discrepancies in results. As part of the QC for a separate research project not related to the demonstration project, both MWH and CSM labs also analyzed blind CEC samples prepared by a specialty laboratory (ERA Laboratories, Inc.) and split samples from the Santa Ana River. Each of these was also analyzed by 3 other laboratories, although not all for the same suite of analytes. Results from this study showed results from both labs were in good agreement. A brief letter provided by Dr. Andy Eaton from Eurofins Eaton Analytical Labs (formerly MWH Labs) addressing the agreement in results between MWH Labs and CSM is is provided in **Appendix B**.

Comparison of CEC results from the 5/1/12 sampling show very close agreement between the labs for RO permeate and UV/AOP product water results with all results below the RL or DL.

3.5.1.3 Travel/Field Blank Results

Due to the extremely low RLs and DLs (ng/L) of CEC compounds, travel or field banks were provided for all associated sampling events. For the initial three monthly CEC sampling events, MWH Labs provided travel blanks. The analysis of the travel blanks for the 8/24/11 sampling showed five compounds were detected at concentrations between 3.8 to 340 ng/L. Three compounds were also detected in the travel blank associated with the 9/14/11 sampling with concentrations between 4.7 to 6.2 ng/L. Subsequent to these findings, the MWH Labs investigated the potential cause of the detected compounds in the travel blanks and discovered an issue with the quality of the water used to prepare the travel blanks. Because of these findings and the fact that travel blanks provide limited information regarding contamination that may happen in the field, the travel blanks were replaced with field blanks made of highly purified deionized water starting on 2/1/12. Results of all subsequent CEC field blanks (sample dates: 2/1/12, 2/8/12, 2/15/12, 2/22/12, 5/1/12, 7/30/12) analyzed by MWH Labs during the previous and current testing period were <DL for the majority of the compounds and the rest were reported below the RL. For the split CEC samples sent to CSM, field blanks were utilized with all results to date reported below the DL for all compounds analyzed.

3.5.2 Data Validation

Third-party validation was performed on the water quality data produced from WECK Laboratory and MWH Labs for a sampling event conducted on 8/24/11 during the first testing period. The purpose of the validation was to assess data quality and review laboratory and sample handling procedures in order to identify possible procedural alterations to be implemented for subsequent sampling events.

Data validation was performed on results from samples collected from the UV/AOP product water (S10). This included the original and blind duplicate samples analyzed by WECK Labs and the split samples analyzed by MWH Labs for all compounds monitored quarterly (CEC's and UCMR3 compounds excluded). Data validation was also performed for S10 samples analyzed for CECs by MWH Labs (8/15/11 sampling event only).

Laboratory Data Consultants, Inc. (LDC) performed all data validation analyses under EPA Level IV guidelines. Level IV review is the most rigorous and is characterized by QA/QC protocols and documentation resulting in a complete qualitative and quantitative analysis of the analytical data. Data that fulfills the requirements of this level of third party validation fulfills the minimum data quality standards needed to allow the data to be used for its intended objective. The analyses were validated using the following documents applicable to each method:

- USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.

- USEPA, CLP National Functional Guidelines for Inorganic Superfund Data Review, January 2010.

- USEPA, CLP National Functional Guidelines for Polychlorinated Dioxins / Dibenzofurans Data Review, Review, September 2005.

- Multiple Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual, July 2004.

The third party validation process showed all the data validated to be acceptable. It was also confirmed that the majority of the data met the strict analytical standards of the USEPA CLP. Given the large number of parameters and control statistics analyzed, it is always likely that a handful of parameters will not quite fulfill all of the validation criteria. The project team notified the laboratories of data that did not fulfill all validation criteria and requested they make any necessary procedural changes for future analysis. A technical memorandum summarizing the extensive data validation reports prepared by LDC for analysis conducted by WECK and MWH Labs is provided in **Appendix C**.

3.5.3 Field Sampling Procedures

The following section describes the equipment and procedures utilized to collect water quality samples during the testing periods as well as components of the CEC monitoring plans incorporated to provide robust data set.

- **General Sampling Procedures.** All sampling personnel utilized clean handling techniques when processing samples such that only new powder- and phthalate-free vinyl gloves (nitrile) were worn when handling the sample bottles. Personnel wore gloves during all sample retrieval operations and changed gloves frequently,

with each change in task. After opening stainless steel sample valves and allowing water to flow for two to three minutes, personnel collected water samples from appropriate sample locations. Prior to sampling operators verified that purification processes (i.e. MF/UF/RO/UV/AOP) were operating normally under design conditions. Efforts were also made to time sequence sample collection to assess treatment performance. Samples were labeled appropriately, and placed into coolers packed with ice packs/blue ice at the conclusion of the sampling event or stored in the onsite fridge dedicated to sample storage. Personnel then shipped the sealed coolers under chain-of-custody to the contracted laboratory. The laboratory processed and analyzed the samples in accordance with their standard operating procedures. Strict adherence with the sample volume quantities, preservation methods and hold times provided by the certified laboratories for each analytical method were followed in order to meet reporting levels.

- **CEC Sampling Procedures**. Due to the common use of pharmaceuticals, the ubiquitous nature of personal care products, common use of target compounds in commercial products and the extremely low levels of detection related to CEC analysis, a number of procedures were followed and pre-cautions taken to avoid field sample contamination. Strict sampling protocols including sample collection, storage and handling procedures provided by the laboratories were reviewed and followed prior to and during all CEC sampling events. This included:

  1. Certified one time use bottles provided by the MWH and CSM Labs and used for all samples collected.

  2. Samples were only collected by trained AWP Facility operators familiar with the strict sampling protocols. Due to schedules and the number of sample locations and required timing it was not possible to have one person collect all samples, however the number of samplers used during the testing periods was limited to three.

  Use of gloves at all times during sampling. Gloves were made of 100% nitrile powder free per recommendation by State Board CEC Expert Panel. The gloves do not contain triclosan or any other CEC compounds.

  1. Based on "lessons learned" from previous CEC monitoring programs several components were incorporated into the monitoring program for the AWP Facility. These included: 1) increased number of samples 2) increased number of QC samples including: field blanks, blind duplicates, and split samples 3) use of multiple laboratories to compare results 4) frequent communication with labs to discuss any results that were not current with expectations based on anticipated treatment performance.

  2. On the day of sampling, AWP Facility operations staff avoided contact with or consumption of the products listed below.

a. Soaps, detergents, including antibacterial cleansers

b. DEET

c. Fragrances

d. Sunscreen

e. Caffeine

f. Tobacco

g. Pharmaceutical

h. Antibiotics

Microbiological Sampling Procedures. Additional procedures were taken when collecting water samples for analysis microbiological parameters including:

1. Sterilization of sample valves using a hand-held propane torch prior to collecting the grab samples.

2. Samples were stored with blue or wet ice and at a target temperature of 3-8 °C.

3. Sample collection and handling procedures were followed as specified in USEPA Methods 1602 (F- and somatic coliphage), 1682 (salmonella), and SAP 2009 Draft (E. coli O157), and method SM 9221 (coliform).

3.6 Summary of Water Quality Monitoring Results for Regulated and Non-Regulated Constituents

3.6.1 Regulated Constituents

Water quality monitoring was conducted in compliance with the Final T&M Plan to demonstrate the feasibility of an AWP Facility to reliably produce purified water that is consistently in compliance with all drinking water quality standards. Water quality goals were established for the Demonstration Facility based on existing recycled water regulations, as well as anticipated future regulatory requirements specific to the City's proposed Full Scale Facility. The overall approach to water quality monitoring was to collect water quality data at different locations throughout the Demonstration Facility water purification process to analyze process performance, and to compare purified water quality to project objectives, screening levels, and existing water supplies. A comparison of key water quality results and the Demonstration Facility goals is presented in **Table 44.** The table shows that the average concentration of all constituents measured in the purified water is below the established Demonstration Facility goals. Note results shown as ND were reported below the RL (i.e. non quantifiable) or below the DL.

3.6.2 Non-Regulated Constituents

Non-regulated constituent monitoring was conducted at various locations in the purification process and the imported raw aqueduct water. These constituents are grouped as follows:

- 30 constituents included in the original 2012 EPA Unregulated Contaminant Monitoring Rule (UCMR3) List 1 and List 2. *Note: on May 2 2012 the EPA issued the Final Rule Promulgation, which removed two constituents from the original List 1;*

- 90 other constituents of emerging concern (CECs), such as pharmaceutical compounds and personal care products;

- 1 additional constituent (lithium) as recommended for testing by the IAP;

- 5 nitrosamines beyond the three which have current NLs (i.e. NDMA, NDEA, and NDPA) as tested as part of the routine water sampling.

- 3 individual beta emitters including: Cesium-137, Iodine-129, and Iodine-131. As described in **Section 3.2.5** these compounds have CDPH drinking water regulatory requirements should Gross Beta exceed a concentration of 50 pCi/L.

The monitoring results of the above 129 constituents conducted at the Demonstration Facility, showed only six were found to be quantifiably detected in the purified water at any time, including three constituents from the UCMR3 list and three CECs. The six constituents, discussed in further detail below, are:

1. Bromochloromethane (BCM)
2. Hexavalent Chromium (Chromium-6)
3. Acesulfame Potassium (Ace-K)
4. Iohexal
5. 2,4,4′ –trichloro-2′-hydroxydiphenyl ether (triclosan)
6. Strontium

Table 45, on page 105 of the Tables and Figures, provides a summary of the six constituents, including average and maximum values measured in both the purified water and imported raw aqueduct water. It should be noted of the 129 constituents contained in the groups listed above some overlap with the 231 regulated constituents shown in **Table ES-2**. Constituents that overlap among the two groups were tested with more sensitive test methods as part of the non-regulated constituent monitoring allowing for lower levels of quantification. Accounting for overlaps, 111 discrete constituents were monitored as part of the non-regulated constituent monitoring.

Additional information on the six constituents and the potential significance of the measured concentrations are discussed below. As part of the Project Advisory Team,

Dr. Shane Snyder (Co-Director of the Arizona Laboratory for Emerging Contaminants located the University of Arizona) also reviewed the results associated with these unregulated constituents. A technical memorandum prepared by Dr. Snyder which summarizes his findings is located in **Appendix D**.

- **Bromochloromethane (BCM).** Also called Halon 1011, is used as a fire-extinguishing fluid and to suppress explosions, as well as a solvent in the manufacturing of pesticides. It may also occur as a disinfection by-product in drinking water, when chlorine used for disinfection reacts with organic material in the water. BCM was detected four times out of four samples in the purified water, with an average value of 0.225 µg/L and a maximum value of 0.250 µg/L. The Drinking Water Equivalent level (DWEL) for bromochloromethane is 40 µg/L (40,000 ng/L) (SWRCB, June 2010), which is more than 170 times higher than the concentration measured in the purified water, suggesting that the concentrations measured in the purified water do not pose a health risk for human consumption.

- **Hexavalent Chromium(Chromium-6)** Chromium is an odorless, tasteless metallic element found naturally in rocks, plants, soil and volcanic dust, and animals. Chromium is commonly found in two forms: trivalent chromium (chromium-3) and hexavalent chromium (chromium-6). Chromium is a heavy metal that occurs throughout the environment. The trivalent form is a required nutrient and has very low toxicity. The hexavalent form, also commonly known as chromium-6, is more toxic and has been known to cause cancer when inhaled. In recent scientific studies in laboratory animals, chromium-6 has also been linked to cancer when ingested.

In 2008, EPA began a rigorous and comprehensive review of chromium-6 health effects based on new scientific information. When this human health assessment is finalized, the EPA will carefully review the conclusions and consider all relevant information to determine if the current chromium standard should be revised. Currently, there is no federal or state MCL specific to the hexavalent form of chromium. Chromium-6 is regulated in drinking water through the establishment of a total chromium MCL. In California, the total chromium MCL is 50 µg/L, while the federal MCL is 100 µg/L.

Additional information on hexavalent chromium can be found at: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chromium6.aspx .

CDPH is in the process of developing an MCL for chromium-6. Currently CDPH is collecting data associated with the risks and prevalence of chromium-6 and has established a detection limit for purposes of reporting (DLR) of 1 µg/L. This detection limit for purposes of reporting is 33 to 50 times higher than the method reporting level (RL) used by the primary laboratory where chromium-6 samples were taken during the Demonstration Facility operation. As a result, data from the

Demonstration Facility includes concentrations that are currently considered undetectable based on CDPH guidelines.

During the Demonstration Facility operation, chromium-6 samples were sent for analysis to two separate labs MWH Lab (Lab 1) and WECK Lab (Lab 2). Information about the sampling of chromium-6 is provided below:

1. For Lab 1 , the method used was EPA 218.6 (RL= 0.02 µg/L, DL=0.009 µg/L) /EPA 218.7 (RL= 0.03 µg/L, DL=0.0083 µg/L). Chromium-6 was found at quantifiable concentrations in the purified water four times out of four samples, with an average value of 0.09 µg/L and a maximum value of 0.16 µg/L. The RL (0.03 µg/L) used by the lab, using EPA 218.7, is in accordance with current UCMR3's RL. The concentration of Chromium-6 in purified water were at or below the results of UCMR monitoring from over 7,000 drinking water sources, from between 2000 to 2011, which showed Chromium-6 at or above the 1-µg/L DLR in about one-third of them. (http://www.cdph.ca.gov/certlic/drinkingwater/pages/chromium6sampling.aspx)

2. Chromium 6 was <RL or <DL in the tertiary effluent by Lab 1, suggesting that chromium-3 may have been oxidized by the advanced oxidation process to form the low levels of chromium-6 measured in the purified water.

3. Lab 2 analyzed chromium-6 using method EPA 218.6 with all results in purified water reported below detectable levels (DL=0.0059 µg/L). The Lab 2 method reporting level was 0.3 µg/L, which is higher than Lab 1. Also the Lab 2 detection limit is lower than Lab 1.

4. All results from both labs were below the CDPH detection limit (DLR) of 1 µg/L.

- **Ace-K: Acesulfame Potassium (Ace-K):** is a widely used artificial sweetener. Ace-K is used in a variety of consumables, including soft drinks, sports drinks, chewable and liquid medications, and other foods. During the testing period, Ace-K was below quantifiable levels in the purified water in seven of nine samples analyzed, with an average concentration below quantifiable levels and maximum concentration of 50 ng/L (RL=20 ng/L). Ace-K was below detectable levels in the RO permeate or RO permeate duplicate in samples collected on the same day that results in the purified water (after advanced oxidation) were reported above the RL, suggesting that even the low levels measured on these days may have resulted from sampling or analytical error. It should be noted based on concentrations measured in the RO feed and RO permeate the AWP process consistently achieved greater than 99.9% removal of Ace-K.

  The Food and Drug Administration has established an Acceptable Daily Intake for Ace-K of 50 mg/kg. Based on this, the calculated DWEL for Ace-K is 525 mg/L,

which is a concentration 10 million times greater than the maximum value reported in the purified water. This suggests that the concentrations of Ace-K measured in the purified water (and in the tertiary water before purification) do not pose a threat to public health.

- **Iohexal:** This compound is a contrasting agent used in x-ray procedures, such as coronary angiographs. Iohexal is typically injected into the body, allowing organic iodine compounds to block x-rays as they pass through the body. This allows for delineation between body structures containing iodine and structures that do not contain iodine. This compound was below quantifiably detectable levels in the purified water for eight of nine samples analyzed, with an average value of below quantifiable levels and a maximum value of 19 ng/L (RL=10 ng/L). RO permeate and RO permeate duplicate QC samples collected during the same sampling event as the single positive result were below quantifiable levels, suggesting that the single positive result may have been the result of analytical imprecision at levels near the MRL. Iohexal is not analyzed by isotope dilution due to lack of an available isotope, so this adds the potential for signal suppression or enhancement in the LC-MS-MS and may make measurements near the MRL less precise therefore he single positive result may have been the result of analytical error.

  The DWEL for this compound is 720,000 ng/L (SWRCB, June 2010), which is nearly 38,000 times higher than the maximum concentration reported in the purified water, suggesting that the concentrations measured do not pose a threat to public health.

- **Triclosan : 2,4,4′ –trichloro-2′-hydroxydiphenyl ether (triclosan):** is used as a synthetic broad-spectrum antimicrobial agent. Triclosan is used in a variety of consumer products , such as antimicrobial hand soaps, toothpaste, and over-the-counter drugs. It also functions as a material preservative in adhesives, fabrics, vinyl, plastics (toys, toothbrushes), polyethylene, polyurethane, polypropylene, floor wax emulsions, textiles (footwear, clothing), caulking compounds, sealants, rubber, carpeting, and a wide variety of other products. In commercial, institutional, and industrial equipment, triclosan is used to prevent microbial growth in conveyor belts, fire hoses, dye bath vats, HVAC coils, and ice-making equipment. Split samples collected in the RO permeate and Purified Water at the same time as one of the two positive results were found to be below detectable limits by a second lab that performed the analysis.

  Seven of nine samples analyzed for triclosan in the purified water were below the RL. A number of factors suggest that the two results (19 ng/L and 17 ng/L) above the RL in the purified water may have resulted from sample contamination. The first factor is the wide spread use of this compound in personal care products. Though careful measures (use of gloves, avoidance of products that contain tricolsan, etc.) were taken during all sampling events to minimize the possibility of field contamination, such contamination cannot be ruled out. All sample bottles used were one time use USEPA certified bottles, however, the laboratory

conducting the analysis reported that because there are no commercially available preserved containers for the CECs, bottles are preserved by lab staff prior to shipping to clients for collection. This introduces the risk of contamination. Another important factor is that duplicate quality control samples taken from both the RO permeate and Purified water (collected on the same day as one of the two samples reported above the RL) were analyzed by a second lab and reported non-detectable values (less than 2.5 ng/L). Additionally, when the first lab analyzed field blanks using two different sample volumes, no triclosan was measured in the larger volume sample. Because of the small sample volume even trace amounts of triclosan in the air could have been enough to lead to measureable values.

It should be noted that the Science Advisory Panel (State Board, 2010) recommended a more practical reporting level of 50 ng/L for Triclosan, which would suggest that all of the samples measured in the purified water should be considered below quantifiably detectable levels. Based on input received from the chair of the SAP (Jörg E. Drewes, Ph.D.) the driver for this recommendation was to avoid the issues encountered in reporting ultra-low levels of this compound. Furthermore, Dr. Drewes stated that avoiding triclosan hits in blanks is almost impossible in practical applications.

The DWEL for triclosan ranges between 350 to 2,600,000 ng/L (SWRCB, June 2010), which is 18 to nearly 137,000 times higher than the maximum concentration reported in the purified water, suggesting that no public health concerns are associated with the low levels of triclosan which may or may not have been present in the purified water.

- **Strontium:** is a naturally-occurring element and is used as a dietary supplement and in various industrial applications, such as pyrotechnics and automobile manufacturing. During the testing period strontium was < RL (0.3 µg/L) in three of the four quarterly samples analyzed from the purified water. The purified water sample taken during Q4 Testing Period was reported at 0.37 µg/L and the result was confirmed with a blind duplicate sample which was reported at 0.41 µg/L. These results are over 10,000 times lower than the EPA's Contaminant Candidate List 3 (CCL3) Health Reference Level for strontium of 4.2 mg/L. The average results from samples collected in the tertiary water during the quarterly sampling was 518 µg/L indicating the AWP process achieved greater than 99.9% removal of strontium. The average concentration in the IAW from samples collected quarterly was 405 µg/L. It should also be noted strontium-90 (the most common radioisotope of strontium), which emits beta particles during radioactive decay, was below the federal and state primary drinking water MCL in all purified water samples analyzed during the previous and current testing period.

Section 4
Integrity Monitoring

4.1 MF and UF Systems Integrity Testing

4.1.1 Pressure Decay Testing (PDT)

During the previous testing periods, monitoring of the integrity of the MF and UF systems was done by conducting daily pressure decay tests (PDT). Results indicated both membrane systems were intact (i.e. no particles larger than the membrane pore size can pass through the membrane) throughout the testing periods. Pressure decay rates measured daily over a 5 minute period for both systems were consistently below 0.1 psi/5 minutes.

PDT testing was continued at the same frequency during the current testing period. **Figures 18 and 19** present cumulative results of the PDTs performed on the MF and UF systems, respectively for all testing periods. Approximately, three hundred and fifty (350) individual PDT tests were performed on the MF and UF systems during the Q1 through Q4 testing period, the pressure decay rates were consistently below 0.1 psi/5 minutes indicating the membranes were intact with no fiber breakage over the entire testing period.

Estimates of the log removal value (LRV) of Cryptosporidium achieved by the MF and UF systems were performed based on the measured values of pressure decay. The predicted log removal values were determined using the Darcy Pipe Flow Model equation for air liquid conversion ratio (ALCR) as presented in the *EPA Membrane Filtration Guidance Manual*, 2005. This equation requires several inputs categorized as operating parameters, direct integrity test parameters, and unit and membrane characteristics. Values for these parameters were obtained from the membrane manufacturers and/or by field verification.

Based on the average pressure decay rates (psi/5 minutes) measured daily from the MF and UF systems during the previous and current testing periods the average predicted log removals were determined to be 4.69 and 5.45, respectively. Utilizing the referenced equation, the calculated pressure decay rate (psi/5 minute) corresponding to 4 LRV of Cryptosporidium for the MF and UF systems was estimated to be 0.4. Based on this estimate and the average PDT measured on both systems the predicted removal of Cryptosporidium by both the MF and UF exceeded 4 LRV.

4.1.2 Online Turbidity Monitoring

During the previous and current testing periods, the integrity of the MF and UF systems were also monitored by measuring online filtrate turbidity. Though this method does not provide the same level of sensitivity as pressure decay testing, it does provide the benefit of being an online measurement which provides continuous feedback on membrane performance.

Turbidity profiles measured for the MF and UF systems during the previous and current testing periods are provided in **Figures 20 and 21**, respectively. Average filtrate turbidities (NTU) based on readings taken twice per day from the online analyzer displays during the Q1 through Q4 testing periods were 0.05 for the MF system and 0.015 for the UF system. The lower turbidity values measured on the UF system are attributed to the fact that this system uses a laser turbidimeter (HACH Model Filter Trak 660 SC) which uses advanced incident light as opposed to the MF system which uses a conventional incandescent light turbidmeter (HACH 1720 E). The specifications on the laser turbidmeter claim the unit can detect changes in turbidity as low as 0.0003 NTU. Based on results from the demonstration testing both types (incandescent light and laser) of online turbidimeters would be appropriate for the potential Full-Scale Facility. It was also observed during testing that taking frequent routine measurements of filtrate turbidity using a desktop turbdimenter (HACH sensION156 Portable Meter) was useful to check the accuracy of the online meters and provided similar turbidity values (i.e. 0.03 to 0.06 NTU) as the HACH 1720E online turbidmeter.

The average value of the online MF/UF feed turbidity during the previous and current testing periods was 0.4 NTU. The scatter shown in the turbidity profiles is attributed to changes in the flow rate entering the turbidimeter. Around run hour 1750, the operations team began checking and adjusting (if needed) the flow resulting in more stable values (~0.2 to 0.4 NTU) for the remainder of the testing period. These values are consistent with that reported in the tertiary effluent by the North City operations team.

4.2 RO Systems Integrity Testing

Pre-Installation. Prior to delivering the RO elements to the AWP Facility the membrane manufacturers were requested to conduct pressure or vacuum decay testing on each element. Such testing is the only direct integrity method available to detect defects or damaged membranes and/or faulty glue lines. The results of the test results provided by the manufacturers are summarized in **Figure 22**. Of the 119 elements provided by Hydranautics the average vacuum decay rate was 0.37 inches Hg/min. Toray reported the 120 elements they tested had a pressure decay <0.29 inches Hg/min. By comparison, the acceptable RO element vacuum decay rate per ASTM D3923 is 6 inches Hg/min. Though the results cannot be directly compared due to differences in the test methods used by each manufacturer and that outlined in the ASTM standard, the low and precise decay rates are a good indication that the elements received for testing were free of any major defects which would inhibit performance. Lastly, in order to not skew the results generated in the AWP Facility demonstration, manufacturers were requested to provide elements that were randomly selected from a standard production lot. Each supplier confirmed this by providing letters to this affect.

Post Installation. Upon installation of the RO membranes the operations team conducted conductivity vessel probing of all vessels on the Train A and Train B systems. The purpose of this testing was to ensure that each membrane element was

installed properly with no leaks at the element interconnection or end-caps, and that they were not damaged during shipping. Conductivity was measured along each vessel at 15 locations spaced approximately 20 inches apart. These locations allowed for conductivity measurements at the end-cap connectors, element interconnections and midway of each element. The trend of conductivity measured from both Train A and Train B were indicative of intact systems. The general trend of intact RO systems being that vessel conductivity should gradually increase in the direction of flow as the feed water becomes more concentrated. In addition, conductivity should also increase from stage to stage as the concentrate from the upstream stage provides feedwater to the downstream stage. Breaches of integrity would also be signified by sharp spikes in conductivity, which were not observed during the testing.

Operation. During operation, conductivity and total organic carbon (TOC) were monitored online to provide continuous assessment of system integrity. All integrity monitoring results indicated the membrane elements and membrane systems for both Train A and Train B were intact through the all testing periods. Results of the online monitoring results of these two parameters to date are discussed below.

4.2.1 Online Monitoring

4.2.1.1 Conductivity

Figures 23 and 24 provide conductivity profiles for the Hydranautics ESPA2 LD and Toray TML RO systems, respectively. The profiles were developed from values recorded twice per day from the online analyzer displays. It should be noted the online analyzer takes continuous measurements of conductivity and the control system on the RO systems was set to shut the systems off automatically if the online permeate conductivity reached a high alarm set point of 150 uS/cm. As shown, the permeate conductivity of both systems remained well below the alarm set point during the entire Q1 through Q4 testing period. The average permeate conductivity (uS/cm) of the Hydranautics and Toray RO systems during at 80% feedwater recovery (FWR) were 18 and 21, respectively.

The permeate conductivity of both RO systems increased notably as expected when the FWR was increased from 80 to 85% corresponding to run hour 6314 (Hydranautics) and run hour 6391 (Toray). As discussed in Section 2, the Toray RO system exhibited scaling after increasing the FWR due to a faulty flow meter which resulted in operation at an even higher FWR than intended (i.e. 87-89%). **Figure 24** shows the permeate conductivity increased over this time period as expected due to concentration polarization. The average permeate conductivity (uS/cm) of the Hydranautics and Toray RO systems during the current testing period while operating at a target 85% FWR were 26 and 30, respectively. Based on the average measured feed conductivity measured over the entire Q1 through Q4 testing periods, the Hydranautics membranes achieved an average conductivity rejection (%) of 98.8 at a FWR of 80% and 98.4 at FWR of 85%. The average calculated conductivity rejection for the Toray membranes is 98.6 % during operation at 80% FWR and 98.1% at a FWR of 85%.

4.2.1.2 Total Organic Carbon (TOC)

During the Q1 testing period, TOC measured online in the combined permeate from the two RO systems during September and October 2011 was consistently between 40 to 80 ppb. The TOC analyzer (GE Sievers Model 5310) was also used to characterize the concentration and diurnal variation of TOC in the RO feedwater. **Figure 25** provides results from an eight day monitoring period conducted in August 2011; it shows the RO feed TOC concentration follows a fairly consistent diurnal pattern with values between approximately 7.5 to 8.5 ppm (7,500 to 8,500 ppb). Over a typical 24 hour period, peak TOC concentrations occurred around 6 AM and low concentrations occurred around 6 PM.

Online TOC monitoring of the combined RO permeate was conducted during the Q1, Q2, Q3 and current testing periods. **Figure 26** provides online values measured every 4 minutes and downloaded directly from the online TOC analyzer. The figure provides cumulative online data measured from 9/1/11 through 7/31/12. Overall results from the previous and current testing period have been consistently between 20 to 80 ppb. The lower concentrations may be due to lower feedwater temperatures which could result in higher rejection by the RO membranes.

As noted on **Figure 26,** during the latter part of December 2011 the location of the online analyzer was switched to the RO feedwater. The purpose of this was to confirm the diurnal characterization observed during the previous testing period. Results collected over a 15 day monitoring period (not shown) indicated the TOC ranged from between 2.0 to 7.0 ppm (2,000 to 7,000 ppb). In addition, an opposite diurnal trend was observed as compared to the Q1 testing period.

Based on follow up discussions with GE the cause of the discrepancy is speculated to have resulted from large swings in the internal cell and ambient temperature that occurred during the December monitoring period. The cell temperature measured by the instrument ranged from 12 to 28 degrees Celsius. The cell temperature measured by the instrument is generally 4-8 degrees Celsius higher than ambient temperature due to heating that occurs within the instrument. The low end of the cell temperatures recorded by the instrument in December indicates that the ambient temperature was lower than 10 Celsius, which is outside the instruments ambient temperature specification of 10 to 40 degrees Celsius. Overall results from the demonstration testing showed the instrument worked properly when operated in the operating specifications.

During the previous testing period, the operations team worked with GE to perform a series of tests and calibrations to ensure the analyzer is working properly within specifications. GE recommended replacing the tubing on the inorganic carbon removal (ICR) component of the analyzer. Upon replacing the tube, the unit passed the 10 ppm (10,000 ppb) TOC single point verification. The unit was then operated on RO feed water for a 1-week period beginning on 2/24/12. The results of the online TOC monitoring of the RO feed are presented in **Figure 27**. As shown, the concentration of TOC ranged from 6.5 to 7.5 ppm (6,500 to 7,500 ppb) and the diurnal

variation was observed to be similar to that measured during the Q1 Testing Period. The range of TOC measured in the RO feed was expected based on the typical concentrations reported in the tertiary effluent by the North City operations staff. On 3/1/12 the analyzer was operated on RO permeate for the remainder of the testing period. The concentration of TOC in the RO permeate was similar to what was measured during previous testing periods.

During the current testing period the unit was operated on RO feed water for an eight day period beginning on 7/5/12. The results of the online TOC monitoring of the RO feed are presented in Figure 28. The concentrations and diurnal variation of TOC in the RO feed water were consistent with results from previous testing periods. Prior to performing the RO feed water characterization the accuracy of the unit was confirmed by running a 10 ppm (10,000 ppb) TOC single point verification standard.

Based on the range of feed TOC concentrations (6,500 to 8500 ppb) measured during short term diurnal testing done on the RO feedwater during each testing period (when the instrument was operated within specification) and the range of TOC concentrations (20 to 80 ppb) recorded from continuous monitoring of the RO permeate, the TOC rejection by the RO membranes ranged from 98.8% to 99.8%.

4.3 Summary of Critical Control Point Monitoring Results

As outlined in the Final T&M Plan a key component of the integrity monitoring plan was to conduct critical control point (CCP) monitoring to identify any change in the performance of the treatment processes that can adversely impact the final water quality. **Table 46** provides a summary of the initial CCP monitoring plan implemented during the Demonstration Facility testing period. The specific parameters, limits, and corrective actions shown were used for the Demonstration Facility; it is expected a comparable plan would be established for the potential Full Scale Facility at a later date. The plan identified CCPs (e.g. MF/UF, RO and UV/AOP system) as well as critical limit parameters (CLP), limits and corrective actions. The values of limits and corrective actions were refined and further defined throughout the testing period. During the design phase of the potential Full-Scale Facility, the City would develop a similar monitoring and response plan that provides sufficient features and assurances that any foreseeable malfunction could be promptly identified and appropriate responses applied.

Table 47 summarizes the CCP monitoring results from the previous and current monitoring periods. During the Q1 testing period one exceedance of the established critical alert limit (CAL) for pressure decay occurred on the UF system. After further investigation, it was determined the high pressure decay rate resulted from a leak in the air piping not the actual membrane(s). Upon repair of the leak, the measured PDT results were well below the CAL for the remainder of the testing period. During the Q1 testing period, the CAL for the UV/AOP reactor power level was not met on four separate occasions each due to the ballast failures. When a single ballast failure occurs, only two of 72 total lamps are out of service, representing a ~3% decrease in

reactor present power. In response, the reactor power automatically increases to 100%. Based on the reactor performance to date it has been determined a reactor power level of approximately 70% is required to achieve the target log removal of NDMA. As a result, the occurrences of ballast failures are highly unlikely to have jeopardized the treatment performance and UV/AOP product. No exceedances of CALs were identified for any of the CLP's during the Q2 testing period.

During the Q3 Testing Period, two CAL exceedances occurred. The first incident was due to the loss of flow confirmation on the hydrogen peroxide dosing pump of the UV/AOP system. Once this occurred, the system auto switched to the stand-by pump. However, the stand-by pump also shut off due to low flow resulting from air lock, thereby causing the system to automatically shut down. The Demonstration Facility operations staff was present when the event occurred and quickly restarted the system with no issues for the remainder of the testing period. The second incident was due to a single ballast failure on the UV/AOP system. The system automatically increased power to 100 percent to accommodate power loss thereby maintaining treatment performance. An alarm notified the operations team of this occurrence, shortly after the system was taken offline and the ballast was replaced.

During the Q4 Testing Period, six CAL exceedances occurred. Five of these were due to the loss of flow confirmation on the hydrogen peroxide dosing pump of the UV/AOP system. Once this occurred, the system auto switched to the stand-by pump. On two occasions the switch to duty pump was successful and the system operated without interruption. However, on the other three occasions, the stand-by pump also shut off due to low flow resulting from air lock, thereby causing the UV/AOP system to automatically shut down. The operations staff were notified by alarms when the unit was shut down, shortly after the system was restarted after operating both pumps in manual to remove entrained air. As described in **Section 2.1.4.1**, the issue was resolved by making adjustments to the degassing interval and pulse length on the peroxide dosing skid and opening a valve on the pump skid to allow off gas to return to the peroxide storage tank.

The sixth CAL exceedance occurred due to a single ballast failure on the UV/AOP system. The system automatically increased power to 100 percent to accommodate power loss thereby maintaining treatment performance. An alarm notified the operations team of this occurrence, shortly after the system was taken offline and the ballast was replaced. As described in **Section 2.1.4.1** at the time this report was prepared a power study was underway to assess if the ballast failures experienced during the testing period are due to power surges. Also, the ballast manufacturer was in the processes of inspecting ballasts that failed during the current and previous testing periods to identify the potential cause(s) of the failures. It should be noted ballast failures are common at other UV facilities and the lessons learned at the Demonstration Facility should be considered in the design of the potential Full-Scale Facility.

Overall the CCP monitoring conducted at the Demonstration Facility proved to be a useful tool for identifying and responding to potential interruptions in treatment performance of the AWP processes. Based on the experience at the Demonstration Facility a similar plan is recommended for the potential Full Scale Facility.

Section 5
AWP Facility Chemical and Power Consumption

5.1 Chemical Consumption of AWP Facility Unit Processes

5.1.1 Process Chemicals

The AWP Facility uses four chemicals during routine operations: ammonium hydroxide, sodium hypochlorite, antiscalant, and hydrogen peroxide. Chemicals are fed into the process stream using diaphragm metering pumps. The speeds of the pumps are flow paced to maintain a constant dose when changes in flow occur. The most notable flow change throughout the AWP Facility process is the feed flow when the MF or UF system goes into backwash or PDT mode. A cylinder drawdown is done each day to make sure that each chemical is being fed accurately and in the proper quantity.

Monitoring of the chemical consumption of the AWP Facility unit processes began during the Q1 testing period and continued over the current testing period. **Table 48** provides information related to chemical usage for the MF, UF, RO and UV/AOP systems. The table provides the following information for each chemical: injection location, target feed concentration, target dose rate, estimated total amount delivered per testing period, and estimated daily consumption.

The typical daily consumption of each chemical was estimated based on full capacity production for a 24 hour day using data from the Q1 Testing period. No changes were made to the chemical dose rates during the subsequent testing periods. During the Q2, Q3, and Q4 testing periods the actual average daily usage of each chemical was determined by monitoring the level of each chemical storage tank before and after each delivery. The volume of each chemical used over the testing period was then calculated based on the difference in tank levels recorded at the beginning and end of the testing period, the total volume delivered over the testing period and the estimated storage capacity per foot of each chemical tank. The total calculated usage over the testing period was then divided by the total number of days in the testing period to estimate the average daily usage. No chemical usage above what was expected was required during any of the testing periods.

5.1.2 Membrane Cleaning Chemicals

During cleaning of the membrane systems, two additional chemicals were used: sodium hydroxide (25% w/w) and citric acid (50% w/w). These chemicals are stored in 55 gallon drums, fed into RO permeate water, and mixed in the CIP system. Based on tracking of membrane cleaning chemicals used over the testing periods it is estimated the RO systems required on average 2-3 gallons of sodium hydroxide and

citric acid per cleaning event. However, the MF and UF systems required a much larger volume of chemicals per cleaning. The MF required approximately 45 gallons of both sodium hydroxide and citric acid and 9 gallons of sodium hypochlorite per CIP. The UF system required approximately 40 gallons and 68 gallons of sodium hypochlorite and citric acid, respectively. The amount of citric acid for the UF system is based on the CIP conducted during the current testing period for which the target pH was reduced from 3 to 1.5. The amount required for previous CIPs was about 60% less.

The UF system was equipped with an additional sodium hypochlorite dosing system to allow dosing in the backwash cycle to maintain a free chlorine residual in the backwash waste stream. This chlorine is fed from a separate 55 gallon drum by a pump mounted on the UF skid. Due to persistent air locking problems, this chlorination system was disabled. Based on the performance of the UF system during the Q3 and current testing period, it was not deemed necessary to perform chlorinated backwashes under the current operating conditions.

5.2 Power Consumption of AWP Unit Processes

The power consumption of each AWP unit process was monitored during all testing periods by taking daily readings of power totals displayed on the main SCADA system. The totals are based on daily power logged by the individual power monitors (Electro Industries model Shark 200) installed in each individual unit process including the MF, UF, RO and UV/AOP systems. An additional power meter was installed during the Q2 testing period to monitor the total main power being used by the AWP Facility. The purpose of the main power meter is to capture the power usage of the various AWP Facility unit processes as well as parasitic loads such as lights, air conditioning and ancillary equipment (i.e. auto-samplers, TOC analyzer, etc.) plugged into the 120 v receptacles, which were not previously recorded.

Table 49 provides daily power totals logged from the main SCADA screen for each unit process from 8/1/11 through 7/31/12 as well as the total power reading. For days that power totals were not recorded from the meters, power usage was estimated based on the estimated runtime and typical power usage over a 24 hour period. The total kW-h per month including daily totals from all systems for the current testing period is as follows: May (partial) = 32,773 kW-h; June 55,002 kW-h; and July 57,558 kW-h. Comparison of the sum of values from the power meters for the individual unit processes to values recorded on the main power meter show the parasitic load to be approximately 3 to 5% of the total power. The average monthly power usage of the AWP equipment (not including the feed pump) based on monthly totals from 8/1/11 through 7/31/12 was 60,701 kW-h per month. The monthly usage varied based on the amount of time the AWP Facility was in operation. The monthly power consumption of the AWP equipment including the feed water pump based on 24 hour per day 7 day per week online time is estimated to be 99,000 kWh-month.

During the testing periods several other areas of power usage related to the AWP Facility were investigated as described below:

- **Power monitoring of the North City Feed pump:** The AWP Facility operations team worked with the City's independent consultant to perform short term power monitoring of the external pump that supplied feedwater to the MF and UF systems. An external power meter was connected to the feed pump for nearly nine days. Based on the total power recorded over this time period the power usage of the feed pump per day was determined to be approximately 960 kW-h / day, representing approximately 30% of the total power recorded from the power monitors on the AWP Facility unit processes for a typical 24 hour operating period. The relatively high power use of the feed pump was attributed to the fact that the pump was programmed to maintain a constant feed pressure which required the motor to ramp up and down each time the MF or UF system went offline (i.e. for backwashing or to perform a PDT). The feed pump was also designed for other high pressure equipment operated at 60 psi which required pressure reducing valves on the MF and UF inlet piping.

- **Investigation of UF Power:** Comparison of the UF and MF power meters showed the MF power total (not including raw water pump) to be approximately 70% lower than the power total of the UF system. The operations team worked with the City's independent consultant to investigate the higher power usage required by the UF system. First, the power requirement of the UF system was confirmed using an external power meter which was connected to the main supply for approximately 14 days. Based on the total power recorded over this time period, the power usage of the UF system was determined to be approximately 200 kW-h/day, which matched closely to the values logged from the power monitor equipped on the system. Next, the power usage of the air compressor on the UF system was monitored for nearly 14 days using the external power meter. Based on the total power recorded over this time period the power usage of the air compressor was determined to be 105 kW-h/day which is about 50% of the total UF power. It is expected that differences in the size and efficiency of the compressors equipped on the UF and MF may account for the discrepancy in power totals. The UF compressor is 40 HP and requires 50 amps while the MF compressor is ~8 HP and requires 7.9 amps. It should be noted both systems operated with similar values of the transmembrane pressure (TMP) and target filtrate flow rates. It was also observed that the daily UF power totals increased notably starting on 1/18/12 after the replacement of the actuator on the inlet valve. After further discussion with the manufacturer it was discovered that the new actuator is designed to bleed air on a continuous basis which would require the system's air compressor to operate more frequently. The increase in observed power total is attributed to the increased operation of the compressor.

- **RO Power Requirements –**The power demand of the RO systems was compared under different operating conditions. After startup a bypass was required on the

Train A energy recovery device (ERD) in order to accommodate the designed recovery rate of 80%. Because of this, the train used more power than it would have with a fully functioning ERD. In January 2012, the ERD was removed and bypass piping was installed. A new, fully functioning ERD was installed in February 2012. In April 2012, the recovery for both trains was adjusted to 85%. Based on comparison of typical power usage data gathered during these time periods, the following observations were made:

1. At 80% recovery, Train B (a 3 stage system) used approximately 8% more power than Train A (a 2 stage system).

2. At 80% recovery, Train A used approximately 7% more power with no ERD installed versus a fully functioning ERD. Note: Calculated values of energy reduction based on average boost pressure values measured during 80% recovery operation were 8% for Train A and 5% for Train B.

3. At 80% recovery, Train A used approximately 4% more power with a partially functioning ERD than with a fully functioning ERD.

4. At 85% recovery, Train B used approximately 19% more power than Train A.

- **Distribution of Power Requirements for AWP Facility Unit Processes:** The percent of total power attributed to each unit process was estimated based on average power measurements made on a typical 24 hour continuous operating period during the Q1 through Q4 testing periods. The average daily power use was estimated to be 3,300 kWh/day, which includes the estimated power for the raw water pump (based on a nine day monitoring period). This equates to a power usage of 3.3 kWh per 1000 gallons of purified water produced and 1,100 kWh per acre-foot of purified water produced. **Figure ES-1** (located in the Executive Summary) provides the breakdown of equipment power.

Section 6
Summary of Maintenance and Equipment Issues

6.1 Equipment Failures

In general, the AWP Facility unit processes and ancillary equipment operated without any major failures that required the AWP Facility to be offline for an extended period of time over the course of the previous and current reporting periods. **Table 50** provides a log of key equipment failures organized by month from August 2011 through July 2012. The log contains items identified during the Q4 testing period including open items identified during the Q1, Q2, and Q3 reporting periods. Each entry in the log identifies the effected equipment, brief description of the issue, action taken to resolve the issue and current status. Of the items identified, the only remaining issue is that the UF system backwash chlorine dosing pump does not hold prime due to off gassing. As previously mentioned, during the current reporting period, chlorinated backwashes (CBs) or daily maintenance cleans (MCs) were not required on the UF system. However, should the UF system be operated under more aggressive operating conditions in the future these fouling prevention measures may be required and the issue with the pump would need to be resolved. Items shown in the log designated with a "monitoring "status are items that have either been reoccurring or require routine maintenance to prevent.

6.2 Routine Maintenance

The operations team has conducted routine maintenance of the AWP Facility process equipment and site over the course of the testing periods. The routine maintenance items associated with the current reporting period follow:

- Replenishment of reagents on the online chlorine and TOC analyzer.
- Replacement of the faulty ballast and UV lamp on the UV/AOP system.
- Recalibration of the online turbidimeter located on the MF/UF feedwater and filtrate.
- Recalibration of the online pH meter located on the MF/UF feedwater.
- Accuracy, precision and linearity verification of the online TOC analyzer.
- Verification check on the TOC analyzer.
- Quarterly comparison of the UV intensity duty sensor to a reference sensor.

- General weekly cleaning of the AWP Facility site including: removal of debris and dust from the tour path, equipment and piping and display sink.
- Tightening of leaky air line fittings on the UF and MF systems.
- Tightening of minor leaks at valves, pipe fittings, dosing pump tubing, etc.
- Changing of air filters on the power distribution cabinet of the UV/AOP system.

The above items are indicative of routine maintenance conducted by the AWP Facility Operations staff during the testing periods. However, the O&M manuals for each major piece of AWP Facility equipment (i.e. MF, UF, RO systems and UV/AOP system) as well as ancillary equipment (e.g. compressors, pumps, etc.), have manufacturer-recommended maintenance schedules that should be followed to maintain the design service life of the equipment.

Section 7
Summary and Conclusions

The testing and monitoring objectives of the Demonstration Facility were met by operating the AWP processes on the North City tertiary effluent (pre-chlorination) over a 13.5 month period beginning in mid-June 2011 through the end of July 2012. The Demonstration Facility was designed to provide multiple barriers to contaminants and consisted of MF, UF, RO, and UV/AOP. Purified water was returned to the North City recycled water upstream of the chlorine contact chamber prior to distribution for use in irrigation and industry. The main components of the testing and monitoring program implemented at the Demonstration Facility follow:

- Operational Performance Monitoring
- Water Quality Monitoring
- Integrity and Critical Control Point Monitoring
- UV/AOP Challenge Testing
- Chemical and Power Usage

The following subsections summarize the major conclusions for each of the above components based on results collected over the testing and monitoring period.

7.1 Operational Performance Monitoring

Operational performance monitoring of the MF, UF, RO, and UV/AOP systems was conducted to assess the overall operation and maintenance (O&M) requirements of the systems during operation at design conditions. The major conclusions for each system follow:

- The MF system operated with cleaning cycles (production time before cleaning is required) exceeding 6 months under target average flux and recovery conditions of 29 gfd and 93%, respectively.
- The UF system operated with cleaning cycles between 3 to 6 months under target flux and recovery conditions of 30 gfd and 95%, respectively. The slightly shorter cleaning cycles associated with the UF, compared to MF, may be attributable to the smaller membrane pore size, which may be more susceptible to organic fouling, to the higher operating recovery (i.e. less frequent backwashing), or possibly to differences in membrane cleaning protocols or membrane chemistry.
- Chemical pretreatment for the MF and UF systems during production consisted of sodium hypochlorite and ammonium hydroxide to achieve target does of 3 mg/L chloramines. No chemicals were used during backwashing. No maintenance cleans (e.g. daily or weekly) were performed.

- Membrane cleanings of the MF and UF systems, performed in accordance with manufacturer's protocols, utilized three chemicals: sodium hypochlorite, sodium hydroxide (MF only) and citric acid. Cleanings were effective at restoring productivity close to values measured when the membranes were new with no indications that irreversible membrane fouling occurred over the testing period.

- The average measured power requirement for the MF and UF systems (not including feed pump energy) each operating at net filtrate production capacities of 0.72 MGD was 66 kW-h/day and 229 kW-h/day, respectively. The higher power required by the UF system was largely attributed to differences in air compressor efficiencies.

- RO Train A and RO Train B operated with cleaning cycles exceeding 6 months under design average flux (Train A = 11.9 gfd, Train B = 11.6 gfd) and feedwater recovery (FWR) of 80%.

- RO Train A operated with a 2 percent fouling rate (average decrease in normalized specific flux per month) over a 3 month period at increased FWR conditions (85%).

- RO Train B operated with a 10 percent fouling rate over a 1 month period at FWR of 85%; additional operation is required to fully assess the impact of FWR on cleaning frequency.

- Operation of the RO Trains at increased FWR is beneficial for the potential Full-Scale Facility in terms of footprint and the amount purified water production capacity (for a fixed amount of feedwater); however, the downside is the likelihood of increased O&M (including energy, pretreatment chemicals and cleaning chemicals). Testing results indicate that the 2-stage system (Train A) operated reliably at this increased FWR, however, further testing is recommended before determining whether or not an 85% FWR could be reliably maintained with a 3-stage configuration.

- The overall average energy reduction resulting from the energy recovery devices was determined to be 8 percent for Train A and 5 percent for Train B during operation at 80 percent recovery. However, the boost pressure was observed to decrease significantly when the recovery was increased to 85 percent due to the reduction of concentrate flow available. The ERD performance observed at the Demonstration Facility under the 85% FWR condition does not represent what could be achieved at the potential Full-Scale Facility. Careful consideration should be made in deciding the economic pay back of these systems for the Full-Scale Facility.

- If ERDs are deemed economical for the potential Full-Scale Facility, the design should consider the use of automatic control valves and auxiliary nozzle valves (not tested at the Demonstration Facility) to optimize the performance of the ERD's

over the expected range of recovery rates, concentrate flow, pressure and temperature.

- The chemical pretreatment requirement for the RO systems included a target dose of antiscalant (Product Name Y2K manufactured by King Lee Technologies). No pH suppression was used upstream of the RO system over the testing period.

- The UV/AOP system operated with an average applied present power of 12.5 kW and EED of 0.303 kWh/1000 gallons at the design conditions over the testing period. The average power was observed to increase slightly due to decreases in UVT resulting from increasing the chloramines dose in the RO feed water and with decreased temperature.

- Comparison of UV intensity measurement readings using both the duty and reference sensor (which measure intensity from 1 lamp only) provided a gross indication that lamp aging was not significant on the UV/AOP system over the testing period. A more detailed assessment of lamp aging would require several lamps to be returned to Trojan for analysis.

- During the testing period six ballast failures occurred on the UV/AOP system. The cause is under investigation via a power study and an assessment of the failed components by the manufacturer. These failures emphasis the importance of redundancy and other measures for use in the design of the potential Full Scale Facility.

7.2 Water Quality Monitoring

A comprehensive water quality monitoring plan was implemented during the testing and monitoring period. The overall approach of the monitoring plan was to collect water quality data at different locations throughout the Demonstration Facility to analyze process performance, and to compare the quality of the purified water to demonstration goals, screening levels, and existing water supplies. The major conclusions follow:

- Results of routine water quality sampling (i.e. sample collection frequency parameter specific including: daily, weekly, bi-weekly or monthly) showed the purified water met all parameter specific numerical water quality goals established for the Demonstration Facility. Such objectives were based on potential regulatory requirements for the Full Scale Facility.

- Results of quarterly monitoring (i.e. samples collected on 8/14/11, 11/8/11 2/1/12, and 5/1/12) for regulated contaminant groups showed the purified water quality met Federal and State Primary and Secondary MCLs, CDPH Notification Levels, and Priority Pollutant Criteria.

- Results of quarterly monitoring of 129 unregulated constituents (including 92 CECs and 30 UCMR3 compounds, resulting in a total of 111 unique constituents not included in previous testing) showed the average measured concentration for all but two contaminants in the purified water were below the RL or DL. The exceptions were Chromium VI (average concentration =0.09 µg/L, maximum 0.016 µg/L, RL=0.03 µg/L) and Bromochoromethane (average concentration of 0.225 µg/L, maximum 0.250 µg/L, RL=0.06 µg/L). Both compounds are associated with disinfection byproducts, and are commonly reported at similar (or higher) concentrations in most drinking water sources.

- Monitoring of a target list of 92 CECs monthly for 4 months upstream and downstream of each purification process showed the RO system effectively removed the majority of CECs detected in tertiary effluent. Only three of these CECs (triclosan, ACE-K, and Iohexal) were reported above the RL in the purified water (concentrations ≤20 ng/L) one or more times during the entire testing period.

- CECs that have been identified by the SWRCB's "Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water (2010)" for groundwater recharge projects, may be used as indicator compounds based on toxicological reliance (i.e. NDMA, 17 beta-estradiol, caffeine and triclosan). The concentrations of these compounds, in all RO permeate and purified water samples analyzed, were less than the recommended health-based practical MRLs.

- Microbial monitoring conducted in the purified water showed measured microbial parameters (i.e. total coliform, fecal coliform, male specific and somatic coliphage) were either not-detected or absent in samples collected during the testing period.

- Based on results of microbial monitoring conducted upstream and downstream of the MF and UF systems, the average log removal of coliforms was determined to be >3.3 (99.95%) for total coliform and >3.8 (99.98%) for fecal coliform. As no detections were found downstream of the MF or UF, higher removals may have been demonstrated had higher concentrations been present in the feed water.

- The UF system achieved a slightly higher log removal of bacteriophage than the MF system, which is attributable to the smaller pore size in the UF membranes. The log removal for Somatic and Male Specific Bacteriophage for the MF system were greater than 3.0 and 1.1, respectively. The log removal of Somatic and Male Specific Bacteriophage for the UF system were calculated as greater than 3.7 and 2.2, respectively.

- Results of microbial monitoring conducted in the tertiary effluent and purified water indicate the purification process achieved log removal values (LRV's) greater than 4.2 (99.99%) for somatic coliphage and 2.2 (99.4%) for male-specific coliphage. As no quantifiable detections were observed for either type of virus in the purified

water, higher removals may have been demonstrated had higher concentrations been present in the feed water.

- On-site water quality monitoring of the MF and UF membrane systems, showed that both systems consistently produced filtrate with similar average concentrations for turbidity (<0.1 NTU), Total Organic Carbon (6.5 mg/L), and UV 254 Absorbance (0.17 cm-1).

- Comparison of feed and permeate concentrations of measured organic, inorganic and microbial constituents from both RO systems showed similar rejection and permeate water quality over the testing period.

7.3 Integrity Monitoring

The integrity and reliability of the AWP processes was evaluated closely during the testing period. Integrity monitoring was conducted using several direct and indirect methods employed at various stages in the testing period. A critical control point (CCP) monitoring plan was also implemented to identify changes in the performance of the AWP processes that could have an adverse impact on the purified water quality.

The major conclusions follow:

- Results of daily pressure decay test conducted on the MF and UF systems showed the average pressure decay rates were consistently below 0.128 psi/5 min. indicating the membranes were intact with no fiber breakage over the entire testing period.

- Predicted log removal of Cryptosporidium values for the MF and UF systems based on the pressure decay rates were 4.7 and 5.5, respectively.

- Direct pressure / vacuum decay tests conducted on each RO element prior to delivery indicated the elements were intact with no defects prior to installation.

- Vessel probing conducted on the RO systems post element installation showed the RO systems were intact with no leaks at end caps or inter connections.

- Continuous online monitoring of conductivity and TOC showed the RO membranes were intact during operation over the testing period.

- Critical control point monitoring for the Demonstration Facility included the identification of CCPs (e.g. MF/UF, RO and UV/AOP system) as well as critical limit parameter (CLP) limits and corrective actions.

- CCP monitoring results showed all CLPs were below their limits during the testing period with the exception of reactor power level (due to occurrences of ballast failures) and peroxide dose (due to air entrained in the dosing system) associated

with the UV/AOP system. When the limits were exceeded they were detected and corrected in a timely fashion mainly via automatic controls thereby preventing a loss in purification performance.

- Overall CCP monitoring was useful to identify and respond to changes in treatment performance at the Demonstration Facility and it is recommended a similar plan be implemented at the potential Full Scale Facility.

- Based on occurrence/consistency 16 CECs were selected as performance indicator compounds. Results showed the rejection of the indicators by the RO system ranged from greater than 65.5% to greater than 99.9%. The demonstration of higher percent removals was limited by non-quantifiable concentrations in the product water and levels in the source water that were too low to demonstrate higher levels of removal.

- Only one compound (acesulfame-K) was present in the RO permeate at a quantifiable concentration to assess removal by the UV/AOP. Monitoring of easily measured bulk surrogate parameters (i.e. conductivity, TOC, Mono-chloramines, UV absorbance) showed consistent removal as expected based on the mechanisms of each process.

7.4 UV/AOP Challenge Testing

The overall water quality demonstration goals included the assessment of the ability of the UV/AOP system to achieve target removal values of two specific contaminants (NDMA and 1,4 Dioxane) based on the August 2008 and November 2011 Draft CPDH Groundwater Replenishment Regulations. Because these contaminants were not present in the Demonstration Facility influent or RO permeate it was necessary to dose laboratory prepared solutions of these contaminants to the influent of the UV/AOP system in order to demonstrate the target removals. The major conclusions associated with the testing follow:

- Results of challenge testing demonstrated the UV/AOP system achieved 1.5 log removal (96.8%) of NDMA under the design flow (1 MGD), UVT (97%) and peroxide dose (3 mg/L) conditions. This exceeded the log removal Demonstration goal of 1.2 log removal (93.7%) based on the 2008 Draft Groundwater Recharge Regulations.

- The average EEO for NDMA was determined to be 0.19 kW-h/1000 gallons/order.

- Results of challenge testing demonstrated the UV/AOP system achieved 0.6 log removal (74.9 %) of 1,4-Dioxane under the design conditions. This exceeded the log removal Demonstration goal of 0.5 (68.7%) based on the 2011 Draft Groundwater Recharge Regulations.

- Results of challenge testing showed a linear correlation between 1,4-Dioxane removal and peroxide dose (1 to 6 mg/L) under constant EED conditions (average 0.3 kWh/1000 gallons). The correlation of these parameters predicts a peroxide dose of 2.3 mg/L would achieve 0.5 log removal (68.7%) under the test conditions. These preliminary results show it may be possible to reduce peroxide dose at the potential Full Scale Facility however further investigation, testing, and discussion with CDPH would be required.

7.5 Chemical and Power Usage

Chemical and power usage of the Demonstration Facility were tracked closely during the testing and monitoring period. This information was evaluated to assess ways to to improve operational efficiency and provide a basis for estimating O&M costs for the Full Scale Facility. The conclusions follow:

- The estimated daily use of AWP process chemicals including sodium hypochlorite (13%), ammonium hydroxide (19%), antiscalant (100%), and hydrogen peroxide (30%) under design conditions were: 39 gallons, 11 gallons, 4 gallons and 8 gallons, respectively.

- The actual chemical consumption of AWP process chemicals over the testing period was consistent with estimated values; average daily usage was slightly lower due to downtime and flow paced dosing control.

- Three membrane cleaning chemicals were used. The chemicals and their concentrations were: sodium hypochlorite (13%), citric acid (50%), and sodium hydroxide (30%).

- The RO systems required on average 2 to 3 gallons of both sodium hydroxide and citric acid per cleaning event.

- The MF system required approximately 45 gallons of both sodium hydroxide and citric acid and 9 gallons of sodium hypochlorite per cleaning.

- The UF system required approximately 40 gallons and 68 gallons of sodium hypochlorite and citric acid, respectively.

- The North City feed pump used to supply the MF and UF systems used about 960 kWh/day; however the relatively high energy requirement for this pump was due to the specific operational control strategy required for the Demonstration Facility and is not representative of what would be required for the Full-Scale Facility.

- The average daily AWP equipment (including feed pump) power use measured during a typical 24 hour operating period at design conditions and 1 MGD purified water production was 3,300 kWh/day. This corresponds to 3.3 kWh/1000 gallons

of purified water produced and 1,100 kWh/acre-foot of purified water produced. Approximately, 3 to 5% additional power was measured for parasitic loads associated with the Demonstration Facility.

- The breakdown (% total daily power) of power values measured during a typical 24 hour operating period at design conditions and 1 MGD purified water production follows: UF System = 7%, MF System = 2%, RO Train A = 25%, RO Train B = 27%, UV/AOP = 10%, Feed Pump = 29%.

- The higher use of power required for the UF system, compared to the MF system, was largely attributed to differences in the size and efficiency of the air compressors equipped on the systems. It seems the UF system air compressor was oversized and the design could be optimized for the Full-Scale Facility.

- The higher power use of RO Train B compared to RO Train A is largely attributed to difference in the membrane configuration (i.e. 3 Stage vs. 2 Stage) and membrane characteristics of the two systems. Train B was equipped with membranes designed for high rejection and low fouling requiring higher feed pressure, while Train A was equipped with membranes designed for energy savings, requiring lower feed pressure.

Tables and Figures

Table 1 Summary of Demonstration Plant Schedule

Milestone	Start Date	End Date	Approximate Number of Months
Start-up Period[1]	Thursday 6/16/11	Thursday 7/15/11	1
Testing Period[2,3]	Friday 7/18/11	Tuesday 6/20/12	11
Operational Period[4]	Wednesday 6/21/12	Monday 12/18/12	6
Total	Thursday 6/16/11	Monday 12/18/12	18

Notes:

[1]125 working days after NTP (concurrent with Substantial Completion) – Start-Up and Operation Begins

[2]145 working days after NTP (20 working days after Substantial Completion) – Testing Starts (and Start-Up ends)

[3]375 working days after NTP (230 working days after Substantial Completion) – Testing Period Complete

[4]500 working days after NTP (375 working days after Substantial Completion) – Operational Period Complete

Table 2 Summary of Quarterly Monitoring Periods

Quarterly Monitoring Periods		Target Data Period Included in Quarterly Report
No.	Dates	
1	6/16/11 – 9/15/11	6/16/11 – 10/31/11
2	9/16/11 – 12/15/11	11/1/11 – 2/10/12[1]
3	12/16/11 – 3/15/12	2/11/12 – 5/14/12[1]
4	3/16/12 – 6/19/12	5/15/12 – 7/31/12[1,2]

Notes:

[1]The end date of the target data period is based on both the expected dates laboratory data will be received and the established due dates for each quarterly report. Q2 report due 3/3/12; Q3 report due 6/7/12; Q4 report due 9/12/12.

[2] Routine water quality data will continue to be collected twice a week for 6 weeks beyond the end of the Testing Period, from 6/19/12 through 7/31/12, in accordance with the Testing and Monitoring Plan.

Table 3: Summary of the RO System Operating Conditions

Parameter	Units	Value
RO Train A		
Anti-scalant dose	mg/L	3
Average flux	gfd	11.9
Feedwater recovery	%	80 to 85
RO Train B		
Anti-scalant dose	mg/L	3
Average flux	gfd	11.6
Feedwater recovery	%	80 to 85

Table 4 Summary of RO Membrane Cleaning Results

RO System	Date of Cleaning	Pre-Clean Temperature Corrected Specific Flux (gfd/psi@ 25 Deg C)	Post Clean Temperature Corrected Specific Flux (gfd/psi @ 25 Deg C)	Cleaning Effectiveness (% change in specific flux pre to post clean)	Cleaning Chemicals
Train A	10/14/11	0.14	0.14	0 %	Caustic followed by citric acid
Train A	4/26/12	0.13	0.15	15%	Citric acid followed by caustic
Train B	10/7/11	0.11	0.13	18%	Caustic followed by citric acid
Train B	4/18/12	0.12	0.14	17%	Citric acid followed by caustic
Train B (3rd Stage Only)	6/7/12	0.05	0.11	120%	Citric acid followed by caustic

Table 5 - UV Intensity Measurements Duty Sensor and Reference Sensor for the Trojan UV/AOP System

Testing Period	Date	Reactor Power (%)	Average (n=3) UV Intensity (mW/cm2) Duty Sensor	Average (n=3) UV Intensity (mW/cm2) Reference Sensor	UVT (%)	Temperature (Deg C)
Q1	9/16/2011	100	30.6	29.3	98.1	29.4
Q2	1/6/2012	100	31.0	29.8	97.1	22.9
Q3	4/24/2012	100	30.2	28.2	96.9	25.7
Q4	6/22/2012	100	28.9	28.6	97.4	28.3

Table 6 Certified Laboratory Results of Potential AOP By-products

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Formaldehyde	8/1/2011	grab	EPA 556	µg/L	0.26	2	6.4	9.6
Formaldehyde	8/8/2011	grab	EPA 556	µg/L	0.26	2	4.4	11
Formaldehyde	8/15/2011	grab	EPA 556	µg/L	0.26	2	9.7	11
Formaldehyde	8/22/2011	grab	EPA 556	µg/L	0.26	2		11
Formaldehyde	8/29/2011	grab	EPA 556	µg/L	0.26	2	<2	12
Formaldehyde	9/6/2011	grab	EPA 556	µg/L	0.26	2	3.4	13
Formaldehyde	9/12/2011	grab	EPA 556	µg/L	0.26	2	4.5	13
Formaldehyde	9/19/2011	grab	EPA 556	µg/L	0.26	2	3.3	9.9
Formaldehyde	2/1/2012	grab	EPA 556	µg/L	0.26	2	4	
Formaldehyde	2/8/2012	grab	EPA 556	µg/L	0.26	2	<2	4.6
Formaldehyde	2/15/2012	grab	EPA 556	µg/L	0.26	2	4.9	6.9
Formaldehyde	2/22/2012	grab	EPA 556	µg/L	0.26	2	2.3	5.2
n =							11	11
Average							4.2	9.7
Maximum							9.7	13
Minimum							1.0	4.6
STDev							2.4	2.9

Table 7 Spiking Experiment No. 1 UV/AOP Summary of NDMA Results

Sample Number	Sample ID	NDMA (ng/L)	1,4 Dioxane (µg/L)
1	**Batch**	6300000	
2	**Control IN - 1**	930	
3	**Control Out- 1**	870	
4	**Control IN - 2**	830	
5	**Control Out -2**	910	
	TEST 1 (64% power)		
6	**Test 1a IN**	790	
7	**Test 1 a Out**	23	
8	**Test1 b IN**	960	ND (<1)
9	**Test 1b OUT**	25	ND (<1)
10	**Test 1 c IN**	760	
11	**Test 1 C Out**	23	
	AVG IN	**837**	
	AVG OUT	**24**	
	TEST 2 (78% power)		
12	**Test 2a IN**	760	
13	**Test 2 a Out**	8.1	
14	**Test2 b IN**	800	ND (<1)
15	**Test 2b OUT**	10	ND (<1)
16	**Test 2 c IN**	750	
17	**Test 2 C Out**	8.5	
	AVG IN	**770**	
	AVG OUT	**8.9**	
	TEST 3 (60% power)		
18	**Test 3A IN**	740	
19	**Test 3A OUT**	29	
20	**Test 3B IN**	980	ND (<1)
21	**Test 3B OUT**	29	ND (<1)
22	**Test 3C IN**	820	
23	**Test 3C Out**	29	
	AVG IN	**847**	
	AVG OUT	**29**	
	TEST 4 (100% power)		
24	**Test 4A IN**	750	
25	**Test 4A OUT**	5.8	
26	**Test 4B IN**	750	ND (<1)
27	**Test 4B OUT**	5.4	ND (<1)
28	**Test 4C IN**	710	
29	**Test 4C OUT**	4.8	
	AVG IN	**737**	
	AVG OUT	**5.3**	

Table 8 Spiking Experiment No. 1 Calculated EE/O Values of the Trojan UV/AOP System

Test #	Reactor Power	UV Power (kW)	UV Feed Flow (gpm)	Time to treat 1000 gallon (min.)	[1]Measured NDMA LRV Average (n=3)	[2]EE/O Calculated (kW-h/1000 gallons/log removal)
1	60%	11.1	699	1.4	1.5	0.176
2	64%	11.8	699	1.4	1.5	0.188
3	78%	14.4	700	1.4	1.9	0.181
4	100%	17.9	694	1.4	2.1	0.205

Note:

1. Measured NDMA LRV Average values show for each test were calculated from results of 3 IN and 3 OUT samples X 4 tests = 24 total samples. An additional 5 samples were analyzed during the experiment including: (1) batch and (4) control samples for a total of 29 samples. Results for all samples are provided in Table 7.

2. EE/O (kW-h/1000 gallons/log removal) was calculated as [UV Power(kW) * (Time to treat 1000 gallons(min/1000 gallons))/60(min/hr))]/Log Removal

Table 9 Spiking Experiment 2 UV/AOP 1,4-Dioxane Test Plan

Sample ID	Target NDMA / 1,4-Dioxane LRV	Target Flowrate (gpm)	Target UVT (%)	Target spike NDMA Feed Concentration (ng/l)	Target spike 1,4-Dioxane Feed Concentration (µg/L)	Target Reactor Power (%)	Peroxide Dose (mg/L)	1,4-Dioxane Samples	NDMA Samples	Peroxide Samples (titanium oxalate method)
Batch	NA	NA	NA	NA	NA	NA	NA	1	1	
Control IN	0	695	97	1000	20	0	0	1	1	
Control OUT	0	695	97	1000	20	0	0	1	1	
Control IN	0	695	97	1000	20	0	3	1	1	1
Control OUT	0	695	97	1000	20	0	3	1	1	1
TEST 1	1.2 / 0.5	695	97	1000	20	~70	1.5	1 in, 3 out	0 in, 0 out	1 out
TEST 2	1.2 / 0.5	695	97	1000	20	~70	3	1 in, 3 out	1 in, 3 out	1 in, 1 out
TEST 3	1.2 / 0.5	695	97	1000	20	~70	6	1 in, 3 out	0 in, 0 out	1 out
TEST 4	TBD / 0.5	695+20%	97	1000	20	60	3	1 in, 3 out	1 in, 3 out	1 in, 1 out
Total number of Samples								**21**	**13**	**8**

Note:

1. Results from spiking experiment number 1 showed the reactor achieved 1.5 log removal (predicted 1.2 log removal) NDMA under the target power 60%, UVT 97% and flow conditions 695 gpm. Due to lamp aging and decrease in water temperature the reactor power level for 1.2 log removal (predicted) is now ~ 70-74%.
2. Surrogates including UV 254/UV228; and mono-chloramine will be measured on site during each run from the inlet and outlet.
3. Note the chloramines concentration in the UV/AOP inlet is typically 3 mg/L.

Table 10 Summary of Spiking Experiment 2 1,4-Dioxane Spiking Results

Sample ID	NDMA (ng/L)	1,4 Dioxane (µg/L)
Batch (mg/L)	8500000	220000
Control In - 1 (System off)	1500	27
Control Out- 1 (System off)	1600	28
Control In - 2 (UV off, 3 mg/L peroxide)	1800	27
Control Out -2 (UV off, 3 mg/L peroxide)	1800	26
TEST 1 (1.5 mg/L peroxide)		
Test 1 IN	----------	31
Test 1 a Out	----------	12
Test 1 b Out	----------	12
Test 1 c Out	----------	11
Average Out (n=3)	----------	12
TEST 2 (3 mg/L peroxide)		
Test 2 IN	2000	28
Test 2 a Out	54	6.6
Test 2 b Out	47	7.8
Test 2 c Out	55	6.9
Average Out (n=3)	52	7.1
TEST 3 (6 mg/L peroxide)		
Test 3 IN	----------	26
Test 3 a Out	----------	3
Test 3 b Out	----------	3.7
Test 3 c Out	----------	3.7
Average Out (n=3)	----------	3.5
TEST 4 (3 mg/L peroxide - lower UV dose)		
Test 4 IN	1900	21
Test 4 a Out	82	6.6
Test 4 b Out	96	8.8
Test 4 c Out	98	10
Average Out (n=3)	92.0	8.5

Table 11 Summary of Calculated EED Values Spiking Experiment 2: Test Conditions 1 to 4

Test	Target Peroxide Dose (mg/L)	Measured Peroxide Dose (mg/L)	1,4 Dioxane LRV (n=3)	NDMA LRV (N=3)	EED Calculated (Kw-h/1000 gallons)
1	1.5	1.3	0.36	-	0.307
2	3.0	2.6	0.57	1.6	0.302
3	6.0	4.9	0.88	-	0.312
4	3.0	2.5	0.39	1.3	0.225

Note:

1. Measured 1,4 Dioxane LRV Average values show for each test were calculated from results of 4 IN and 3 OUT/test samples X 4 tests = 16 total samples. An additional 5 samples were analyzed during the experiment including: (1) batch and (4) control samples for a total of 21 samples. Results for all samples are provided in Table 10.

Table 12: Summary of Membrane Filtration Operation

Operational Period following chemical cleanings	Run Time Hours (Months)	Average Feed Pressure (psi)	Average Filtrate Pressure (psi)	Total Delta H between Feed & Filtrate Pressure Transmitters (psi)	Average TMP[1] (psi)	Fouling Rate (% decrease temp. corrected specific flux per month)
MF System						
Operating Period 1 (10/6/11 to 4/5/12)	3,962 (5.5)	15.0	8.5	1.5	5.0	11
Operating Period 2 (4/6/12 to 7/31/12)	2,444 (3.4)	15.2	8.6	1.5	5.1	12
UF System						
Operating Period 1 (9/8/11 to 3/22/12)	4,138 (5.7)	16.0	11.3	1.3	3.4	11
(Operating Period 2 (3/23/12 to 5/31/12)	1,472 (2)	19.4	11.3	1.3	6.8	38
Operating Period 3 (6/2/12 to 7/31/12)	1,225 (1.7)	15.3	11.3	1.3	2.7	26

Notes:

1. TMP was calculated as Average Feed Pressure minus Average Filtrate Pressure minus total Delta H (difference in elevation between feed and filtrate pressure transmitters).
2. chemical cleanings performed on the MF system on 10/5/11 and 4/5/12.
3. chemical cleanings performed on the UF system on 9/7/11, 3/22/12, 5/31/12.

Table13: Summary of the RO System Trains A and B Operation

Operational Period following chemical cleanings	Run Time Hours (Months)	Target Feed Water Recovery (%)	Average Feed Pressure (psi)	Net operating pressure(psi)	Average Specific Flux or Permeability (gfd/psi@25 °C)	Fouling Rate (% decrease temperature corrected specific flux per month)
Train A (Two-stage)						
Operating Period 1 (10/16/11 to 4/16/12)	4,020 (5.6)	80	133	98	1st Stage: 0.12 2nd Stage: 0.14	1.4
Operating Period 2 (4/19/12 to 7/31/12)	2,144 (3)	85	124	87	1st Stage: 0.13 2nd Stage: 0.16	2.1
Train B (Three-stage)						
Operating Period 1 (10/6/11 to 4/17/12)	4,254 (5.9)	80	139	104	1st Stage: 0.12 2nd Stage: 0.13 3rd Stage: 0.10	1.6
(Operating Period 2 (4/23/12 to 6/7/12)	920 (1.3)	[1]85	138	97	1st Stage: 0.13 2nd Stage: 0.14 3rd Stage: 0.08	15 (Stage 3 =40)
[2] Operating Period 3 (6/8/12 to 7/9/12)	591 (0.8)	80	130	91	1st Stage: 0.12 2nd Stage: 0.13 3rd Stage: 0.10	2.1
Operating Period 4 (7/10/12 to 7/31/12)	493 (0.7)	85	130	88	1st Stage: 0.12 2nd Stage: 0.13 3rd Stage: 0.10	9.9

Note:

1. The actual feed water recovery during Operating Period 2 was determined to be between 87 to 89%.
2. No cleaning was performed between Operating Period 3 and Operating Period 4.

Table 14: Comparison of RO System Trains A and B Permeate Water Quality

Contaminant	Units	Number of Samples (n)	Train A Permeate (Hydranautics ESPA2) (Average ±STD)	Train B Permeate (Toray TML) (Average ±STD)
Nutrients				
Ammonia, Total	mg/L-N	20	0.39 ±0.13	0.40 ±0.14
Nitrate	mg/L-N	20	0.38 ±0.09	0.40 ±0.09
Nitrite	mg/L-N	14	0.01 ±0.03	0.01 ±0.03
Nitrogen, Total	mg/L-N	20	0.82 ±0.15	0.82 ±0.13
Phosphorus, Total	µg/L-P	21	4 ±2	4 ±3
Inorganic				
TDS	mg/L	17	14 ±2	14 ±2
Sodium	mg/L	15	3.1 ±0.7	3.1 ±0.8
Chloride	mg/L	18	2.5 ±0.5	2.4 ±0.6
Boron	mg/L	15	0.23 ±0.02	0.23 ±0.02
Manganese	mg/L	15	0.002 ±0.001	0.002 ±0.001
Fluoride	mg/L	17	0.02 ±0.01	0.02 ±0.02
Organics				
TOC	mg/L	9	0.18 ±0.01	0.18 ±0.01
UV 254	cm-1	41	0.016 ±0.00	0.016 ±0.00
Microbial				
Total / Fecal Coliform	MPN/100 mL	73	<1	<1

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Ammonia as N	8/1/2011	grab	EPA 350.1	mg/L	0.048	0.1	1.2	0.19	0.21		0.12
Ammonia as N	8/4/2011	grab	EPA 350.1	mg/L	0.048	0.1					<0.1
Ammonia as N	8/8/2011	grab	EPA 350.1	mg/L	0.048	0.1					<0.1
Ammonia as N	8/11/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.15
Ammonia as N	8/15/2011	grab	EPA 350.1	mg/L	0.048	0.1	1.4	0.28	0.27		0.15
Ammonia as N	8/18/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.16
Ammonia as N	8/22/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.2
Ammonia as N	8/25/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.16
Ammonia as N	8/29/2011	grab	EPA 350.1	mg/L	0.048	0.1	1.8	0.7	0.72	0.74	0.36
Ammonia as N	9/1/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.79
Ammonia as N	9/6/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.16
Ammonia as N	9/8/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.14
Ammonia as N	9/12/2011	grab	EPA 350.1	mg/L	0.048	0.1	1.4	0.24	0.24	0.26	0.18
Ammonia as N	9/15/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.18
Ammonia as N	9/19/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.17
Ammonia as N	9/22/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.16
Ammonia as N	9/26/2011	grab	EPA 350.1	mg/L	0.048	0.1	1.3	0.28	0.28	0.28	0.15
Ammonia as N	9/29/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.12
Ammonia as N	10/3/2011	grab	EPA 350.1	mg/L	0.048	0.1					<0.1
Ammonia as N	10/6/2011	grab	EPA 350.1	mg/L	0.048	0.1					0.18
Ammonia as N	10/10/2011	grab	EPA 350.1	mg/L	0.048	0.1	1.4	0.31	0.32	0.31	0.2
Ammonia as N	10/13/2011	grab	EPA 350.1	mg/L	0.048	0.1					<0.1
Ammonia as N	10/17/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.18
Ammonia as N	10/20/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.2
Ammonia as N	10/24/2011	composite	EPA 350.1	mg/L	0.048	0.1	1.4	0.33	0.46	0.37	0.25
Ammonia as N	10/31/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.17
Ammonia as N	11/3/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	11/7/2011	composite	EPA 350.1	mg/L	0.048	0.1	1.5	0.55	0.52	0.36	0.22
Ammonia as N	11/10/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	11/14/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.21
Ammonia as N	11/17/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	11/21/2011	composite	EPA 350.1	mg/L	0.048	0.1	1.3	0.48	0.5	0.46	0.2
Ammonia as N	11/29/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.2
Ammonia as N	12/1/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.23
Ammonia as N	12/5/2011	composite	EPA 350.1	mg/L	0.048	0.1	1.4	0.32	0.33	0.36	0.17

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Ammonia as N	12/8/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.24
Ammonia as N	12/12/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.18
Ammonia as N	12/15/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.2
Ammonia as N	12/19/2011	composite	EPA 350.1	mg/L	0.048	0.1	1.4	0.57	0.62	0.37	0.19
Ammonia as N	12/22/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.22
Ammonia as N	12/27/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.2
Ammonia as N	12/29/2011	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	1/3/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.5	0.31	0.34	0.34	0.22
Ammonia as N	1/5/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.31
Ammonia as N	1/9/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.15
Ammonia as N	1/12/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.25
Ammonia as N	1/17/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.33	0.31	0.34	0.2
Ammonia as N	1/19/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.21
Ammonia as N	1/23/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.16
Ammonia as N	1/26/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.20
Ammonia as N	1/30/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.3	0.32	0.32	0.20
Ammonia as N	2/2/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.33
Ammonia as N	2/9/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	2/14/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.56	0.6	0.57	0.19
Ammonia as N	2/23/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.17
Ammonia as N	2/27/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.34	0.31	0.32	
Ammonia as N	3/1/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	3/6/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	3/8/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.22
Ammonia as N	3/12/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.32	0.32	0.34	0.21
Ammonia as N	3/15/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.17
Ammonia as N	3/19/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.18
Ammonia as N	3/22/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.28
Ammonia as N	3/26/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.49	0.52	0.48	0.36
Ammonia as N	3/29/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.29
Ammonia as N	4/2/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.26
Ammonia as N	4/5/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.34
Ammonia as N	4/9/2012	composite	EPA 350.1	mg/L	0.048	0.1	4.40	0.41	0.33	0.34	0.24
Ammonia as N	4/12/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.15
Ammonia as N	4/16/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.14
Ammonia as N	4/23/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.50			0.48	0.20
Ammonia as N	4/26/2012	composite	EPA 350.1	mg/L	0.048	0.1		0.52	0.52		0.26

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Ammonia as N	4/30/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.26
Ammonia as N	5/3/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.36
Ammonia as N	5/7/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.50	0.48	0.49	0.39	0.20
Ammonia as N	5/14/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.29
Ammonia as N	5/21/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.70	0.50	0.56	0.54	0.25
Ammonia as N	5/24/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.21
Ammonia as N	5/29/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.19
Ammonia as N	5/31/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.20
Ammonia as N	6/4/2012	composite	EPA 350.1	mg/L	0.048	0.1	1.40	0.49	0.53	0.52	0.24
Ammonia as N	6/7/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.25
Ammonia as N	6/11/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.23
Ammonia as N	6/21/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.18
Ammonia as N	6/28/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.20
Ammonia as N	7/2/2012	composite	EPA 350.1	mg/L	0.048	0.1				0.52	0.18
Ammonia as N	7/5/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.23
Ammonia as N	7/9/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.21
Ammonia as N	7/12/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.23
Ammonia as N	7/16/2012	composite	EPA 350.1	mg/L	0.048	0.1				0.36	0.23
Ammonia as N	7/19/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.27
Ammonia as N	7/23/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.23
Ammonia as N	7/26/2012	composite	EPA 350.1	mg/L	0.048	0.1					0.21
Ammonia as N	7/30/2012	composite	EPA 350.1	mg/L	0.048	0.1				0.47	0.22
n =							23	23	23	24	93
Average							1.78	0.40	0.42	0.41	0.21
Maximum							6.00	0.70	0.72	0.74	0.79
Minimum							1.20	0.20	0.20	0.30	0.10
STDev							1.11	0.13	0.14	0.11	0.08

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
TKN	08/01/11	grab	EPA 351.2	mg/L	0.074	0.10	0.93	0.43	0.27		0.2
TKN	08/04/11	grab	EPA 351.2	mg/L	0.074	0.10					<0.1
TKN	08/08/11	grab	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	08/15/11	grab	EPA 351.2	mg/L	0.074	0.10	<0.074	0.37	0.33		0.13
TKN	08/18/11	grab	EPA 351.2	mg/L	0.074	0.10					0.2
TKN	08/22/11	grab	EPA 351.2	mg/L	0.074	0.10					0.11
TKN	08/25/11	grab	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	08/29/11	grab	EPA 351.2	mg/L	0.074	0.10	3.9	0.45	0.4	0.46	0.13
TKN	09/01/11	grab	EPA 351.2	mg/L	0.074	0.10					0.8
TKN	09/08/11	grab	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	09/12/11	grab	EPA 351.2	mg/L	0.074	0.10	1.1	0.29	0.28	0.32	0.13
TKN	09/19/11	grab	EPA 351.2	mg/L	0.074	0.10					0.23
TKN	09/22/11	grab	EPA 351.2	mg/L	0.074	0.10					0.25
TKN	09/26/11	grab	EPA 351.2	mg/L	0.074	0.10	<0.074	0.39	0.32	0.3	0.16
TKN	09/29/11	grab	EPA 351.2	mg/L	0.074	0.10					0.15
TKN	10/03/11	grab	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	10/06/11	grab	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	10/10/11	grab	EPA 351.2	mg/L	0.074	0.10	1.6	0.31	0.18	0.48	0.38
TKN	10/13/11	grab	EPA 351.2	mg/L	0.074	0.10					0.13
TKN	10/17/11	grab	EPA 351.2	mg/L	0.074	0.10					0.28
TKN	10/20/11	composite	EPA 351.2	mg/L	0.074	0.10					0.16
TKN	10/24/11	composite	EPA 351.2	mg/L	0.074	0.10	<0.1	0.35	0.33	0.37	0.22
TKN	10/31/11	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	11/03/11	composite	EPA 351.2	mg/L	0.074	0.10					0.17
TKN	11/07/11	composite	EPA 351.2	mg/L	0.074	0.10	0.16	0.42	0.39	0.34	0.13
TKN	11/10/11	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	11/14/11	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	11/17/11	composite	EPA 351.2	mg/L	0.074	0.10					0.16
TKN	11/21/11	composite	EPA 351.2	mg/L	0.074	0.10	0.13	0.43	0.52	0.42	<0.1
TKN	11/29/11	composite	EPA 351.2	mg/L	0.074	0.10					0.12
TKN	12/01/11	composite	EPA 351.2	mg/L	0.074	0.10					<0.1
TKN	12/05/11	composite	EPA 351.2	mg/L	0.074	0.10	0.43	0.4	0.42	0.46	0.18
TKN	12/08/11	composite	EPA 351.2	mg/L	0.074	0.10					0.14
TKN	12/12/11	composite	EPA 351.2	mg/L	0.074	0.10					0.19
TKN	12/15/11	composite	EPA 351.2	mg/L	0.074	0.10					<0.074

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
TKN	12/19/11	composite	EPA 351.2	mg/L	0.074	0.10	<0.074	0.37	0.38	0.4	0.13
TKN	12/22/11	composite	EPA 351.2	mg/L	0.074	0.10					0.17
TKN	12/27/11	composite	EPA 351.2	mg/L	0.074	0.10					0.12
TKN	12/29/11	composite	EPA 351.2	mg/L	0.074	0.10					<0.1
TKN	01/03/12	composite	EPA 351.2	mg/L	0.074	0.10	0.31	0.56	0.44	0.45	0.14
TKN	01/05/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.1
TKN	01/09/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	01/12/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	01/17/12	composite	EPA 351.2	mg/L	0.074	0.10	1.20	0.35	0.32	0.41	0.18
TKN	01/19/12	composite	EPA 351.2	mg/L	0.074	0.10					0.19
TKN	01/23/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	01/26/12	composite	EPA 351.2	mg/L	0.074	0.10					0.2
TKN	01/30/12	composite	EPA 351.2	mg/L	0.074	0.10	<0.074	0.43	0.39	0.48	0.12
TKN	02/02/12	composite	EPA 351.2	mg/L	0.074	0.10					0.18
TKN	02/06/12	composite	EPA 351.2	mg/L	0.074	0.10					0.21
TKN	02/09/12	composite	EPA 351.2	mg/L	0.074	0.10					0.14
TKN	02/14/12	composite	EPA 351.2	mg/L	0.074	0.10	0.16	0.26	0.29	0.33	<0.1
TKN	02/16/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	02/20/12	composite	EPA 351.2	mg/L	0.074	0.10					0.12
TKN	02/23/12	composite	EPA 351.2	mg/L	0.074	0.10					0.12
TKN	02/27/12	composite	EPA 351.2	mg/L	0.074	0.10	0.35	0.37	0.35	0.38	
TKN	03/01/12	composite	EPA 351.2	mg/L	0.074	0.10					0.49
TKN	03/06/12	composite	EPA 351.2	mg/L	0.074	0.10					0.48
TKN	03/08/12	composite	EPA 351.2	mg/L	0.074	0.10					0.11
TKN	03/12/12	composite	EPA 351.2	mg/L	0.074	0.10	0.39	0.35	0.44	0.28	<0.074
TKN	03/15/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.1
TKN	03/19/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	03/22/12	composite	EPA 351.2	mg/L	0.074	0.10					0.26
TKN	03/26/12	composite	EPA 351.2	mg/L	0.074	0.10	4.40	0.54	0.6	0.51	0.27
TKN	03/29/12	composite	EPA 351.2	mg/L	0.074	0.10					0.42
TKN	04/02/12	composite	EPA 351.2	mg/L	0.074	0.10					0.32
TKN	04/05/12	composite	EPA 351.2	mg/L	0.074	0.10					0.32
TKN	04/09/12	composite	EPA 351.2	mg/L	0.074	0.10	2.80	0.41	0.38	0.38	0.31
TKN	04/12/12	composite	EPA 351.2	mg/L	0.074	0.10					0.14
TKN	04/16/12	composite	EPA 351.2	mg/L	0.074	0.10					0.36
TKN	04/23/12	composite	EPA 351.2	mg/L	0.074	0.10	0.34	0.49	0.2	0.41	<0.074
TKN	04/26/12	composite	EPA 351.2	mg/L	0.074	0.10					0.12

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
TKN	04/30/12	composite	EPA 351.2	mg/L	0.074	0.10					0.13
TKN	05/03/12	composite	EPA 351.2	mg/L	0.074	0.10					0.12
TKN	05/07/12	composite	EPA 351.2	mg/L	0.074	0.10	1.10	0.45	0.44	0.36	0.11
TKN	05/14/12	composite	EPA 351.2	mg/L	0.074	0.10					0.21
TKN	05/21/12	composite	EPA 351.2	mg/L	0.074	0.10	0.25	0.44	0.37	0.30	<0.074
TKN	05/24/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	05/29/12	composite	EPA 351.2	mg/L	0.074	0.10					0.21
TKN	05/31/12	composite	EPA 351.2	mg/L	0.074	0.10					1.20
TKN	06/04/12	composite	EPA 351.2	mg/L	0.074	0.10	0.89	0.51	0.26	0.16	0.11
TKN	06/07/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	06/11/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	06/21/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.1
TKN	06/28/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/02/12	composite	EPA 351.2	mg/L	0.074	0.10				0.11	<0.074
TKN	07/05/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/09/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/12/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/16/12	composite	EPA 351.2	mg/L	0.074	0.10				0.34	<0.1
TKN	07/19/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/23/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/26/12	composite	EPA 351.2	mg/L	0.074	0.10					<0.074
TKN	07/30/12	composite	EPA 351.2	mg/L	0.074	0.10				<0.074	<0.074
n =							23	23	23	24	93
Average							0.90	0.41	0.36	0.35	0.15
Maximum							4.4	0.56	0.60	0.51	1.2
Minimum							0.0	0.30	0.20	0.0	0.0
STDev							1.2	0.08	0.10	0.12	0.17

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrate + Nitrite as N	08/01/11	grab	EPA 353.2	mg/L	0.01	0.10	12	0.42	0.44		0.55
Nitrate + Nitrite as N	08/04/11	grab	EPA 353.2	mg/L	0.01	0.10					0.73
Nitrate + Nitrite as N	08/08/11	grab	EPA 353.2	mg/L	0.01	0.10					0.72
Nitrate + Nitrite as N	08/11/11	grab	EPA 353.2	mg/L	0.01	0.10					0.72
Nitrate + Nitrite as N	08/15/11	grab	EPA 353.2	mg/L	0.01	0.10	12	0.47	0.43		0.57
Nitrate + Nitrite as N	08/18/11	grab	EPA 353.2	mg/L	0.01	0.10					0.69
Nitrate + Nitrite as N	08/22/11	grab	EPA 353.2	mg/L	0.01	0.10					0.63
Nitrate + Nitrite as N	08/25/11	grab	EPA 353.2	mg/L	0.01	0.10					0.7
Nitrate + Nitrite as N	08/29/11	grab	EPA 353.2	mg/L	0.01	0.10	9.5	0.35	0.33	0.31	0.5
Nitrate + Nitrite as N	09/01/11	grab	EPA 353.2	mg/L	0.01	0.10					0.46
Nitrate + Nitrite as N	09/01/11	grab	EPA 353.2	mg/L	0.01	0.10					0.46
Nitrate + Nitrite as N	09/06/11	grab	EPA 353.2	mg/L	0.01	0.10					0.71
Nitrate + Nitrite as N	09/08/11	grab	EPA 353.2	mg/L	0.01	0.10					0.85
Nitrate + Nitrite as N	09/12/11	grab	EPA 353.2	mg/L	0.01	0.10	9.7	0.32	0.4	0.36	0.52
Nitrate + Nitrite as N	09/15/11	grab	EPA 353.2	mg/L	0.01	0.10					0.82
Nitrate + Nitrite as N	09/19/11	grab	EPA 353.2	mg/L	0.01	0.10					0.62
Nitrate + Nitrite as N	09/22/11	grab	EPA 353.2	mg/L	0.01	0.10					0.72
Nitrate + Nitrite as N	09/26/11	grab	EPA 353.2	mg/L	0.01	0.10	14	0.46	0.52	0.5	0.68
Nitrate + Nitrite as N	09/29/11	grab	EPA 353.2	mg/L	0.01	0.10					0.79
Nitrate + Nitrite as N	10/03/11	grab	EPA 353.2	mg/L	0.01	0.10					0.58
Nitrate + Nitrite as N	10/06/11	grab	EPA 353.2	mg/L	0.01	0.10					0.62
Nitrate + Nitrite as N	10/10/11	grab	EPA 353.2	mg/L	0.01	0.10	11	0.32	0.45	0.38	0.57
Nitrate + Nitrite as N	10/13/11	grab	EPA 353.2	mg/L	0.01	0.10					0.6
Nitrate + Nitrite as N	10/17/11	grab	EPA 353.2	mg/L	0.01	0.10					0.7
Nitrate + Nitrite as N	10/20/11	composite	EPA 353.2	mg/L	0.01	0.10					0.75
Nitrate + Nitrite as N	10/24/11	composite	EPA 353.2	mg/L	0.01	0.10	13	0.42	0.4	0.47	0.66
Nitrate + Nitrite as N	10/31/11	composite	EPA 353.2	mg/L	0.01	0.10					0.53
Nitrate + Nitrite as N	11/03/11	composite	EPA 353.2	mg/L	0.01	0.10					0.8
Nitrate + Nitrite as N	11/07/11	composite	EPA 353.2	mg/L	0.01	0.10	13	0.3	0.35	0.43	0.63
Nitrate + Nitrite as N	11/10/11	composite	EPA 353.2	mg/L	0.01	0.10					0.79
Nitrate + Nitrite as N	11/14/11	composite	EPA 353.2	mg/L	0.02	0.20					0.64
Nitrate + Nitrite as N	11/17/11	composite	EPA 353.2	mg/L	0.01	0.10					0.7
Nitrate + Nitrite as N	11/21/11	composite	EPA 353.2	mg/L	0.01	0.10	13	0.29	0.36	0.31	0.64
Nitrate + Nitrite as N	11/29/11	composite	EPA 353.2	mg/L	0.01	0.10					0.56
Nitrate + Nitrite as N	12/01/11	composite	EPA 353.2	mg/L	0.01	0.10					0.59

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrate + Nitrite as N	12/05/11	composite	EPA 353.2	mg/L	0.01	0.10	11	0.27	0.31	0.41	0.6
Nitrate + Nitrite as N	12/08/11	composite	EPA 353.2	mg/L	0.01	0.10					0.66
Nitrate + Nitrite as N	12/12/11	composite	EPA 353.2	mg/L	0.01	0.10					0.62
Nitrate + Nitrite as N	12/15/11	composite	EPA 353.2	mg/L	0.01	0.10					0.62
Nitrate + Nitrite as N	12/19/11	composite	EPA 353.2	mg/L	0.01	0.10	13	0.32	0.37	0.39	0.74
Nitrate + Nitrite as N	12/22/11	composite	EPA 353.2	mg/L	0.01	0.10					0.6
Nitrate + Nitrite as N	12/27/11	composite	EPA 353.2	mg/L	0.01	0.10					0.56
Nitrate + Nitrite as N	12/29/11	composite	EPA 353.2	mg/L	0.01	0.10					0.51
Nitrate + Nitrite as N	01/03/12	composite	EPA 353.2	mg/L	0.01	0.10	12	0.33	0.33	0.36	0.5
Nitrate + Nitrite as N	01/05/12	composite	EPA 353.2	mg/L	0.01	0.10					0.61
Nitrate + Nitrite as N	01/09/12	composite	EPA 353.2	mg/L	0.01	0.10					0.57
Nitrate + Nitrite as N	01/12/12	composite	EPA 353.2	mg/L	0.01	0.10					0.67
Nitrate + Nitrite as N	01/17/12	composite	EPA 353.2	mg/L	0.01	0.10	15	0.43	0.43	0.47	0.63
Nitrate + Nitrite as N	01/19/12	composite	EPA 353.2	mg/L	0.01	0.10					0.71
Nitrate + Nitrite as N	01/23/12	composite	EPA 353.2	mg/L	0.01	0.10					0.54
Nitrate + Nitrite as N	01/26/12	composite	EPA 353.2	mg/L	0.01	0.10					0.67
Nitrate + Nitrite as N	01/30/12	composite	EPA 353.2	mg/L	0.01	0.10	12	0.34	0.34	0.36	0.52
Nitrate + Nitrite as N	02/02/12	composite	EPA 353.2	mg/L	0.01	0.10					0.64
Nitrate + Nitrite as N	02/06/12	composite	EPA 353.2	mg/L	0.01	0.10					0.52
Nitrate + Nitrite as N	02/09/12	composite	EPA 353.2	mg/L	0.01	0.10					0.59
Nitrate + Nitrite as N	02/14/12	composite	EPA 353.2	mg/L	0.01	0.10	14.00	0.47	0.46	0.47	0.59
Nitrate + Nitrite as N	02/16/12	composite	EPA 353.2	mg/L	0.01	0.10					0.64
Nitrate + Nitrite as N	02/20/12	composite	EPA 353.2	mg/L	0.01	0.10					0.54
Nitrate + Nitrite as N	02/23/12	composite	EPA 353.2	mg/L	0.01	0.10					0.6
Nitrate + Nitrite as N	02/27/12	composite	EPA 353.2	mg/L	0.01	0.10	13	0.38	0.38	0.44	
Nitrate + Nitrite as N	03/01/12	composite	EPA 353.2	mg/L	0.01	0.10					0.72
Nitrate + Nitrite as N	03/06/12	composite	EPA 353.2	mg/L	0.01	0.10					0.58
Nitrate + Nitrite as N	03/08/12	composite	EPA 353.2	mg/L	0.01	0.10					0.65
Nitrate + Nitrite as N	03/12/12	composite	EPA 353.2	mg/L	0.01	0.10	12	0.32	0.44	0.79	0.57
Nitrate + Nitrite as N	03/15/12	composite	EPA 353.2	mg/L	0.01	0.10					0.78
Nitrate + Nitrite as N	03/19/12	composite	EPA 353.2	mg/L	0.01	0.10					0.58
Nitrate + Nitrite as N	03/22/12	composite	EPA 353.2	mg/L	0.01	0.10					0.66
Nitrate + Nitrite as N	03/26/12	composite	EPA 353.2	mg/L	0.01	0.10	12	0.36	0.39	0.68	0.81
Nitrate + Nitrite as N	03/29/12	composite	EPA 353.2	mg/L	0.01	0.10					0.63
Nitrate + Nitrite as N	04/02/12	composite	EPA 353.2	mg/L	0.01	0.10					0.6
Nitrate + Nitrite as N	04/05/12	composite	EPA 353.2	mg/L	0.01	0.10					0.66
Nitrate + Nitrite as N	04/09/12	composite	EPA 353.2	mg/L	0.01	0.10	6.80	0.43	0.48	0.54	0.67

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrate + Nitrite as N	04/12/12	composite	EPA 353.2	mg/L	0.01	0.10					0.74
Nitrate + Nitrite as N	04/16/12	composite	EPA 353.2	mg/L	0.01	0.10					0.66
Nitrate + Nitrite as N	04/23/12	composite	EPA 353.2	mg/L	0.01	0.10	13.00	0.63	0.64	0.74	0.91
Nitrate + Nitrite as N	04/26/12	composite	EPA 353.2	mg/L	0.01	0.10					1.20
Nitrate + Nitrite as N	04/30/12	composite	EPA 353.2	mg/L	0.01	0.10					0.83
Nitrate + Nitrite as N	05/03/12	composite	EPA 353.2	mg/L	0.01	0.10					1.00
Nitrate + Nitrite as N	05/07/12	composite	EPA 353.2	mg/L	0.01	0.10	11.00	0.53	0.65	0.61	0.77
Nitrate + Nitrite as N	05/14/12	composite	EPA 353.2	mg/L	0.01	0.10					0.93
Nitrate + Nitrite as N	05/21/12	composite	EPA 353.2	mg/L	0.01	0.10	13.00	0.56	0.68	0.88	0.96
Nitrate + Nitrite as N	05/24/12	composite	EPA 353.2	mg/L	0.01	0.10					1.30
Nitrate + Nitrite as N	05/29/12	composite	EPA 353.2	mg/L	0.01	0.10					1.00
Nitrate + Nitrite as N	05/31/12	composite	EPA 353.2	mg/L	0.01	0.10					1.00
Nitrate + Nitrite as N	06/04/12	composite	EPA 353.2	mg/L	0.01	0.10	13.00	0.67	0.80	0.88	1.00
Nitrate + Nitrite as N	06/07/12	composite	EPA 353.2	mg/L	0.01	0.10					0.88
Nitrate + Nitrite as N	06/11/12	composite	EPA 353.2	mg/L	0.01	0.10					0.93
Nitrate + Nitrite as N	06/21/12	composite	EPA 353.2	mg/L	0.01	0.10					0.98
Nitrate + Nitrite as N	06/28/12	composite	EPA 353.2	mg/L	0.01	0.10					1.00
Nitrate + Nitrite as N	07/02/12	composite	EPA 353.2	mg/L	0.01	0.10				0.77	0.94
Nitrate + Nitrite as N	07/05/12	composite	EPA 353.2	mg/L	0.01	0.10					0.92
Nitrate + Nitrite as N	07/09/12	composite	EPA 353.2	mg/L	0.01	0.10					1.40
Nitrate + Nitrite as N	07/12/12	composite	EPA 353.2	mg/L	0.01	0.10					1.00
Nitrate + Nitrite as N	07/16/12	composite	EPA 353.2	mg/L	0.01	0.10				0.73	0.90
Nitrate + Nitrite as N	07/19/12	composite	EPA 353.2	mg/L	0.01	0.10					1.10
Nitrate + Nitrite as N	07/23/12	composite	EPA 353.2	mg/L	0.01	0.10					0.95
Nitrate + Nitrite as N	07/26/12	composite	EPA 353.2	mg/L	0.01	0.10					1.10
Nitrate + Nitrite as N	07/30/12	composite	EPA 353.2	mg/L	0.01	0.10				0.67	0.91
n =							23	23	23	24	97
Average							12	0.41	0.45	0.54	0.73
Maximum							15	0.67	0.80	0.88	1.4
Minimum							6.8	0.30	0.30	0.30	0.50
STDev							1.7	0.11	0.13	0.18	0.19

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrate as N	8/1/2011	grab	EPA 353.2	mg/L	0.04	0.11	11.97	0.41	0.43		0.54
Nitrate as N	8/4/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.72
Nitrate as N	8/8/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.72
Nitrate as N	8/11/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.72
Nitrate as N	8/15/2011	grab	EPA 353.2	mg/L	0.04	0.11	11.52	0.47	0.43		0.56
Nitrate as N	8/18/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.70
Nitrate as N	8/22/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.63
Nitrate as N	8/25/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.70
Nitrate as N	8/29/2011	grab	EPA 353.2	mg/L	0.04	0.11	9.48	0.36	0.32	0.32	0.50
Nitrate as N	9/1/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.47
Nitrate as N	9/6/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.72
Nitrate as N	9/8/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.86
Nitrate as N	9/12/2011	grab	EPA 353.2	mg/L	0.04	0.11	9.71	0.32	0.41	0.36	0.52
Nitrate as N	9/15/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.81
Nitrate as N	9/19/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.63
Nitrate as N	9/22/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.72
Nitrate as N	9/26/2011	grab	EPA 353.2	mg/L	0.04	0.11	14.45	0.45	0.52	0.50	0.68
Nitrate as N	9/29/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.79
Nitrate as N	10/6/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.61
Nitrate as N	10/10/2011	grab	EPA 353.2	mg/L	0.04	0.11	11.29	0.32	0.45	0.38	0.56
Nitrate as N	10/13/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.61
Nitrate as N	10/17/2011	grab	EPA 353.2	mg/L	0.04	0.11					0.70
Nitrate as N	10/20/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.75
Nitrate as N	10/24/2011	composite	EPA 353.2	mg/L	0.04	0.11	12.65	0.43	0.41	0.47	0.65
Nitrate as N	10/31/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.52
Nitrate as N	11/3/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.79
Nitrate as N	11/7/2011	composite	EPA 353.2	mg/L	0.04	0.11	12.87	0.29	0.34	0.43	0.63
Nitrate as N	11/10/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.79
Nitrate as N	11/14/2011	composite	EPA 353.2	mg/L	0.08	0.23					0.63
Nitrate as N	11/17/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.70
Nitrate as N	11/21/2011	composite	EPA 353.2	mg/L	0.04	0.11	13.10	0.29	0.36	0.32	0.63
Nitrate as N	11/29/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.56
Nitrate as N	12/1/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.59
Nitrate as N	12/5/2011	composite	EPA 353.2	mg/L	0.04	0.11	11.29	0.27	0.32	0.41	0.59
Nitrate as N	12/8/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.65
Nitrate as N	12/12/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.61

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrate as N	12/15/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.63
Nitrate as N	12/19/2011	composite	EPA 353.2	mg/L	0.04	0.11	13.10	0.32	0.38	0.38	0.75
Nitrate as N	12/22/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.59
Nitrate as N	12/27/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.56
Nitrate as N	12/29/2011	composite	EPA 353.2	mg/L	0.04	0.11					0.50
Nitrate as N	1/3/2012	composite	EPA 353.2	mg/L	0.04	0.11	11.97	0.34	0.32	0.36	0.50
Nitrate as N	1/5/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.61
Nitrate as N	1/9/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.56
Nitrate as N	1/12/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.68
Nitrate as N	1/17/2012	composite	EPA 353.2	mg/L	0.04	0.11	15.35	0.43	0.43	0.47	0.63
Nitrate as N	1/19/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.79
Nitrate as N	1/23/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.54
Nitrate as N	1/26/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.68
Nitrate as N	1/30/2012	composite	EPA 353.2	mg/L	0.04	0.11	12.19	0.34	0.34	0.36	0.52
Nitrate as N	2/2/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.63
Nitrate as N	2/6/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.52
Nitrate as N	2/9/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.59
Nitrate as N	2/14/2012	composite	EPA 353.2	mg/L	0.04	0.11	14.45	0.47	0.45	0.47	0.59
Nitrate as N	2/16/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.63
Nitrate as N	2/20/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.54
Nitrate as N	2/23/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.61
Nitrate as N	2/27/2012	composite	EPA 353.2	mg/L	0.04	0.11	13.00	0.38	0.38	0.44	0.59
Nitrate as N	3/1/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.72
Nitrate as N	3/6/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.58
Nitrate as N	3/8/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.65
Nitrate as N	3/12/2012	composite	EPA 353.2	mg/L	0.04	0.11	12.00	0.32	0.44	0.79	0.57
Nitrate as N	3/15/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.78
Nitrate as N	3/19/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.58
Nitrate as N	3/22/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.66
Nitrate as N	3/26/2012	composite	EPA 353.2	mg/L	0.04	0.11	12.00	0.36	0.38	0.68	0.81
Nitrate as N	3/29/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.63
Nitrate as N	4/2/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.60
Nitrate as N	4/5/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.66
Nitrate as N	4/9/2012	composite	EPA 353.2	mg/L	0.04	0.11	6.60	0.43	0.48	0.54	0.67
Nitrate as N	4/12/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.74
Nitrate as N	4/16/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.66
Nitrate as N	4/23/2012	composite	EPA 353.2	mg/L	0.04	0.11	13.00	0.63	0.64	0.74	0.91

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrate as N	4/26/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.20
Nitrate as N	4/30/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.83
Nitrate as N	5/3/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.00
Nitrate as N	5/7/2012	composite	EPA 353.2	mg/L	0.04	0.11	11.00	0.53	0.65	0.61	0.77
Nitrate as N	5/14/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.93
Nitrate as N	5/21/2012	composite	EPA 353.2	mg/L	0.04	0.11	13.00	0.56	0.68	0.88	0.96
Nitrate as N	5/24/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.30
Nitrate as N	5/29/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.00
Nitrate as N	5/31/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.00
Nitrate as N	6/4/2012	composite	EPA 353.2	mg/L	0.04	0.11	13.00	0.67	0.80	0.88	1.00
Nitrate as N	6/7/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.88
Nitrate as N	6/11/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.93
Nitrate as N	6/21/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.98
Nitrate as N	6/28/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.00
Nitrate as N	7/2/2012	composite	EPA 353.2	mg/L	0.04	0.11				0.77	0.94
Nitrate as N	7/5/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.92
Nitrate as N	7/9/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.40
Nitrate as N	7/12/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.00
Nitrate as N	7/16/2012	composite	EPA 353.2	mg/L	0.04	0.11				0.73	0.90
Nitrate as N	7/19/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.10
Nitrate as N	7/23/2012	composite	EPA 353.2	mg/L	0.04	0.11					0.95
Nitrate as N	7/26/2012	composite	EPA 353.2	mg/L	0.04	0.11					1.10
Nitrate as N	7/30/2012	composite	EPA 353.2	mg/L	0.04	0.11				0.67	0.91
n =							23	23	23	24	96
Average							12.1	0.41	0.45	0.54	0.73
Maximum							15.4	0.67	0.80	0.88	1.4
Minimum							6.60	0.30	0.30	0.30	0.50
STDev							1.83	0.11	0.13	0.18	0.19

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL. Nitrate concentrations were calculated by subtracting measured concentrations of nitrite-N from measured concentrations of (nitrate-+nitrite as N).

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrite as N	8/15/2011	grab	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01		<0.01
Nitrite as N	8/18/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	8/22/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	8/25/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	8/29/2011	grab	EPA 353.2	mg/L	0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite as N	9/1/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/1/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/6/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/8/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/12/2011	grab	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	9/15/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/19/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/22/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	9/26/2011	grab	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	9/29/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	10/6/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	10/10/2011	grab	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	10/13/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	10/17/2011	grab	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	10/20/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	10/24/2011	composite	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	10/31/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	11/3/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	11/7/2011	composite	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	11/10/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	11/14/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	11/17/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	11/21/2011	composite	EPA 353.2	mg/L	0.01	0.09	0.13	<0.01	<0.01	<0.01	<0.01
Nitrite as N	11/29/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	12/1/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	12/5/2011	composite	EPA 353.2	mg/L	0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.09
Nitrite as N	12/8/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	12/12/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	12/15/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	12/19/2011	composite	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	12/22/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrite as N	12/27/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	12/29/2011	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/3/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	1/5/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/9/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/12/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/17/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	1/19/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/23/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/26/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	1/30/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.09	<0.01	<0.01	<0.01	<0.01
Nitrite as N	2/2/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	2/6/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	2/9/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	2/14/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite as N	2/16/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	2/20/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	2/23/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	2/27/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.1	<0.1	<0.1	<0.01	<0.1
Nitrite as N	3/1/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.1
Nitrite as N	3/6/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	3/8/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	3/12/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite as N	3/15/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	3/19/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	3/22/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	3/26/2012	composite	EPA 353.2	mg/L	0.01	0.09	0.31	<0.01	<0.01	<0.01	<0.01
Nitrite as N	3/29/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	4/2/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	4/5/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	4/9/2012	composite	EPA 353.2	mg/L	0.01	0.09	0.48	<0.01	<0.01	<0.01	<0.01
Nitrite as N	4/12/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	4/16/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	4/23/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.1	<0.01	<0.01	<0.01	<0.01
Nitrite as N	4/26/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	4/30/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	5/3/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrite as N	5/7/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite as N	5/14/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	5/21/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.1	<0.01	<0.01	<0.01	<0.01
Nitrite as N	5/24/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	5/29/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	5/31/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	6/4/2012	composite	EPA 353.2	mg/L	0.01	0.09	<0.1	<0.01	<0.01	<0.01	<0.01
Nitrite as N	6/7/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	6/11/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	6/21/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	6/28/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/2/2012	composite	EPA 353.2	mg/L	0.01	0.09				<0.01	<0.01
Nitrite as N	7/5/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/9/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/12/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/16/2012	composite	EPA 353.2	mg/L	0.01	0.09				<0.01	<0.01
Nitrite as N	7/19/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/23/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/26/2012	composite	EPA 353.2	mg/L	0.01	0.09					<0.01
Nitrite as N	7/30/2012	composite	EPA 353.2	mg/L	0.01	0.09				<0.01	<0.01
n =							22	22	22	24	93
Average							<0.09	<0.01	<0.01	<0.01	<0.01
Maximum							0.48	0.10	0.10	0.09	0.10
Minimum							0.0	0.0	0.0	0.0	0.0
STDev							0.1	0.0	0.0	0.0	0.0

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrogen, Total - N	8/1/2011	grab	Various	mg/L	0.074	0.1	13	0.85	0.71		0.75
Nitrogen, Total - N	8/4/2011	grab	Various	mg/L	0.074	0.1					0.8
Nitrogen, Total - N	8/8/2011	grab	Various	mg/L	0.074	0.1					0.8
Nitrogen, Total - N	8/11/2011	grab	Various	mg/L	0.074	0.1					0.98
Nitrogen, Total - N	8/15/2011	grab	Various	mg/L	0.074	0.1	12	0.85	0.76		0.7
Nitrogen, Total - N	8/18/2011	grab	Various	mg/L	0.074	0.1					0.88
Nitrogen, Total - N	8/22/2011	grab	Various	mg/L	0.074	0.1					0.74
Nitrogen, Total - N	8/25/2011	grab	Various	mg/L	0.074	0.1					0.7
Nitrogen, Total - N	8/29/2011	grab	Various	mg/L	0.074	0.1	13	0.81	0.73	0.77	0.63
Nitrogen, Total - N	9/1/2011	grab	Various	mg/L	0.074	0.1					1.3
Nitrogen, Total - N	9/6/2011	grab	Various	mg/L	0.074	0.1					0.71
Nitrogen, Total - N	9/8/2011	grab	Various	mg/L	0.074	0.1					0.85
Nitrogen, Total - N	9/12/2011	grab	Various	mg/L	0.074	0.1	11	0.62	0.68	0.68	0.65
Nitrogen, Total - N	9/15/2011	grab	Various	mg/L	0.074	0.1					0.82
Nitrogen, Total - N	9/19/2011	grab	Various	mg/L	0.074	0.1					0.85
Nitrogen, Total - N	9/22/2011	grab	Various	mg/L	0.074	0.1					0.97
Nitrogen, Total - N	9/26/2011	grab	Various	mg/L	0.074	0.1	14	0.84	0.84	0.8	0.84
Nitrogen, Total - N	9/29/2011	grab	Various	mg/L	0.074	0.1					0.94
Nitrogen, Total - N	10/3/2011	grab	Various	mg/L	0.074	0.1					0.58
Nitrogen, Total - N	10/6/2011	grab	Various	mg/L	0.074	0.1					0.62
Nitrogen, Total - N	10/10/2011	grab	Various	mg/L	0.074	0.1	13	0.63	0.63	0.86	0.95
Nitrogen, Total - N	10/13/2011	grab	Various	mg/L	0.074	0.1					0.73
Nitrogen, Total - N	10/17/2011	grab	Various	mg/L	0.074	0.1					0.98
Nitrogen, Total - N	10/20/2011	composite	Various	mg/L	0.074	0.1					0.91
Nitrogen, Total - N	10/24/2011	composite	Various	mg/L	0.074	0.1	13	0.84	0.79	0.84	0.87
Nitrogen, Total - N	10/31/2011	composite	Various	mg/L	0.074	0.1					0.53
Nitrogen, Total - N	11/3/2011	composite	Various	mg/L	0.074	0.1					0.97
Nitrogen, Total - N	11/7/2011	composite	Various	mg/L	0.074	0.1	13	0.65	0.67	0.77	0.76
Nitrogen, Total - N	11/10/2011	composite	Various	mg/L	0.074	0.1					0.79
Nitrogen, Total - N	11/14/2011	composite	Various	mg/L	0.074	0.2					0.64
Nitrogen, Total - N	11/17/2011	composite	Various	mg/L	0.074	0.1					0.86
Nitrogen, Total - N	11/21/2011	composite	Various	mg/L	0.074	0.1	13	0.72	0.88	0.73	0.74
Nitrogen, Total - N	11/29/2011	composite	Various	mg/L	0.074	0.1					0.68
Nitrogen, Total - N	12/1/2011	composite	Various	mg/L	0.074	0.1					0.68
Nitrogen, Total - N	12/5/2011	composite	Various	mg/L	0.074	0.1	12	0.66	0.73	0.87	0.77

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrogen, Total - N	12/8/2011	composite	Various	mg/L	0.074	0.1					0.8
Nitrogen, Total - N	12/12/2011	composite	Various	mg/L	0.074	0.1					0.8
Nitrogen, Total - N	12/15/2011	composite	Various	mg/L	0.074	0.1					0.62
Nitrogen, Total - N	12/19/2011	composite	Various	mg/L	0.074	0.2	13	0.69	0.76	0.78	0.87
Nitrogen, Total - N	12/22/2011	composite	Various	mg/L	0.074	0.2					0.76
Nitrogen, Total - N	12/27/2011	composite	Various	mg/L	0.074	0.2					0.68
Nitrogen, Total - N	12/29/2011	composite	Various	mg/L	0.074	0.2					0.6
Nitrogen, Total - N	1/3/2012	composite	Various	mg/L	0.074	0.2	12	0.9	0.77	0.8	0.65
Nitrogen, Total - N	1/5/2012	composite	Various	mg/L	0.074	0.2					0.71
Nitrogen, Total - N	1/9/2012	composite	Various	mg/L	0.074	0.2					0.57
Nitrogen, Total - N	1/12/2012	composite	Various	mg/L	0.074	0.2					0.67
Nitrogen, Total - N	1/17/2012	composite	Various	mg/L	0.074	0.2	17	0.78	0.76	0.88	0.82
Nitrogen, Total - N	1/19/2012	composite	Various	mg/L	0.074	0.2					0.9
Nitrogen, Total - N	1/23/2012	composite	Various	mg/L	0.074	0.2					0.54
Nitrogen, Total - N	1/26/2012	composite	Various	mg/L	0.074	0.2					0.87
Nitrogen, Total - N	1/30/2012	composite	Various	mg/L	0.074	0.2	12	0.77	0.74	0.84	0.63
Nitrogen, Total - N	2/2/2012	composite	Various	mg/L	0.074	0.2					0.82
Nitrogen, Total - N	2/6/2012	composite	Various	mg/L	0.074	0.2					0.72
Nitrogen, Total - N	2/9/2012	composite	Various	mg/L	0.074	0.2					0.73
Nitrogen, Total - N	2/14/2012	composite	Various	mg/L	0.074	0.2	15	0.74	0.74	0.8	0.67
Nitrogen, Total - N	2/16/2012	composite	Various	mg/L	0.074	0.2					0.64
Nitrogen, Total - N	2/20/2012	composite	Various	mg/L	0.074	0.2					0.65
Nitrogen, Total - N	2/23/2012	composite	Various	mg/L	0.074	0.2					0.72
Nitrogen, Total - N	2/27/2012	composite	Various	mg/L	0.074	0.2	13	0.74	0.73	0.82	
Nitrogen, Total - N	3/1/2012	composite	Various	mg/L	0.074	0.2					1.2
Nitrogen, Total - N	3/6/2012	composite	Various	mg/L	0.074	0.2					1.1
Nitrogen, Total - N	3/8/2012	composite	Various	mg/L	0.074	0.2					0.76
Nitrogen, Total - N	3/12/2012	composite	Various	mg/L	0.074	0.2	13	0.66	0.88	1.1	0.57
Nitrogen, Total - N	3/15/2012	composite	Various	mg/L	0.074	0.2					0.88
Nitrogen, Total - N	3/19/2012	composite	Various	mg/L	0.074	0.2					0.58
Nitrogen, Total - N	3/22/2012	composite	Various	mg/L	0.074	0.2					0.92
Nitrogen, Total - N	3/26/2012	composite	Various	mg/L	0.074	0.2	16	0.9	0.99	1.2	1.1
Nitrogen, Total - N	3/29/2012	composite	Various	mg/L	0.074	0.2					1
Nitrogen, Total - N	4/2/2012	composite	Various	mg/L	0.074	0.2					0.92
Nitrogen, Total - N	4/5/2012	composite	Various	mg/L	0.074	0.2					0.98
Nitrogen, Total - N	4/9/2012	composite	Various	mg/L	0.074	0.2	9.6	0.84	0.86	0.92	0.98
Nitrogen, Total - N	4/12/2012	composite	Various	mg/L	0.074	0.2					0.88

Table 15 Certified Laboratory Results of Nitrogen Parameters Sampled from Various Locations in the AWPF (Cont.)

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Nitrogen, Total - N	4/16/2012	composite	Various	mg/L	0.074	0.2					1
Nitrogen, Total - N	4/23/2012	composite	Various	mg/L	0.074	0.2	14	1.1	0.84	1.2	0.91
Nitrogen, Total - N	4/26/2012	composite	Various	mg/L	0.074	0.2					1.30
Nitrogen, Total - N	4/30/2012	composite	Various	mg/L	0.074	0.2					0.96
Nitrogen, Total - N	5/3/2012	composite	Various	mg/L	0.075	1.2					1.20
Nitrogen, Total - N	5/7/2012	composite	Various	mg/L	0.074	0.2	12.00	0.98	1.10	0.97	0.88
Nitrogen, Total - N	5/14/2012	composite	Various	mg/L	0.074	0.2					1.10
Nitrogen, Total - N	5/21/2012	composite	Various	mg/L	0.074	0.2	13.00	1.00	1.00	1.20	0.96
Nitrogen, Total - N	5/24/2012	composite	Various	mg/L	0.074	0.2					1.30
Nitrogen, Total - N	5/29/2012	composite	Various	mg/L	0.074	0.2					1.20
Nitrogen, Total - N	5/31/2012	composite	Various	mg/L	0.074	0.2					2.20
Nitrogen, Total - N	6/4/2012	composite	Various	mg/L	0.074	0.2	14.00	1.20	1.10	1.00	1.20
Nitrogen, Total - N	6/7/2012	composite	Various	mg/L	0.074	0.2					0.88
Nitrogen, Total - N	6/11/2012	composite	Various	mg/L	0.074	0.2					0.93
Nitrogen, Total - N	6/21/2012	composite	Various	mg/L	0.074	0.2					1.10
Nitrogen, Total - N	6/28/2012	composite	Various	mg/L	0.074	0.2					1.00
Nitrogen, Total - N	7/2/2012	composite	Various	mg/L	0.074	0.2				0.89	0.94
Nitrogen, Total - N	7/5/2012	composite	Various	mg/L	0.074	0.2					0.92
Nitrogen, Total - N	7/9/2012	composite	Various	mg/L	0.074	0.2					1.40
Nitrogen, Total - N	7/12/2012	composite	Various	mg/L	0.074	0.2					1.00
Nitrogen, Total - N	7/16/2012	composite	Various	mg/L	0.074	0.2				1.10	0.98
Nitrogen, Total - N	7/19/2012	composite	Various	mg/L	0.074	0.2					1.10
Nitrogen, Total - N	7/23/2012	composite	Various	mg/L	0.074	0.2					0.95
Nitrogen, Total - N	7/26/2012	composite	Various	mg/L	0.074	0.2					1.10
Nitrogen, Total - N	7/30/2012	composite	Various	mg/L	0.074	0.2				0.67	0.91
n =							23	23	23	24	96
Average							13	0.82	0.81	0.90	0.87
Maximum							17	1.2	1.1	1.2	2.2
Minimum							9.6	0.60	0.60	0.70	0.50
STDev							1.5	0.15	0.13	0.16	0.23

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 15 Certified Laboratory Results of Total Phosphorus Sampled from Various Locations in the AWPF

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Phosphorus-P	8/1/2011	grab	EPA 365.1	µg/L	35	250	2200	11	11		
Total Phosphorus-P	8/15/2011	grab	EPA 365.1	µg/L	1.4	10	1100	<10	<10		<10
Total Phosphorus-P	8/18/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	8/22/2011	grab	EPA 365.1	µg/L	1.4	10					<1.4
Total Phosphorus-P	8/25/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	8/29/2011	grab	EPA 365.1	µg/L	1.4	10	1100	<10	<10	<10	<10
Total Phosphorus-P	9/1/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	9/6/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	9/8/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	9/12/2011	grab	EPA 365.1	µg/L	1.4	10	320	<1.4	<1.4	<10	<1.4
Total Phosphorus-P	9/15/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	9/19/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	9/22/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	9/26/2011	grab	EPA 365.1	µg/L	1.4	10	2100	<10	<10	<10	<10
Total Phosphorus-P	9/29/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	10/3/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	10/6/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	10/10/2011	grab	EPA 365.1	µg/L	1.4	10	2500	<10	<10	<10	<10
Total Phosphorus-P	10/10/2011	grab	EPA 365.1	µg/L	1.4	10	2000	<10	<10		
Total Phosphorus-P	10/13/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	10/17/2011	grab	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	10/20/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	10/24/2011	composite	EPA 365.1	µg/L	1.4	10	1800	<10	<10	<10	<10
Total Phosphorus-P	10/31/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	11/3/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	11/7/2011	composite	EPA 365.1	µg/L	1.4	10	1200	<1.4	<1.4	<10	<10
Total Phosphorus-P	11/10/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	11/14/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	11/17/2011	composite	EPA 365.1	µg/L	1.4	10					<1.4
Total Phosphorus-P	11/21/2011	composite	EPA 365.1	µg/L	1.4	10	1600	<1.4	<1.4	<1.4	<1.4
Total Phosphorus-P	11/29/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	12/5/2011	composite	EPA 365.1	µg/L	1.4	10	1200	<10	<10	<10	<10
Total Phosphorus-P	12/01/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	12/8/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	12/12/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	12/15/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	12/19/2011	composite	EPA 365.1	µg/L	1.4	10	1700	<10	<10	14	<10
Total Phosphorus-P	12/22/2011	composite	EPA 365.1	µg/L	1.4	10					<10

Table 15 Certified Laboratory Results of Total Phosphorus Sampled from Various Locations in the AWPF

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Phosphorus-P	12/27/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	12/29/2011	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	1/3/2012	composite	EPA 365.1	µg/L	1.4	10	300	<10	<10	<10	<10
Total Phosphorus-P	1/5/2012	composite	EPA 365.1	µg/L	70	500					940
Total Phosphorus-P	1/9/2012	composite	EPA 365.1	µg/L	1.4	10					14
Total Phosphorus-P	1/12/2012	composite	EPA 365.1	µg/L	1.4	10					<1.4
Total Phosphorus-P	1/17/2012	composite	EPA 365.1	µg/L	1.4	10	430.00	<1.4	<1.4	<10	20
Total Phosphorus-P	1/19/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	1/23/2012	composite	EPA 365.1	µg/L	1.4	10					45
Total Phosphorus-P	1/26/2012	composite	EPA 365.1	µg/L	1.4	10					18
Total Phosphorus-P	1/30/2012	composite	EPA 365.1	µg/L	1.4	10	430	<10	<10	280	21
Total Phosphorus-P	2/2/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	2/9/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	2/14/2012	composite	EPA 365.1	µg/L	1.4	10	560	<10	<1.4	<10	<10
Total Phosphorus-P	2/23/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	2/27/2012	composite	EPA 365.1	µg/L	1.4	10	1800	<10	<1.4	<10	
Total Phosphorus-P	3/1/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	3/6/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	3/8/2012	composite	EPA 365.1	µg/L	1.4	10					420
Total Phosphorus-P	3/12/2012	composite	EPA 365.1	µg/L	1.4	10	1900	<10	<1.4	<10	<10
Total Phosphorus-P	3/15/2012	composite	EPA 365.1	µg/L	1.4	10					140
Total Phosphorus-P	3/19/2012	composite	EPA 365.1	µg/L	1.4	10					26
Total Phosphorus-P	3/22/2012	composite	EPA 365.1	µg/L	1.4	10					140
Total Phosphorus-P	3/26/2012	composite	EPA 365.1	µg/L	1.4	10	1400	<10	<10	<10	11
Total Phosphorus-P	3/29/2012	composite	EPA 365.1	µg/L	1.4	10					22
Total Phosphorus-P	4/2/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	4/5/2012	composite	EPA 365.1	µg/L	1.4	10					15
Total Phosphorus-P	4/9/2012	composite	EPA 365.1	µg/L	1.4	10	490	<10	<1.4	<10	<10
Total Phosphorus-P	4/12/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	4/16/2012	composite	EPA 365.1	µg/L	1.4	10					120
Total Phosphorus-P	4/23/2012	composite	EPA 365.1	µg/L	1.4	10	910	<10	<10	<10	<10
Total Phosphorus-P	4/26/2012	composite	EPA 365.1	µg/L	1.4	10					11
Total Phosphorus-P	4/30/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	5/3/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	5/7/2012	composite	EPA 365.1	µg/L	1.4	10	1000.00	<1.4	<10	<10	<10
Total Phosphorus-P	5/14/2012	composite	EPA 365.1	µg/L	1.4	10					29.00
Total Phosphorus-P	5/21/2012	composite	EPA 365.1	µg/L	1.4	10	680.00	<1.4	<1.4	<10	<10

Table 15 Certified Laboratory Results of Total Phosphorus Sampled from Various Locations in the AWPF

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Phosphorus-P	5/24/2012	composite	EPA 365.1	µg/L	1.4	10	1100.00			<10	<10
Total Phosphorus-P	5/29/2012	composite	EPA 365.1	µg/L	1.4	10	870.00			<10	<10
Total Phosphorus-P	5/31/2012	composite	EPA 365.1	µg/L	1.4	10	1100.00			23.00	<10
Total Phosphorus-P	6/4/2012	composite	EPA 365.1	µg/L	1.4	10	1400.00	<10	<10	<10	<10
Total Phosphorus-P	6/7/2012	composite	EPA 365.1	µg/L	1.4	10	1900.00			<10	14.00
Total Phosphorus-P	6/11/2012	composite	EPA 365.1	µg/L	1.4	10	1600.00			<10	<10
Total Phosphorus-P	6/21/2012	composite	EPA 365.1	µg/L	1.4	10	2100.00			<10	<10
Total Phosphorus-P	6/28/2012	composite	EPA 365.1	µg/L	1.4	10	2100.00			<10	<10
Total Phosphorus-P	7/2/2012	composite	EPA 365.1	µg/L	1.4	10				<10	<10
Total Phosphorus-P	7/5/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	7/9/2012	composite	EPA 365.1	µg/L	1.4	10					<1.4
Total Phosphorus-P	7/12/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	7/16/2012	composite	EPA 365.1	µg/L	1.4	10				<10	<10
Total Phosphorus-P	7/19/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	7/23/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	7/26/2012	composite	EPA 365.1	µg/L	1.4	10					<10
Total Phosphorus-P	7/30/2012	composite	EPA 365.1	µg/L	1.4	10				<10	<10
n =							31	24	24	31	88
Average							1320	<10	<10	15	16
Maximum							2500	11	11	280	420
Minimum							300	0.70	0.70	0.70	0.70
STDev							630	2.4	2.6	49	50

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL. . The result shown for S10 (940 µg/L) on 1/5/2012 is considered an outlier and ommitted for determination of statistical parameters. Data flags provided in the original laboratory reports are not shown.

Table 16 Certified Laboratory Results of Trihalomethanes, Methylene Chloride, 1, 2 Dichloroethane, and Napthalene

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
THMs, Total	8/1/2011	grab	EPA 524.2	µg/L	0.60	2.0		3.7	2.1	<2
THMs, Total	9/1/2011	grab	EPA 524.2	µg/L	0.60	2.0	<0.6		<0.6	<0.6
THMs, Total	10/3/2011	grab	EPA 524.2	µg/L	0.60	2.0	<2		<0.6	<0.6
THMs, Total	11/2/2011	grab	EPA 524.2	µg/L	0.60	2.0	<2		<0.6	<0.6
THMs, Total	12/1/2011	grab	EPA 524.2	µg/L	0.60	2.0	<0.6	<2	<0.6	<0.6
THMs, Total	1/3/2012	grab	EPA 524.2	µg/L	0.60	2.0	<0.6	<2	<0.6	<0.6
THMs, Total	2/1/2012	grab	EPA 524.2	µg/L	0.60	2.0	<0.6	<0.6	<0.6	<0.6
THMs, Total	3/6/2012	grab	EPA 524.2	µg/L	0.60	2.0	3	3.1	<2	<2
THMs, Total	4/2/2012	grab	EPA 524.2	µg/L	0.60	2.0	<0.6	<0.6	<0.6	<0.6
THMs, Total	5/1/2012	grab	EPA 524.2	µg/L	0.60	2.0	<2	<2	<0.6	<0.6
THMs, Total	6/4/2012	grab	EPA 524.2	µg/L	0.60	2.0	<2	<2		<2
THMs, Total	7/2/2012	grab	EPA 524.2	µg/L	0.60	2.0	<2			<0.6
n =							11	8	10	12
Average							<2	<2	<2	<0.6
Maximum							3	4	2	1
Minimum							0.3	0.3	0.3	0.3
STDev							0.8	1	0.6	0.3
Methylene chloride	8/1/2011	grab	EPA 524.2	µg/L	0.14	0.50		<0.14	<0.5	<0.5
Methylene chloride	9/1/2011	grab	EPA 524.2	µg/L	0.14	0.50	0.72		0.62	0.59
Methylene chloride	10/3/2011	grab	EPA 524.2	µg/L	0.14	0.50	<0.5		<0.5	<0.5
Methylene chloride	11/2/2011	grab	EPA 524.2	µg/L	0.14	0.50	<0.14		<0.14	<0.14
Methylene chloride	12/1/2011	grab	EPA 524.2	µg/L	0.14	0.50	<0.5	<0.5	<0.5	<0.5
Methylene chloride	1/3/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.5	<0.5	<0.5	<0.5
Methylene chloride	2/1/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.5	<0.5	<0.5	<0.5
Methylene chloride	3/6/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.5	<0.5	<0.14	<0.14
Methylene chloride	4/2/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.5	<0.5	<0.5	<0.5
Methylene chloride	5/1/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.5	<0.5	<0.5	<0.5
Methylene chloride	6/4/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.14	<0.14		<0.14
Methylene chloride	7/2/2012	grab	EPA 524.2	µg/L	0.14	0.50	<0.14			<0.14
n =							11.0	8.0	10.0	12.0
Average							<0.5	<0.5	<0.5	<0.5
Maximum							0.7	0.3	0.6	0.6
Minimum							0.1	0.1	0.1	0.1
STDev							0.2	0.1	0.1	0.1

Table 16 Certified Laboratory Results of Trihalomethanes, Methylene Chloride, 1, 2 Dichloroethane, and Napthalene

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Dibromochloromethane	8/1/2011	grab	EPA 524.2	µg/L	0.20	0.50		1	<0.5	<0.20
Dibromochloromethane	9/1/2011	grab	EPA 524.2	µg/L	0.20	0.50	<0.20		<0.20	<0.20
Dibromochloromethane	10/3/2011	grab	EPA 524.2	µg/L	0.20	0.50	<0.5		<0.5	<0.20
Dibromochloromethane	11/2/2011	grab	EPA 524.2	µg/L	0.20	0.50	0.51		<0.5	<0.20
Dibromochloromethane	12/1/2011	grab	EPA 524.2	µg/L	0.20	0.50	<0.5	<0.5	<0.20	<0.20
Dibromochloromethane	1/3/2012	grab	EPA 524.2	µg/L	0.20	0.50	<0.5	<0.5	<0.5	<0.20
Dibromochloromethane	2/1/2012	grab	EPA 524.2	µg/L	0.20	0.50	<0.5	<0.5	<0.20	<0.20
Dibromochloromethane	3/6/2012	grab	EPA 524.2	µg/L	0.20	0.50	0.8	0.84	<0.5	<0.20
Dibromochloromethane	4/2/2012	grab	EPA 524.2	µg/L	0.20	0.50	<0.5	<0.20	<0.20	<0.20
Dibromochloromethane	5/1/2012	grab	EPA 524.2	µg/L	0.20	0.50	0.53	<0.5	<0.2	<0.2
Dibromochloromethane	6/4/2012	grab	EPA 524.2	µg/L	0.20	0.50	0.6	<0.5		0.6
Dibromochloromethane	7/2/2012	grab	EPA 524.2	µg/L	0.20	0.50	<0.5			<0.2
n =							11	8	10	12
Average							<0.5	<0.5	<0.2	<0.2
Maximum							0.8	1.0	0.3	0.6
Minimum							0.1	0.1	0.1	0.1
STDev							0.2	0.3	0.1	0.1
Chloroform	8/1/2011	grab	EPA 524.2	µg/L	0.12	0.5		1.3	1.3	1.1
Chloroform	9/1/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.12		<0.12	<0.12
Chloroform	10/3/2011	grab	EPA 524.2	µg/L	0.12	0.5	0.89		0.52	<0.5
Chloroform	11/2/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.5		<0.12	<0.12
Chloroform	12/1/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.5	0.61	<0.12	<0.12
Chloroform	1/3/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.5	0.71	<0.5	<0.12
Chloroform	2/1/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.5	<0.5	<0.12	<0.12
Chloroform	3/6/2012	grab	EPA 524.2	µg/L	0.12	0.5	1.1	1.1	1	0.97
Chloroform	4/2/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.5	<0.5	<0.12	<0.12
Chloroform	5/1/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.5	0.67	<0.12	<0.12
Chloroform	6/4/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.5	<0.5		<0.5
Chloroform	7/2/2012	grab	EPA 524.2	µg/L	0.12	0.5	0.68			<0.5
n =							11	8	10	12
Average							<0.5	0.6	<0.5	<0.5
Maximum							1	1	1	1
Minimum							0.1	0.3	0.1	0.1
STDev							0.3	0.4	0.5	0.4

Table 16 Certified Laboratory Results of Trihalomethanes, Methylene Chloride, 1, 2 Dichloroethane, and Napthalene

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Bromoform	8/1/2011	grab	EPA 524.2	µg/L	0.19	0.5		<0.19	<0.19	<0.19
Bromoform	9/1/2011	grab	EPA 524.2	µg/L	0.19	0.5	<0.19		<0.19	<0.19
Bromoform	10/3/2011	grab	EPA 524.2	µg/L	0.19	0.5	<0.19		<0.19	<0.19
Bromoform	11/2/2011	grab	EPA 524.2	µg/L	0.19	0.5	<0.19		<0.19	<0.19
Bromoform	12/1/2011	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19
Bromoform	1/3/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19
Bromoform	2/1/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19
Bromoform	3/6/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19
Bromoform	4/2/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19
Bromoform	5/1/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19
Bromoform	6/4/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19		<0.19
Bromoform	7/2/2012	grab	EPA 524.2	µg/L	0.19	0.5	<0.19			<0.19
n =							11	8	10	12
Average							<0.19	<0.19	<0.19	<0.19
Maximum							0.10	0.10	0.10	0.10
Minimum							0.10	0.10	0.10	0.10
STDev							0.0	0.0	0.0	0.0
Bromodichloromethane	8/1/2011	grab	EPA 524.2	µg/L	0.090	0.5		1.4	0.84	0.71
Bromodichloromethane	9/1/2011	grab	EPA 524.2	µg/L	0.090	0.5	<0.090		<0.090	<0.090
Bromodichloromethane	10/3/2011	grab	EPA 524.2	µg/L	0.090	0.5	0.71		<0.5	<0.5
Bromodichloromethane	11/2/2011	grab	EPA 524.2	µg/L	0.090	0.5	0.71		<0.5	<0.5
Bromodichloromethane	12/1/2011	grab	EPA 524.2	µg/L	0.090	0.5	<0.5	0.52	<0.5	<0.5
Bromodichloromethane	1/3/2012	grab	EPA 524.2	µg/L	0.090	0.5	<0.5	0.59	<0.5	<0.5
Bromodichloromethane	2/1/2012	grab	EPA 524.2	µg/L	0.090	0.5	<0.5	0.57	<0.5	<0.5
Bromodichloromethane	3/6/2012	grab	EPA 524.2	µg/L	0.090	0.5	1.1	1.2	0.71	0.56
Bromodichloromethane	4/2/2012	grab	EPA 524.2	µg/L	0.090	0.5	<0.5	<0.5	<0.090	<0.090
Bromodichloromethane	5/1/2012	grab	EPA 524.2	µg/L	0.090	0.5	0.53	0.59	<0.5	<0.5
Bromodichloromethane	6/4/2012	grab	EPA 524.2	µg/L	0.090	0.5	0.78	0.66		0.85
Bromodichloromethane	7/2/2012	grab	EPA 524.2	µg/L	0.090	0.5	0.61			<0.5
n =							11	8	10	12
Average							<0.5	0.7	<0.5	<0.5
Maximum							1.1	1.4	0.8	0.9
Minimum							0.0	0.3	0.0	0.0
STDev							0.3	0.4	0.3	0.2

Table 16 Certified Laboratory Results of Trihalomethanes, Methylene Chloride, 1, 2 Dichloroethane, and Napthalene

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
1,2-Dichloroethane	8/1/2011	grab	EPA 524.2	µg/L	0.12	0.5		<0.12	<0.12	<0.12
1,2-Dichloroethane	9/1/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.12		<0.12	<0.12
1,2-Dichloroethane	10/3/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.12		<0.12	<0.12
1,2-Dichloroethane	11/2/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.12		<0.12	<0.12
1,2-Dichloroethane	12/1/2011	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12
1,2-Dichloroethane	1/3/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12
1,2-Dichloroethane	2/1/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12
1,2-Dichloroethane	3/6/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12
1,2-Dichloroethane	4/2/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12
1,2-Dichloroethane	5/1/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12
1,2-Dichloroethane	6/4/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12		<0.12
1,2-Dichloroethane	7/2/2012	grab	EPA 524.2	µg/L	0.12	0.5	<0.12			<0.12
n =							11	8	10	12
Average							<0.12	<0.12	<0.12	<0.12
Maximum							0.1	0.1	0.1	0.1
Minimum							0.1	0.1	0.1	0.1
STDev							0.0	0.0	0.0	0.0
Naphthalene	4/2/2012	Grab	EPA 524.2	µg/L	0.42	0.5	<0.42	<0.42	<0.42	<0.42
Naphthalene	5/1/2012	Grab	EPA 524.2	µg/L	0.42	0.5	<0.42	<0.42	<0.42	<0.42
Naphthalene	6/4/2012	Grab	EPA 524.2	µg/L	0.42	0.5	<0.42	<0.42		<0.42
Naphthalene	7/2/2012	Grab	EPA 524.2	µg/L	0.42	0.5	<0.42			<0.42
n =							4	3	2	4
Average							<0.42	<0.42	<0.42	<0.42
Maximum							0.2	0.2	0.2	0.2
Minimum							0.2	0.2	0.2	0.2
STDev							0.0	0.0	0.0	0.0

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 17 Certified Laboratory Results of Haloacetic Acids

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Monochloroacetic acid (mcaa)	8/4/2011	grab	EPA 552.2	µg/L	0.32	2.0		<0.32				<0.32
Monochloroacetic acid (mcaa)	9/1/2011	grab	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	10/3/2011	grab	EPA 552.2	µg/L	0.32	2.0	<0.32		<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	10/4/2011	grab	EPA 552.2	µg/L	0.32	2.0		<0.32				
Monochloroacetic acid (mcaa)	11/2/2011	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	12/1/2011	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	1/3/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	2/1/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	3/6/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	4/2/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	5/1/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	6/4/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Monochloroacetic acid (mcaa)	7/2/2012	composite	EPA 552.2	µg/L	0.32	2.0	<0.32	<0.32			<0.32	<0.32
n =							11	12	10	10	11	12
Average							<0.32	<0.32	<0.32	<0.32	<0.32	<0.32
Maximum							0.3	0.3	0.3	0.3	0.3	0.2
Minimum							0.2	0.2	0.2	0.2	0.2	0.2
STDev							0.1	0.1	0.1	0.1	0.1	0.0
Monobromoacetic acid (mbaa)	8/4/2011	grab	EPA 552.2	µg/L	0.21	1.0		<0.21				<0.21
Monobromoacetic acid (mbaa)	9/1/2011	grab	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	10/3/2011	grab	EPA 552.2	µg/L	0.21	1.0	<0.21		<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	10/4/2011	grab	EPA 552.2	µg/L	0.21	1.0		<0.21				
Monobromoacetic acid (mbaa)	11/2/2011	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	12/1/2011	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	1/3/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	2/1/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	3/6/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	4/2/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	5/1/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	6/4/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Monobromoacetic acid (mbaa)	7/2/2012	composite	EPA 552.2	µg/L	0.21	1.0	<0.21	<0.21			<0.21	<0.21
n =							11	12	10	10	11	12
Average							<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Maximum							0.2	0.2	0.2	0.2	0.2	0.2
Minimum							0.1	0.1	0.1	0.1	0.1	0.1
STDev							0.0	0.0	0.0	0.0	0.0	0.0

Table 17 Certified Laboratory Results of Haloacetic Acids

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Dichloroacetic acid (dcaa)	8/4/2011	grab	EPA 552.2	µg/L	0.41	1		5.8				<0.41
Dichloroacetic acid (dcaa)	9/1/2011	grab	EPA 552.2	µg/L	0.41	1	<0.41	<0.41	<0.41	<1	<0.41	<0.41
Dichloroacetic acid (dcaa)	10/3/2011	grab	EPA 552.2	µg/L	0.41	1	<0.41		<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	10/4/2011	grab	EPA 552.2	µg/L	0.41	1		7.1				
Dichloroacetic acid (dcaa)	11/2/2011	composite	EPA 552.2	µg/L	0.41	1	<0.41	8.1	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	12/1/2011	composite	EPA 552.2	µg/L	0.41	1	<0.41	5.7	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	1/3/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	5.4	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	2/1/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	6.9	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	3/6/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	7.3	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	4/2/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	6.9	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	5/1/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	5	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	6/4/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	6.6	<0.41	<0.41	<0.41	<0.41
Dichloroacetic acid (dcaa)	7/2/2012	composite	EPA 552.2	µg/L	0.41	1	<0.41	6.4			<0.41	<0.41
n =							11	12	10	10	11	12
Average							<0.41	6	<0.41	<0.41	<0.41	<0.41
Maximum							0.2	8	0.2	0.5	0.2	0.2
Minimum							0.2	0.2	0.2	0.2	0.2	0.2
STDev							0.0	2	0.0	0.1	0.0	0.0
Trichloroacetic acid (tcaa)	8/4/2011	grab	EPA 552.2	µg/L	0.22	1.0		6.9				<0.22
Trichloroacetic acid (tcaa)	9/1/2011	grab	EPA 552.2	µg/L	0.22	1.0	1.2	1.7	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	10/3/2011	grab	EPA 552.2	µg/L	0.22	1.0	1.6		<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	10/4/2011	grab	EPA 552.2	µg/L	0.22	1.0		2				
Trichloroacetic acid (tcaa)	11/2/2011	composite	EPA 552.2	µg/L	0.22	1.0	1.4	1.6	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	12/1/2011	composite	EPA 552.2	µg/L	0.22	1.0	2.1	2.9	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	1/3/2012	composite	EPA 552.2	µg/L	0.22	1.0	3.5	4.4	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	2/1/2012	composite	EPA 552.2	µg/L	0.22	1.0	4.6	4.1	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	3/6/2012	composite	EPA 552.2	µg/L	0.22	1.0	4.2	5.1	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	4/2/2012	composite	EPA 552.2	µg/L	0.22	1.0	<0.22	3.4	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	5/1/2012	composite	EPA 552.2	µg/L	0.22	1.0	2.3	2.9	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	6/4/2012	composite	EPA 552.2	µg/L	0.22	1.0	1.4	3.2	<0.22	<0.22	<0.22	<0.22
Trichloroacetic acid (tcaa)	7/2/2012	composite	EPA 552.2	µg/L	0.22	1.0	2.5	3.4			<0.22	<0.22
n =							11	12	10	10	11	12
Average							2.3	3.5	<0.22	<0.22	<0.22	<0.22
Maximum							4.6	6.9	0.1	0.1	0.1	0.1
Minimum							0.1	1.6	0.1	0.1	0.1	0.1
STDev							1.4	1.5	0.0	0.0	0.0	0.0
Dibromoacetic acid (dbaa)	8/4/2011	grab	EPA 552.2	µg/L	0.13	1.0		<1				<0.13

Table 17 Certified Laboratory Results of Haloacetic Acids

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Dibromoacetic acid (dbaa)	9/1/2011	grab	EPA 552.2	µg/L	0.13	1.0	<0.13	<1	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	10/3/2011	grab	EPA 552.2	µg/L	0.13	1.0	<0.13		<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	10/4/2011	grab	EPA 552.2	µg/L	0.13	1.0		<1				
Dibromoacetic acid (dbaa)	11/2/2011	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<1	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	12/1/2011	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<1	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	1/3/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<1	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	2/1/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<1	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	3/6/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<1	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	4/2/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	5/1/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	6/4/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	1.3	<0.13	<0.13	<0.13	<0.13
Dibromoacetic acid (dbaa)	7/2/2012	composite	EPA 552.2	µg/L	0.13	1.0	<0.13	1.1			<0.13	<0.13
n =							11	12	10	10	11	12
Average							<0.13	<1	<0.13	<0.13	<0.13	<0.13
Maximum							0.1	1	0.1	0.1	0.1	0.1
Minimum							0.1	0.1	0.1	0.1	0.1	0.1
STDev							0.0	0.3	0.0	0.0	0.0	0.0
HAA5, Total	8/4/2011	grab	EPA 552.2	µg/L	NA	1.0		13				<1
HAA5, Total	9/1/2011	grab	EPA 552.2	µg/L	NA	1.0	1.2	1.7	<1	<1	<1	<1
HAA5, Total	10/3/2011	Grab	EPA 552.2	µg/L	NA	1.0	1.6		<1	<1	<1	<1
HAA5, Total	10/4/2011	Grab	EPA 552.2	µg/L	NA	1.0		9.1				
HAA5, Total	11/2/2011	composite	EPA 552.2	µg/L	NA	1.0	1.4	9.7	<1	<1	<1	<1
HAA5, Total	12/1/2011	composite	EPA 552.2	µg/L	NA	1.0	2.1	8.6	<1	<1	<1	<1
HAA5, Total	1/3/2012	composite	EPA 552.2	µg/L	NA	1.0	3.5	9.8	<1	<1	<1	<1
HAA5, Total	2/1/2012	composite	EPA 552.2	µg/L	NA	1.0	4.6	11	<1	<1	<1	<1
HAA5, Total	3/6/2012	composite	EPA 552.2	µg/L	NA	1.0	4.2	12	<1	<1	<1	<1
HAA5, Total	4/2/2012	composite	EPA 552.2	µg/L	NA	1.0	<1	10	<1	<1	<1	<1
HAA5, Total	5/1/2012	composite	EPA 552.2	µg/L	NA	1.0	2.3	7.8	<1	<1	<1	<1
HAA5, Total	6/4/2012	composite	EPA 552.2	µg/L	NA	1.0		11	<1	<1	<1	<1
HAA5, Total	7/2/2012	composite	EPA 552.2	µg/L	NA	1.0	2.5	11			<1	<1
n =							11	12	10	10	11	12
Average							2.3	9.6	<1	<1	<1	<1
Maximum							4.6	13	0.5	0.5	0.5	0.5
Minimum							0.0	1.7	0.0	0.0	0.0	0.0
STDev							1.4	2.9	0.0	0.0	0.0	0.0

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported below the DL were considered the 0.5 X DL.

Table 18 Certified Laboratory Results of Nitrosamines

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
N-Nitrosodiethylamine (NDEA)	8/1/2011	grab	EPA 521	ng/L	0.72	2.0		<0.72	<0.72	<0.72	<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	9/1/2011	grab	EPA 521	ng/L	0.72	2.0	<2	<2	<2	<0.72	<2	<0.72
N-Nitrosodiethylamine (NDEA)	10/3/2011	grab	EPA 521	ng/L	0.72	2.0	<0.72	<2	<0.72	<0.72	<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	11/2/2011	grab	EPA 521	ng/L	0.72	2.0	<2.3	<0.72	<0.72	6.1	<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	12/1/2011	grab	EPA 521	ng/L	0.72	2.0	<2	2.6	<0.72	<0.72	<0.72	2.5
N-Nitrosodiethylamine (NDEA)	1/3/2012	grab	EPA 521	ng/L	0.72	2.0	11	7.9	<2	<0.72	<2	2.9
N-Nitrosodiethylamine (NDEA)	2/1/2012	grab	EPA 521	ng/L	0.72	2.0	<2	<2	<0.72	<2	<2	<2
N-Nitrosodiethylamine (NDEA)	2/8/2012	grab	EPA 521	ng/L	0.72	2.0	<2	<0.72			<2	<2
N-Nitrosodiethylamine (NDEA)	2/15/2012	grab	EPA 521	ng/L	0.72	2.0	<0.72	<2			<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	2/22/2012	grab	EPA 521	ng/L	0.72	2.0	<0.72	3.4			<2	<0.72
N-Nitrosodiethylamine (NDEA)	3/6/2012	grab	EPA 521	ng/L	0.72	2.0	<0.72	<2		<0.72	<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	4/2/2012	grab	EPA 521	ng/L	0.72	2.0	<2	<2	<0.72	<0.72		
N-Nitrosodiethylamine (NDEA)	4/23/2012	grab	EPA 521	ng/L	0.72	2.0					<2	4.9
N-Nitrosodiethylamine (NDEA)	5/1/2012	grab	EPA 521	ng/L	0.72	2.0	<2	<0.72	<0.72	<0.72	<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	6/4/2012	grab	EPA 521	ng/L	0.72	2.0	<0.72	<0.8	<0.72	<0.72	<0.72	<0.72
N-Nitrosodiethylamine (NDEA)	7/2/2012	grab	EPA 521	ng/L	0.72	2.0	<0.72	<0.72			<0.72	<0.72
n =							14	15	11	11	15	15
Average							<2	<2	<0.72	<2	<0.72	<2
Maximum							11	7.9	1.0	6.1	1.0	4.9
Minimum							0.40	0.40	0.1	0.40	0.40	0.40
STDev							2.8	2.0	0.30	1.7	0.30	1.3
N-Nitrosodimethylamine (NDMA)	8/1/2011	grab	EPA 521	ng/L	0.28	2.0		3.8	<2	<2	<2	<0.28
N-Nitrosodimethylamine (NDMA)	9/1/2011	grab	EPA 521	ng/L	0.28	2.0	3.6	6.3	<2	2.6	<2	<2
N-Nitrosodimethylamine (NDMA)	10/3/2011	grab	EPA 521	ng/L	0.28	2.0	<2	6.1	<2	<2	<2	<2
N-Nitrosodimethylamine (NDMA)	10/18/2011	grab	EPA 521	ng/L	0.28	2.0						
N-Nitrosodimethylamine (NDMA)	11/2/2011	grab	EPA 521	ng/L	0.28	2.0	3.2	2.3	ND	<2	ND	<0.28
N-Nitrosodimethylamine (NDMA)	12/1/2011	grab	EPA 521	ng/L	0.28	2.0	2.1	2.1	<2	2.3	<2	<0.28
N-Nitrosodimethylamine (NDMA)	1/3/2012	grab	EPA 521	ng/L	0.28	2.0	7.6	<2	<2	<2	<2	5.5
N-Nitrosodimethylamine (NDMA)	2/1/2012	grab	EPA 521	ng/L	0.28	2.0	<2	2.9	<2	<2	ND	<2
N-Nitrosodimethylamine (NDMA)	2/8/2012	grab	EPA 521	ng/L	0.28	2.0		<2			<2	<0.28
N-Nitrosodimethylamine (NDMA)	2/15/2012	grab	EPA 521	ng/L	0.28	2.0		<2			<2	<2
N-Nitrosodimethylamine (NDMA)	2/22/2012	grab	EPA 521	ng/L	0.28	2.0		<2			<2	<2
N-Nitrosodimethylamine (NDMA)	3/6/2012	grab	EPA 521	ng/L	0.28	2.0	<2	<2		<2	<2	<0.28
N-Nitrosodimethylamine (NDMA)	4/2/2012	grab	EPA 521	ng/L	0.28	2.0	20	17	7.9	8.7		
N-Nitrosodimethylamine (NDMA)	4/23/2012	grab	EPA 521	ng/L	0.28	2.0					ND	<0.28
N-Nitrosodimethylamine (NDMA)	5/1/2012	grab	EPA 521	ng/L	0.28	2.0						<2

Table 18 Certified Laboratory Results of Nitrosamines

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
N-Nitrosodimethylamine (NDMA)	6/4/2012	grab	EPA 521	ng/L	0.28	2.0	<2	<2.2	<0.28	<2	<0.28	<0.28
N-Nitrosodimethylamine (NDMA)	7/2/2012	grab	EPA 521	ng/L	0.28	2.0	<2	<2			<2	<2
n =							10	14	9	10	14	15
Average							4.2	3.5	<2.0	2.1	<2.0	<2.0
Maximum							20	17	7.9	8.7	2.0	5.5
Minimum							1.0	1.0	0.10	1.0	0.10	0.10
STDev							5.9	4.3	2.4	2.4	0.60	1.3
N-Nitrosodi-n-butylamine (NDBA)	8/1/2011	grab	EPA 521	ng/L	0.59	2.0		<2	<0.59	<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	9/1/2011	grab	EPA 521	ng/L	0.59	2.0	<0.59	<2	<0.59	<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	10/3/2011	grab	EPA 521	ng/L	0.59	2.0	<0.59	<2	<0.59	<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	11/2/2011	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	12/1/2011	grab	EPA 521	ng/L	0.59	2.0	<2	<0.59	<0.59	<0.59	<2	<0.59
N-Nitrosodi-n-butylamine (NDBA)	1/3/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	2/1/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59	<2	<0.59	<0.59	<2
N-Nitrosodi-n-butylamine (NDBA)	2/8/2012	grab	EPA 521	ng/L	0.59	2.0		<0.59			<2	<0.59
N-Nitrosodi-n-butylamine (NDBA)	2/15/2012	grab	EPA 521	ng/L	0.59	2.0		<0.59			<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	2/22/2012	grab	EPA 521	ng/L	0.59	2.0		<0.59			<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	3/6/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59		<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	4/2/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59	<0.59	<0.59		
N-Nitrosodi-n-butylamine (NDBA)	4/23/2012	grab	EPA 521	ng/L	0.59	2.0					<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	5/1/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59
N-Nitrosodi-n-butylamine (NDBA)	6/4/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<2.2	<0.59	<2	<0.59	<2
N-Nitrosodi-n-butylamine (NDBA)	7/2/2012	grab	EPA 521	ng/L	0.59	2.0	<0.59	<0.59			<0.59	<0.59
n =							11	15	10	11	15	15
Average							<0.59	<0.59	<0.59	<0.59	<0.59	<0.59
Maximum							1.0	1.1	1.0	1.0	1.0	1.0
Minimum							0.3	0.3	0.3	0.3	0.3	0.3
STDev							0.2	0.3	0.2	0.2	0.2	0.2

Table 18 Certified Laboratory Results of Nitrosamines

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
N-Nitrosodi-n-propylamine (NDPA)	8/1/2011	grab	EPA 521	ng/L	0.35	2.0		<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	9/1/2011	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	10/3/2011	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	11/2/2011	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	12/1/2011	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	1/3/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	2/1/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	2/8/2012	grab	EPA 521	ng/L	0.35	2.0		<0.35			<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	2/15/2012	grab	EPA 521	ng/L	0.35	2.0		<0.35			<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	2/22/2012	grab	EPA 521	ng/L	0.35	2.0		<0.35			<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	3/6/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35		<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	4/2/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35		
N-Nitrosodi-n-propylamine (NDPA)	4/23/2012	grab	EPA 521	ng/L	0.35	2.0					<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	5/1/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	6/4/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.39	<0.35	<0.35	<0.35	<0.35
N-Nitrosodi-n-propylamine (NDPA)	7/2/2012	grab	EPA 521	ng/L	0.35	2.0	<0.35	<0.35			<0.35	<0.35
n =							11	15	10	11	15	15
Average							<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Maximum							0.2	0.2	0.2	0.2	0.2	0.2
Minimum							0.2	0.2	0.2	0.2	0.2	0.2
STDev							0.0	0.0	0.0	0.0	0.0	0.0
N-Nitrosomethylethylamine (NMEA)	8/1/2011	grab	EPA 521	ng/L	0.28	2.0		<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	9/1/2011	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	10/3/2011	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	11/2/2011	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	12/1/2011	grab	EPA 521	ng/L	0.28	2.0	<2	<0.28	<0.28	<2	<0.28	<2
N-Nitrosomethylethylamine (NMEA)	1/3/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	2/1/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	2/8/2012	grab	EPA 521	ng/L	0.28	2.0		<0.28			<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	2/15/2012	grab	EPA 521	ng/L	0.28	2.0		<0.28			<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	2/22/2012	grab	EPA 521	ng/L	0.28	2.0		<0.28			<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	3/6/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28		<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	4/2/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28		
N-Nitrosomethylethylamine (NMEA)	4/23/2012	grab	EPA 521	ng/L	0.28	2.0					<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	5/1/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
N-Nitrosomethylethylamine (NMEA)	6/4/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.31	<0.28	<0.28	<0.28	<0.28

Table 18 Certified Laboratory Results of Nitrosamines

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
N-Nitrosomethylethylamine (NMEA)	7/2/2012	grab	EPA 521	ng/L	0.28	2.0	<0.28	<0.28			<0.28	<0.28
n =							11	15	10	11	15	15
Average							<0.28	<0.28	<0.28	<0.28	<0.28	<0.28
Maximum							1.0	0.2	0.2	1.0	0.2	1.0
Minimum							0.1	0.1	0.1	0.1	0.1	0.1
STDev							0.3	0.0	0.0	0.3	0.0	0.2
N-Nitrosomorpholine (NMOR)	8/1/2011	grab	EPA 521	ng/L	0.47	2.0		20	<0.47	<2	<2	<0.47
N-Nitrosomorpholine (NMOR)	9/1/2011	grab	EPA 521	ng/L	0.47	2.0	25	23	<0.47	<0.47	<2	<0.47
N-Nitrosomorpholine (NMOR)	10/3/2011	grab	EPA 521	ng/L	0.47	2.0	17	21	<0.47	<2	<2	<0.47
N-Nitrosomorpholine (NMOR)	11/2/2011	grab	EPA 521	ng/L	0.47	2.0	25	25	<2.2	<2	<2.3	<0.47
N-Nitrosomorpholine (NMOR)	12/1/2011	grab	EPA 521	ng/L	0.47	2.0	23	19	<2	<2	<2	<0.47
N-Nitrosomorpholine (NMOR)	1/3/2012	grab	EPA 521	ng/L	0.47	2.0	17	14	<0.47	<0.47	<0.47	<0.47
N-Nitrosomorpholine (NMOR)	2/1/2012	grab	EPA 521	ng/L	0.47	2.0	28	28	<2	<2	<2	<2
N-Nitrosomorpholine (NMOR)	2/8/2012	grab	EPA 521	ng/L	0.47	2.0		34			<2	<0.47
N-Nitrosomorpholine (NMOR)	2/15/2012	grab	EPA 521	ng/L	0.47	2.0		17			<0.47	<0.47
N-Nitrosomorpholine (NMOR)	2/22/2012	grab	EPA 521	ng/L	0.47	2.0		22			<0.47	<0.47
N-Nitrosomorpholine (NMOR)	3/6/2012	grab	EPA 521	ng/L	0.47	2.0	26	30		<2	<2	<0.47
N-Nitrosomorpholine (NMOR)	4/2/2012	grab	EPA 521	ng/L	0.47	2.0	8.8	7.7	<2	<2		
N-Nitrosomorpholine (NMOR)	4/23/2012	grab	EPA 521	ng/L	0.47	2.0					<2	<0.47
N-Nitrosomorpholine (NMOR)	5/1/2012	grab	EPA 521	ng/L	0.47	2.0	15	13	<2	<0.47	<2	<0.47
N-Nitrosomorpholine (NMOR)	6/4/2012	grab	EPA 521	ng/L	0.47	2.0	19	23	<2	<2	<2	<0.47
N-Nitrosomorpholine (NMOR)	7/2/2012	grab	EPA 521	ng/L	0.47	2.0	12	14			<2	<0.47
n =							11	15	10	11	15	15
Average							20	21	<2.0	<2.0	<2.0	<0.47
Maximum							28	34	1.1	1.0	1.2	1.0
Minimum							8.8	7.7	0.2	0.2	0.2	0.2
STDev							6.3	7.0	0.4	0.4	0.3	0.2
N-Nitrosopiperidine (NPIP)	8/1/2011	grab	EPA 521	ng/L	0.71	2.0		<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	9/1/2011	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	10/3/2011	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	11/2/2011	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	12/1/2011	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	1/3/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	2/1/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	2/8/2012	grab	EPA 521	ng/L	0.71	2.0		<0.71			<0.71	<0.71
N-Nitrosopiperidine (NPIP)	2/15/2012	grab	EPA 521	ng/L	0.71	2.0		<0.71			<0.71	<0.71
N-Nitrosopiperidine (NPIP)	2/22/2012	grab	EPA 521	ng/L	0.71	2.0		<0.71			<0.71	<0.71

Table 18 Certified Laboratory Results of Nitrosamines

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
N-Nitrosopiperidine (NPIP)	3/6/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71		<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	4/2/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71		
N-Nitrosopiperidine (NPIP)	4/23/2012	grab	EPA 521	ng/L	0.71	2.0					<0.71	<0.71
N-Nitrosopiperidine (NPIP)	5/1/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	6/4/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.79	<0.71	<0.71	<0.71	<0.71
N-Nitrosopiperidine (NPIP)	7/2/2012	grab	EPA 521	ng/L	0.71	2.0	<0.71	<0.71			<0.71	<0.71
n =							11	15	10	11	15	15
Average							<0.71	<0.71	<0.71	<0.71	<0.71	<0.71
Maximum							0.4	0.4	0.4	0.4	0.4	0.4
Minimum							0.4	0.4	0.4	0.4	0.4	0.4
STDev							0.0	0.0	0.0	0.0	0.0	0.0
N-Nitrosopyrrolidine (NPYR)	8/1/2011	grab	EPA 521	ng/L	0.66	2.0		<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	9/1/2011	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	10/3/2011	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	11/2/2011	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	12/1/2011	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	1/3/2012	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	2/1/2012	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	2/8/2012	grab	EPA 521	ng/L	0.66	2.0		<0.66			<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	2/15/2012	grab	EPA 521	ng/L	0.66	2.0		<0.66			<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	2/22/2012	grab	EPA 521	ng/L	0.66	2.0		<0.66			<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	3/6/2012	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66		<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	4/2/2012	grab	EPA 521	ng/L	0.66	2.0	<2	<0.66	<0.66	<0.66		
N-Nitrosopyrrolidine (NPYR)	4/23/2012	grab	EPA 521	ng/L	0.66	2.0					<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	5/1/2012	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	6/4/2012	grab	EPA 521	ng/L	0.66	2.0	<2	<2.2	<0.66	<0.66	<0.66	<0.66
N-Nitrosopyrrolidine (NPYR)	7/2/2012	grab	EPA 521	ng/L	0.66	2.0	<0.66	<0.66			<0.66	<0.66
n =							11	15	10	11	15	15
Average							<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Maximum							1.0	1.1	0.4	0.3	0.4	0.3
Minimum							0.3	0.3	0.3	0.3	0.3	0.3
STDev							0.3	0.2	0.0	0.0	0.0	0.0

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 19 Certified Laboratory Results of 1,4-Dioxane

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
1,4-Dioxane	8/1/2011	grab	EPA 8270M	µg/L	0.040	0.50	1.9			<0.040	<0.040
1,4-Dioxane	9/1/2011	grab	EPA 8270M	µg/L	0.040	0.50	1.6	<0.040	<0.040	<0.040	<0.040
1,4-Dioxane	10/3/2011	grab	EPA 8270M	µg/L	0.040	0.50	1.8	<0.040	<0.040	<0.040	<0.040
1,4-Dioxane	11/2/2011	composite	EPA 8270M	µg/L	0.040	0.50	1.0	<0.040	<0.040	<0.040	<0.040
1,4-Dioxane	12/1/2011	composite	EPA 8270M	µg/L	0.040	0.50	1.2	<0.040	<0.5	<0.5	<0.040
1,4-Dioxane	1/3/2012	composite	EPA 8270M	µg/L	0.040	0.50	1.3	<0.040	<0.5	<0.040	<0.040
1,4-Dioxane	2/1/2012	composite	EPA 8270M	µg/L	0.040	0.50	1.2	<0.040	<0.040	<0.5	<0.040
1,4-Dioxane	3/6/2012	composite	EPA 8270M	µg/L	0.040	0.50	1.4	<0.040	<0.040	<0.040	<0.040
1,4-Dioxane	4/2/2012	composite	EPA 8270M	µg/L	0.040	0.50	1.4	<0.040	<0.040	<0.040	<0.046
1,4-Dioxane	5/1/2012	composite	EPA 8270M	µg/L	0.040	0.50	1.5	<0.04	<0.04	<0.04	<0.04
1,4-Dioxane	6/4/2012	composite	EPA 8270M	µg/L	0.040	0.50	1.3			<0.04	<0.04
1,4-Dioxane	7/2/2012	composite	EPA 8270M	µg/L	0.040	0.50				<0.04	<0.04
n =							11	9	9	12	12
Average							1.4	<0.040	<0.50	<0.50	<0.040
Maximum							1.9	0.02	0.25	0.25	0.03
Minimum							1.0	0.02	0.02	0.02	0.02
STDev							0.27	0.00	0.10	0.09	0.00

Note: For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported <DL were considered the 0.5 X DL.

Table 20 Certified Laboratory Results of Total Organic Carbon (TOC)

Parameter	Sample Date	[1] Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Organic Carbon (TOC)	8/1/2011	grab	SM5310C	mg/l	0.009	0.3	6		0.31		0.35
Total Organic Carbon (TOC)	8/4/2011	grab	SM5310C	mg/l	0.009	0.3		0.46		<0.3	<0.3
Total Organic Carbon (TOC)	8/8/2011	grab	SM5310C	mg/l	0.009	0.3					0.45
Total Organic Carbon (TOC)	8/11/2011	grab	SM5310C	mg/l	0.009	0.3					0.45
Total Organic Carbon (TOC)	8/15/2011	grab	SM5310C	mg/l	0.009	0.3					0.9
Total Organic Carbon (TOC)	8/18/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	8/22/2011	grab	SM5310C	mg/l	0.009	0.3					0.66
Total Organic Carbon (TOC)	8/25/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	8/29/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/1/2011	grab	SM5310C	mg/l	0.009	0.3	7.2	<0.3	0.34	0.31	0.32
Total Organic Carbon (TOC)	9/6/2011	grab	SM5310C	mg/l	0.009	0.3					0.41
Total Organic Carbon (TOC)	9/8/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/12/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/15/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/19/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/22/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/26/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	9/29/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/3/2011	grab	SM5310C	mg/l	0.009	0.3		<0.3	<0.3	<0.009	<0.3
Total Organic Carbon (TOC)	10/4/2011	grab	SM5310C	mg/l	0.009	0.3	5				
Total Organic Carbon (TOC)	10/6/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/10/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/13/2011	grab	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/17/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/20/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/24/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	10/31/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	11/2/2011	composite	SM5310C	mg/l	0.009	0.3	4.3	<0.3	<0.3	<0.3	
Total Organic Carbon (TOC)	11/3/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	11/7/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	11/10/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	11/14/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3

Table 20 Certified Laboratory Results of Total Organic Carbon (TOC)

Parameter	Sample Date	[1] Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Organic Carbon (TOC)	11/17/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	11/21/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	11/29/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/1/2011	composite	SM5310C	mg/l	0.009	0.3	5.8	<0.3	<0.3	<0.3	<0.3
Total Organic Carbon (TOC)	12/5/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/8/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/12/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/15/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/19/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/22/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/27/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	12/29/2011	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/3/2012	composite	SM5310C	mg/l	0.009	0.3	6.5	<0.3	<0.3	<0.3	<0.3
Total Organic Carbon (TOC)	1/5/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/9/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/12/2012	composite	SM5310C	mg/l	0.009	0.3					[2] 1.4
Total Organic Carbon (TOC)	1/17/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/19/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/23/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/26/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	1/30/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/1/2012	composite	SM5310C	mg/l	0.018	0.6	5.8	<0.3	<0.3	<0.3	
Total Organic Carbon (TOC)	2/2/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/6/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/9/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/14/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/16/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/20/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/22/2012	composite	SM5310C	mg/l	0.009	0.3	6.4			<0.3	<0.3
Total Organic Carbon (TOC)	2/23/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	2/27/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/1/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3

Table 20 Certified Laboratory Results of Total Organic Carbon (TOC)

Parameter	Sample Date	[1] Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Organic Carbon (TOC)	3/6/2012	composite	SM5310C	mg/l	0.009	0.3	6	<0.3	<0.3	<0.3	<0.3
Total Organic Carbon (TOC)	3/8/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/12/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/15/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/19/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/22/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/26/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	3/29/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	4/2/2012	composite	SM5310C	mg/l	0.009	0.3	7	<0.3	<0.3	<0.3	<0.3
Total Organic Carbon (TOC)	4/5/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	4/9/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	4/12/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	4/16/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	4/23/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	4/26/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/1/2012	composite	SM5310C	mg/l	0.009	0.3	5.3	<0.3	<0.3	<0.3	<0.3
Total Organic Carbon (TOC)	5/3/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/7/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/14/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/21/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/24/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/29/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	5/31/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	6/4/2012	composite	SM5310C	mg/l	0.009	0.3	4.3	<0.3	<0.3	<0.3	<0.3
Total Organic Carbon (TOC)	6/11/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	6/21/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	6/28/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/2/2012	composite	SM5310C	mg/l	0.009	0.3				<0.3	<0.3
Total Organic Carbon (TOC)	7/5/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/9/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/12/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/16/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3

Table 20 Certified Laboratory Results of Total Organic Carbon (TOC)

Parameter	Sample Date	[1] Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Organic Carbon (TOC)	7/19/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/23/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/26/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
Total Organic Carbon (TOC)	7/30/2012	composite	SM5310C	mg/l	0.009	0.3					<0.3
n =							12	11	11	16	97
[3] Average							6	<0.3	<0.3	<0.3	<0.3
Maximum							7	0.5	0.3	0.3	1
Minimum							4	0.2	0.2	0.0	0.2
STDev							0.9	0.1	0.1	0.1	0.2

Note:

1. The result of 1.4 mg/L was determined to be an outlier and is not representative of the TOC concentration consistently measured in the UV/AOP product water. TOC measured online upstream of the UV/AOP system on the day of the sampling event was below 0.07 mg/L.

2. All S7 and S8 samples were grab samples.

3. For purposes of calculating statistical parameters, results reported below the RL were considered 0.5 X RL and results reported ND were considered the DL.

Table 21 Certified Laboratory Results of Total and Fecal Coliform

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Total Coliform	8/2/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
E. coli	8/2/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
Total Coliform	8/3/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
E. coli	8/3/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
Total Coliform	8/4/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
E. coli	8/4/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
Total Coliform	8/8/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
E. coli	8/8/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
Total Coliform	8/9/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
E. coli	8/9/2011	grab	[1]SM 9223B	NA	1	1	Present	<1	<1	<1	<1	<1	<1
Total Coliform	8/10/2011	grab	[1]SM 9223B	NA	1	1	>2419.6	<1	<1	<1	<1	1	<1
E. coli	8/10/2011	grab	[1]SM 9223B	NA	1	1	>2419.6	<1	<1	<1	<1	<1	<1
Total Coliform	8/11/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/11/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/12/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	5.1	<1.1	<1.1	<1.1
Fecal Coliform	8/12/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/15/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	9000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/15/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/16/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	17000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/16/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/17/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	11000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/17/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/18/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/18/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/19/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/19/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/22/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/22/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/23/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/23/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/24/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	9000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Table 21 Certified Laboratory Results of Total and Fecal Coliform

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Fecal Coliform	8/24/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/25/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/25/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/26/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	30000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/26/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	530	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/30/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/30/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/31/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	50000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/31/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/29/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	17000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/29/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	7000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	8/31/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	50000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	8/31/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/1/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	2.2	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/1/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/2/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/2/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/6/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/6/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/8/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/8/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/12/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	1.1	<1.1	<1.1	1.1	<1.1
Fecal Coliform	9/12/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1100	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/13/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	3.6	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/13/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/14/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	22000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/14/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/15/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/15/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	11000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/16/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/16/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	9000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/19/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Table 21 Certified Laboratory Results of Total and Fecal Coliform

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Fecal Coliform	9/19/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/20/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	9000	<1.1	<1.1	<1.1	<1.1	1.1	<1.1
Fecal Coliform	9/20/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/21/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/21/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/22/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/22/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/23/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/23/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/26/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/26/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	10/3/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	10/3/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	240	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	10/10/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1100	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	10/10/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	10/17/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	10/17/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	10/24/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	10/24/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	10/31/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	10/31/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	11/7/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	11/7/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	240	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	11/15/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	11/15/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	11/21/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	11/21/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	11/29/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	330	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	11/29/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	80	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	12/6/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	1.1	<1.1
Fecal Coliform	12/6/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	170	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	12/12/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Table 21 Certified Laboratory Results of Total and Fecal Coliform

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Fecal Coliform	12/12/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	12/19/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	12/19/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	80	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	12/27/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	12/27/2011	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	1/3/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	1/3/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	1/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	1/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	1/18/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	1/18/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	300	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	1/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	1/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	240	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	1/30/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	1/30/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/2/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/2/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/6/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/6/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	300	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/14/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/14/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	300	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/16/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/16/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/20/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1600	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/20/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	300	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	2/27/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	2/27/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/1/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Table 21 Certified Laboratory Results of Total and Fecal Coliform

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Fecal Coliform	3/1/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/6/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/6/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/8/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/8/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/12/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2800	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/12/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/15/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/15/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/19/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/19/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/22/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/22/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/26/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/26/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	3/29/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	3/29/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/2/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1100	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/2/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	11000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/5/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/5/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	3000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	300	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/12/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/12/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/16/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/16/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/26/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	4/26/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	ND	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	4/30/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Table 21 Certified Laboratory Results of Total and Fecal Coliform

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Fecal Coliform	4/30/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	300	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	5/7/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	220	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	5/7/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1700	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	5/21/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	5/21/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	30000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	5/29/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	5/29/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	30000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	6/4/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	6/4/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	7000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	6/11/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	6/11/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	6/18/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	900	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	6/18/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	7/2/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	7/2/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2200	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	7/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	5000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	7/9/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	2400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	7/16/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	60000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	7/16/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	16000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	7/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	48000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	7/23/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	10000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	7/30/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	48000	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	7/30/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	500	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Total Coliform	9/17/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	4400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Fecal Coliform	9/17/2012	grab	SM 9221B/E	MPN/100 ml	1.1	1.1	1400	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1

Note:

1. SM 9223B analyses were performed as present or absent from 8/2/2011 to 8/9/2011 and quantifiable on 8/10/2011.

Table 22 Certified Laboratory Results of Somatic & Male Specific Bacteriophage

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Bacteriophage, Somatic	8/8/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	3000	<1	NP	NP	NP	NP	NP
Bacteriophage, Somatic	8/8/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	A	A	A	A
Bacteriophage, Male Specific	8/8/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	30	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	8/8/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	8/15/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	3000	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	8/15/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Male Specific	8/15/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	67	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	8/15/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	8/22/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	3000	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	8/22/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Male Specific	8/22/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	15	<1	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	8/22/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	A	A	A	A
Bacteriophage, Somatic	8/29/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	630	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	8/29/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Male Specific	8/29/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	<1	NP	NP	<1	NP	NP	NP
Bacteriophage, Male Specific	8/29/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	P	A	A	A
Bacteriophage, Somatic	9/12/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	840	NP	<1	<1	NP	NP	NP
Bacteriophage, Somatic	9/12/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	P	P	A	A	A
Bacteriophage, Male Specific	9/12/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	7	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	9/12/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	9/19/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	99	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	9/19/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	9/26/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	720	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	9/26/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Male Specific	9/26/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	32	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	9/26/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	10/10/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	1090	1	NP	<1	NP	NP	NP
Bacteriophage, Somatic	10/10/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Male Specific	10/10/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	19	<1	NP	1	NP	NP	NP
Bacteriophage, Male Specific	10/10/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Somatic	10/17/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	300	10	NP	4	NP	NP	NP
Bacteriophage, Somatic	10/17/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Male Specific	10/17/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	12	11	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	10/17/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	A	A	A	A
Bacteriophage, Somatic	10/25/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	629	3	NP	<1	NP	NP	NP

Table 22 Certified Laboratory Results of Somatic & Male Specific Bacteriophage

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Bacteriophage, Somatic	10/25/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Male Specific	10/25/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	23	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	10/25/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	11/7/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	1200	2	<1	<1	NP	NP	NP
Bacteriophage, Somatic	11/7/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	P	P	A	A	A
Bacteriophage, Male Specific	11/7/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	7	5	NP	<1	NP	NP	NP
Bacteriophage, Male Specific	11/7/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Male Specific	11/15/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	17	<1	NP	<1	NP	NP	NP
Bacteriophage, Male Specific	11/15/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Somatic	11/15/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	3000	<1	<1	1	NP	NP	NP
Bacteriophage, Somatic	11/15/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	P	P	A	A	A
Bacteriophage, Male Specific	12/12/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	20	4	NP	2	<1	NP	NP
Bacteriophage, Male Specific	12/12/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	P	A	A
Bacteriophage, Somatic	12/12/2011	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	2100	2	NP	<1	NP	NP	NP
Bacteriophage, Somatic	12/12/2011	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Male Specific	1/9/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	10	3	NP	<1	NP	NP	NP
Bacteriophage, Male Specific	1/9/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Somatic	1/9/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	3000	<1	NP	NP	NP	NP	NP
Bacteriophage, Somatic	1/9/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	A	A	A	A
Bacteriophage, Male Specific	2/13/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	9	<1	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	2/13/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	A	A	A	A
Bacteriophage, Somatic	2/13/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	810	2	<1	NP	NP	NP	NP
Bacteriophage, Somatic	2/13/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	P	A	A	A	A
Bacteriophage, Male Specific	3/12/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	<1	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	3/12/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	3/12/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	>3000	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	3/12/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Male Specific	4/9/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	12	1	NP	<1	NP	NP	NP
Bacteriophage, Male Specific	4/9/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Somatic	4/9/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	630	2	NP	28	NP	NP	NP
Bacteriophage, Somatic	4/9/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	A	P	A	A	A
Bacteriophage, Male Specific	6/18/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	4	NP	NP	NP	NP	NP	NP
Bacteriophage, Male Specific	6/18/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A
Bacteriophage, Somatic	6/18/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	578	<1	<1	NP	NP	NP	NP
Bacteriophage, Somatic	6/18/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	P	P	A	A	A	A

Table 22 Certified Laboratory Results of Somatic & Male Specific Bacteriophage

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S1 (tertiary effluent)	S4 (MF Filtrate)	S5 (UF Filtrate)	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S10 (UV/AOP Product)
Bacteriophage, Male Specific	7/9/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	6	NP	NP	25	NP	NP	NP
Bacteriophage, Male Specific	7/9/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	P	A	A	A
Bacteriophage, Somatic	7/9/2012	grab	EPA 1602 (821-R-01-029)	pfu/100 ml	1/100 mL	1/100 mL	1500	NP	NP	NP	NP	NP	NP
Bacteriophage, Somatic	7/9/2012	grab	EPA 1601 (821-R-01-030)	P/A per L	P/A per L	P/A per L	NP	A	A	A	A	A	A

Note:

1. NP=not performed. A=absent. P= present.
2. A sample set was collected on 5/29/12 however results are not valid because EPA 1601 Somatic Coliphage Phage analysis were made past the recommended holdtime due to a lab issue.

Table 23 Basin Plan Number Water Quality Objectives

Constituent	Water Quality Objective
Total Dissolved Solids	300 mg/L
Chloride	50 mg/L
Sulfate	65 mg/L
Percent Sodium	60%
Iron	0.3 mg/L
Manganese	0.05 mg/L
Boron	1.0 mg/L
Turbidity	20 NTU
Color	20 color units
Fluoride	1.0 mg/L
Nutrients	-Total Phosphorus less than 0.025 mg/L -Natural ratios of total nitrogen to total phosphorus are to be upheld, if no data is available a ratio (N:P) of 10:1 is to be used.
Ammonia (unionized as N)	0.025 mg/L
Fecal Coliform	-Not less than 5 samples every 30 days -Sampling shall not exceed a log mean of 200/100mL -No more than 10% of samples during any 30 day period shall exceed 400/100mL
Dissolved Oxygen	- not less than 6.0 mg/L -annual mean DO shall not be less than 7.0 mg/L more than 10% of the time
pH	-change in pH level shall not exceed 0.5 units -pH shall not be depressed below 6.5 nor raised above 8.5
Phenolic Compounds	1.0 µg/L

Note:

1. Water Quality Control Plan for the San Diego Basin California Regional Water Quality Control Board San Diego Region September 8, 1994. http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Total Dissolved Solids	8/15/2011	grab	SM2540C	mg/l	4	10	810	13	15		14
Total Dissolved Solids	8/29/2011	grab	SM2540C	mg/l	4	10	770	13	12	11	14
Total Dissolved Solids	9/12/2011	grab	SM2540C	mg/l	4	10	820	17	15	13	19
Total Dissolved Solids	9/26/2011	grab	SM2540C	mg/l	4	10	750	12	11		15
Total Dissolved Solids	9/29/2011	grab	SM2540C	mg/l	4	10					11
Total Dissolved Solids	10/10/2011	grab	SM2540C	mg/l	4	10	740	15	13		11
Total Dissolved Solids	10/24/2011	composite	SM2540C	mg/l	4	10	680	13	18		15
Total Dissolved Solids	11/7/2011	composite	SM2540C	mg/l	4	10	700	18	13		17
Total Dissolved Solids	11/21/2011	composite	SM2540C	mg/l	4	10	600	16	11		13
Total Dissolved Solids	12/5/2011	composite	SM2540C	mg/l	4	10	890	13	17		19
Total Dissolved Solids	12/19/2011	composite	SM2540C	mg/l	4	10	540	14	17		13
Total Dissolved Solids	1/3/2012	composite	SM2540C	mg/l	4	10	660	11	14		11
Total Dissolved Solids	1/17/2012	composite	SM2540C	mg/l	4	10	800	11	12		13
Total Dissolved Solids	2/14/2012	composite	SM2540C	mg/l	4	10	770	12	15		15
Total Dissolved Solids	2/27/2012	composite	SM2540C	mg/l	4	10					17
Total Dissolved Solids	3/12/2012	composite	SM2540C	mg/l	4	10	800	17	12		15
Total Dissolved Solids	3/26/2012	composite	SM2540C	mg/l	4	10	690	13	14		11
Total Dissolved Solids	4/9/2012	composite	SM2540C	mg/l	4	10	750	11	15		16
Total Dissolved Solids	4/23/2012	composite	SM2540C	mg/l	4	10	800	11	12		<10
Total Dissolved Solids	5/7/2012	composite	SM2540C	mg/l	4	10	790	15	16		11
Total Dissolved Solids	5/21/2012	composite	SM2540C	mg/l	4	10	770	17	11		13
Total Dissolved Solids	6/4/2012	composite	SM2540C	mg/l	4	10	800	11	15		13
Total Dissolved Solids	7/2/2012	composite	SM2540C	mg/l	4	10					11
Total Dissolved Solids	7/16/2012	composite	SM2540C	mg/l	4	10	930	13	12		11
Total Dissolved Solids	7/30/2012	composite	SM2540C	mg/l	4	10					14
n =							21	21	21	2	25
Average							760	14	14	12	14
Maximum							930	18	18	13	19
Minimum							540	11	11	11	10
STDev							89	2.3	2.1	1.4	2.6

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Chloride, Total	8/15/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	250	2.5	2.2		2.8
Chloride, Total	8/29/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	240	2.1	2	2.1	2.9
Chloride, Total	9/12/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	260	2.2	2	2.2	2.7
Chloride, Total	9/26/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	260	2.4	2.3		2.9
Chloride, Total	10/10/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	240	2.2	2.1		2.8
Chloride, Total	10/24/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	2	1.8		3.3
Chloride, Total	11/7/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	240	2.6	2.5		2.9
Chloride, Total	11/21/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	260	2.3	1.9		2.8
Chloride, Total	12/5/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	240	2.2	2.2		2.7
Chloride, Total	12/19/2011	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	2.5	2.4		2.8
Chloride, Total	1/3/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	260	2.4	2.1		2.6
Chloride, Total	1/17/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	280	1.9	1.7		2.8
Chloride, Total	1/30/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	250	2.1	2		2.6
Chloride, Total	2/14/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	2.3	2		2.8
Chloride, Total	2/27/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5					2.9
Chloride, Total	3/12/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	280	2.3	2.2		3.1
Chloride, Total	3/26/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	2.2	2.2		3.1
Chloride, Total	4/9/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	2.5	2.3		3
Chloride, Total	4/23/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	280	3.4	3.1		3.7
Chloride, Total	5/7/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	3.6	3.6		4.1
Chloride, Total	5/21/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	270	3.3	3.4		3.9
Chloride, Total	6/4/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5	290	3.4	3.6		4.3
Chloride, Total	7/2/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5					4.1
Chloride, Total	7/16/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5					3.9
Chloride, Total	7/30/2012	Composite	300.0_Cl Water	mg/l	0.1	0.5					4
n =							21	21	21	2	25
Average							260	2.5	2.4	2.2	3.2
Maximum							290	3.6	3.6	2.2	4.3
Minimum							240	1.9	1.7	2.1	2.6
STDev							15	0.50	0.60	0.10	0.60

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Sulfate as SO4	8/15/2011	grab	EPA 300.0	mg/l	0.1	0.5	170	<0.5	<0.5		<0.1
Sulfate as SO4	8/29/2011	grab	EPA 300.0	mg/l	0.1	0.5	140	<0.5	<0.1	<0.5	<0.5
Sulfate as SO4	9/12/2011	grab	EPA 300.0	mg/l	0.1	0.5	160	<0.1	<0.1	<0.1	<0.5
Sulfate as SO4	9/26/2011	grab	EPA 300.0	mg/l	0.1	0.5	150	<0.1	<0.5		<0.5
Sulfate as SO4	10/10/2011	grab	EPA 300.0	mg/l	0.1	0.5	130	<0.5	<0.5		<0.1
Sulfate as SO4	10/24/2011	composite	EPA 300.0	mg/l	0.1	0.5	140	<0.5	<0.1		<0.5
Sulfate as SO4	11/7/2011	composite	EPA 300.0	mg/l	0.1	0.5	130	<0.5	<0.1		0.58
Sulfate as SO4	11/21/2011	composite	EPA 300.0	mg/l	0.1	0.5	150	<0.5	<0.5		<0.5
Sulfate as SO4	12/5/2011	composite	EPA 300.0	mg/l	0.1	0.5	130	<0.1	<0.5		<0.5
Sulfate as SO4	12/19/2011	composite	EPA 300.0	mg/l	0.1	0.5	140	<0.5	<0.1		<0.5
Sulfate as SO4	1/3/2012	composite	EPA 300.0	mg/l	0.1	0.5	130	<0.1	<0.1		<0.1
Sulfate as SO4	1/17/2012	composite	EPA 300.0	mg/l	0.1	0.5	170	<0.1	<0.1		<0.5
Sulfate as SO4	2/14/2012	composite	EPA 300.0	mg/l	0.1	0.5	150	<0.1	<0.5		<0.5
Sulfate as SO4	2/27/2012	composite	EPA 300.0	mg/l	0.1	0.5					<0.5
Sulfate as SO4	3/12/2012	composite	EPA 300.0	mg/l	0.1	0.5	170	<0.1	<0.5		<0.5
Sulfate as SO4	3/26/2012	composite	EPA 300.0	mg/l	0.1	0.5	170	<0.5	<0.1		<0.5
Sulfate as SO4	4/9/2012	composite	EPA 300.0	mg/l	0.1	0.5	160	<0.5	<0.1		1.1
Sulfate as SO4	4/23/2012	composite	EPA 300.0	mg/l	0.1	0.5	180	<0.5	<0.1		<0.5
Sulfate as SO4	5/7/2012	composite	EPA 300.0	mg/l	0.1	0.5	180	<0.5	<0.5		<0.5
Sulfate as SO4	5/21/2012	composite	EPA 300.0	mg/l	0.1	0.5	170	<0.5	<0.1		<0.5
Sulfate as SO4	6/4/2012	composite	EPA 300.0	mg/l	0.1	0.5	200	<0.5	<0.1		<0.5
Sulfate as SO4	7/2/2012	composite	EPA 300.0	mg/l	0.1	0.5					<0.5
Sulfate as SO4	7/9/2012	composite	EPA 300.0	mg/l	0.1	0.5	190	<0.5	<0.5		
Sulfate as SO4	7/16/2012	composite	EPA 300.0	mg/l	0.1	0.5	180	<0.5	<0.5		<0.5
Sulfate as SO4	7/23/2012	composite	EPA 300.0	mg/l	0.1	0.5	200	<0.5	<0.5		
Sulfate as SO4	7/30/2012	composite	EPA 300.0	mg/l	0.1	0.5	170	<0.5	<0.5		<0.5
n =							24	24	24	2	24
Average							160	<0.5	<0.5	<0.5	<0.5
Maximum							200	0.3	0.3	0.3	1.1
Minimum							130	0.1	0.1	0.1	0.1
STDev							22	0.1	0.1	0.1	0.2

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Sodium, Total	8/15/2011	grab	EPA 200.7	mg/l	0.015	0.5	170	3.3	3.1		3.3
Sodium, Total	8/29/2011	grab	EPA 200.7	mg/l	0.015	0.5				3.8	3.8
Sodium, Total	9/12/2011	grab	EPA 200.7	mg/l	0.015	0.5				3.3	3.3
Sodium, Total	9/26/2011	grab	EPA 200.7	mg/l	0.015	0.5					3.1
Sodium, Total	10/10/2011	grab	EPA 200.7	mg/l	0.015	0.5	170	3.2	3.4		3.2
Sodium, Total	10/24/2011	composite	EPA 200.7	mg/l	0.015	0.5	160	3.1	3.1		3.3
Sodium, Total	11/7/2011	composite	EPA 200.7	mg/l	0.015	0.5	150	2.7	2.7		2.8
Sodium, Total	11/21/2011	composite	EPA 200.7	mg/l	0.015	0.5	160	2.6	2.6		2.8
Sodium, Total	12/5/2011	composite	EPA 200.7	mg/l	0.015	0.5	160	2.4	2.4		2.6
Sodium, Total	12/19/2011	composite	EPA 200.7	mg/l	0.015	0.5	170	2.6	2.7		2.8
Sodium, Total	1/3/2012	composite	EPA 200.7	mg/l	0.015	0.5	160	2.4	2.4		2.4
Sodium, Total	1/17/2012	composite	EPA 200.7	mg/l	0.015	0.5	170	2.8	2.6		2.8
Sodium, Total	2/14/2012	composite	EPA 200.7	mg/l	0.015	0.5	160	2.4	2.4		2.4
Sodium, Total	2/27/2012	composite	EPA 200.7	mg/l	0.015	0.5	160	2.4	2.4		2.6
Sodium, Total	3/12/2012	composite	EPA 200.7	mg/l	0.015	0.5	180	3	3		3
Sodium, Total	3/26/2012	composite	EPA 200.7	mg/l	0.015	0.5	160	2.9	3.1		3.1
Sodium, Total	4/9/2012	composite	EPA 200.7	mg/l	0.015	0.5	180	3.1	3.1		3.3
Sodium, Total	4/23/2012	composite	EPA 200.7	mg/l	0.015	0.5	180	3.7	3.4		3.9
Sodium, Total	5/7/2012	composite	EPA 200.7	mg/l	0.015	0.5	170	3.7	4		4
Sodium, Total	5/21/2012	composite	EPA 200.7	mg/l	0.015	0.5	180	4.3	4.5		4.6
Sodium, Total	6/4/2012	composite	EPA 200.7	mg/l	0.015	0.5	190	4.6	5.1		5.3
Sodium, Total	7/2/2012	composite	EPA 200.7	mg/l	0.015	0.5					4.5
Sodium, Total	7/16/2012	composite	EPA 200.7	mg/l	0.015	0.5					4.6
Sodium, Total	7/30/2012	composite	EPA 200.7	mg/l	0.015	0.5					4.8
n =							18	18	18	2	24
Average							170	3.1	3.1	3.6	3.4
Maximum							190	4.6	5.1	3.8	5.3
Minimum							150	2.4	2.4	3.3	2.4
STDev							10	0.70	0.80	0.40	0.80

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Iron, Total	8/15/2011	grab	EPA 200.7	µg/L	1.1	10	55	<1.1	<1.1		<1.1
Iron, Total	8/29/2011	grab	EPA 200.7	mg/l	0.001	0.01				<0.001	<0.001
Iron, Total	9/12/2011	grab	EPA 200.7	µg/L	1.1	10				<1.1	<1.1
Iron, Total	9/26/2011	grab	EPA 200.7	mg/l	0.001	0.01					<0.001
Iron, Total	10/10/2011	grab	EPA 200.7	mg/l	0.001	0.01	54	<0.001	<0.001		<0.001
Iron, Total	10/24/2011	composite	EPA 200.7	µg/L	1.1	10	66	<1.1	<1.1		<10
Iron, Total	11/7/2011	composite	EPA 200.7	µg/L	1.1	10	50	<10	<10		<10
Iron, Total	11/21/2011	composite	EPA 200.7	µg/L	1.1	10	85	<1.1	<1.1		<10
Iron, Total	12/5/2011	composite	EPA 200.7	µg/L	1.1	10	72	0.018	<10		<10
Iron, Total	12/19/2011	composite	EPA 200.7	µg/L	1.1	10	68	<10	<10		<10
Iron, Total	1/3/2012	composite	EPA 200.7	µg/L	1.1	10	59	<10	<1.1		<1.1
Iron, Total	1/17/2012	composite	EPA 200.7	µg/L	1.1	10	67	<10	<1.1		<10
Iron, Total	2/14/2012	composite	EPA 200.7	µg/L	1.1	10	63	<10	<10		<1.1
Iron, Total	2/27/2012	composite	EPA 200.7	µg/L	1.1	10	53	<10	<10		<10
Iron, Total	3/12/2012	composite	EPA 200.7	µg/L	1.1	10	70	<1.1	<1.1		<10
Iron, Total	3/26/2012	composite	EPA 200.7	µg/L	1.1	10	73	<10	<1.1		<10
Iron, Total	4/9/2012	composite	EPA 200.7	µg/L	1.1	10	75	<1.1	<1.1		<1.1
Iron, Total	4/23/2012	composite	EPA 200.7	µg/L	1.1	10	47	<1.1	<1.1		<1.1
Iron, Total	5/7/2012	composite	EPA 200.7	µg/L	1.1	10	54	<1.1	<1.1		<10
Iron, Total	5/21/2012	composite	EPA 200.7	µg/L	1.1	10	68	<1.1	<10		<1.1
Iron, Total	6/4/2012	composite	EPA 200.7	µg/L	1.1	10	57	<0.0011	<0.0011		<0.0011
Iron, Total	7/2/2012	composite	EPA 200.7	µg/L	1.1	10					<0.01
Iron, Total	7/16/2012	composite	EPA 200.7	µg/L	1.1	10					<0.0011
Iron, Total	7/30/2012	composite	EPA 200.7	µg/L	1.1	10					<1.1
n =							18	18	18	2	24
Average							63	<10	<10	<1.1	<10
Maximum							85	10	10	0.60	10
Minimum							47	0.0	0.0	0.0	0.0
STDev							10	2.9	2.8	0.40	2.8

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Manganese, Total	8/15/2011	grab	EPA 200.7	µg/L	2.6	5	87	<2.6	<2.6		<2.6
Manganese, Total	8/29/2011	grab	EPA 200.7	mg/l	0.003	0.01				<0.003	<0.003
Manganese, Total	9/12/2011	grab	EPA 200.7	µg/L	2.6	5				<2.6	<2.6
Manganese, Total	9/26/2011	grab	EPA 200.7	mg/l	0.003	0.01					<0.003
Manganese, Total	10/10/2011	grab	EPA 200.7	mg/l	0.003	0.01	0.081	<0.003	<0.003		<0.003
Manganese, Total	10/24/2011	composite	EPA 200.7	µg/L	2.6	5	95	<2.6	<2.6		<2.6
Manganese, Total	11/7/2011	composite	EPA 200.7	µg/L	2.6	5	77	<2.6	<2.6		<2.6
Manganese, Total	11/21/2011	composite	EPA 200.7	µg/L	2.6	5	69	<2.6	<2.6		<2.6
Manganese, Total	12/5/2011	composite	EPA 200.7	µg/L	2.6	5	0.085	<2.6	<2.6		<2.6
Manganese, Total	12/19/2011	composite	EPA 200.7	µg/L	2.6	5	66	<2.6	<2.6		<2.6
Manganese, Total	1/3/2012	composite	EPA 200.7	µg/L	2.6	5	94	<2.6	<2.6		<2.6
Manganese, Total	1/17/2012	composite	EPA 200.7	µg/L	2.6	5	98	<2.6	<2.6		<2.6
Manganese, Total	2/14/2012	composite	EPA 200.7	µg/L	2.6	5	72	<2.6	<2.6		<2.6
Manganese, Total	2/27/2012	composite	EPA 200.7	µg/L	2.6	5	76	<5	<5		<5
Manganese, Total	3/12/2012	composite	EPA 200.7	µg/L	2.6	5	85	<2.6	<2.6		<2.6
Manganese, Total	3/26/2012	composite	EPA 200.7	µg/L	2.6	5	0.091	<0.0026	<0.0026		<0.0026
Manganese, Total	4/9/2012	composite	EPA 200.7	µg/L	2.6	5	120	<2.6	<2.6		<2.6
Manganese, Total	4/23/2012	composite	EPA 200.7	µg/L	2.6	5	0.09	<2.6	<2.6		<0.0026
Manganese, Total	5/7/2012	composite	EPA 200.7	µg/L	2.6	5	83	<2.6	<2.6		<2.6
Manganese, Total	5/21/2012	composite	EPA 200.7	µg/L	2.6	5	96	<2.6	<2.6		<2.6
Manganese, Total	6/4/2012	composite	EPA 200.7	µg/L	2.6	5	0.1	<0.0026	<0.0026		<0.0026
Manganese, Total	7/2/2012	composite	EPA 200.7	µg/L	2.6	5					<0.0026
Manganese, Total	7/16/2012	composite	EPA 200.7	µg/L	2.6	5					<2.6
Manganese, Total	7/30/2012	composite	EPA 200.7	µg/L	2.6	5					<2.6
n =							18	18	18	2	24
Average							62	<2.6	<2.6	<2.6	<2.6
Maximum							120	5.0	5.0	1.3	5.0
Minimum							0.10	0.0	0.0	0.0	0.0
STDev							42	1.1	1.1	0.90	1.0

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Boron, Total	8/1/2011	grab	EPA 200.7	µg/L	1	10	410				
Boron, Total	8/15/2011	grab	EPA 200.7	µg/L	1	10	410	230	220		220
Boron, Total	8/29/2011	grab	EPA 200.7	µg/L	1	10				230	240
Boron, Total	9/12/2011	grab	EPA 200.7	µg/L	1	10				280	280
Boron, Total	9/26/2011	grab	EPA 200.7	µg/L	1	10					230
Boron, Total	10/10/2011	grab	EPA 200.7	µg/L	1	10	390	210	220		220
Boron, Total	10/24/2011	composite	EPA 200.7	µg/L	1	10	430	260	260		240
Boron, Total	11/7/2011	composite	EPA 200.7	µg/L	1	10	370	230	230		200
Boron, Total	11/21/2011	composite	EPA 200.7	µg/L	1	10	380	220	210		200
Boron, Total	12/5/2011	composite	EPA 200.7	µg/L	1	10	360	190	180		180
Boron, Total	12/19/2011	composite	EPA 200.7	µg/L	1	10	400	210	200		200
Boron, Total	1/3/2012	composite	EPA 200.7	µg/L	1	10	390	220	210		220
Boron, Total	1/17/2012	composite	EPA 200.7	µg/L	1	10	400	220	210		210
Boron, Total	2/14/2012	composite	EPA 200.7	µg/L	1	10	400	200	190		200
Boron, Total	2/27/2012	composite	EPA 200.7	µg/L	1	10	400	210	220		200
Boron, Total	3/12/2012	composite	EPA 200.7	µg/L	1	10	410	230	230		210
Boron, Total	3/26/2012	composite	EPA 200.7	µg/L	1	10	390	230	230		210
Boron, Total	4/9/2012	composite	EPA 200.7	µg/L	1	10	400	220	210		210
Boron, Total	4/23/2012	composite	EPA 200.7	µg/L	1	10	390	260	250		240
Boron, Total	5/7/2012	composite	EPA 200.7	µg/L	1	10	440	270	270		290
Boron, Total	5/21/2012	composite	EPA 200.7	µg/L	1	10	400	260	260		250
Boron, Total	6/4/2012	composite	EPA 200.7	µg/L	1	10	410	280	270		260
Boron, Total	7/2/2012	composite	EPA 200.7	µg/L	1	10					260
Boron, Total	7/16/2012	composite	EPA 200.7	µg/L	1	10					280
Boron, Total	7/30/2012	composite	EPA 200.7	µg/L	1	10					250
n =							19	18	18	2	24
Average							400	230	230	255	230
Maximum							440	280	270	280	290
Minimum							360	190	180	230	180
STDev							19	25	27	35	30

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Color	8/15/2011	grab	SM2120B	CU		3	20	<3	<3		<3
Color	8/29/2011	grab	SM2120B	CU		3				<3	<3
Color	9/12/2011	grab	SM2120B	CU		3				<3	<3
Color	9/26/2011	grab	SM2120B	CU		3				<3	<3
Color	10/10/2011	grab	SM2120B	CU		3				<3	<3
Color	10/24/2011	composite	SM2120B	CU		3				<3	<3
Color	11/7/2011	composite	SM2120B	CU		3				<3	<3
Color	11/21/2011	composite	SM2120B	CU		3				<3	<3
Color	12/5/2011	composite	SM2120B	CU		3				<3	<3
Color	12/19/2011	composite	SM2120B	CU		3				<3	<3
Color	1/3/2012	composite	SM2120B	CU		3				<3	<3
Color	1/17/2012	composite	SM2120B	CU		3				<3	<3
Color	2/14/2012	composite	SM2120B	CU		3				<3	<3
Color	2/27/2012	composite	SM2120B	CU		3				<3	<3
Color	3/12/2012	composite	SM2120B	CU		3				<3	<3
Color	3/26/2012	composite	SM2120B	CU		3				<3	<3
Color	4/9/2012	composite	SM2120B	CU		3				<3	<3
Color	4/23/2012	composite	SM2120B	CU		3				<3	<3
Color	5/7/2012	composite	SM2120B	CU		3				<3	<3
Color	5/21/2012	composite	SM2120B	CU		3				<3	<3
Color	6/4/2012	composite	SM2120B	CU		3				<3	<3
Color	7/2/2012	composite	SM2120B	CU		3					<3
Color	7/16/2012	composite	SM2120B	CU		3					<3
Color	7/30/2012	composite	SM2120B	CU		3					<3
n =							1	1	1	20	24
Average							20	<3	<3	<3	<3
Maximum							20	3	3	3	3
Minimum							20	0	0	0	0
STDev										0	0

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S6 (RO Feed)	S7 (RO Perm. Train A)	S8 (RO Perm. Train B)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Fluoride, Total	8/15/2011	grab	EPA 300.0	mg/l	0.02	0.1	0.67	<0.02	<0.02		<0.02
Fluoride, Total	8/29/2011	grab	EPA 300.0	mg/l	0.02	0.1	0.58	<0.02	<0.02	<0.02	<0.1
Fluoride, Total	9/12/2011	grab	EPA 300.0	mg/l	0.02	0.1	0.61	<0.02	<0.02	<0.02	<0.02
Fluoride, Total	9/26/2011	grab	EPA 300.0	mg/l	0.02	0.1	0.65	<0.1	<0.1		<0.1
Fluoride, Total	10/10/2011	grab	EPA 300.0	mg/l	0.02	0.1	0.61	<0.02	<0.02		<0.1
Fluoride, Total	10/24/2011	composite	EPA 300.0	mg/l	0.02	0.1	0.56	<0.1	<0.1		<0.1
Fluoride, Total	11/7/2011	composite	EPA 300.0	mg/l	0.02	0.1	0.64	<0.02	<0.02		<0.02
Fluoride, Total	11/21/2011	composite	EPA 300.0	mg/l	0.02	0.1	0.61	<0.02	<0.02		<0.02
Fluoride, Total	12/5/2011	composite	EPA 300.0	mg/l	0.02	0.1	0.55	<0.02	<0.02		<0.02
Fluoride, Total	12/19/2011	composite	EPA 300.0	mg/l	0.02	0.1	0.59	<0.02	<0.02		<0.02
Fluoride, Total	1/3/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.52	<0.02	<0.02		<0.02
Fluoride, Total	1/17/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.56	<0.02	<0.1		<0.1
Fluoride, Total	2/14/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.56	<0.1	<0.1		<0.02
Fluoride, Total	2/27/2012	composite	EPA 300.0	mg/l	0.02	0.1					<0.1
Fluoride, Total	3/12/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.6	<0.02	<0.1		<0.1
Fluoride, Total	3/26/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.72	<0.02	<0.02		<0.02
Fluoride, Total	4/9/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.68	<0.02	<0.02		<0.02
Fluoride, Total	4/23/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.69	<0.02	<0.02		<0.02
Fluoride, Total	5/7/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.76	<0.02	<0.02		<0.02
Fluoride, Total	5/21/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.63	<0.02	<0.02		<0.02
Fluoride, Total	6/4/2012	composite	EPA 300.0	mg/l	0.02	0.1	0.67	<0.02	<0.02		<0.02
Fluoride, Total	7/2/2012	composite	EPA 300.0	mg/l	0.02	0.1					<0.02
Fluoride, Total	7/16/2012	composite	EPA 300.0	mg/l	0.02	0.1					<0.1
Fluoride, Total	7/30/2012	composite	EPA 300.0	mg/l	0.02	0.1					<0.02
n =							20	20	20	2	24
Average							0.6	<0.02	<0.02	<0.02	<0.02
Maximum							0.8	0.1	0.1	0.0	0.1
Minimum							0.5	0.0	0.0	0.0	0.0
STDev							0.1	0.0	0.0	0.0	0.0

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Phenolics (Total)	9/1/2011	grab	EPA 420.4	mg/l	0.004	0.01		0.022
Phenolics (14 compounds)	10/10/2011	grab	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (13 compounds)	10/24/2011	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenol	10/24/2011	composite	EPA 8270C-SIM	µg/L	0.35	1	1.4	1.9
Phenolics (13 compounds)	11/17/2011	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenol	11/7/2011	composite	EPA 8270C-SIM	µg/L	0.35	1	<1	<1
Phenolics (13 compounds)	11/21/2011	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenol	11/21/2011	composite	EPA 8270C-SIM	µg/L	0.35	1	<1	2.6
Phenolics (13 compounds)	12/5/2011	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenol	12/5/2011	composite	EPA 8270C-SIM	µg/L	0.35	1	<1	<1
Phenolics[1] (14 compounds)	12/19/2011	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	1/3/2012	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (12 compounds)	1/17/2012	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
2,4-Dichlorophenol	1/17/2012	composite	EPA 8270C-SIM	µg/L	0.51	1	<1	<1
4,6-Dinitro-2-methylphenol	1/17/2012	composite	EPA 8270C-SIM	µg/L	0.14	1	<1	<1
Phenolics (14 compounds)	1/23/2012	composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	2/14/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	2/27/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	3/12/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	3/26/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	4/9/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1

Table 24 Certified Laboratory Results of Select General Inorganic Parameters with Basin Plan Numeric Objectives

Parameter	Sample Date	Sample Type	Method	Units	DL	RL	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
Phenolics (14 compounds)	4/23/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	5/7/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	5/21/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	6/4/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies	<1	<1
Phenolics (14 compounds)	7/2/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies		<1
Phenolics (14 compounds)	7/16/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies		<1
Phenolics (14 compounds)	7/30/2012	Composite	EPA 8270C-SIM	µg/L	varies	varies		<1

1. Samples were re-extracted and reanalyzed past hold time due reported lab contamination

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
8/11/2011	HACH sensION156 Portable Meter	5.79	26.8		0.04
8/12/2011	HACH sensION156 Portable Meter	5.77	26		0.05
8/13/2011	HACH sensION156 Portable Meter	5.8	26.9		0.07
8/14/2011	HACH sensION156 Portable Meter	5.88	26.7		0.04
8/15/2011	HACH sensION156 Portable Meter	5.86	23.6		0.05
8/16/2011	HACH sensION156 Portable Meter	5.88	22.4		0.04
8/17/2011	HACH sensION156 Portable Meter	5.72	21		0.04
8/18/2011	HACH sensION156 Portable Meter	5.75	21.5		0.04
8/19/2011	HACH sensION156 Portable Meter	5.71	25.7		0.04
8/21/2011	HACH sensION156 Portable Meter				0.04
8/22/2011	HACH sensION156 Portable Meter	5.79	27		0.05
8/23/2011	HACH sensION156 Portable Meter	5.87	27.2		0.04
8/24/2011	HACH sensION156 Portable Meter	5.7	24.7		0.08
8/25/2011	HACH sensION156 Portable Meter	5.74	26		0.05
8/26/2011	HACH sensION156 Portable Meter	5.82	26.4		0.06
8/27/2011	HACH sensION156 Portable Meter	5.85	27.8		0.05
8/28/2011	HACH sensION156 Portable Meter	5.86	27.7		0.06
8/29/2011	HACH sensION156 Portable Meter	5.92	25.4		0.03
8/30/2011	HACH sensION156 Portable Meter	6.15	25.6		0.06
8/31/2011	HACH sensION156 Portable Meter	6.32	23.7		0.05
9/1/2011	HACH sensION156 Portable Meter	6.45	21.6		0.04
9/2/2011	HACH sensION156 Portable Meter	6.31	21.9		0.05
9/3/2011	HACH sensION156 Portable Meter	5.86	25.6		0.04
9/4/2011	HACH sensION156 Portable Meter	5.76	27.2		0.03
9/6/2011	HACH sensION156 Portable Meter	5.87	27.8		0.05
9/7/2011	HACH sensION156 Portable Meter	5.68	30		0.04
9/8/2011	HACH sensION156 Portable Meter	5.76	28.8		0.05
9/12/2011	HACH sensION156 Portable Meter	5.91	24.7		0.06
9/13/2011	HACH sensION156 Portable Meter	5.73	27.9	7.34	0.03
9/14/2011	HACH sensION156 Portable Meter	5.67	25.7		0.04
9/15/2011	HACH sensION156 Portable Meter	5.76	22.1	7.55	0.04
9/16/2011	HACH sensION156 Portable Meter	5.77	23.9		0.05
9/17/2011	HACH sensION156 Portable Meter	6.4	25.6		0.05
9/18/2011	HACH sensION156 Portable Meter	5.89	23.1	7.07	0.03
9/19/2011	HACH sensION156 Portable Meter	5.82	23.7		0.05
9/20/2011	HACH sensION156 Portable Meter	5.75	25.5	7.3	0.03

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
9/21/2011	HACH sensION156 Portable Meter	5.92	27.4		0.03
9/22/2011	HACH sensION156 Portable Meter	5.78	21.3	7.41	0.04
9/23/2011	HACH sensION156 Portable Meter	5.74	24.6		0.04
9/24/2011	HACH sensION156 Portable Meter	5.88	26.6		0.05
9/26/2011	HACH sensION156 Portable Meter	5.73	24.1		0.06
9/27/2011	HACH sensION156 Portable Meter	5.69	21.8	6.96	0.06
9/28/2011	HACH sensION156 Portable Meter	5.65	20.4		0.05
9/29/2011	HACH sensION156 Portable Meter	5.91	20.3	6.77	0.05
9/30/2011	HACH sensION156 Portable Meter	5.86	22		0.05
10/1/2011	HACH sensION156 Portable Meter	6.15	27.1		0.07
10/2/2011	HACH sensION156 Portable Meter	6.27	27.8	6.39	0.07
10/3/2011	HACH sensION156 Portable Meter	5.83	27.9		0.04
10/4/2011	HACH sensION156 Portable Meter	5.63	20.8	7.1	0.07
10/5/2011	HACH sensION156 Portable Meter	5.61	20.3		0.06
10/6/2011	HACH sensION156 Portable Meter	5.5	22.1	7.12	0.03
10/9/2011	HACH sensION156 Portable Meter	5.54	26.4	6.72	0.04
10/10/2011	HACH sensION156 Portable Meter	5.63	26.7		0.03
10/11/2011	HACH sensION156 Portable Meter	5.79	27.1		0.05
10/12/2011	HACH sensION156 Portable Meter	5.53	24.3	7.03	0.05
10/13/2011	HACH sensION156 Portable Meter	5.47	26.8	7.47	0.06
10/14/2011	HACH sensION156 Portable Meter	5.45	26.7		0.06
10/15/2011	HACH sensION156 Portable Meter	5.91	26.7		0.05
10/16/2011	HACH sensION156 Portable Meter	5.95	26.5	7.15	0.06
10/17/2011	HACH sensION156 Portable Meter	6.39	27.5		0.06
10/19/2011	HACH sensION156 Portable Meter	5.6	26.6	9.54	0.04
10/20/2011	HACH sensION156 Portable Meter	5.43	26.6	6.58	0.07
10/21/2011	HACH sensION156 Portable Meter	5.48	26.6		0.06
10/22/2011	HACH sensION156 Portable Meter	5.52	26.5		0.04
10/23/2011	HACH sensION156 Portable Meter	5.46	25.7		0.06
10/24/2011	HACH sensION156 Portable Meter	5.65	26.3		0.04
10/25/2011	HACH sensION156 Portable Meter	5.54	26.3		0.05
10/26/2011	HACH sensION156 Portable Meter	5.5	26.3		0.05
10/27/2011	HACH sensION156 Portable Meter	5.46	26.3		0.06
10/28/2011	HACH sensION156 Portable Meter	5.43	26.4		0.05
10/29/2011	HACH sensION156 Portable Meter	5.63	26.3		0.04
10/30/2011	HACH sensION156 Portable Meter	5.77	26	7.89	0.04
10/31/2011	HACH sensION156 Portable Meter	5.51	26		0.04

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
11/1/2011	HACH sensION156 Portable Meter	5.46	26.3	6.85	0.06
11/2/2011	HACH sensION156 Portable Meter	5.46	26.4		0.04
11/3/2011	HACH sensION156 Portable Meter	5.53	25.6	7.3	0.05
11/4/2011	HACH sensION156 Portable Meter	5.64	19.1		0.04
11/5/2011	HACH sensION156 Portable Meter	5.58	25.5		0.05
11/6/2011	HACH sensION156 Portable Meter	5.72	24.7	7.79	0.10
11/7/2011	HACH sensION156 Portable Meter	6.28	26		0.04
11/8/2011	HACH sensION156 Portable Meter	5.41	24.9	7.63	0.04
11/9/2011	HACH sensION156 Portable Meter	5.50	22		0.05
11/10/2011	HACH sensION156 Portable Meter	5.51	21.6	7.68	0.05
11/11/2011	HACH sensION156 Portable Meter	5.82	21.1		0.04
11/12/2011	HACH sensION156 Portable Meter	5.37	21.3		0.05
11/13/2011	HACH sensION156 Portable Meter	5.58	25.2	7.67	0.06
11/16/2011	HACH sensION156 Portable Meter	5.32	21.5		0.06
11/17/2011	HACH sensION156 Portable Meter	5.40	24.8	7.55	0.05
11/18/2011	HACH sensION156 Portable Meter	5.49	19.6		0.05
11/19/2011	HACH sensION156 Portable Meter	5.42	22.2		0.05
11/20/2011	HACH sensION156 Portable Meter	5.50	23.5	7.47	0.05
11/21/2011	HACH sensION156 Portable Meter	5.49	24.5		0.05
11/22/2011	HACH sensION156 Portable Meter	5.26	18.8	7.54	0.05
11/23/2011	HACH sensION156 Portable Meter	5.42	18.4		0.04
11/25/2011	HACH sensION156 Portable Meter	5.48	24.1		0.05
11/26/2011	HACH sensION156 Portable Meter	5.40	24.7		0.04
11/27/2011	HACH sensION156 Portable Meter	5.43	24.8	7.59	0.05
11/28/2011	HACH sensION156 Portable Meter	5.42	24.8		0.04
11/29/2011	HACH sensION156 Portable Meter	5.44	24	7.44	0.05
11/30/2011	HACH sensION156 Portable Meter	5.37	24.1		0.05
12/1/2011	HACH sensION156 Portable Meter	5.48	21.7	7.19	0.04
12/2/2011	HACH sensION156 Portable Meter	5.41	17.9		0.05
12/3/2011	HACH sensION156 Portable Meter	5.33	23.5		0.04
12/4/2011	HACH sensION156 Portable Meter	5.39	23.5	7.25	0.05
12/5/2011	HACH sensION156 Portable Meter	5.53	19.2		0.05
12/6/2011	HACH sensION156 Portable Meter	5.35	15.9	7.31	0.05
12/7/2011	HACH sensION156 Portable Meter	5.36	22.7		0.04
12/8/2011	HACH sensION156 Portable Meter	5.42	23.4	7.3	0.04
12/9/2011	HACH sensION156 Portable Meter	5.25	19		0.05
12/10/2011	HACH sensION156 Portable Meter	5.47	23.4		

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
12/11/2011	HACH sensION156 Portable Meter	5.43	23.1	7.38	
12/12/2011	HACH sensION156 Portable Meter	5.38	23.1		
12/13/2011	HACH sensION156 Portable Meter	5.47		7.28	0.05
12/14/2011	HACH sensION156 Portable Meter	5.38	21.9		0.04
12/15/2011	HACH sensION156 Portable Meter	5.24	22.7	7.78	0.05
12/16/2011	HACH sensION156 Portable Meter	5.46	17.1		0.04
12/17/2011	HACH sensION156 Portable Meter	5.39	23.4		0.04
12/18/2011	HACH sensION156 Portable Meter	5.42	22.3	7.91	0.04
12/19/2011	HACH sensION156 Portable Meter	5.39	22.9		0.05
12/20/2011	HACH sensION156 Portable Meter	5.48	16.3	7.67	0.04
12/21/2011	HACH sensION156 Portable Meter	5.39	22.2		0.05
12/22/2011	HACH sensION156 Portable Meter	5.39	22.8	7.58	0.04
12/23/2011	HACH sensION156 Portable Meter	5.41	22		0.04
12/26/2011	HACH sensION156 Portable Meter	5.35	23.2		0.04
12/27/2011	HACH sensION156 Portable Meter	5.32	23.3	7.83	0.05
12/28/2011	HACH sensION156 Portable Meter	5.38	23.1		0.05
12/29/2011	HACH sensION156 Portable Meter	5.52	23.1	7.92	0.05
12/30/2011	HACH sensION156 Portable Meter	5.52	20.8		0.04
12/31/2011	HACH sensION156 Portable Meter	5.29	23		0.04
1/2/2012	HACH sensION156 Portable Meter	5.36	23.1		0.04
1/3/2012	HACH sensION156 Portable Meter	5.37	21.1	7.96	0.04
1/4/2012	HACH sensION156 Portable Meter	5.43	22.2		0.04
1/5/2012	HACH sensION156 Portable Meter	5.35	22.9	8	0.04
1/6/2012	HACH sensION156 Portable Meter	5.43	21.3		0.04
1/7/2012	HACH sensION156 Portable Meter	5.33	23.1		0.04
1/8/2012	HACH sensION156 Portable Meter	5.35	23	7.9	0.04
1/9/2012	HACH sensION156 Portable Meter	5.47	23		0.04
1/10/2012	HACH sensION156 Portable Meter	5.27	20.5	7.81	0.05
1/12/2012	HACH sensION156 Portable Meter	5.28	20.9	7.77	0.05
1/13/2012	HACH sensION156 Portable Meter	5.40	22.2		0.05
1/14/2012	HACH sensION156 Portable Meter	5.42	22.7		0.05
1/15/2012	HACH sensION156 Portable Meter	5.46	22.6	7.47	0.04
1/16/2012	HACH sensION156 Portable Meter	5.56	21.7		0.05
1/17/2012	HACH sensION156 Portable Meter	5.58	21.4	7.76	0.04
1/18/2012	HACH sensION156 Portable Meter	5.46	22.2		0.05
1/19/2012	HACH sensION156 Portable Meter	5.44	18	7.82	0.04
1/20/2012	HACH sensION156 Portable Meter	5.50			0.04

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
1/21/2012	HACH sensION156 Portable Meter	5.50	22.4		0.03
1/22/2012	HACH sensION156 Portable Meter	5.81	22.7	7.58	0.04
1/23/2012	HACH sensION156 Portable Meter	5.57	22		0.04
1/24/2012	HACH sensION156 Portable Meter	5.27	18.8	7.97	0.04
1/25/2012	HACH sensION156 Portable Meter	5.37	22.6		0.06
1/26/2012	HACH sensION156 Portable Meter	5.31	21.7	8.09	0.04
1/27/2012	HACH sensION156 Portable Meter	5.31	19.4		0.05
1/28/2012	HACH sensION156 Portable Meter	5.37	22.9		0.06
1/29/2012	HACH sensION156 Portable Meter	5.27	23	7.8	0.05
1/30/2012	HACH sensION156 Portable Meter	5.61	22.4		0.05
1/31/2012	HACH sensION156 Portable Meter	5.25	21.8	7.53	0.04
2/1/2012	HACH sensION156 Portable Meter	5.25	22.2		0.05
2/2/2012	HACH sensION156 Portable Meter	5.26	21.5	7.78	0.04
2/3/2012	HACH sensION156 Portable Meter	5.31			0.05
2/4/2012	HACH sensION156 Portable Meter	5.43	22.4		0.05
2/5/2012	HACH sensION156 Portable Meter	5.36	22.1	7.92	0.05
2/6/2012	HACH sensION156 Portable Meter	5.59	22.8		0.05
2/7/2012	HACH sensION156 Portable Meter	5.39	22.4	7.99	0.05
2/8/2012	HACH sensION156 Portable Meter	5.55	22.6		0.04
2/9/2012	HACH sensION156 Portable Meter	5.95	22.4		0.06
2/10/2012	HACH sensION156 Portable Meter	5.75	21.5		0.04
2/11/2012	HACH sensION156 Portable Meter				
2/12/2012	HACH sensION156 Portable Meter				
2/13/2012	HACH sensION156 Portable Meter	5.95	21.3		
2/14/2012	HACH sensION156 Portable Meter	5.53	22.2	7.72	0.05
2/15/2012	HACH sensION156 Portable Meter	5.31	22.5		0.05
2/16/2012	HACH sensION156 Portable Meter	5.47	21.7		0.04
2/18/2012	HACH sensION156 Portable Meter	5.46	22.1		0.05
2/19/2012	HACH sensION156 Portable Meter	5.45	22.1	7.93	0.04
2/20/2012	HACH sensION156 Portable Meter				0.04
2/22/2012	HACH sensION156 Portable Meter	5.40	22.4		0.04
2/23/2012	HACH sensION156 Portable Meter	5.91	22.8	7.93	0.03
2/24/2012	HACH sensION156 Portable Meter	5.60	21.5		0.03
2/25/2012	HACH sensION156 Portable Meter	5.41	22.2		0.04
2/26/2012	HACH sensION156 Portable Meter	5.43	22.4	7.91	0.04
2/27/2012	HACH sensION156 Portable Meter	5.57	22.3		0.04
2/28/2012	HACH sensION156 Portable Meter	5.23	17.1		

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
2/29/2012	HACH sensION156 Portable Meter	5.25	21.7		0.03
3/1/2012	HACH sensION156 Portable Meter	5.28	21.8	7.9	0.05
3/2/2012	HACH sensION156 Portable Meter	5.43	22.1		0.03
3/3/2012	HACH sensION156 Portable Meter	5.66	22.3		0.03
3/5/2012	HACH sensION156 Portable Meter	5.93	22.5		0.04
3/6/2012	HACH sensION156 Portable Meter	5.32	22	7.87	0.04
3/7/2012	HACH sensION156 Portable Meter	5.52	22.3		0.04
3/8/2012	HACH sensION156 Portable Meter	5.77	22.2	8.13	0.04
3/9/2012	HACH sensION156 Portable Meter	5.51	22.8		0.05
3/10/2012	HACH sensION156 Portable Meter	6.11	23		0.04
3/11/2012	HACH sensION156 Portable Meter	5.56	22.7	7.99	0.03
3/12/2012	HACH sensION156 Portable Meter	5.58	22.6		0.04
3/13/2012	HACH sensION156 Portable Meter	5.47	22.3	7.91	0.04
3/14/2012	HACH sensION156 Portable Meter	5.51	22.1		0.04
3/15/2012	HACH sensION156 Portable Meter	5.53	21.2	7.84	0.04
3/16/2012	HACH sensION156 Portable Meter	5.48	22.2		0.04
3/17/2012	HACH sensION156 Portable Meter	5.55	22.8		0.05
3/18/2012	HACH sensION156 Portable Meter	5.54	21.7	7.92	0.04
3/19/2012	HACH sensION156 Portable Meter	5.84	20.6		0.04
3/20/2012	HACH sensION156 Portable Meter	6.13	21.6	7.84	0.04
3/21/2012	HACH sensION156 Portable Meter	5.69	21.7		0.03
3/22/2012	HACH sensION156 Portable Meter	5.92	22	7.92	0.04
3/23/2012	HACH sensION156 Portable Meter	5.73	22		0.04
3/24/2012	HACH sensION156 Portable Meter	5.63	22		0.03
3/25/2012	HACH sensION156 Portable Meter	5.80	22.6	8.09	0.04
3/26/2012	HACH sensION156 Portable Meter	5.85	22.2		0.05
3/27/2012	HACH sensION156 Portable Meter	6.01	20.5	7.91	0.05
3/28/2012	HACH sensION156 Portable Meter	5.86	20.3		0.04
3/29/2012	HACH sensION156 Portable Meter	5.76	21.9	7.7	0.04
3/30/2012	HACH sensION156 Portable Meter	5.71	22		0.04
3/31/2012	HACH sensION156 Portable Meter	5.80	22.6		0.04
4/1/2012	HACH sensION156 Portable Meter	5.79	20.9	7.82	0.04
4/2/2012	HACH sensION156 Portable Meter	6.05	22.2		0.04
4/3/2012	HACH sensION156 Portable Meter	5.86	22.8	7.7	0.05
4/4/2012	HACH sensION156 Portable Meter	5.92	22.7		0.04
4/5/2012	HACH sensION156 Portable Meter	5.99	21.8	7.59	0.05
4/6/2012	HACH sensION156 Portable Meter	5.62	22.5		0.04

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
4/7/2012	HACH sensION156 Portable Meter	5.87	22.7		0.04
4/8/2012	HACH sensION156 Portable Meter	5.38	23.4	7.86	0.04
4/9/2012	HACH sensION156 Portable Meter	5.62	23.5		0.04
4/10/2012	HACH sensION156 Portable Meter	5.57	23	7.88	0.04
4/11/2012	HACH sensION156 Portable Meter	5.53	22.8		0.04
4/12/2012	HACH sensION156 Portable Meter	5.41	22.7	7.65	0.05
4/13/2012	HACH sensION156 Portable Meter	5.44	22.3		0.04
4/14/2012	HACH sensION156 Portable Meter	5.51	22.7		0.05
4/15/2012	HACH sensION156 Portable Meter	5.55	22.8	7.95	0.03
4/16/2012	HACH sensION156 Portable Meter	5.53	23.4		0.05
4/17/2012	HACH sensION156 Portable Meter	5.25	23.2	7.45	0.05
4/19/2012	HACH sensION156 Portable Meter	5.43	23.3		0.04
4/20/2012	HACH sensION156 Portable Meter	5.44	23.4	7.81	0.04
4/21/2012	HACH sensION156 Portable Meter	5.49	23.7		0.05
4/22/2012	HACH sensION156 Portable Meter	5.43	23.2	7.83	0.04
4/23/2012	HACH sensION156 Portable Meter	5.65	23.8		0.03
4/24/2012	HACH sensION156 Portable Meter	5.93	22.9	7.88	0.04
4/25/2012	HACH sensION156 Portable Meter	5.57	23.3		0.04
4/26/2012	HACH sensION156 Portable Meter	5.52	23.8	7.98	0.04
4/27/2012	HACH sensION156 Portable Meter	5.49	23.3		0.04
4/28/2012	HACH sensION156 Portable Meter	5.46	23.9		0.03
4/29/2012	HACH sensION156 Portable Meter	5.44	23.3	7.92	0.04
4/30/2012	HACH sensION156 Portable Meter	5.63	23.9		0.05
5/1/2012	HACH sensION156 Portable Meter	5.62	24.2	7.52	0.08
5/2/2012	HACH sensION156 Portable Meter	5.56	23.6		0.04
5/3/2012	HACH sensION156 Portable Meter	5.54	23.6	7.37	0.04
5/4/2012	HACH sensION156 Portable Meter	5.61	23.7		0.04
5/5/2012	HACH sensION156 Portable Meter	5.70	24.1		0.05
5/6/2012	HACH sensION156 Portable Meter	5.63	23.9	7.45	0.04
5/7/2012	HACH sensION156 Portable Meter	5.64	24		0.04
5/12/2012	HACH sensION156 Portable Meter	5.62	24.6		0.05
5/13/2012	HACH sensION156 Portable Meter	5.75	24.8	7.69	0.04
5/14/2012	HACH sensION156 Portable Meter	5.56	25		0.04
5/15/2012	HACH sensION156 Portable Meter	5.49	24.6	7.46	0.04
5/16/2012	HACH sensION156 Portable Meter	5.57	24.9		0.04
5/17/2012	HACH sensION156 Portable Meter	5.56	24.7	7.5	0.04
5/18/2012	HACH sensION156 Portable Meter	5.62	24.7		0.04

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
5/19/2012	HACH sensION156 Portable Meter	5.70	25.2		0.04
5/20/2012	HACH sensION156 Portable Meter	5.68	25.1	7.6	0.04
5/21/2012	HACH sensION156 Portable Meter	5.66	25.3		0.04
5/23/2012	HACH sensION156 Portable Meter	5.63	25.1		0.04
5/25/2012	HACH sensION156 Portable Meter	5.66	24.7		0.04
5/28/2012	HACH sensION156 Portable Meter	5.64	25.4		0.04
5/29/2012	HACH sensION156 Portable Meter	5.70	25.8	7.51	0.04
5/30/2012	HACH sensION156 Portable Meter	5.65	24.7		0.04
6/2/2012	HACH sensION156 Portable Meter	5.69	25.8		0.04
6/3/2012	HACH sensION156 Portable Meter	5.75	25.9	6.87	0.05
6/4/2012	HACH sensION156 Portable Meter	5.66	25.9		0.05
6/5/2012	HACH sensION156 Portable Meter	5.66	25.4	7.87	0.06
6/6/2012	HACH sensION156 Portable Meter	5.63	25.7		0.05
6/7/2012	HACH sensION156 Portable Meter	5.52	26.1		0.05
6/9/2012	HACH sensION156 Portable Meter	5.62	26.1		0.05
6/10/2012	HACH sensION156 Portable Meter	5.79	26	7.28	0.04
6/11/2012	HACH sensION156 Portable Meter	5.86	25.7		0.05
6/12/2012	HACH sensION156 Portable Meter	5.76	25.6	7.58	0.05
6/13/2012	HACH sensION156 Portable Meter	5.57	25.4		0.05
6/14/2012	HACH sensION156 Portable Meter	5.60	25.5	7.43	0.05
6/16/2012	HACH sensION156 Portable Meter	5.70	25.8		0.04
6/17/2012	HACH sensION156 Portable Meter	5.66	25.6	7.37	0.04
6/18/2012	HACH sensION156 Portable Meter	5.73	26		0.06
6/20/2012	HACH sensION156 Portable Meter	5.62	26.2		0.04
6/21/2012	HACH sensION156 Portable Meter	5.64	26.3	7.27	0.06
6/22/2012	HACH sensION156 Portable Meter	5.65	26.4		0.04
6/26/2012	HACH sensION156 Portable Meter	5.60	26.5	7.36	0.05
6/27/2012	HACH sensION156 Portable Meter	5.55	26.6		0.05
6/28/2012	HACH sensION156 Portable Meter	5.82	25.2	6.74	0.06
7/2/2012	HACH sensION156 Portable Meter	5.72	26.8		0.05
7/3/2012	HACH sensION156 Portable Meter	6.05	26	7.26	0.05
7/5/2012	HACH sensION156 Portable Meter	6.02	26	7.32	0.05
7/6/2012	HACH sensION156 Portable Meter	5.68	26.5		0.04
7/10/2012	HACH sensION156 Portable Meter	5.72	27.2	6.93	0.04
7/11/2012	HACH sensION156 Portable Meter	5.65	27.4		0.04
7/12/2012	HACH sensION156 Portable Meter	5.69	27.3		0.04
7/13/2012	HACH sensION156 Portable Meter	5.68	27.2		0.04

Table 25 On-site Laboratory UV/AOP Product Water Results of General Parameters with Basin Plan Numeric Objectives

Sample Date	Method	Parameter Measured @ S10 UV/AOP Product			
		pH	Temperature, Deg C	DO, mg/L	Turbidity, NTU
7/16/2012	HACH sensION156 Portable Meter	5.85	27.2		0.05
7/17/2012	HACH sensION156 Portable Meter	5.74	27.4	7.05	0.04
7/18/2012	HACH sensION156 Portable Meter	5.83	27.5		0.05
7/19/2012	HACH sensION156 Portable Meter	5.78	27.8		0.04
7/20/2012	HACH sensION156 Portable Meter	5.78	27.7		0.05
7/23/2012	HACH sensION156 Portable Meter	5.82	27.7		0.04
7/24/2012	HACH sensION156 Portable Meter	5.81	27.5	7.42	0.05
7/25/2012	HACH sensION156 Portable Meter	5.75	27.5		0.04
7/26/2012	HACH sensION156 Portable Meter	5.65	27.6	7.26	0.04
7/27/2012	HACH sensION156 Portable Meter	5.69	27.5		0.06
7/31/2012	HACH sensION156 Portable Meter	6.04	27.9	7.32	0.05
n =		301	298	109	298
Average		5.6	24	7.6	0.05
Maximum		6.5	30	9.5	0.10
Minimum		5.2	16	6.4	0.03
STDev		0.2	2.4	0.4	0.01

Table 26 Summary of Compounds with Federal and State Primary Drinking Water Standards Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 2/1/2012			Quarter 4: 5/1/2012			[1] Federal Drinking Water MCL	[1] CDPH Drinking Water MCL
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water		
1,1,1-Trichloroethane	EPA 524.2	µg/L	0.11	0.5	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	200	200
1,1,2,2-Tetrachloroethane	EPA 524.2	µg/L	0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	1
1,1,2-Trichloroethane	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	5	5
1,1-Dichloroethane	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	-	5
1,1-Dichloroethene	EPA 524.2	µg/L	0.16	0.5	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	7	6
1,2,4-Trichlorobenzene	EPA 524.2	µg/L	0.17	0.5	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	70	5
1,2-Dibromo-3-chloropropane	EPA 504.1	µg/L	0.0034	0.01	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0034	0.2	0.2
1,2-Dibromoethane (EDB)	EPA 504.1	µg/L	0.0054	0.02	<0.0054	<0.0054	<0.0054	<0.0054	<0.0054	<0.0054	<0.0054	<0.0054	<0.02	<0.0054	<0.0054	<0.0054	0.05	0.05
1,2-Dichloroethane	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	5	0.5
1,2-Dichloropropane	EPA 524.2	µg/L	0.13	0.5	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	5	5
1,3-Dichloropropene, Total	EPA 524.2	µg/L	0.15	0.5	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	-	0.5
2,3,7,8-Tetra CDD	EPA 1613B mod.	pg/L	1.9	10	<10	<9.5	<9.3	<10	<10	<9.8	<9.7	<9.5	<9.5	<5.2	<5.2	<5.2	30	30
2,4,5-TP (Silvex)	EPA 515.3	µg/L	0.09	0.2	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	50	50
2,4-D	EPA 515.3	µg/L	0.07	0.4	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	70	70
Alachlor	EPA 525.2	µg/L	0.022	0.1	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	2	2
Aluminum, Total	EPA 200.8	µg/L	0.61	5	11	<5	37	8.8	<5	26	16	<5	29	6.1	<5	16	-	1000
Antimony, Total	EPA 200.8	µg/L	0.04	0.5	0.58	<0.04	<0.5	0.53	<0.5	<0.5	<0.5	<0.04	<0.5	<0.5	<0.04	<0.5	6	6
Arsenic, Total	EPA 200.8	µg/L	0.036	0.4	0.97	<0.036	2.5	0.98	<0.036	2.3	0.62	<0.036	2	0.77	<0.4	2.2	10	10
Asbestos	EPA 100.2	MFL	NA	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	7	7
Atrazine	EPA 525.2	µg/L	0.034	0.1	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	3	1
Barium, Total	EPA 200.8	µg/L	0.03	0.5	22	<0.03	39	18	<0.03	39	21	<0.03	47	20	<0.5	70	2000	1000
Bentazon	EPA 515.3	µg/L	0.11	2	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	-	18
Benzene	EPA 524.2	µg/L	0.15	0.5	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	5	1
Benzo (a) pyrene	EPA 525.2	µg/L	0.07	0.1	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.2	0.2
Beryllium, Total	EPA 200.8	µg/L	0.088	0.1	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	<0.088	4	4
Bis(2-ethylhexyl)adipate	EPA 525.2	µg/L	0.1	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	400	400
Bis(2-ethylhexyl)phthalate	EPA 525.2	µg/L	1.1	3	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<3	<1.1	6	4
Bromate	EPA 326.0	µg/L	1.2	2.5	<1.2	<0.25	<0.25	<0.25	<0.25	<0.25	<0.5	<0.5	<0.5	<0.25	<0.25	<0.25	10	10
Cadmium, Total	EPA 200.8	µg/L	0.02	0.1	<0.02	<0.02	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	5	5
Carbofuran	EPA 531.1	µg/L	0.59	2	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	40	18
Carbon tetrachloride	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	5	0.5
Chlordane (tech)	EPA 508	µg/L	0.066	0.1	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	2	0.1
Chlorite	EPA 300.1	µg/L	0.7	10	<0.7	<0.7	<0.7	<0.7	<10	<0.7	<0.7	<0.7	<0.7	<1.4	<0.7	<0.7	1000	1000
Chlorobenzene	EPA 524.2	µg/L	0.15	0.5	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	100	70
Chromium, Total	EPA 200.8	µg/L	0.074	0.2	0.25	<0.074	<0.2	0.56	<0.074	<0.2	0.52	<0.074	<0.2	0.28	<0.074	<0.2	100	50
cis-1,2-Dichloroethene	EPA 524.2	µg/L	0.11	0.5	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	70	6
Copper, Total	EPA 200.8	µg/L	0.27	0.5	1.6	<0.27	2.6	1.8	<0.27	4.1	1.7	<0.27	3	1.6	<0.27	3.1	1300a	1300a
Cyanide, Total	EPA 335.4	µg/L	2.7	5	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	200	150
Dalapon	EPA 515.3	µg/L	0.1	0.4	<0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.4	<0.1	<0.1	<0.1	<0.1	<0.1	200	200
Dinoseb	EPA 515.3	µg/L	0.14	0.4	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	7	7
Diquat	EPA 549.2	µg/L	0.9	4	<0.9	<0.9	<0.9	<4	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	20	20
Endothall	EPA 548.1	µg/L	3.5	45	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	100	100
Endrin	EPA 508	µg/L	0.002	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	2	2
Ethylbenzene	EPA 524.2	µg/L	0.21	0.5	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	700	300

Table 26 Summary of Compounds with Federal and State Primary Drinking Water Standards Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 2/1/2012			Quarter 4: 5/1/2012			[1] Federal Drinking Water MCL	[1] CDPH Drinking Water MCL
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water		
Fluoride, Total	EPA 300.0	mg/l	0.02	0.1	0.61	<0.1	0.14	0.63	<0.02	0.16	0.54	<0.02	0.13	0.71	<0.02	0.25	4	2
Freon 113	EPA 524.2	µg/L	0.27	5	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	-	1200
gamma-BHC (Lindane)	EPA 508	µg/L	0.0015	0.01	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.2	0.2
Glyphosate	EPA 547	µg/L	1.8	5	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	700	700
[2] Gross Alpha	EPA 900.0	pCi/L	NA	NA	0.016+/-0.16 (MDA=0.016)	0.94+/-0.404 (MDA=0.601)	2.1+/-0.77 (MDA=1.089)	5.78+/-0.393 (MDA=0.016)	-2.0+/-0.582 (MDA=0.886)	0.31+/-0.584 (MDA=1)	0.016+/-0.15 (MDA=0.016)	-0.30+/-0.47 (MDA=0.801)	2.3+/-0.68 (MDA=1)	0.016+/-0.164 (MDA=0.016)	0.16+/-0.529 (MDA=0.927)	1.02+/-0.222 (MDA=0.016)	15 pCi/L	15 pCi/L
[3] Gross Beta	EPA 900.0	pCi/L	NA	NA	21+/-1.096 (MDA=1.117)	-0.59+/-0.578 (MDA=0.968)	1.7+/-0.626 (MDA=0.991)	24+/-1.329 (MDA=1.365)	-1.4+/-0.575 (MDA=0.922)	2.8+/-0.75 (MDA=1.191)	7.6+/-0.84 (MDA=1.1096)	0.28+/-0.532 (MDA=0.902)	3.2+/-0.537 (MDA=0.808)	3.4+/-0.829 (MDA=1.25)	0.62+/-0.531 (MDA=0.884)	5+/-0.83 (MDA=1.215)	4 mrem/ yr	50 pCi/L 4 mrem/ yr
HAA5, Total	EPA 552.2	µg/L		1	2.6	<1	2.5	1.5	<1	2.7	4	<1	5.7	2.1	<1	3.6	60	60
Heptachlor	EPA 508	µg/L	0.0009	0.01	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	0.4	0.01
Heptachlor epoxide	EPA 508	µg/L	0.0011	0.01	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	0.2	0.01
Hexachlorobenzene	EPA 508	µg/L	0.003	0.01	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.01	<0.003	<0.003	<0.003	<0.003	<0.003	1	1
Hexachlorocyclopentadiene	EPA 508	µg/L	0.014	0.05	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	50	50
Lead, Total	EPA 200.8	µg/L	0.011	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.011	<0.2	<0.2	<0.011	<0.2	15a	15a
Mercury, Total	EPA 245.1	µg/L	0.0039	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.0039	<0.0039	<0.0039	2	2
Methoxychlor	EPA 508	µg/L	0.0044	0.01	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044	40	30
Methyl tert-butyl ether (MTBE)	EPA 524.2	µg/L	0.19	2	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	-	13
Methylene chloride	EPA 524.2	µg/L	0.14	0.5	<0.5	<0.5	<0.14	<0.14	<0.14	<0.14	<0.5	<0.5	<0.14	<0.5	<0.5	<0.14	5	5
Molinate	EPA 525.2	µg/L	0.039	0.1	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	<0.039	-	20
Nickel, Total	EPA 200.8	µg/L	0.13	0.8	3.6	<0.13	1.2	3.5	<0.13	1.5	4.4	<0.13	1.1	3.2	<0.13	1.2	-	100
Nitrate as NO3	EPA 353.2	mg/l	0.36	1	73	3.1	1.6	70	2.9	1.5	69	3	1.3	66	4.3	<1	(as N) 10	(as NO3) 45
Nitrite as N	EPA 353.2	µg/L	10	100	<100	<10	<10	<100	<10	<10	<100	<10	<100	<100	<10	<10	1000	1000
NO2+NO3 as N	EPA 353.2	µg/L	20	200	17000	700	370	16000	660	350	16000	670	300	15000	970	200	10000	10000
o-Dichlorobenzene	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	600	600
Oxamyl	EPA 531.1	µg/L	0.48	2	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	200	50
PCBs, Total	EPA 508	µg/L	0.049	0.5	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049	0.5	0.5
p-Dichlorobenzene	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	75	5
Pentachlorophenol	EPA 515.3	µg/L	0.04	0.2	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	1	1
Perchlorate	EPA 314.0	µg/L	0.95	2	5.8	<0.95	<0.95	4.9	<0.95	<0.95	12	<0.95	<0.95	9.8	<0.95	<0.95	-	6
Picloram	EPA 515.3	µg/L	0.05	0.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	500	500
[4]Radium 226	EPA 903.1	pCi/L	NA	NA	0.433+/-0.278 (MDA=0.439)	0.118+/-0.172 (MDA=0.439)	0.078+/-0.153 (MDA=0.439)	0.108+/-0.259 (MDA=0.439)	0.000+/-0.21 (MDA=0.439)	0.053+/-0.233 (MDA=0.439)	0.241+/-0.341 (MDA=0.439)	0.048+/-0.282 (MDA=0.439)	0.00+/-0.265 (MDA=0.439)	0.265+/-0.267 (MDA=0.354)	0.22+/-0.259 (MDA=0.354)	0.572+/-0.311 (MDA=0.354)	5	5
[4]Radium 228	EPA Ra-05	pCi/L	NA	NA	0.00+/-0.631 (MDA=0.322)	0.207+/-0.707 (MDA=0.277)	0.00+/-0.563 (MDA=0.205)	0.000+/-0.562 (MDA=0.276)	0.000+/-0.484 (MDA=0.204)	0.000+/-0.625 (MDA=0.322)	0.00+/-0.453 (MDA=0.205)	0.00+/-0.418 (MDA=0.203)	0.00+/-0.702 (MDA=0.261)	0.25+/-0.431 (MDA=0.25)	0.2+/-0.495 (MDA=0.2)	0.203+/-0.464 (MDA=0.203)	5	5
Selenium, Total	EPA 200.8	µg/L	0.28	0.4	0.56	<0.28	<0.4	0.57	<0.28	<0.4	0.48	<0.28	0.43	1.1	<0.28	0.87	50	50
Simazine	EPA 525.2	µg/L	0.015	0.1	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	4	4
Strontium 90	EPA 905.0	pCi/L		NA	0.00+/-0.471 (MDA=0.676)	0.00+/-0.411 (MDA=0.675)	0.00+/-0.435 (MDA=0.675)	0.183+/-0.223 (MDA=0.675)	0.152+/-0.215 (MDA=0.675)	0.579+/-0.31 (MDA=0.676)	0.00+/-0.267 (MDA=0.636)	0.062+/-0.287 (MDA=0.636)	0.218+/-0.283 (MDA=0.636)	0.636+/-0.508 (MDA=0.636)	0.636+/-0.546 (MDA=0.636)	0.636+/-0.469 (MDA=0.636)	8	8
Styrene	EPA 524.2	µg/L	0.19	0.5	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	100	100
Tetrachloroethene	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	5	5
Thallium, Total	EPA 200.8	µg/L	0.009	0.2	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.2	<0.2	<0.2	<0.2	<0.009	<0.009	2	2
Thiobencarb	EPA 525.2	µg/L	0.025	0.1	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	70
THMs, Total	EPA 524.2	µg/L	0.6	2	3	2.2	54	<2	<0.6	38	<0.6	<0.6	33	<2	<0.6	36	80	80

Table 26 Summary of Compounds with Federal and State Primary Drinking Water Standards Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 2/1/2012			Quarter 4: 5/1/2012			[1] Federal Drinking Water MCL	[1] CDPH Drinking Water MCL
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water		
Toluene	EPA 524.2	µg/L	0.14	0.5	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.5	<0.14	<0.14	1000	150
Toxaphene	EPA 508	µg/L	0.066	1	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	<0.066	3	3
trans-1,2-Dichloroethene	EPA 524.2	µg/L	0.11	0.5	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	100	10
Trichloroethene	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	5	5
Trichlorofluoromethane	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	-	150
Tritium[5]	EPA 906.0	pCi/L	NA	NA	0.00+/-246 (MDA=423)	0.00+/-242 (MDA=423)	0.00+/-244 (MDA=423)	0.000+/-417 (MDA=714)	0.00+/-421 (MDA=714)	0.00+/-422 (MDA=714)	126+/-268 (MDA=437)	0+/-267 (MDA=437)	0.00+/-261 (MDA=437)	505+/-303 (MDA=505)	25.7+/-305 (MDA=505)	505+/-301 (MDA=505)	20000	20000
Uranium Rad[5]	EPA 200.8	pCi/L	0.019	0.13	0.17	<0.019	0.92	<0.13	<0.019	0.96	0.16	<0.019	1.3	0.31	<0.019	2.2	20.1	20
Vinyl chloride	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	2	0.5
Xylenes, Total	EPA 524.2	µg/L	0.33	0.5	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	10000	1750

Note:

1. California Department of Public Health, *Maximum Contaminant Levels and Regulatory Dates for Drinking Water U.S. EPA Vs California*, November 2008. http://www.cdph.ca.gov/certlic/drinkingwater/pages/chemicalcontaminants.aspx
2. Gross Alpha Radioactivity is simply a measurement of all alpha activity present, regardless of specific radionuclide source. Gross measurements are used as a method to screen samples for relative levels of radioactivity.
3. Gross Beta Radioactivity is simply a measurement of all beta activity present, regardless of specific radionuclide source. Gross measurements are used as a method to screen samples for relative levels of radioactivity.
4. MCL for Radium 226 and Radium 228 is expressed as Combined Radium (226+228)
5. Refer to **Section 3.2.5 URs** for how to interpret MDAs and Counting Errors.
6. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 27 Summary of Compounds with Federal and State Secondary Drinking Water Standards Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 2/1/2012			Quarter 4: 5/1/2012			Federal Drinking Water MCL	CDPH Drinking Water MCL
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water		
Aluminum, Total	EPA 200.8	µg/L	0.61	5	11	<5	37	8.8	<5	26	16	<5	29	6.1	<5	16	50 to 200	200
Chloride, Total	EPA 300.0	mg/l	1	5	250	<5	61	240	<5	54	260	<5	63	270	<5	71	250	250
Color	SM2120B	Color Units	NA	3	20	<3	<3	20	<3	<3	15	<3	<3	15	<3	<3	15	15
Copper, Total	EPA 200.8	µg/L	0.27	0.5	1.6	<0.27	2.6	1.8	<0.27	4.1	1.7	<0.27	3	1.6	<0.27	3.1	1000	1000
Iron, Total	EPA 200.7	µg/L	1.1	10	93	<1.1	22	73	<1.1	33	110	<1.1	35	69	<1.1	18	300	300
Langelier Index @ 20 C	EPA 200.2	N/A	-10.0	-10.0	<-10	-6.64	<-10	<-10	-6.69	<-10	-0.832	-6.59	-0.483	-0.784	-6.15	-0.112	Non Corrosive	----------
Manganese, Total	EPA 200.8	µg/L	0.11	0.2	110	<0.11	23	70	<0.11	5.7	93	0.37	4.3	72	<0.2	2.8	50	50
MBAS	SM 5540 C	mg/l	0.019	0.05	0.063	<0.019	<0.05	<0.05	<0.019	<0.019	0.054	<0.019	<0.019	0.07	<0.019	<0.019	0.5	0.5
Methyl tert-butyl ether (MTBE)	EPA 524.2	µg/L	0.19	2	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	----------	5
pH water	General Preparation	Units	0.1	0.1	7.08	5.82	7.48	7.04	5.99	7.4	6.99	5.75	7.52	6.91	5.89	7.62	6.5-8.5	----------
Silver, Total	EPA 200.8	µg/L	0.027	0.2	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	0.21	<0.2	<0.2	100	100
Specific Conductance (EC)	SM2510B	umhos/cm	0.47	4	1500	22	470	1100	16	370	1400	20	520	1500	26	670	NR	900
Sulfate as SO4	EPA 300.0	mg/l	0.1	0.5	170	<0.1	61	130	<0.5	56	150	<0.1	73	180	<0.5	130	250	250
Thiobencarb	EPA 525.2	µg/L	0.025	0.1	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	----------	1
Threshold Odor Number	EPA 140.1	T.O.N.	NA	1	10	<1	<1	2	<1	2	20	<1	<1	10	<1	<1	3	3
Total Dissolved Solids	SM2540C	mg/l	4	10	850	16	280	760	16	380	710	13	270	650	11	290	500	500
Turbidity	EPA 180.1	NTU	0.024	0.1	0.35	<0.024	0.61	<0.024	<0.024	<0.024	0.17	<0.024	0.35	<0.024	<0.024	<0.024	5	5
Zinc, Total	EPA 200.8	µg/L	1.1	5	66	<1.1	5.5	48	<1.1	<5	100	<1.1	<5	36	<1.1	<5	5000	5000

Note:

1. NR=not regulated. California Code of Regulation Title 22. Division 4. Environmental Health Chapter 15. Domestic Water Quality and Monitoring Regulations Article 16.
2. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 28 Summary of Detected Priority Pollutant Results North City Tertiary Effluent (Pre-chlorination)

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011	Quarter 2: 11/08/2011	Quarter 3: 02/01/2012	Quarter 4: 05/01/2012	Fresh Water Criterion Continuous Conc. Aquatic (µg/L)	Human Health (10-6) risk for carcinogens) For the Consumption of: Water & Organisms (µg/L)
2,3,7,8-Tetra CDD	EPA 1613B mod.	pg/L	varies	10	<10	<10	<9.7	<5.2		0.000000013 c
Antimony, Total	EPA 200.8	µg/L	0.04	0.5	0.58	0.53	<0.5	<0.5		14 a,s
Arsenic, Total	EPA 200.8	µg/L	0.036	0.4	0.97	0.98	0.62	0.77	150 i,m,w	
Asbestos	EPA 100.2	MFL	0	0.2	<0.2	<0.2	<0.2	<0.2		7,000,000 fibers/L k,s
Bromodichloromethane	EPA 524.2	µg/L	0.09	0.5	1	0.58	<0.5	0.51		0.56 a,c
Cadmium, Total	EPA 200.8	µg/L	0.02	0.1	<0.02	<0.1	<0.02	<0.02	2.2 e,i,m,w	n
Chloroform	EPA 524.2	µg/L	0.12	0.5	1.4	0.8	<0.5	0.52	Reserved	Reserved
Chromium, Total (Cr (III) + Cr(VI))	EPA 200.8	µg/L	0.074	0.2	0.25	0.56	0.52	0.28	11 i,m,w (Cr(VI))/180 e,i,m,o(Cr(III))	n
Copper, Total	EPA 200.8	µg/L	0.27	0.5	1.6	1.8	1.7	1.6	9.0 e,i,m,w	1300
Dibromochloromethane	EPA 524.2	µg/L	0.2	0.5	0.65	<0.5	<0.5	<0.5		0.401 a,c
Lead, Total	EPA 200.8	µg/L	0.011	0.2	<0.2	<0.2	<0.2	<0.2	2.5 e,i,m	n
Mercury, Total	EPA 245.1	µg/L	0.0039	0.05	<0.05	<0.05	<0.05	<0.0039	[Reserved]	0.050 a
Methylene chloride	EPA 524.2	µg/L	0.14	0.5	<0.5	<0.14	<0.5	<0.5		4.7 a,c
Nickel, Total	EPA 200.8	µg/L	0.13	0.8	3.6	3.5	4.4	3.2	52 e,i,m,w	610 a
Selenium, Total	EPA 200.8	µg/L	0.28	0.4	0.56	0.57	0.48	1.1	5.0 q	n
Thallium, Total	EPA 200.2	µg/L	0.009	0.2	<0.009	<0.009	<0.2	<0.2		
Zinc, Total	EPA 200.8	µg/L	1.1	5	66	48	100	36	120 e,i,m,w	
N-Nitrosodimethylamine	EPA 521	ng/l	0.14	2	2.9	<2	<0.14	<0.14		0.00069 a,c,s

Note:

1. Footnotes are defined in Federal Register / Vol. 65, No. 97/Thursday, May 18, 2000/Rules and Regulations. The complete list of priority pollutants analyzed is provided in Table 31.
2. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 29 Summary of Detected Priority Pollutant Results UV/AOP Product Water

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011	Quarter 2: 11/08/2011	Quarter 3: 02/01/2012	Quarter 4: 05/01/2012	Fresh Water Criterion Continuous Conc. Aquatic (µg/L)	Human Health (10-6) risk for carcinogens) For the Consumption of: Water & Organisms (µg/L)
2,3,7,8-Tetra CDD	EPA 1613B mod.	pg/L	varies	10	<9.5	<10	<9.5	<5.2		0.000000013 c
Antimony, Total	EPA 200.8	µg/L	0.04	0.5	<0.04	<0.5	<0.04	<0.04		14 a,s
Arsenic, Total	EPA 200.8	µg/L	0.036	0.4	<0.036	<0.036	<0.036	<0.4	150 i,m,w	
Asbestos	EPA 100.2	MFL	0	0.2	<0.2	<0.2	<0.2	<0.2		7,000,000 fibers/L k,s
Bromodichloromethane	EPA 524.2	µg/L	0.09	0.5	0.78	<0.5	<0.5	<0.5		0.56 a,c
Chloroform	EPA 524.2	µg/L	0.12	0.5	1.4	<0.5	<0.12	<0.5	Reserved	Reserved
Diethyl phthalate	EPA 625	µg/L	0.15	1	<1	<0.15	<0.15	<0.15		23000 a,s
Dimethyl phthalate	EPA 625	µg/L	0.18	1	<1	<0.18	<0.18	<0.18		313000 s
Di-n-butyl phthalate	EPA 625	µg/l	0.24	1	2.2	<0.24	<0.24	<0.24		2700 a,s
Lead, Total	EPA 200.8	µg/L	0.011	0.2	<0.2	<0.2	<0.011	<0.011	2.5 e,i,m	n
Mercury, Total	EPA 245.1	µg/L	0.0039	0.05	<0.05	<0.05	<0.05	<0.0039	[Reserved]	0.050 a
Methylene chloride	EPA 524.2	µg/L	0.14	0.5	<0.5	<0.14	<0.5	<0.5		4.7 a,c
N-Nitrosodimethylamine	EPA 521	ng/l	0.14	2	<0.14	<0.14	<0.14	<0.14		0.00069 a,c,s
Silver, Total	EPA 200.8	µg/L	0.027	0.2	<0.027	<0.027	<0.027	<0.2		

Note:

1. Footnotes are defined in Federal Register / Vol. 65, No. 97/Thursday, May 18, 2000/Rules and Regulations. The complete list of priority pollutants analyzed is provided in Table 31.
2. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 30 Summary of Detected Priority Pollutant Results Imported Raw Aqueduct Water

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011	Quarter 2: 11/08/2011	Quarter 3: 02/01/2012	Quarter 4: 05/01/2012	[1] Fresh Water Criterion Continuous Conc. Aquatic (µg/L)	[1] Human Health (10-6) risk for carcinogens) For the Consumption of: Water & Organisms (µg/L)
2,3,7,8-Tetra CDD	EPA 1613B mod.	pg/L	varies	10	<9.3	<9.8	<9.5	<5.2		0.000000013 c
Antimony, Total	EPA 200.8	µg/L	0.04	0.5	<0.5	<0.5	<0.5	<0.5		14 a,s
Arsenic, Total	EPA 200.8	µg/L	0.036	0.4	2.5	2.3	2	2.2	150 i,m,w	
Asbestos	EPA 100.2	MFL	0	0.2	<0.2	<0.2	<0.2	<0.2		7,000,000 fibers/L k,s
Bis(2-ethylhexyl)phthalate	EPA 625	µg/L	2.3	5	<2.3	<2.3	<2.3	<5		
Bromodichloromethane	EPA 524.2	µg/L	0.09	0.5	19	14	10	10		0.56 a,c
Bromoform	EPA 524.2	µg/L	0.19	0.5	3.5	2.9	3.8	6.2		4.3 a,c
Chloroform	EPA 524.2	µg/L	0.12	0.5	11	6.6	4.8	4.8	Reserved	Reserved
[2] Chromium, Total (Cr (III) + Cr(VI))	EPA 200.8	µg/L	0.074	0.2	<0.2	<0.2	<0.2	<0.2	11 i,m,w (Cr(VI))/180 e,i,m,o(Cr(III))	n
Copper, Total	EPA 200.8	µg/L	0.27	0.5	2.6	4.1	3	3.1	9.0 e,i,m,w	1300
Dibromochloromethane	EPA 524.2	µg/L	0.2	0.5	21	14	14	15		0.401 a,c
Heptachlor epoxide	EPA 508	µg/L	0.0011	0.01	<0.0011	<0.0011	<0.0011	<0.0011	0.0038 g	0.0001 a,c
Lead, Total	EPA 200.8	µg/L	0.011	0.2	<0.2	<0.2	<0.2	<0.2	2.5 e,i,m	n
Mercury, Total	EPA 245.1	µg/L	0.0039	0.05	<0.05	<0.05	<0.05	<0.0039	[Reserved]	0.050 a
Nickel, Total	EPA 200.8	µg/L	0.13	0.8	1.2	1.5	1.1	1.2	52 e,i,m,w	610 a
Nitrobenzene	EPA 625	µg/L	0.36	1	<0.36	<0.36	<0.36	<0.36		17 a,s
Phenanthrene	EPA 625	µg/L	0.32	1	<0.32	<0.32	<0.32	<0.32		
Pyrene	EPA 625	µg/L	0.25	1	<0.25	<0.25	<0.25	<0.25		960 a
Selenium, Total	EPA 200.8	µg/L	0.28	0.4	<0.4	<0.4	0.43	0.87	5.0 q	n
Silver, Total	EPA 200.8	µg/L	0.027	0.2	<0.027	<0.027	<0.027	<0.2		
Vinyl chloride	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18		2 c,s
Zinc, Total	EPA 200.8	µg/L	1.1	5	5.5	<5	<5	<5	120 e,i,m,w	

Note:

1. Footnotes are defined in Federal Register / Vol. 65, No. 97/Thursday, May 18, 2000/Rules and Regulations. Data flags provided in the original laboratory reports are not shown. The complete list of priority pollutants analyzed is provided in Table 31.
2. Lab 2 condcuted these analysis. Hexavalent Chromium results are presented in Table 33 (Lab 1) and Table 33 (Lab 2). Cr (III) = Trivalent chromium is determined based on calculation of Total Chromium minus Cr VI (hexavalent chromium).
3. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 31 Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule

A		B Freshwater		C Saltwater		D Human Health (10^{-6} risk for carcinogens) For consumption of:	
# Compound	CAS Number	Criterion Maximum Conc. [d] B1	Criterion Continuous Conc. [d] B2	Criterion Maximum Conc. [d] C1	Criterion Continuous Conc. [d] C2	Water & Organisms (µg/L) D1	Organisms Only (µg/L) D2
1. Antimony	7440360					14 a,s	4300 a,t
2. Arsenic [b]	7440382	340 i,m,w	150 i,m,w	69 i,m	36 i,m		
3. Beryllium	7440417					n	n
4. Cadmium [b]	7440439	4.3 e,i,m,w,x	2.2 e,i,m,w	42 i,m	9.3 i,m	n	n
5a. Chromium (III)	16065831	550 e,i,m,o	180 e,i,m,o			n	n
5b. Chromium (VI) [b]	18540299	16 i,m,w	11 i,m,w	1100 i,m	50 i,m	n	n
6. Copper [b]	7440508	13 e,i,m,w,x	9.0 e,i,m,w	4.8 i,m	3.1 i,m	1300	
7. Lead [b]	7439921	65 e,i,m	2.5 e,i,m	210 i,m	8.1 i,m	n	n
8. Mercury [b]	7439976	[Reserved]	[Reserved]	[Reserved]	[Reserved]	0.050 a	0.051 a
9. Nickel [b]	7440020	470 e,i,m,w	52 e,i,m,w	74 i,m	8.2 i,m	610 a	4600 a
10. Selenium [b]	7782492	[Reserved] p	5.0 q	290 i,m	71 i,m	n	n
11. Silver [b]	7440224	3.4 e,i,m		1.9 i,m			
12. Thallium	7440280					1.7 a,s	6.3 a,t
13. Zinc [b]	7440666	120 e,i,m,w,x	120 e,i,m,w	90 i,m	81 i,m		
14. Cyanide [b]	57125	22 o	5.2 o	1 r	1 r	700 a	220,000 a,j
15. Asbestos	1332214					7,000,000 fibers/L k,s	
16. 2,3,7,8-TCDD (Dioxin)	1746016					0.000000013 c	0.000000014 c
17. Acrolein	107028					320 s	780 t
18. Acrylonitrile	107131					0.059 a,c,s	0.66 a,c,t
19. Benzene	71432					1.2 a,c	71 a,c
20. Bromoform	75252					4.3 a,c	360 a,c
21. Carbon Tetrachloride	56235					0.25 a,c,s	4.4 a,c,t
22. Chlorobenzene	108907					680 a,s	21,000 a,j,t
23. Chlorodibromomethane	124481					0.401 a,c	34 a,c
24. Chloroethane	75003						
25. 2-Chloroethylvinyl Ether	110758						

Table 31 Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule (Cont.)

A		B Freshwater		C Saltwater		D Human Health (10^{-6} risk for carcinogens) For consumption of:	
# Compound	CAS Number	Criterion Maximum Conc. [d] B1	Criterion Continuous Conc. [d] B2	Criterion Maximum Conc. [d] C1	Criterion Continuous Conc. [d] C2	Water & Organisms (µg/L) D1	Organisms Only (µg/L) D2
26. Chloroform	67663					[Reserved]	[Reserved]
27. Dichlorobromomethane	75274					0.56 a,c	46 a,c
28. 1,1-Dichloroethane	75343						
29. 1,2-Dichloroethane	107062					0.38 a,c,s	99 a,c,t
30. 1,1-Dichloroethylene	75354					0.057 a,c,s	3.2 a,c,t
31. 1,2-Dichloropropane	78875					0.52 a	39 a
32. 1,3-Dichloropropylene	542756					10 a,s	1,700 a,t
33. Ethylbenzene	100414					3,100 a,s	29,000 a,t
34. Methyl Bromide	74839					48 a	4,000 a
35. Methyl Chloride	74873					n	n
36. Methylene Chloride	75092					4.7 a,c	1,600 a,c
37. 1,1,2,2-Tetrachloroethane	79345					0.17 a,c,s	11 a,c,t
38. Tetrachloroethylene	127184					0.8 c,s	8.85 c,t
39. Toluene	108883					6,800 a	200,000 a
40. 1,2-Trans-Dichloroethylene	156605					700 a	140,000 a
41. 1,1,1-Trichloroethane	71556					n	n
42. 1,1,2-Trichloroethane	79005					0.60 a,c,s	42 a,c,t
43. Trichloroethylene	79016					2.7 c,s	81 c,t
44. Vinyl Chloride	75014					2 c,s	525 c,t
45. 2-Chlorophenol	95578					120 a	400 a
46. 2,4-Dichlorophenol	120832					93 a,s	790 a,t
47. 2,4-Dimethylphenol	105679					540 a	2,300 a
48. 2-Methyl-4,6-Dinitrophenol	534521					13.4 s	765 t
49. 2,4-Dinitrophenol	51285					70 a,s	14,000 a,t
50. 2-Nitrophenol	88755						
51. 4-Nitrophenol	100027						
52. 3-Methyl-4-Chlorophenol	59507						
53. Pentachlorophenol	87865	19 f,w	15 f,w	13	7.9	0.28 a,c	8.2 a,c,j
54. Phenol	108952					21,000 a	4,600,000 a,j,t
55. 2,4,6-Trichlorophenol	88062					2.1 a,c	6.5 a,c
56. Acenaphthene	83329					1,200 a	2,700 a
57. Acenaphthylene	208968						
58. Anthracene	120127					9,600 a	110,000 a

Table 31 Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule (Cont.)

A		B Freshwater		C Saltwater		D Human Health (10^{-6} risk for carcinogens) For consumption of:	
# Compound	CAS Number	Criterion Maximum Conc. [d] B1	Criterion Continuous Conc. [d] B2	Criterion Maximum Conc. [d] C1	Criterion Continuous Conc. [d] C2	Water & Organisms (µg/L) D1	Organisms Only (µg/L) D2
59. Benzidine	92875					0.00012 a,c,s	0.00054 a,c,t
60. Benzo(a)Anthracene	56553					0.0044 a,c	0.049 a,c
61. Benzo(a)Pyrene	50328					0.0044 a,c	0.049 a,c
62. Benzo(b)Fluoranthene	205992					0.0044 a,c	0.049 a,c
63. Benzo(ghi)Perylene	191242						
64. Benzo(k)Fluoranthene	207089					0.0044 a,c	0.049 a,c
65. Bis(2-Chloroethoxy)Methane	111911						
66. Bis(2-Chloroethyl)Ether	111444					0.031 a,c,s	1.4 a,c,t
67. Bis(2-Chloroisopropyl)Ether	39638329					1,400 a	170,000 a,t
68. Bis(2-Ethylhexyl)Phthalate	117817					1.8 a,c,s	5.9 a,c,t
69. 4-Bromophenyl Phenyl Ether	101553						
70. Butylbenzyl Phthalate	85687					3,000 a	5,200 a
71. 2-Chloronaphthalene	91587					1,700 a	4,300 a
72. 4-Chlorophenyl Phenyl Ether	7005723						
73. Chrysene	218019					0.0044 a,c	0.049 a,c
74. Dibenzo(a,h)Anthracene	53703					0.0044 a,c	0.049 a,c
75. 1,2 Dichlorobenzene	95501					2,700 a	17,000 a
76. 1,3 Dichlorobenzene	541731					400	2,600
77. 1,4 Dichlorobenzene	106467					400	2,600
78. 3,3'-Dichlorobenzidine	91941					0.04 a,c,s	0.077 a,c,t
79. Diethyl Phthalate	84662					23,000 a,s	120,000 a,t
80. Dimethyl Phthalate	131113					313,000 s	2,900,000 t
81. Di-n-Butyl Phthalate	84742					2,700 a,s	12,000 a,t
82. 2,4-Dinitrotoluene	121142					0.11 c,s	9.1 c,t
83. 2,6-Dinitrotoluene	606202						
84 Di-n-Octyl Phthalate	117840						
85. 1,2-Diphenylhydrazine	122667					0.040 a,c,s	0.54 a,c,t
86. Fluoranthene	206440					300 a	370 a
87. Fluorene	86737					1,300 a	14,000 a
88. Hexachlorobenzene	118741					0.00075 a,c	0.00077 a,c
89. Hexachlorobutadiene	87683					0.44 a,c,s	50 a,c,t
90. Hexachlorocyclopentadiene	77474					240 a,s	17,000 a,j,t
91. Hexachloroethane	67721					1.9 a,c,s	8.9 a,c,t

Table 31 Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule (Cont.)

A		B Freshwater		C Saltwater		D Human Health (10^{-6} risk for carcinogens) For consumption of:	
# Compound	CAS Number	Criterion Maximum Conc. [d] B1	Criterion Continuous Conc. [d] B2	Criterion Maximum Conc. [d] C1	Criterion Continuous Conc. [d] C2	Water & Organisms (µg/L) D1	Organisms Only (µg/L) D2
92. Indeno(1,2,3-cd) Pyrene	193395					0.0044 a,c	0.049 a,c
93. Isophorone	78591					8.4 c,s	600 c,t
94. Naphthalene	91203						
95. Nitrobenzene	98953					17 a,s	1,900 a,j,t
96. N-Nitrosodimethylamine	62759					0.00069 a,c,s	8.1 a,c,t
97. N-Nitrosodi-n-Propylamine	621647					0.005 a	1.4 a
98. N-Nitrosodiphenylamine	86306					5.0 a,c,s	16 a,c,t
99. Phenanthrene	85018						
100. Pyrene	129000					960 a	11,000 a
101. 1,2,4-Trichlorobenzene	120821						
102. Aldrin	309002	3 g		1.3 g		0.00013 a,c	0.00014 a,c
103. alpha-BHC	319846					0.0039 a,c	0.013 a,c
104. beta-BHC	319857					0.014 a,c	0.046 a,c
105. gamma-BHC	58899	0.95 w		0.16 g		0.019 c	0.063 c
106. delta-BHC	319868						
107. Chlordane	57749	2.4 g	0.0043 g	0.09 g	0.004 g	0.00057 a,c	0.00059 a,c
108. 4,4'-DDT	50293	1.1 g	0.001 g	0.13 g	0.001 g	0.00059 a,c	0.00059 a,c
109. 4,4'-DDE	72559					0.00059 a,c	0.00059 a,c
110. 4,4'-DDD	72548					0.00083 a,c	0.00084 a,c
111. Dieldrin	60571	0.24 w	0.056 w	0.71 g	0.0019 g	0.00014 a,c	0.00014 a,c
112. alpha-Endosulfan	959988	0.22 g	0.056 g	0.034 g	0.0087 g	110 a	240 a
113. beta-Endosulfan	33213659	0.22 g	0.056 g	0.034 g	0.0087 g	110 a	240 a
114. Endosulfan Sulfate	1031078					110 a	240 a
115. Endrin	72208	0.086 w	0.036 w	0.037 g	0.0023 g	0.76 a	0.81 a,j
116. Endrin Aldehyde	7421934					0.76 a	0.81 a,j
117. Heptachlor	76448	0.52 g	0.0038 g	0.053 g	0.0036 g	0.00021 a,c	0.00021 a,c
118. Heptachlor Epoxide	1024573	0.52 g	0.0038 g	0.053 g	0.0036 g	0.00010 a,c	0.00011 a,c
119-125. Polychlorinated biphenyls (PCBs)			0.014 u		0.03 u	0.00017 c,v	0.00017 c,v
126. Toxaphene	8001352	0.73	0.0002	0.21	0.0002	0.00073 a,c	0.00075 a,c
Total Number of Criteria [h]		22	21	22	20	92	90

Note: Footnotes are defined in Federal Register / Vol. 65, No. 97/Thursday, May 18, 2000/Rules and Regulations.

Table 32 Summary of Compounds with CDPH Drinking Water Notification Levels Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 02/01/2012			Quarter 4: 05/01/2012			CDPH Drinking Water Notification Level [1]
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	
1,2,3-Trichloropropane	SRL 524M-TCP	µg/L	0.0012	0.005	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	0.005
1,2,4-Trimethylbenzene	EPA 524.2	µg/L	0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	330
1,3,5-Trimethylbenzene	EPA 524.2	µg/L	0.17	0.5	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	330
1,4-Dioxane	EPA 8270M	µg/L	0.04	0.5	1.8	<0.04	<0.04	5.6	<0.04	<0.04	1.2	<0.04	<0.04	1.6	<0.04	<0.04	1
2,4,6-Trinitrotoluene	EPA 8330A	µg/L	0.2	2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	1
2-Chlorotoluene	EPA 524.2	µg/L	0.15	0.5	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	140
4-Chlorotoluene	EPA 524.2	µg/L	0.15	0.5	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	140
Methyl isobutyl Ketone (MIBK)	EPA 524.2	µg/L	0.56	5	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	120
Boron, Total	EPA 200.8	µg/L	0.28	1	400	240	160	340	210	130	360	200	140	370	290	150	1000
Carbon Disulfide	EPA 524.2	µg/L	0.13	0.5	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	160
Chlorate	EPA 300.1	µg/L	0.95	10	16	<0.95	<0.95	580	<10	<10	88	<0.95	<10	14	<0.95	13	800
Diazinon	EPA 525.2	µg/L	0.096	0.1	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	<0.096	1.2
Dichlorodifluoromethane (Freon 12)	EPA 524.2	µg/L	0.12	0.5	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	1000
[2]Ethylene glycol	EPA 8015B	mg/l	11	50	<11	<11	<11	<11	<11	<11	<11	<11	<11	<50	<50	<50	14
Formaldehyde	EPA 556	µg/L	0.26	2	6.8	8.9	5	6	11	2.8	8.2	5.7	2.7	8.5	6.5	2.5	100
HMX	EPA 8330A	µg/L	3	10	<3	<0.59	<0.59	<1.5	<0.3	<0.3	<1.5	<0.3	<0.3	<1.5	<0.3	<0.3	350
Isopropylbenzene	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	770
Manganese, Total	EPA 200.8	µg/L	0.11	0.2	110	<0.11	23	70	<0.11	5.7	93	0.37	4.3	72	<0.2	2.8	500
Naphthalene	EPA 524.2	µg/L	0.42	0.5	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	17
n-Butylbenzene	EPA 524.2	µg/L	0.29	0.5	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	260
N-Nitrosodiethylamine	EPA 521	ng/l	0.72	2	<2	<0.72	<0.72	<0.72	<0.72	3.3	<2	5.7	<0.72	<2	4.9	<0.72	10
N-Nitrosodimethylamine	EPA 521	ng/l	0.28	2.2	2.9	<2	<0.28	<2	<0.28	<0.28	<2	<2	<0.28	5.2	<2.2	<2	10
N-Nitrosodi-n-propylamine	EPA 521	ng/l	0.35	2.2	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<2.2	<0.35	10
n-Propylbenzene	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	260
Propachlor	EPA 508	µg/L	0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	90
RDX	EPA 8330A	µg/L	0.32	2	<0.32	<0.32	<0.32	<0.16	<0.16	<0.16	<0.8	<0.16	<0.16	<0.8	<0.16	<0.16	0.3
sec-Butylbenzene	EPA 524.2	µg/L	0.24	0.5	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	260
Tert-butyl alcohol	EPA 524.2	µg/L	0.45	2	<0.45	<0.45	<0.45	<2	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	12
tert-Butylbenzene	EPA 524.2	µg/L	0.18	0.5	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	260
Vanadium, Total	EPA 200.8	µg/L	0.047	0.5	1.1	<0.5	2.6	<0.047	<0.047	1.3	0.8	<0.5	2.7	0.81	<0.047	2.8	50

Note:

1. CDPH Drinking Water Notification Levels Last Update: December 14, 2010. For notes on toxicological enpoints, references, history, and other information visit: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/default.aspx.

2. Additonal testing was conducted for ethylene glycol at sample locations S1 and S10 using a more sensitive method (EPA 8270 C DL=0.5 mg/L; RL= 1 mg/L). Samples from each location were collected on 8/13/12 and 8/15/12. All results were <0.5 mg/L.

3. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 33 Summary of Proposed Contaminants EPA's Unregulated Contaminant Monitoring Rule (UCMR 3) Assessment Monitoring (List 1and List 2) Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 03/08/2012			Quarter 4: 05/01/2012		
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water
1,1-Dichloroethane	EPA 524.3	ng/L	10	30	<10	<10	<10	**<10**	**<10**	**<10**	<10	<10	<10	<10	<10	<10
1,2,3-Trichloropropane	EPA 524.3	ng/L	4.6	30	<4.6	<4.6	<4.6	**<4.6**	**<4.6**	**<4.6**	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6
1,3-butadiene	EPA 524.3	ng/L	37	100	<37	<37	<37	**<37**	**<37**	**<37**	<37	<100	<37	<37	<37	<37
1,4-Dioxane	EPA 522	µg/L	0.035	0.070	0.95	<0.035	<0.035	4.2	<0.070	<0.035	0.97	<0.035	<0.035	1.2	<0.035	<0.070
17 alpha-ethynylestradiol	EPA 539	µg/L	0.00010	0.00040	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
17-beta-Estradiol	EPA 539	µg/L	0.00010	0.00090	<0.00090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00090	<0.00010	<0.00010	<0.00090	<0.00010	<0.00010
4-androstene-3,17-dione	EPA 539	µg/L	0.000040	0.00030	0.0012	<0.000040	<0.00030	0.0018	<0.00030	<0.00030	0.0032	<0.000040	<0.00030	0.0032	<0.000040	<0.00030
Bromochloromethane (BCM)	EPA 524.3	ng/L	5.5	60	220	230	<60	**260**	**190**	**<5.5**	230	230	78	170	250	79
Bromomethane	EPA 524.3	ng/L	35	200	<35	<35	<35	**<35**	**<35**	**<200**	<35	<35	<35	<35	<35	<35
Chlorate	UCMR 300.1	µg/L	2.0	20	<20	<2.0	<2.0	580	<20	<2.0	28	<2.0	<20	<20	<2.0	<20
Chlorodifluoromethane	EPA 524.3	ng/L	6.8	80	<80	<80	<80	**<80**	**<80**	**<80**	<80	<80	<80	<6.8	<6.8	<6.8
Chloromethane	EPA 524.3	ng/L	6.0	200	<200	<6.0	<200	**<6.0**	**<200**	**<200**	<6.0	<6.0	<6.0	<200	<200	<6.0
Chromium	UCMR 200.8	µg/L	0.021	0.30	1.1	<0.021	0.37	<0.3	**<0.021**	<0.021	<0.30	<0.30	**<0.021**	0.35	<0.021	<0.15
Cobalt	UCMR 200.8	µg/L	0.28	1.0	<1.0	<0.28	<0.28	<1.0	**<0.28**	<0.28	<1.0	<0.28	**<0.28**	<1.0	<0.28	<0.28
Equilin	EPA 539	µg/L	0.00040	0.0040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Estriol	EPA 539	µg/L	0.00020	0.00080	<0.00080	<0.00020	<0.00020	<0.00020	<0.00020	<0.00080	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Estrone	EPA 539	µg/L	0.00020	0.0020	0.0047	<0.00020	<0.0020	<0.0020	<0.00020	<0.00020	0.0043	<0.00020	<0.00020	0.0038	<0.00020	0.87
Hexavalent chromium(Dissolved)	EPA 218.6/218.7	µg/L	0.0090	0.020	<0.0090	0.090	0.052	<0.0090	0.083	0.045	<0.030	0.040	0.048	<0.030	0.16	<0.030
Molybdenum	UCMR 200.8	µg/L	0.057	1.0	8.0	<0.057	2.1	7.5	**<0.057**	2.1	5.6	<0.057	**<0.057**	6.2	<0.50	3.6
n-Propylbenzene	EPA 524.3	ng/L	5.4	30	<5.4	<5.4	<5.4	**<5.4**	**<5.4**	**<5.4**	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4
Perfluoro octanesulfonic acid - PFOS	EPA 537	µg/L	0.0023	0.040	<0.040	<0.0023	<0.0023	<0.040	<0.0023	<0.0023	<0.040	<0.0023	<0.0023	<0.040	<0.0023	<0.0023
Perfluoro-1-butanesulfonic acid -PFBS	EPA 537	µg/L	0.0018	0.090	<0.090	<0.0018	<0.090	<0.090	<0.0018	<0.0018	<0.090	<0.0018	<0.0018	<0.090	<0.0018	<0.0018
Perfluoro-1-hexanesulfonic acid - PFHxS	EPA 537	µg/L	0.0020	0.030	<0.030	<0.0020	<0.0020	<0.030	<0.0020	<0.0020	<0.030	<0.0020	<0.0020	<0.030	<0.0020	<0.0020
Perfluoroheptanoic acid - PFHpA	EPA 537	µg/L	0.0031	0.010	0.032	<0.0031	<0.0031	0.036	<0.010	<0.0031	0.023	<0.0031	<0.0031	0.026	<0.0031	<0.0031
Perfluoro-n-nonanoic acid -PFNA	EPA 537	µg/L	0.0022	0.020	<0.020	<0.0022	<0.0022	0.020	<0.0022	<0.0022	<0.020	<0.0022	<0.0022	<0.020	<0.0022	<0.0022
Perfluorooctanoic acid - PFOA	EPA 537	µg/L	0.0035	0.020	0.17	<0.0022	<0.0022	0.29	<0.0035	<0.0022	0.21	<0.0035	<0.0035	0.23	<0.0035	<0.0035
sec-Butylbenzene	EPA 524.3	ng/L	1.5	40	<1.5	<1.5	<1.5	**<1.5**	**<1.5**	**<1.5**	<40	<40	<40	<1.5	<1.5	<1.5
Strontium	UCMR 200.8	µg/L	0.016	0.30	580	<0.30	280	400	**<0.30**	290	480	<0.30	430	310	0.37	610
Testosterone	EPA 539	µg/L	0.000020	0.00010	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.00010	<0.00010	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Vanadium	UCMR 200.8	µg/L	0.011	0.20	1.2	<0.011	2.3	<0.20	<0.011	2.6	<0.20	<0.011	**<0.011**	0.79	<0.011	2.4

Note: Shaded results are from resamples collected on 1/18/2012 and 3/14/2012. Resampling was required due to lab error and /or QC failures that occurred during analyses of original samples. Data flags provided in the original laboratory reports are not shown. On May 2, 2012, the EPA issued the Final Rule Promulgation, which removed two compounds from the original List 1. These compounds are n-Propylbenzene and sec-Butylbenzene. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 34 Summary of Other Radionuclides Results

Parameter	Method	Units	Sample Date: 08/24/2011			Sample Date: 11/08/2011			Sample Date: 02/01/2012			Sample Date: 05/01/2012			Sample Date: 7/9/2012		
			S1 Tertiary Effluent	S10 AWPF Product	Imported Raw Aqueduct Water	S1 Tertiary Effluent	S10 AWPF Product	Imported Raw Aqueduct Water	S1 Tertiary Effluent	S10 AWPF Product	Imported Raw Aqueduct Water	S1 Tertiary Effluent	S10 AWPF Product	Imported Raw Aqueduct Water	S1 Tertiary Effluent	S10 AWPF Product	Imported Raw Aqueduct Water
Cesium - 137	Gamma Ray Spectrometry	pCi/L	-5.05+/-8.2 (MDA=11.1)	0.900+/-7.9 (MDA=10.2)	-3.88+/-6.7 (MDA=13.4)	-6.60+/-16 (MDA=16.7)	-3.33+/-5.8 (MDA=16.0)	-3.88+/-13 (MDA=13.1)	-0.840+/-13 (MDA=23.1)	-9.60+/-14 (MDA=23.7)	2.32+/-13 (MDA=18.5)	-1.46+/-10 (MDA=20.3)	-2.18+/-11 (MDA=15.0)	0.180+/-0.64 (MDA=1.25)	not sampled	not sampled	not sampled
Iodine - 129	X-Ray Spectrometry	pCi/L	0.834+/-3.1 (MDA=3.86)	0.087+/-2.4 (MDA=3.25)	-1.20+/-2.5 (MDA=3.38)	-0.415+/-1.1 (MDA=2.40)	-1.63+/-3.6 (MDA=4.17)	-0.031+/-0.93 (MDA=2.10)	3.31+/-3.0 (MDA=3.86)	-2.17+/-2.4 (MDA=3.47)	-1.54+/-3.0 (MDA=4.10)	-0.783+/-0.95 (MDA=2.16)	-0.990+/-1.9 (MDA=3.73)	-1.30+/-1.9 (MDA=3.61)	0.046+/-0.25 (MDA=0.572)	0.092+/-0.28 (MDA=0.636)	0.110+/-0.21 (MDA=0.462)
Iodine - 131	Gamma Ray Spectrometry	pCi/L	46.6+/-16 (MDA=18.2)	1.79+/-12 (MDA=16.0)	0.720+/-9.9 (MDA=26.4)	15.6+/-27 (MDA=27.9)	-15.6+/-20 (MDA=21.6)	-7.28+/-16 (MDA=18.5)	-2.08+/-5.7 (MDA=11.3)	-1.99+/-25 (MDA=23.0)	-4.10+/-7.0 (MDA=11.2)	-6.45+/-21 (MDA=38.7)	-5.97+/-16 (MDA=24.6)	0.610+/-1.2 (MDA=2.48)	3.03+/-1.4 (MDA=1.64)	-0.044+/-0.11 (MDA=0.154)	-0.001+/-0.12 (MDA=0.162)

Note:

1. MDA is the Minimum Detectable Activity @ 95% confidence interval. Table 26 provides results for nuclide parameters regulated in drinking water including: Gross Beta (Examples of beta emitters include: Cesium 137, Iodine 129 and Iodine 131), Gross Alpha, Radium 226, Radium 228, Tritium, Strontium 90, and Uranium
2. Refer to **Section 3.2.5 URs** for how to interpret MDAs and Counting Errors.

Table 35 Summary of Other Measured Compounds Results

Parameter	Method	Units	DL	RL	Quarter 1: 08/24/2011			Quarter 2: 11/08/2011			Quarter 3: 02/01/2012			Quarter 4: 05/01/2012		
					S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water
Benzo (k) fluoranthene	EPA 525.2	µg/L	0.09	0.5	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Hexavalent chromium(Dissolved)	EPA 218.6	µg/L	0.0059	0.3	<0.0059	<0.0059	<0.3	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.3	<0.0059	<0.0059	<0.3
Lithium, Total	EPA 200.7	µg/L	1.4	10	26	<1.4	<10	20	<1.4	<10	23	<10	14	28	<10	21

Note: Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 36 Summary of Initial Characterization Results of Chemical of Emerging Concern (CECs) Analyzed by MWH Laboratories 4 X Monthly Samples

Compound Name	Common Use	Method	Units	DL	RL	8/15/2011					9/14/2011					10/17/2011					11/8/2011				
						S1 (tertiary effluent) 9/1/11	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water (10/18/11)	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water
1,7-Dimethylxanthine	Caffeine Degradant	LC-MS-MS	ng/L	3.4	10	<10	5.4	<3.4	<3.4	<3.4	<3.4	<10	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4
2,4-D	Herbicide	LC-MS-MS	ng/L	5	5	49	<5	<5	<5	9.8	2000	2200	6.4	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4-nonylphenol - semi quantitative	Surfactant	LC-MS-MS	ng/L	50	100	1400	780	<50	<50	280	410	480	<100	<100	<100	200	260	<50	<50	<50	330	470	<50	<50	<50
4-tert-Octylphenol	Surfactant	LC-MS-MS	ng/L	6.9	50	<50	<50	<6.9	<6.9	<6.9	<50	<50	<6.9	<6.9	<6.9	<50	<50	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9	<6.9
Acesulfame-K	Sugar Substitute	LC-MS-MS	ng/L	20	20	27000	26000	40	<20	370	29000	29000	65	50	360	33000	33000	66	<20	360	28000	27000	<20	<20	280
Acetaminophen	Analgesic	LC-MS-MS	ng/L	3	5	<3	<3	<3	<3	<3	<5	<3	<3	<3	<3	<3	<3	<3	<3	<3	10	8.3	<3	<3	<3
Albuterol	Anti Asthmatic	LC-MS-MS	ng/L	2.4	5	9.6	6.6	<2.4	<5	<5	8.1	6.5	<2.4	<2.4	<2.4	9.9	7.6	<2.4	<2.4	<2.4	10	<2.4	<2.4	<2.4	<2.4
Amoxicillin (semi-quantitative)	Antibiotic	LC-MS-MS	ng/L	6.4	20	1400	90	<6.4	<6.4	<6.4	470	220	<6.4	<6.4	<6.4	960	61	24	<20	<6.4	320	48	<6.4	<6.4	<6.4
Andorostenedione	Steroid Hormone	LC-MS-MS	ng/L	1.7	5	<1.7	5.1	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
Atenolol	Beta Blocker	LC-MS-MS	ng/L	3.9	5	670	210	<3.9	<3.9	<3.9	250	250	7.7	<3.9	<3.9	59	74	<3.9	<3.9	<3.9	150	150	<3.9	<3.9	<3.9
Atrazine	Triazine Herbicide	LC-MS-MS	ng/L	2.3	5	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3
Azithromycin	Antibiotic	LC-MS-MS	ng/L	10	20	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bendroflumethiazide	Triazide	LC-MS-MS	ng/L	4.4	5	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
Bezafibrate	Lipid Regulator	LC-MS-MS	ng/L	3.5	5	6	<3.5	<3.5	<3.5	<3.5	7.6	6	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5
BPA	Plasticizer	LC-MS-MS	ng/L	7.2	10	<7.2	<7.2	<7.2	<7.2	<7.2	74	81	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2	<7.2
Bromacil	Herbicide	LC-MS-MS	ng/L	3.2	5	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<5	<3.2	<3.2	<3.2	<3.2	<3.2
Butalbital	Analgesic-NSAID	LC-MS-MS	ng/L	2.9	5	16	16	<2.9	<2.9	<5	39	29	<2.9	<2.9	<2.9	25	28	<2.9	<2.9	<2.9	21	15	<2.9	<2.9	<2.9
Butylparaben	Preservative	LC-MS-MS	ng/L	3.3	5	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Caffeine	Stimulant	LC-MS-MS	ng/L	4.3	5	77	28	<4.3	<4.3	22	61	<5	<4.3	<4.3	<4.3	36	6.5	<4.3	<4.3	<4.3	20	6.7	<4.3	<4.3	<4.3
Carbadox	Antibiotic	LC-MS-MS	ng/L	4.2	5	8.6	<4.2	<4.2	<4.2	<4.2	13	30	<4.2	<4.2	<4.2	5.7	8.8	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2
Carbamazepine	Anti Seizure	LC-MS-MS	ng/L	1.2	5	300	170	<1.2	<1.2	<5	190	190	<5	<1.2	<5	190	180	<5	<1.2	<5	170	160	<1.2	<1.2	<5
Carisoprodol	Muscle Relaxant	LC-MS-MS	ng/L	1.2	5	150	200	<1.2	<1.2	<5	42	43	<1.2	<1.2	<1.2	62	69	<1.2	<1.2	<1.2	52	60	<1.2	<1.2	<1.2
Chloramphenicol	Antibiotic	LC-MS-MS	ng/L	3.1	10	<3.1	<3.1	<3.1	<3.1	<3.1	<10	12	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1	<3.1
Chloridazon	Enzyme	LC-MS-MS	ng/L	1.6	5	<5	<1.6	<1.6	<1.6	<1.6	<1.6	<5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
Chlorotoluron	Herbicide	LC-MS-MS	ng/L	0.89	5	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89
Cimetidine	H2 Blocker	LC-MS-MS	ng/L	2.7	5	62	<5	<2.7	<2.7	<2.7	22	<5	<2.7	<2.7	<2.7	12	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7
Clofibric Acid	Anti Cholesterol	LC-MS-MS	ng/L	5	5	<5	7.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cotinine	Nicotine Degradate	LC-MS-MS	ng/L	4.8	10	44	33	<10	<10	<10	<10	20	<4.8	<4.8	<4.8	25	11	<4.8	<4.8	<4.8	31	18	<4.8	<4.8	<4.8
Cyanazine	Triazine Herbicide	LC-MS-MS	ng/L	1.7	5	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
DACT	Triazine Degradate	LC-MS-MS	ng/L	3.9	5	36	27	<3.9	<3.9	<3.9	32	21	<3.9	<3.9	<3.9	26	13	<3.9	<3.9	<3.9	21	<3.9	<3.9	<3.9	<5
Deethylatrazine	Triazine Degradate	LC-MS-MS	ng/L	1.5	5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
DEET	Mosquito Repellant	LC-MS-MS	ng/L	1.1	10	30	180	<1.1	<1.1	<10	63	40	<10	<1.1	<10	180	170	<1.1	<1.1	<10	160	170	<10	<10	12

Table 36 Summary of Initial Characterization Results of Chemical of Emerging Concern (CECs) Analyzed by MWH Laboratories 4 X Monthly Samples

Compound Name	Common Use	Method	Units	DL	RL	8/15/2011					9/14/2011					10/17/2011					11/8/2011				
						S1 (tertiary effluent) 9/1/11	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water (10/18/11)	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water
Dehydronifedipine	Heart Medication	LC-MS-MS	ng/L	1.4	5	160	280	<5	<5	6	120	120	<1.4	<5	<5	360	400	<1.4	<1.4	<5	40	47	<1.4	<1.4	<1.4
DIA	Triazine Degradate	LC-MS-MS	ng/L	2.4	5	5.5	<5	<2.4	<2.4	<2.4	<5	<5	<2.4	<2.4	<2.4	<5	6.7	<2.4	<2.4	<2.4	<5	<5	<2.4	<2.4	<5
Diazepam	Valium - Antianxiety	LC-MS-MS	ng/L	2.1	5	<5	<5	<2.1	<2.1	<2.1	<5	<5	<2.1	<2.1	<2.1	<2.1	<5	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
Diclofenac	Anti Inflammatory	LC-MS-MS	ng/L	3.3	5	60	58	<3.3	<3.3	<3.3	59	63	<3.3	<3.3	<3.3	59	67	<3.3	<3.3	<3.3	95	70	<3.3	<3.3	<3.3
Dilantin	Anti Seizure	LC-MS-MS	ng/L	13	20	86	82	<13	<13	<13	79	70	<13	<13	<13	110	82	<13	<13	<13	130	110	<13	<13	<13
Diuron	Herbicide	LC-MS-MS	ng/L	1.8	5	42	75	<5	<5	52	60	47	<1.8	<1.8	60	74	70	<5	<5	66	61	68	<1.8	<1.8	110
Erythromycin	Antibiotic	LC-MS-MS	ng/L	4	10	45	23	<4	<4	<4	58	48	<4	<4	<4	25	28	<4	<4	<4	45	57	<4	<4	<4
Estradiol	Estrogenic Hormone	LC-MS-MS	ng/L	4.4	5	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4	<4.4
Estrone	Estrogenic Hormone	LC-MS-MS	ng/L	3.9	5	16	21	<3.9	<3.9	<3.9	10	9.2	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9
Ethinyl Estradiol - 17 alpha	Contraceptive Hormone	LC-MS-MS	ng/L	3.3	5	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Ethylparaben	Preservative	LC-MS-MS	ng/L	11	20	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
Flumeqine	Antibiotic	LC-MS-MS	ng/L	7.1	10	<7.1	<10	<10	<7.1	<10	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1
Fluoxetine	Antidepressant	LC-MS-MS	ng/L	10	10	34	59	<10	<10	<10	50	43	<10	<10	<10	39	28	<10	<10	<10	28	21	<10	<10	<10
Gemfibrozil	Lipid Regulator	LC-MS-MS	ng/L	2.5	5	68	62	<2.5	<2.5	<2.5	73	64	<2.5	<2.5	<2.5	34	33	<2.5	<2.5	<2.5	28	24	<2.5	<2.5	<2.5
Hydrazine	Anti Depressant	LC-MS-MS	ng/L	2.5	5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Ibuprofen	Analgesic-NSAID	LC-MS-MS	ng/L	8.6	15	<8.6	<8.6	<8.6	<8.6	<8.6	20	<15	<15	<8.6	<8.6	<8.6	<8.6	<8.6	<15	<8.6	<8.6	<8.6	<8.6	<8.6	<8.6
Iohexal	X-ray Contrast Agent	LC-MS-MS	ng/L	7.7	10	3100	4500	<7.7	<7.7	41	9500	8700	<10	19	55	4500	3900	<7.7	<7.7	41	4100	6000	<7.7	<7.7	34
Iopromide	X-ray Contrast Agent	LC-MS-MS	ng/L	1.6	5	140	<5	<1.6	<1.6	<5	93	100	<1.6	<1.6	<1.6	<5	<1.6	<1.6	<1.6	<1.6	27	33	<1.6	<1.6	<1.6
Isobutylparaben	Preservative	LC-MS-MS	ng/L	4.2	5	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2
Isoproturon	Herbicide	LC-MS-MS	ng/L	12	100	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<100	<100	<12	<12	<12
Ketoprofen	Anti Inflammatory	LC-MS-MS	ng/L	2.6	5	10	15	<2.6	<2.6	<2.6	11	15	<2.6	<2.6	<2.6	38	24	<2.6	<2.6	<2.6	<5	<2.6	<2.6	<2.6	<2.6
Ketorolac	Anti Inflammatory	LC-MS-MS	ng/L	2.1	5	16	<5	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<5	<5	<2.1	<2.1	<2.1	<5	<2.1	<2.1	<2.1	<2.1
Lidocaine	Analgesic	LC-MS-MS	ng/L	1.1	5	78	310	<1.1	<1.1	<1.1	100	110	<1.1	<1.1	<1.1	90	95	<5	<1.1	<1.1	120	130	<1.1	<1.1	<1.1
Lincomycin	Antibiotic	LC-MS-MS	ng/L	1.7	10	<10	<10	<1.7	<1.7	<1.7	<10	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<10	<1.7	<1.7	<1.7	<1.7
Linuron	Herbicide	LC-MS-MS	ng/L	2.8	5	<5	9.2	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8	6.3	<2.8	<2.8	<2.8	<2.8
Lopressor	Beta Blocker	LC-MS-MS	ng/L	5.1	20	400	300	<5.1	<5.1	<5.1	280	300	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	270	270	<5.1	<5.1	<5.1
Meclofenamic Acid	Anti Inflammatory	LC-MS-MS	ng/L	4.7	5	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7
Meprobamate	Anti Anxiety	LC-MS-MS	ng/L	2	5	110	200	<5	<5	<5	130	130	<2	<2	<2	92	99	<2	<2	<2	120	120	<2	<2	<5
Metazachlor	Herbicide	LC-MS-MS	ng/L	1.3	5	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Methylparaben	Preservative	LC-MS-MS	ng/L	11	20	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<20	<20	<11	<11	<11	<11	<11	<11
Naproxen	Analgesic-NSAID	LC-MS-MS	ng/L	8.5	10	<8.5	23	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	13	12	<8.5	<8.5	<8.5	19	21	<8.5	<8.5	<8.5
Nifedipine	Calcium Blocker	LC-MS-MS	ng/L	12	20	48	<12	<12	<12	<12	<12	<12	<12	<12	<12	40	<20	<12	<12	<12	57	<20	<12	<12	<12
Norethisterone	Steroid Hormone	LC-MS-MS	ng/L	2.3	5	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<2.3	<5	<2.3	<2.3	<2.3	<2.3
Oxolinic acid	Antibiotic	LC-MS-MS	ng/L	2.5	10	19	<2.5	<2.5	<10	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<10	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Pentoxifylline	Blood Thinner	LC-MS-MS	ng/L	1.5	5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Phenazone	Analgesic	LC-MS-MS	ng/L	5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Table 36 Summary of Initial Characterization Results of Chemical of Emerging Concern (CECs) Analyzed by MWH Laboratories 4 X Monthly Samples

Compound Name	Common Use	Method	Units	DL	RL	8/15/2011					9/14/2011					10/17/2011					11/8/2011				
						S1 (tertiary effluent) 9/1/11	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water (10/18/11)	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water
Primidone	Anti Convulsant	LC-MS-MS	ng/L	4.8	5	110	96	<4.8	<4.8	<4.8	83	88	<4.8	<4.8	<4.8	76	86	<4.8	<4.8	<4.8	65	62	<4.8	<4.8	<4.8
Progesterone	Steroid Hormone	LC-MS-MS	ng/L	2.9	5	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
Propazine	Triazine Herbicide	LC-MS-MS	ng/L	1.8	5	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
Propylparaben	Preservative	LC-MS-MS	ng/L	2.9	5	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
Quinoline	Organophosphate Pesticide	LC-MS-MS	ng/L	2.5	5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Simazine	Triazine Herbicide	LC-MS-MS	ng/L	1.2	5	7.6	5.1	<1.2	<1.2	10	8.4	8	<1.2	<1.2	15	11	9	<1.2	<1.2	14	7.4	7.7	<1.2	<1.2	11
Sucralose	Sugar Substitute	LC-MS-MS	ng/L	42	100	48000	20000	<42	<42	410	34000	31000	<42	<42	300	50000	55000	200	<42	310	26000	22000	<100	<100	380
Sulfachloropyridazine	Sulfa Antibiotic	LC-MS-MS	ng/L	2.1	5	<2.1	<5	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<5	<2.1	<2.1	<2.1	<2.1
Sulfadiazine	Sulfa Antibiotic	LC-MS-MS	ng/L	3.9	5	<3.9	9.6	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<5	<5	<3.9	<3.9	<3.9
Sulfadimethoxine	Sulfa Antibiotic	LC-MS-MS	ng/L	1.6	5	<1.6	<1.6	<5	<5	<5	<1.6	<1.6	<1.6	<5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
Sulfamerazine	Sulfa Antibiotic	LC-MS-MS	ng/L	4.6	5	16	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6	<4.6
Sulfamethazine	Sulfa Antibiotic	LC-MS-MS	ng/L	1.5	5	<5	<1.5	<5	<5	<5	<1.5	<1.5	<1.5	<1.5	<1.5	<5	<5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Sulfamethizole	Sulfa Antibiotic	LC-MS-MS	ng/L	3.2	5	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2
Sulfamethoxazole	Sulfa Antibiotic	LC-MS-MS	ng/L	2.8	5	820	870	<2.8	<2.8	<2.8	480	410	<2.8	<2.8	<2.8	470	580	<2.8	<2.8	<2.8	780	740	<2.8	<2.8	<5
Sulfathiazole	Sulfa Antibiotic	LC-MS-MS	ng/L	2.4	5	<2.4	<5	<5	<5	<5	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4
TCEP	Flame Retardant	LC-MS-MS	ng/L	3.2	10	160	180	<5	<5	5.5	380	380	<3.2	<3.2	<3.2	520	550	<3.2	<10	13	410	370	<3.2	<3.2	<3.2
TCPP	Flame Retardant	LC-MS-MS	ng/L	20	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
TDCPP	Flame Retardant	LC-MS-MS	ng/L	20	100	500	NR	<20	<20	<20	650	710	<20	<20	<20	710	600	<20	<20	<20	320	130	<20	<20	<20
Testosterone	Steroid Hormone	LC-MS-MS	ng/L	2.5	5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Theobromine	Caffeine Degradant	LC-MS-MS	ng/L	3.2	10	<3.2	400	19	<10	54	25	42	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	<3.2	31	<3.2	<3.2	<3.2	<3.2	<3.2
Theophylline	Anti Asthmatic	LC-MS-MS	ng/L	4.8	10	<4.8	<4.8	<4.8	<4.8	<4.8	57	48	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8
Triclosan	Antibacterial	LC-MS-MS	ng/L	6.3	10	120	68	20	<6.3	<10	44	37	34	19	<6.3	140	120	29	<6.3	<6.3	84	60	12	<6.3	<6.3
Trimethoprim	Antibiotic	LC-MS-MS	ng/L	1.8	5	150	200	<1.8	<1.8	<1.8	100	120	<5	<1.8	<1.8	200	220	<5	<1.8	<1.8	120	120	<1.8	<1.8	<1.8
Warfarin	Anticoagulant	LC-MS-MS	ng/L	4.1	5	<5	<5	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1
Count						43	39	3	0	11	41	40	4	3	5	35	34	4	0	7	36	32	1	0	6
Maximum						48000	26000	40	0	410	34000	31000	65	50	360	50000	55000	200	0	360	28000	27000	12	0	380
Minimum						5.5	5.1	19	0	5.5	7.6	6	6.4	19	15	5.7	6.5	24	0	13	6.3	6.7	12	0	11

Notes:

1. NR (not reported) due to batch lab QC concerns. QC indicates the method was not reliable for these compounds duirng the testing period.
2. Results in yellow highlight were from re-analysis conducted due to issues with original analysis.
3. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 37 Colorado School of Mines CEC Summary Results

			8/15/2011					11/8/2011					
Compound	**Units**	**Method**	**Detection Limit (S6)**	**S6**	**Detection Limit (S9 and S10)**	**S9**	**S10**	**DL**	**S1**	**S6**	**S9**	**S10**	**IAW**
Acetaminophen	ng/L	ESI Positive	20	BDL	1	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL
Amitriptyline	ng/L	ESI Positive	20	26.8	1	BDL	BDL	1	30	23.8	BDL	BDL	BDL
Atenolol	ng/L	ESI Positive	20	455	1	BDL	BDL	1	172	174	BDL	BDL	BDL
Atrazine	ng/L	ESI Positive	20	BDL	1	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL
Benzophenone	ng/L	ESI Positive	200	260	10	BDL	BDL	25	BDL	BDL	BDL	BDL	BDL
Caffeine	ng/L	ESI Positive	50	BDL	2.5	BDL	BDL	2.5	23.1	17.1	BDL	BDL	6.4
Carbamazepine	ng/L	ESI Positive	20	243	2.5	BDL	BDL	1	244	241	BDL	BDL	2
Cimetidine[3]	ng/L	ESI Positive	20	BDL	1	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL
DEET	ng/L	ESI Positive	20	327	2.5	BDL	BDL	2.5	248	255	BDL	BDL	BDL
Diazepam	ng/L	ESI Positive	20	BDL	1	BDL	BDL	1	3	3	BDL	BDL	BDL
Dilantin	ng/L	ESI Positive	20	156	5	BDL	BDL	5	112	113	BDL	BDL	BDL
Diphenhydramine	ng/L	ESI Positive	20	509	0	BDL	BDL	1	374	361	BDL	BDL	BDL
Fluoexetine	ng/L	ESI Positive	20	32.1	1	BDL	BDL	1	43.4	28	BDL	BDL	BDL
Hydrocodone	ng/L	ESI Positive	20	75.6	2.5	BDL	BDL	2.5	69.3	65.5	BDL	BDL	BDL
Meprobamate	ng/L	ESI Positive	20	295	1	BDL	BDL	1	290	287	BDL	BDL	4
Norfluoxetine	ng/L	ESI Positive	20	BDL	2.5	BDL	BDL	2.5	16.8	17	BDL	BDL	BDL
Oxybenzone	ng/L	ESI Positive	20	35.6	5	BDL	BDL	5	8.5	7.5	BDL	BDL	BDL
Primidone	ng/L	ESI Positive	20	110	1	BDL	BDL	1	85.9	88.8	BDL	BDL	2
Sulfamethoxazole	ng/L	ESI Positive	20	1563	1	BDL	BDL	1	1630	1310	1	BDL	BDL
Trimethoprim	ng/L	ESI Positive	20	248	1	BDL	BDL	1	153	160	BDL	BDL	BDL
TCEP	ng/L	ESI Positive	20	683	2.5	BDL	BDL	5	401	403	BDL	BDL	BDL
TCPP	ng/L	ESI Positive	20	3750	2.5	BDL	BDL	10	2840	2640	BDL	BDL	BDL
TDCPP	ng/L	ESI Positive	20	1338	10	BDL	BDL	10	1250	1080	BDL	BDL	BDL

Note: BDL = Below Detection Limit

Table 37 Colorado School of Mines CEC Summary Result (cont.)

			8/15/2011				11/8/2011					
Compound	Units	Method	Detection Limit	S6	S9	S10	DL	S1	S6	S9	S10	IAW
Bisphenol A	ng/L	ESI Negative	5	BDL	BDL	BDL	10	BDL	BDL	BDL	BDL	BDL
Diclofenac	ng/L	ESI Negative	1	184	BDL	BDL	1	138	139	BDL	BDL	BDL
Gemfibrizol	ng/L	ESI Negative	2.5	73.9	BDL	BDL	5	37.6	36.1	BDL	BDL	BDL
Ibuprofen	ng/L	ESI Negative	5	BDL	BDL	BDL	10	BDL	BDL	BDL	BDL	BDL
Ketoprofen	ng/L	ESI Negative	25	BDL	BDL	BDL	25	BDL	BDL	BDL	BDL	BDL
Methylparaben	ng/L	ESI Negative	5	15.2	BDL	BDL	5	8.3	5.9	BDL	BDL	BDL
Naproxen	ng/L	ESI Negative	2.5	27.7	BDL	BDL	1	23.5	24.2	BDL	BDL	BDL
4-n-Nonylphenol	ng/L	ESI Negative	25	BDL	BDL	BDL	25	BDL	BDL	BDL	BDL	BDL
Propylparaben	ng/L	ESI Negative	2.5	BDL	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL
Sucralose[1]	ng/L	ESI Negative	50	NA	NA	NA	NA	NA	NA	NA	NA	NA
Triclocarban	ng/L	ESI Negative	2.5	81.5	BDL	BDL	5	113	106	BDL	BDL	BDL
Triclosan	ng/L	ESI Negative	1	96.1	BDL	BDL	5	79.3	69	BDL	BDL	BDL
Estradiol 17B	ng/L	APCI (steroids)	5	BDL	BDL	BDL	5	BDL	BDL	BDL	BDL	BDL
Estriol	ng/L	APCI (steroids)	5	BDL	BDL	BDL	5	BDL	BDL	BDL	BDL	BDL
Estrone	ng/L	APCI (steroids)	5	BDL[2]	BDL	BDL	5	BDL	BDL	BDL	BDL	BDL
Ethynylestradiol	ng/L	APCI (steroids)	2.5	BDL	BDL	BDL	5	BDL	BDL	BDL	BDL	BDL
Progesterone	ng/L	APCI (steroids)	2.5	BDL	BDL	BDL	2.5	BDL	BDL	BDL	BDL	BDL
Testosterone	ng/L	APCI (steroids)	1	BDL	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL

Notes (provided by lab):

1. Results for 8/15/11 sucralose not reported due to lab issue
2. Estrone signal in the 8/15/11 S6 sample marginally failed the QC criteria due to high background noise in the sample. Calculated concentration was at 23 ppt.
3. presence in the 2/1/12 S1 sample is likely due to contamination
4. BDL = Below Detection Limit

Table 38 Revised CEC Monitoring Plan

CEC Contaminant Group	[1] Sampling Locations	Rationale for Monitoring
Initial Feed Water Characterization (sample monthly for the first four months) – COMPLETE.		
List of 91 CECs analyzed by MWH Laboratories	S1, S6, S9, S10 Imported Aqueduct Water	1. Characterize NCWRP tertiary water. 2. Identify appropriate indicator constituents. 3. Assess AWP unit process CEC removal performance. 4. Compare water quality of AWP to imported water.
1, 4-Dioxane	S1, S6, S9, S10 Imported Aqueduct Water	
NDMA	S1, S6, S9, S10 Imported Aqueduct Water	
List for On-going Characterization (Quarters 3 and 4)		
Caffeine	S1, S6, S9, S10 Imported Aqueduct Water	• Compounds prioritized based on toxicological evidence. Measured environmental concentration (MEC) greater than monitoring trigger level (MTL), as developed in SWRCB, 2010. • Ongoing characterization of NCWRP tertiary water. 5. Assess AWP unit process CEC removal performance. • Compare water quality of AWP to imported water.
E2 (17β-Estradiol)	S1, S6, S9, S10 Imported Aqueduct Water	
NDMA	S1, S6, S9, S10 Imported Aqueduct Water	
Triclosan	S1, S6, S9, S10 Imported Aqueduct Water	
1,4-Dioxane	S1, S6, S9, S10 Imported Aqueduct Water	• Revised Draft CDPH Groundwater Recharge Regulations specify the AOP be sized to achieve 0.5 log removal of 1,4-Dioxane for direction injection applications. Alternatively, AOP sizing can be based on demonstrated log removals of select indicator compounds from different functional groups.
Potential Performance Indicator Compounds (sample weekly for 4 weeks to assess differential removal along with surrogate parameters)		
Sucralose	S6, S9, S10	• Identified for surface spreading and direct injection operations as viable performance indicator compounds along with certain surrogate parameters (SWRCB, 2010). These compounds were also detected in the RO feed consistently during the initial feed water characterization period with low variability (Relative Standard Deviation <100 %.)
NDMA	S6, S9, S10	
DEET	S6, S9, S10	
Additional 30 CEC compounds (See Table 39)	S6, S9,S10	• These compounds were also consistently present in the RO feed during the initial feed water characterization period with low variability. Based on the 4 weeks of sample results a shorter list of RO and UV/AOP performance indicator compounds will be recommended for continued monitoring. The 30 compound list may also serve useful for periodic monitoring of source water quality.
Caffeine	S6, S9, S10	• Recommendation from IAP: Draft Memorandum: Findings and Recommendations of the Advanced Water Purification Facility Subcommittee, February 2, 2012.
Theobromine	S6, S9, S10	
Linuron	S6, S9, S10	
Estrone	S6, S9, S10	

Note: S1 = tertiary effluent; S6 = RO feed; S9=RO permeate; S10=UV/AOP product.

Table 39 Potential performance indicator compounds to be monitored weekly for 4 weeks

Compound Name	
Butalbital	**TDCPP**
Erythromycin	**Diclofenac**
Simazine	Albuterol
Primidone	Ketoprofen
Lidocaine	Naproxen
4-nonylphenol - semi quantitative	DACT
Gemfibrozil	**Lopressor**
Amoxicillin (semi-quantitative)	Fluoxetine
Atenolol	**Acesulfame-K**
Carbamazepine	Dilantin
Diuron	**Meprobamate**
Triclosan	**Iohexal**
Cotinine	**Dehydronifedipine**
TCEP	**Sulfamethoxazole**
Carisoprodol	**Trimethoprim**

Note: compounds in bold were detected in the RO feed at concentrations greater than 10 times the detection limit in 50% or more of the samples measured during the initial characterization period.

Table 40 Summary of Results for Group A (on-going characterization) CECs for Quarter 3 and Quarter 4

Parameter	Method	Units	DL	RL	Quarter 3: 2/1/2012					Quarter 4: 5/1/2012				
					S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water	S1 (tertiary effluent)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	Imported Raw Aqueduct Water
Triclosan	LC-MS-MS	ng/L	6.3	10	79	74	13	17	ND	35	28	<6.3	<6.3	<6.3
Estradiol	LC-MS-MS	ng/L	4	5	ND	ND	ND	ND	11	<4.4	<5	<4.4	<4.4	<4.4
Caffeine	LC-MS-MS	ng/L	4	5	59	9.8	ND	ND	ND	53	<4.3	<4.3	<4.3	<4.3
N-Nitroso-dimethylamine (NDMA)	EPA 521	ng/L	0.28	2	<2	3.2	ND	<2	ND	11	<2	<2	<2	<2
1,4 dioxane	EPA 8270M	ng/L	0.04	0.5	1.2	1.2	<0.5	ND	ND	1.6	1.5	<0.04	<0.04	<0.04

Note: Detections of triclosan at S9 and S10 are based on results from analysis conducted by MWH Labs. Results of split samples analyzed by Colorado School of Mines Lab reported triclosan to be ND (DL=5 ng/L) for both S9 and S10. Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 41 Summary of Results for Group B (Potential Performance Indicators) CECs 4X Weekly Samples

Parameter	Method	Units	DL	RL	2/1/2012			2/8/2012			2/15/2012			2/22/2012			5/1/2012				
					S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	S6 (RO Feed)	S9 (RO Perm. Combined)	S10 (UV/AOP Product)	S6 (RO Feed)	S7	S8	S9 (RO Perm. Combined)	S10 (UV/AOP Product)
4-nonylphenol - semi quantitative	LC-MS-MS	ng/L	50	100	<50	<50	<50	<100	<50	<50	<50	<50	<50	1800	<100	<100	520	<50	<100	<50	<50
Acesulfame-K	LC-MS-MS	ng/L	20	20	48000	31	<20	31000	<20	<20	44000	<20	31	37000	42	<20	6400	<20	<20	<20	<20
Albuterol	LC-MS-MS	ng/L	2.4	5	12	<2.4	<2.4	24	<2.4	<2.4	16	<2.4	<2.4	<2.4	<2.4	<2.4	18	<2.4	<2.4	<5	<2.4
Amoxicillin (semi-quantitative)	LC-MS-MS	ng/L	6.4	20	270	<6.4	<6.4	280	<6.4	<6.4	120	<6.4	<6.4	260	<6.4	<6.4	150	<6.4	<6.4	<6.4	<6.4
Atenolol	LC-MS-MS	ng/L	3.9	5	42	<3.9	<3.9	110	<3.9	<3.9	60	<3.9	<3.9	89	<3.9	<3.9	43	<3.9	<3.9	<3.9	<3.9
Butalbital	LC-MS-MS	ng/L	2.9	5	<2.9	<2.9	<2.9	<2.9	<2.9	<5	<2.9	<2.9	<2.9	180	<2.9	<2.9	9.9	<2.9	<2.9	<2.9	<2.9
Caffeine	LC-MS-MS	ng/L	4.3	5	9.8	<4.3	<5	19	8.5	<4.3	7.9	<4.3	<4.3	25	<4.3	<4.3	<4.3	<5	<4.3	<4.3	<4.3
Carbamazepine	LC-MS-MS	ng/L	1.2	5	190	<5	<1.2	200	<1.2	<1.2	190	<1.2	<1.2	180	<1.2	<1.2	210	<1.2	<1.2	<1.2	<1.2
Carisoprodol	LC-MS-MS	ng/L	1.2	5	780	<1.2	<1.2	79	<1.2	<1.2	48	<1.2	<1.2	30	<1.2	<1.2	60	<1.2	<1.2	<1.2	<1.2
Cotinine	LC-MS-MS	ng/L	4.8	10	15	<4.8	<4.8	49	<4.8	<4.8	34	<4.8	<4.8	83	72	<10	60	<4.8	<4.8	<4.8	<4.8
DACT	LC-MS-MS	ng/L	3.9	5	11	<3.9	<3.9	19	<3.9	<3.9	27	<3.9	<3.9	<3.9	<3.9	<3.9	58	<3.9	<5	<5	<3.9
DEET	LC-MS-MS	ng/L	1.1	10	260	<10	<10	67	<10	<10	70	<10	<10	100	<10	<10	210	<10	<10	<10	<10
Dehydronifedipine	LC-MS-MS	ng/L	1.4	5	140	<5	<1.4	62	<1.4	<1.4	49	<1.4	<1.4	240	<5	<1.4	210	<5	<1.4	<1.4	<1.4
Diclofenac	LC-MS-MS	ng/L	3.3	5	18	<3.3	<3.3	35	<3.3	<3.3	<5	<3.3	<3.3	120	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Dilantin	LC-MS-MS	ng/L	13	20	110	<13	<13	130	<13	<13	120	<13	<13	82	<13	<13	140	<13	<13	<13	<13
Diuron	LC-MS-MS	ng/L	1.8	5	92	<1.8	<1.8	57	<1.8	<1.8	68	<1.8	<5	89	<1.8	<1.8	80	<1.8	<1.8	<1.8	<1.8
Erythromycin	LC-MS-MS	ng/L	4	10	90	<4	<4	210	<4	<4	120	<4	<4	<10	<4	<4	61	<4	<4	<4	<4
Estrone	LC-MS-MS	ng/L	3.9	5	15	<3.9	<5	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9	<3.9
Fluoxetine	LC-MS-MS	ng/L	10	10	100	<10	<10	120	<10	<10	100	<10	<10	67	<10	<10	31	<10	<10	<10	<10
Gemfibrozil	LC-MS-MS	ng/L	2.5	5	79	<2.5	<5	100	<2.5	<2.5	39	<2.5	<2.5	130	<2.5	<2.5	52	<2.5	<2.5	<2.5	<2.5
Iohexal	LC-MS-MS	ng/L	7.7	10	40000	24	<7.7	18000	<7.7	<7.7	2300	<7.7	<7.7	15000	<10	<7.7	6700	<7.7	<7.7	<7.7	<7.7
Ketoprofen	LC-MS-MS	ng/L	2.6	5	75	<2.6	<2.6	31	<2.6	<2.6	13	<2.6	<2.6	28	<2.6	<2.6	17	<2.6	<2.6	<2.6	<2.6
Lidocaine	LC-MS-MS	ng/L	1.1	5	220	<1.1	<1.1	150	<1.1	<1.1	120	<1.1	<1.1	220	<1.1	<1.1	120	<1.1	<1.1	<1.1	<1.1
Linuron	LC-MS-MS	ng/L	2.8	5	210	<2.8	<2.8	<5	<2.8	<2.8	<5	<2.8	<2.8	<2.8	<2.8	<2.8	6.5	<2.8	<2.8	<2.8	<2.8
Lopressor	LC-MS-MS	ng/L	5.1	20	200	<5.1	<5.1	480	<5.1	<5.1	390	<5.1	<5.1	400	<20	<5.1	210	<5.1	<5.1	<5.1	<5.1
Meprobamate	LC-MS-MS	ng/L	2	5	550	<2	<2	140	<2	<2	96	<2	<2	220	<2	<2	160	<2	<2	<2	<2
Naproxen	LC-MS-MS	ng/L	8.5	10	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	11	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5	<8.5
N-Nitroso-dimethylamine (NDMA)	EPA 521	ng/L	0.96	2	3.2	<0.96	<0.96	<2	<0.96	<0.96	1.9	0.58	0.4	1.4	0.53	0.36	6.1	-	-	<2	2.1
Primidone	LC-MS-MS	ng/L	4.8	5	93	<4.8	<4.8	100	<4.8	<4.8	110	<4.8	<4.8	120	<4.8	<4.8	97	<4.8	<4.8	<4.8	<4.8
Simazine	LC-MS-MS	ng/L	1.2	5	15	<1.2	<1.2	8.5	<1.2	<1.2	9.1	<1.2	<1.2	24	<1.2	<1.2	<5	<1.2	<1.2	<1.2	<1.2
Sucralose	LC-MS-MS	ng/L	42	100	45000	<100	<42	81000	<100	<42	62000	<42	<42	37000	<42	<42	48000	<42	<42	<42	<42
Sulfamethoxazole	LC-MS-MS	ng/L	2.8	5	1200	<2.8	<2.8	1100	<2.8	<2.8	700	<2.8	<2.8	860	<2.8	<2.8	870	<2.8	<2.8	<2.8	<2.8
TCEP	LC-MS-MS	ng/L	3.2	10	400	<3.2	<3.2	290	<3.2	<3.2	280	<3.2	<3.2	220	12	<3.2	270	<10	<3.2	<3.2	<10
TCPP	LC-MS-MS	ng/L	20	100	1600	<20	<20	2600	<20	<100	1400	<20	<20	2000	160	<100	2300	<20	<20	<20	<20
TDCPP	LC-MS-MS	ng/L	20	100	270	<20	<20	1100	<20	<20	910	<20	<20	930	<100	<20	780	<20	<20	<20	<100
Theobromine	LC-MS-MS	ng/L	3.2	10	<3.2	<3.2	<3.2	86	<3.2	<10	25	<10	<10	<3.2	<3.2	<3.2	<3.2	<10	<10	<3.2	<10
Triclosan	LC-MS-MS	ng/L	6.3	10	74	13	17	47	<6.3	<10	44	<6.3	<6.3	47	<6.3	<6.3	28	<6.3	<6.3	<6.3	<6.3
Trimethoprim	LC-MS-MS	ng/L	1.8	5	450	<5	<5	410	<5	<1.8	210	<1.8	<1.8	280	<1.8	<1.8	280	<1.8	<1.8	<1.8	<1.8

Note: Results shown as less than (<VALUE) indicate the reported result was less than the RL or DL. In some instances, the RL and/or DL varied during the testing period due to laboratory QC procedures or changes in method procedures.

Table 42 Summary of Differential Removal of Performance Indicator Compounds

No.	Compound	Method	Units	DL	RL				RO	UV/AOP
						Avg RO Feed (n = 5)	Avg RO Perm. (n = 5)	Avg UV/AOP (n = 5)	Δ Removal	Δ Removal
1	Acesulfame-K	LC-MS-MS	ng/L	20	20	33000	<27	<22	>99.9%	>16.5%
2	Amoxicillin (semi-quantitative)	LC-MS-MS	ng/L	6.4	20	220	<6.4	<6.4	>97%	-
3	Carbamazepine	LC-MS-MS	ng/L	1.2	5	190	<5	<1.2	>99%	-
4	Dilantin	LC-MS-MS	ng/L	13	20	120	<13	<13	>88.8%	-
5	Diuron	LC-MS-MS	ng/L	1.8	5	77	<1.8	<5	>97.7%	-
6	Fluoxetine	LC-MS-MS	ng/L	10	10	84	<10	<10	>88%	-
7	Lidocaine	LC-MS-MS	ng/L	1.1	5	170	<1.1	<1.1	>99.3%	-
8	Lopressor	LC-MS-MS	ng/L	5.1	20	340	<20	<5.1	>97.6%	-
9	N-Nitroso-dimethylamine (NDMA)	EPA 521	ng/L	0.96	2	3	<2	<0.96	>65.5%	-
10	Primidone	LC-MS-MS	ng/L	4.8	5	100	<4.8	<4.8	>95.4%	-
11	Sucralose	LC-MS-MS	ng/L	42	100	55000	<100	<42	>99.9%	-
12	Sulfamethoxazole	LC-MS-MS	ng/L	2.8	5	950	<2.8	<2.8	>99.7%	-
13	TCEP	LC-MS-MS	ng/L	3.2	10	300	<10	<10	>98.3%	-
14	TCPP	LC-MS-MS	ng/L	20	100	2000	<100	<100	>97.6%	-
15	Triclosan	LC-MS-MS	ng/L	6.3	10	48	<10	<10	>84.1%	-
16	Trimethoprim	LC-MS-MS	ng/L	1.8	5	330	<5	<5	>99.1%	-

Note: For calculating average concentrations, results reported below the RL were considered the value of the RL and for values reported below the DL the value of the DL was used. Dashes shown for the UV/AOP Differential Removal indicate the average concentration in the RO permeate and UV/AOP product were below the RL or DL and therefore removal could not be quantified.

Table 43 Summary of Differential Removal of Surrogate Compounds

No.	Surrogate	RO	UV/AOP
		Δ Removal (%)	Δ Removal (%)
1	TOC	99.6%	NA
2	UV 254	88.8%	68.7%
3	Monochloramines	----------	72.8%
4	Conductivity	99.0%	NA

Table 44 Comparison of Key Water Quality Results and Demonstration Goals

Constituent	Units	RL	[d]Purified Water Results			Water Quality Goal[b]
			Number of Samples	Average Concentration[a]	Maximum Concentration	
Nitrate as N	mg/L	0.11	100	0.73	1.4	1
Nitrite as N	mg/L	0.09	97	ND	ND	1
Ammonia as N (unionized)	mg/L	varies[c]	93	ND	0.021	0.025
Phosphorus, Total	mg/L	0.01	88	0.016	0.420	0.10
Nitrogen, Total	mg/L	0.1	96	0.87	2.2	1
Bromoform	µg/L	0.5	16	ND	0.1	0.5
Methylene Chloride	µg/L	0.50	16	ND	0.59	4.7
Trihalomethanes, Total	µg/L	2.0	16	ND	ND	80
Bromodichloromethane	µg/L	0.5	16	ND	0.85	0.56
Dibromochloromethane	µg/L	0.5	16	ND	0.6	0.5
Haloacetic Acids (HAA5)	µg/L	1	16	ND	ND	60
N-Nitrosodiethylamine	ng/L	2	19	ND	5.7	10
N-Nitrosodimethylamine (NDMA)	ng/L	2	19	ND	5.5	2
1,4-Dioxane	µg/L	0.5	16	ND	ND	1
1,2-Dichloroethane	µg/L	0.5	16	ND	ND	0.5
Total Organic Carbon	mg/L	0.3	97	ND	1.4	0.5
Total Dissolved Solids	mg/L	10	29	13.7	19	300
Chloride	mg/L	0.5	29	3.10	4.3	50
Sulfate	mg/L	0.5	28	ND	1.10	65
Boron	mg/L	0.01	28	0.230	0.290	1.0
Turbidity	NTU	-	298	0.05	0.10	0.2

Notes:

a. **Average concentration calculation assumes non-quantifiable results are half of the reporting level and non-detectable results are half of the detection limit.**
b. **See Testing and Monitoring Plan, Table 5-2 (Appendix A).**
c. **Unionized values of ammonia were estimated based on USEPA's *Aqueous Ammonia Equilibrium – Tabulation of Percent Un-ionized Ammonia (EPA-600/3-79-091)* using average values of temperature and pH measured on-site.**
d. **Results shown as ND are non-quantifiable or non-detectable.**

Acronyms:
RL – Method reporting level
ND – Not detectable or not quantifiable, shown for all values below method reporting level
mg/L – milligrams per liter, equivalent to parts per million (ppm)
µg/L – micrograms per liter, equivalent to parts per billion (ppb)
ng/L – nanograms per liter, equivalent to parts per trillion (ppt)
NTU – Nephelometric Turbidity Units

Table 45: Other Non-Regulated Constituents Detected in Purified Water and Imported Raw Aqueduct Water

Note: ***Of the 111 additional non-regulated constituents measured at the Demonstration Facility, only six were found to be quantifiably detected at any time in the purified water.***

Constituent	Classification/ Common Use	Units	RL	[c]Purified Water			[c]Imported Raw Aqueduct Water		
				Number of Samples	Average Concentration[a]	Maximum Concentration	Number of Samples	Average Concentration[a]	Maximum Concentration
Bromochloromethane	UCMR3 Disinfection byproduct	µg/L	0.06	4	0.225	0.250	4	ND	0.08
Chromium (VI)[b]	UCMR3 Disinfection byproduct, industrial byproduct	µg/L	0.02	4	0.09	0.16	4	0.047	0.052
Acesulfame-K	CEC Sugar Substitute	ng/L	20	9	ND	50	4	343	370
Iohexal	CEC X-ray contrast agent	ng/L	10	9	ND	19	4	43	55
Triclosan	CEC Antibacterial	ng/L	10	9	ND	19	5	ND	ND
Strontium	UCMR3 Alkaline earth Metal	µg/L	0.3	4	ND	0.37	4	405	610

Notes:

a. Average concentration calculation assumes non-quantifiable results are half of the reporting level and non-detectable results are half of the detection limit.

b. Three Chromium (VI) samples were sent to another lab and all results were ND (DL = 0.0059 µg/L). The CDPH Detection Limit for purposes of Reporting (DLR) is 1 µg/L.

c. Results shown as ND are non-quantifiable or non-detectable.

Acronyms:
RL – Method reporting level
ND – Not detectable or not quantifiable, shown for all values below method reporting level
µg/L – micrograms per liter, equivalent to parts per billion (ppb)
ng/L – nanograms per liter, equivalent to parts per trillion (ppt)

Table 46 Summary of Critical Control Point Monitoring Plan for the San Diego AWPF

Critical Control Point	Critical Limit Parameter	Monitoring Frequency	[1]Alert Limit	[1]Critical Limit	[1]Example Corrective Actions
MF/UF	Pressure Decay	1 per day	Value above baseline that approaches Critical limit.	0.4 psi / 5 min. based on the maximum decay predicted to achieve 4 log removal Cryptosporidium.	Confirm Results. Assess fiber breakage. Isolate/ repair/replace damaged membrane.
RO	TOC, Conductivity	Continuous	% change of measured concentration in combined RO permeate.	Online permeate conductivity = 150 µs/cm. Online permeate TOC = 100 ppb or greater for five consecutive measurements.	Automatic shutdown (conductivity). Monitor individual RO trains. Verify analyzer accuracy. Conduct vessel probing.
UV/AOP	Reactor Power Level	Continuous	100% (2 to 7 lamp failures or 1 to 3 ballast failures).	0% (8 or more lamp failures or 4 ballast failures).	System alarm. Automatic increase of reactor power to 100% or system shutdown. Check / replace lamps and/or ballasts.
UV/AOP	Hydrogen peroxide dose rate Continuous (flow confirmation)	1 per day by draw down Continuous flow confirmation	minimum dose (~22 ml/min.) to provide 3 mg/L peroxide	0 ml/min. indicating pump failure or loss of flow confirmation,	Check dosing system. Recalibrate pump. Auto switch to standby pump.

Note:

1. Specific limit values are based on baseline performance observed at the Demonstration Facility. During the design phase of the potential Full-Scale Facility, it is anticipated that the City would develop a similar monitoring and response plan that provides sufficient features and assurances that any foreseeable malfunction could be promptly identified and appropriate response applied.

Table 47 Summary of Critical Control Point Monitoring Results for the San Diego AWPF

Critical Control Point	Critical Limit Parameter	Monitoring Frequency	Number of Exceedances Above Limits				Notes
			Q1	Q2	Q3	Q4	
MF/UF	Pressure Decay	1 per day	1 (UF)	0	0	0	Pressure decay above limit due to leak in air piping not membrane integrity. Repair made, PDT repeated and passed.
RO	TOC, Conductivity	Continuous	0	0	0	0	None.
UV/AOP	Reactor Power Level	Continuous	4	0	1	1	Exceedances due to occurrences of single failed ballasts. System automatically increased power to 100% to accommodate power loss.
UV/AOP	Hydrogen peroxide dose	1 per day (draw down) Continuous (flow confirmation)	0	0	1	5	Q3 -Duty pump auto switched to standby pump and standby pump shutoff, due to low flow (air lock). System automatic shutdown. Restarted shortly after issue self-resolved. Q4 - Pump failures due to air locking. Adjustments made to degas interval and return off gas piping.

Table 48 Chemical Consumption of the Various AWP Unit Processes

Chemical	Concentration (w/w)	Injection Location	Target Dose (mg/L)	Dose Rate (mL/min)	Total Amount Delivered Quarter 1: 5/3/11 to 10/31/11 (gal)	Total Amount Delivered Quarter 2: 11/1/11 to 2/10/12 (gal)	Total Amount Delivered Quarter 3: 2/11/12 to 5/14/12 (gal)	Total Amount Delivered Quarter 4: 5/15/12 to 7/31/12 (gal)
Ammonium Hydroxide	19%	MF/UF Feed	1.5	38	1593	1007	1208	865
Sodium Hypochlorite	13%	MF/UF Feed	3.8	110	4229	2932	3464	2455
Antiscalant	100%	RO Feed	3	10	440	275	220	212
Hydrogen Peroxide	30%	UV Feed	3	22	1784	869	550	550

Chemical	Estimated Daily Consumption Quarter 1 based on 24 hour runtime (gal)	Estimated Average Daily Consumption Quarter 2 (gal)	Estimated Average Daily Consumption Quarter 3 (gal)	Estimated Average Daily Consumption Quarter 4 (gal)	Delivery Interval (Weeks)
Ammonium Hydroxide	11	10	12.4	11.9	3
Sodium Hypochlorite	24 (@ 2 mg/L target dose 7-1-11 to 8-9-11); 39 (@3 mg/L target dose 8-10-11 to 10-31-11)	30	34.7	33.8	1.5
Antiscalant	4	2.7	3.2	2.1	5
Hydrogen Peroxide	8	5.8	7.8	7	6

Note: Target dose rate is based on feed flow (MGD): MF+UF = 1.58; RO=1.25; UV=1. The total amount of chemical delivered for each quarter is based the measured volume delivered as reported by the Brenntag represenative at the time of delivery with the exception of hydrogen peroxide which was calcuated based the difference in tank level before and after each delivery. The estimated Average Daily Consumption for Q2, Q3 and Q4 was determined from differences in chemical tank levels recorded at the start and end of the testing period and the total amount delivered over the testing period.

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
8/1/11	177175	69382	154749	785020	275289	1461615	NA	RO A power meter reading low.
8/2/11	174969	71411	270270	820177	273271	1610098	NA	RO A power meter reading low.
8/3/11	164713	62367	207498	642896	214921	1292395	NA	RO A power meter reading low.
8/4/11	0	0	0	0	0	0	NA	Offline for North City filter mudball chlorination
8/5/11		0	0	0	0	0	NA	Offline for North City filter mudball chlorination
8/6/11	0	0	0	0	0	0	NA	Offline for North City filter mudball chlorination
8/7/11	105975	3197	0	0	21600	130772	NA	RO systems offline.
8/8/11	153239	50077	190139	260084	199665	853204	NA	RO A power meter reading low.
8/9/11	166572	76340	268418	827364	280904	1619598	NA	RO A power meter reading low.
8/10/11	168510	76306	285679	802415	281882	1614792	NA	RO A power meter reading low.
8/11/11	158422	73287	507055	761544	270528	1770836	NA	Electrician swapped 2 wires on RO A power meter.
8/12/11	172002	72739	786253	840360	286875	2158229	NA	
8/13/11	164452	70661	769482	820144	264656	2089395	NA	
8/14/11	144236	47229	507716	540324	243933	1483438	NA	
8/15/11	154829	67876	743783	791380	274836	2032704	NA	
8/16/11	157357	71481	784927	835420	302400	2151585	NA	
8/17/11	146844	71754	783901	833325	300013	2135837	NA	
8/18/11	144077	71502	794484	838166	302465	2150694	NA	
8/19/11						0	NA	Totals not recorded.
8/20/11	124587	29478	290233	309204	109878	863380	NA	
8/21/11	118133	17433	173358	160102	67017	536043	NA	
8/22/11	133286	50326	551012	569555	208435	1512614	NA	
8/23/11	148203	74411	811023	829978	301956	2165571	NA	
8/24/11	154231	72283	805821	856534	302195	2191064	NA	
8/25/11	149646	72297	806455	858888	310680	2197966	NA	
8/26/11	148074	58773	647053	675318	244696	1773914	NA	
8/27/11						0	NA	Totals not recorded.
8/28/11	154274	72920	799079	854588	311392	2192253	NA	
8/29/11	160316	72549	805315	848794	302346	2189320	NA	
8/30/11	155077	72399	816466	861770	302412	2208124	NA	
8/31/11	153396	72574	819239	862184	298566	2205959	NA	
TOTAL (kW-h)	**3953**	**1621**	**14379**	**18086**	**6553**	**44591**	NA	
9/1/11	150591	71884	822969	849608	268390	2163442	NA	
9/2/11	141659	66237	741020	755582	237032	1941530	NA	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
9/3/11	137444	53834	591336	612258	184835	1579707	NA	
9/4/11						0	NA	Totals not available.
9/5/11	107038	3089	0	0	0	110127	NA	RO and UV/AOP offline.
9/6/11	128629	88037	562688	580606	186182	1546142	NA	
9/7/11	178902	191669	796060	542594	274407	1983632	NA	UF cleaning.
9/8/11						0	NA	Blackout occurred at 3:30 p.m. Offline for weekend
9/9/11						0	NA	Offline due to blackout
9/10/11						0	NA	Offline due to blackout
9/11/11	43260	0	0	0	0	43260	NA	Offline due to blackout
9/12/11	121213	50852	525600	458486	178267	1334418	NA	Back online at ~8 A.M.
9/13/11	174005	72443	814238	859576	263788	2184050	NA	
9/14/11	170557	72086	826192	862508	262035	2193378	NA	
9/15/11	175543	71458	834726	863430	261465	2206622	NA	
9/16/11	163775	62254	726872	743700	238493	1935094	NA	
9/17/11	171963	72249	840096	863858	267446	2215612	NA	
9/18/11	176938	70673	839302	863892	265498	2216303	NA	
9/19/11	171889	71472	835564	846810	271549	2197284	NA	
9/20/11	167910	71943	837178	814944	269463	2161438	NA	
9/21/11	173320	71865	840548	826312	268666	2180711	NA	
9/22/11	173608	70729	828866	832392	264021	2169616	NA	
9/23/11						0	NA	Totals not available.
9/24/11	194134	71068	838174	811920	201340	2116636	NA	
9/25/11	195343	70878	832254	804412	4	1902891	NA	UV/AOP offline.
9/26/11	193885	71214	804784	767424	194237	2031544	NA	
9/27/11	190600	71366	835984	805804	282694	2186448	NA	
9/28/11	169839	40928	462392	451376	173747	1298282	NA	
9/29/11	174505	51536	520864	561296	209871	1518072	NA	
9/30/11	180890	58670	622260	672508	237928	1772256	NA	
TOTAL (kW-h)	**4027**	**1668**	**17180**	**17051**	**5261**	**45188**	NA	
10/1/11	172270	71720	816800	849632	300201	2210623	NA	
10/2/11	174610	71950	813808	846920	337770	2245058	NA	
10/3/11	181130	71260	810744	844152	331570	2238856	NA	
10/4/11						0	NA	Totals not available.
10/5/11	180010	77960	810744	3612	318560	1390886	NA	MF cleaning. RO B offline.

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
10/6/11	179870	163170	823136	607880	306130	2080186	NA	RO B Cleaning.
10/7/11	181190	328000	812024	263412	314110	1898736	NA	RO B Cleaning.
10/8/11						0	NA	Totals not available.
10/9/11	195070	64620	830600	824432	337490	2252212	NA	
10/10/11	198260	62610	815200	814184	352790	2243044	NA	
10/11/11	200490	64100	824320	828432	350530	2267872	NA	
10/12/11	201950	64070	802168	835616	294820	2198624	NA	
10/13/11	209210	43200	650692	719760	261660	1884522	NA	
10/14/11	203640	216800	243188	822336	227770	1713734	NA	RO A Cleaning. (MF/RO A/UV offline)
10/15/11	205610	154040	296972	829672	118420	1604714	NA	RO A Cleaning. (MF/RO A/UV offline)
10/16/11	199630	64350	814980	838960	304300	2222220	NA	
10/17/11	198400	64560	814832	837464	302420	2217676	NA	
10/18/11	190220	56580	719648	739600	265780	1971828	NA	All systems offline for ~ 4 hours.
10/19/11	200870	63840	822300	844800	302340	2234150	NA	
10/20/11	200650	63440	823960	846064	303800	2237914	NA	
10/21/11	185450	54270	674788	700952	276240	1891700	NA	All systems offline for ~ 3 hours.
10/22/11	197810	63930	809192	846880	362210	2280022	NA	
10/23/11	194730	63460	807568	845760	311430	2222948	NA	
10/24/11	191690	63070	806584	844008	304990	2210342	NA	
10/25/11	194180	62810	812520	850880	302610	2223000	NA	
10/26/11	190480	63000	806728	845136	301720	2207064	NA	
10/27/11	190810	63720	817688	859104	304480	2235802	NA	
10/28/11	182170	57490	746472	783920	276400	2046452	NA	
10/29/11	188780	63140	824152	866568	305230	2247870	NA	
10/30/11	177060	53160	678688	711600	244740	1865248	NA	
10/31/11	194310	63670	820288	859520	298030	2235818	NA	
TOTAL (kW-h)	**5561**	**2438**	**21951**	**22211**	**8619**	**60779**	NA	
11/1/11	199080	63260	826400	865336	333772	2287848	NA	
11/2/11	192000	58030	746280	781184	275416	2052910	NA	All systems offline for ~2 hours.
11/3/11	197890	64040	832344	872424	306584	2273282	NA	
11/4/11	171680	44060	567168	593936	212868	1589712	NA	All systems offline for ~8 hours.
11/5/11	140795	35850	498769	548883	181349	1405647	NA	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
11/6/11	196160	62360	847048	886792	313860	2306220	NA	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
11/7/11	199020	63570	844960	884672	313200	2305422	NA	
11/8/11	202120	63170	855552	897256	311212	2329310	NA	
11/9/11	165105	42040	584887	643654	212661	1648348	NA	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
11/10/11	157930	32750	393912	405496	146784	1136872	NA	All systems offline for ~13 hours.
11/11/11	158623	40390	561923	618382	204311	1583628	NA	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
11/12/11	158623	40390	561923	618382	204311	1583628	NA	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
11/13/11	158623	40390	561923	618382	204311	1583628	NA	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
11/14/11	181330	51400	693800	715344	251344	1893218	NA	All systems offline for ~5 hours.
11/15/11	148660	41940	498892	502728	189416	1381636	NA	All systems offline for ~10 hours.
11/16/11	144240	26980	319268	332760	119920	943168	NA	All systems offline for ~15 hours.
11/17/11	145890	22590	260308	260608	97560	786956	NA	All systems offline for ~17 hours.
11/18/11	156820	32730	384012	442840	154840	1171242	NA	All systems offline for ~12 hours. Total AWPF Power Meter Installed.
11/19/11	205690	62320	858300	897944	300852	2325106	2452280	
11/20/11	207820	62030	860536	900576	300212	2331174	2461540	
11/21/11	206470	61900	867816	907632	325200	2369018	2496990	
11/22/11	204720	61630	875704	914952	356040	2413046	2542740	
11/23/11	244113	62158	864772	951661	314425	2437129	2556849	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
11/24/11	203850	61730	870944	911264	436920	2484708	2616290	
11/25/11	207110	61560	863920	904248	432752	2469590	2597210	
11/26/11	202060	60890	875064	914760	434248	2487022	2618050	
11/27/11	207050	61430	868504	909288	434740	2481012	2614940	
11/28/11	211570	61620	869200	909864	361280	2413534	2545380	
11/29/11	217290	61350	875540	916688	299892	2370760	2501650	
11/30/11	200170	61410	875704	914832	298068	2350184	2477260	
TOTAL (kW-h)	**5593**	**1566**	**21265**	**22443**	**8328**	**59195**	**NA**	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
12/1/11	206210	55830	778264	813840	267052	2121196	2236112	All systems offline for ~3 hours.
12/2/11	213390	61100	884864	922928	302068	2384350	2500536	
12/3/11	223180	61030	801808	838088	275480	2199586	2319144	RO Trains and UV offline for ~3 hours.
12/4/11	202450	61360	884432	925496	304252	2377990	2501068	
12/5/11	188950	59890	741376	901856	294760	2186832	2305920	UF and ROA offline for ~4 hours.
12/6/11	201290	60770	869408	932992	301568	2366028	2487720	
12/7/11	190510	60740	833504	937712	301208	2323674	2441092	
12/8/11	189320	57720	832880	890296	285392	2255608	2375200	All systems offline for ~1 hour.
12/9/11	186670	55670	810336	862792	277440	2192908	2310536	All systems offline for ~2 hours.
12/10/11	217020	61210	883824	943168	302728	2407950	2532384	
12/11/11	217970	60970	883656	941936	302272	2406804	2529368	
12/12/11	210410	60530	872808	930560	298128	2372436	2499232	
12/13/11	212540	62050	887680	943360	302292	2407922	2512840	
12/14/11	207080	61420	892152	946424	304612	2411688	2536696	
12/15/11	197880	61090	890200	939256	301088	2389514	2511720	
12/16/11	190080	51480	726960	769512	246752	1984784	2099864	All systems offline for ~4 hours.
12/17/11	206570	54770	778768	825224	263280	2128612	2245824	All systems offline for ~3 hours.
12/18/11	216410	61240	890968	946408	303608	2418634	2545344	
12/19/11	213990	61960	891232	946616	303672	2417470	2545072	
12/20/11	185170	43490	619712	657592	211568	1717532	1826304	All systems offline for ~7 hours.
12/21/11	180810	41970	589264	623336	205400	1640780	1746208	All systems offline for ~8 hours.
12/22/11	211690	63130	888896	943952	306792	2414460	2542416	
12/23/11	165550	49620	705440	746528	241656	1908794	2016672	All systems offline for ~5 hours.
12/24/11	236010	60095	836066	920070	303987	2356228	2471975	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
12/25/11	196540	61820	892312	946744	305200	2402616	2521992	
12/26/11	200860	61030	899616	949472	303092	2414070	2536656	
12/27/11	193100	61420	902928	950336	303492	2411276	2530784	
12/28/11	193660	60800	909304	952520	303328	2419612	2546936	
12/29/11	239048	60868	846831	931917	307901	2386566	2503803	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
12/30/11	199720	53800	775680	818560	263852	2111612	2227360	All systems offline for ~3 hours.
12/31/11	243100	61900	861184	947712	313120	2427016	2546240	Power totals not available. Values estimated

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
								based on runtime and typical power usage for 24 hour period.
TOTAL (kW-h)	**6337**	**1811**	**25762**	**27547**	**8907**	**70365**	**74053**	
1/1/12	210870	61330	895440	948720	306432	2422792	2550712	
1/2/12	210870	61290	896248	949424	305388	2423220	2551456	
1/3/12	213840	61390	877672	937760	301620	2392282	2522992	
1/4/12	216520	61700	892608	947888	303592	2422308	2553648	
1/5/12	212100	61120	895768	950368	304776	2424132	2558856	
1/6/12	194900	51820	731960	772304	257224	2008208	2125112	All systems offline for ~5 hours.
1/7/12	212300	61270	898584	950192	309028	2431374	2557264	
1/8/12	204230	62110	904952	951936	309060	2432288	2554896	
1/9/12	206940	62970	905584	951920	311232	2438646	2559944	
1/10/12	162030	34190	484688	551376	182136	1414420	1515768	All systems offline for ~10 hours. Energy recovery device removed from RO Train A.
1/11/12	113400	6440	9816	8816	11760	150232	221592	Systems offline for ERD maintenance.
1/12/12	173412	39350	569488	576752	193640	1552642	1661320	All systems offline for ~9 hours.
1/13/12	192656	59470	921472	946208	302172	2421978	2546944	
1/14/12	188904	60000	926504	954512	301300	2431220	2549808	
1/15/12	204708	60510	931680	953824	305900	2456622	2576352	
1/16/12	204260	60540	931304	955136	305188	2456428	2580400	
1/17/12	208672	57900	886480	867776	290744	2311572	2429648	
1/18/12	254888	60450	937496	955200	309408	2517442	2634832	Positioner on UF feed valve controller replaced.
1/19/12	267432	60530	939224	955184	311592	2533962	2654848	
1/20/12	245968	18620	733080	747696	246976	1992340	2133616	All systems offline for ~5 hours.
1/21/12	266550	60760	931936	954112	311632	2524990	2662048	
1/22/12	265340	60760	932880	954976	312408	2526364	2647504	
1/23/12	259820	60470	937256	954304	315760	2527610	2653248	
1/24/12	262020	60660	934400	954656	310440	2522176	2643376	
1/25/12	266040	60830	936960	954464	310112	2528406	2654512	
1/26/12	266120	59940	923280	935840	304992	2490172	2619808	
1/27/12	231260	57980	496280	886368	276240	1948128	2063248	
1/28/12	226840	62610	489360	956368	295920	2031098	2145840	
1/29/12	250920	60890	928616	956448	315176	2512050	2633104	
1/30/12	240400	51150	762712	785056	261240	2100558	2213680	All systems offline for ~4 hours.
1/31/12	267348	61400	928240	958528	314384	2529900	2657568	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
TOTAL (kW-h)	**6902**	**1720**	**25372**	**27084**	**8797**	**69876**	**73634**	
2/1/12	266864	60190	928600	957712	312388	2525754	2651936	
2/2/12	263280	60270	928904	956528	315240	2524222	2642992	
2/3/12	254416	54520	823528	849328	280628	2262420	2378288	
2/4/12	239048	60868	846831	931917	307901	2386566	2503803	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
2/5/12	262320	60350	934344	957632	316420	2531066	2650592	
2/6/12	262860	60860	929640	956864	316440	2526664	2649680	
2/7/12	268440	60950	929352	956784	313320	2528846	2666944	
2/8/12	269060	60710	933360	958640	313460	2535230	2666080	
2/9/12	269928	60890	937600	958688	309220	2536326	2667232	
2/10/12	256532	51780	775936	794768	261300	2140316	2251232	All systems offline for ~4 hours.
2/11/12	264612	61390	936064	958000	317392	2537458	2657888	
2/12/12	264840	60790	930496	956896	318028	2531050	2652992	
2/13/12	262928	60830	928032	956208	317988	2525986	2649296	
2/14/12	267688	60410	932080	956720	318532	2535430	2657200	
2/15/12	261852	60540	931392	943600	311508	2508892	2630880	
2/16/12	260680	58030	898768	909872	298160	2425510	2544224	
2/17/12	246440	59870	747568	755584	249584	2059046	2156112	
2/18/12	266020	61100	940368	954688	315560	2537736	2659424	
2/19/12	267780	61100	938592	954832	320120	2542424	2665120	
2/20/12	251612	52490	774320	809904	271856	2160182	2273808	
2/21/12	262056	61390	862000	957728	318960	2462134	2581136	
2/22/12	258832	60550	861552	958992	316652	2456578	2586976	
2/23/12	260840	60400	847072	873648	290900	2332860	2455520	
2/24/12	261432	61620	872352	955680	316760	2467844	2592416	
2/25/12	260268	61190	872128	955264	316352	2465202	2587824	
2/26/12	259040	61320	868592	952840	320344	2462136	2585280	
2/27/12	243759	61416	788134	885108	320021	2298439	2405254	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
2/28/12	259536	60390	867296	948624	315296	2451142	2574256	
2/29/12	261112	61250	878144	957024	317632	2475162	2597808	
TOTAL (kW-h)	**7554**	**1737**	**25643**	**26880**	**8918**	**70733**	**74242**	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
3/1/12	259900	61360	875760	956400	318176	2471596	2598560	
3/2/12	249700	55080	758144	828960	278464	2170348	2284544	
3/3/12	252680	55850	794624	869456	293600	2266210	2382416	
3/4/12	172448	5370	4672	4560	11632	198682	267184	UF Critical alarm shut down plant (Bray air valve)
3/5/12	199532	32940	414061	456848	15728	1119109	1360848	
3/6/12	241612	61210	844544	899632	315536	2362534	2484128	
3/7/12	226948	49930	670400	738000	250872	1936150	2044992	
3/8/12	239300	61740	866112	952640	322672	2442464	2561504	
3/9/12	236740	56410	776480	858944	287360	2215934	2333472	
3/10/12	246132	61820	851368	948416	313560	2421296	2546304	
3/11/12	244640	61580	851360	948496	318648	2424724	2548736	
3/12/12	244760	61990	844560	948816	318400	2418526	2541856	
3/13/12	244868	62100	848800	948160	309296	2413224	2535264	
3/14/12	245740	61900	848480	949376	309992	2415488	2539468	
3/15/12	244940	62130	846576	948432	313048	2415126	2537312	
3/16/12	245280	61500	843552	948960	313328	2412620	2533920	
3/17/12	243300	62010	844192	946080	313504	2409086	2530240	
3/18/12	243760	61680	853632	948928	316272	2424272	2543168	
3/19/12	242700	61750	854640	948352	315488	2422930	2542720	
3/20/12	240360	60470	851952	937152	307568	2397502	2518336	
3/21/12	243100	61900	861184	947712	313120	2427016	2546240	
3/22/12	204528	342470	857712	481664	288640	2175014	2312320	
3/23/12	199472	290286	838352	418128	281344	2027582	2167104	
3/24/12	244072	61870	863200	951312	316248	2436702	2558432	
3/25/12	240536	62270	862176	951456	314352	2430790	2550944	
3/26/12	243652	61270	861856	950256	317288	2434322	2554752	
3/27/12	239012	58050	832736	935792	297136	2362726	2476608	
3/28/12	244640	52700	871072	1024640	314856	2507908	2639616	
3/29/12	243768	52310	870432	1019616	319552	2505678	2636480	
3/30/12	233552	56210	779840	914912	286456	2270970	2386720	
3/31/12	240368	59140	863152	1024384	304200	2491244	2607456	
TOTAL (kW-h)	**7342**	**2277**	**24706**	**26606**	**8896**	**69828**	**73672**	
4/1/12	244100	62050	863680	1085504	317360	2572694	2695872	
4/2/12	243040	61870	860768	1043136	316728	2525542	2651552	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
4/3/12	240892	61770	860272	1057616	315192	2535742	2662400	
4/4/12	238968	238810	836208	1028688	307040	2649714	2770432	
4/5/12	244872	182990	685936	981968	306192	2401958	2520320	
4/6/12	236208	105050	772480	893552	286088	2293378	2408160	
4/7/12	242280	62060	849232	1036224	312176	2501972	2626080	
4/8/12	245368	62600	846288	1037232	311976	2503464	2625760	
4/9/12	243840	62090	839232	1023536	312296	2480994	2604960	
4/10/12	243192	62340	840304	1009312	308448	2463596	2583712	
4/11/12	245632	62040	842048	1007008	305584	2462312	2584512	
4/12/12	245256	62850	839728	1002528	306104	2456466	2574592	
4/13/12	235712	56920	753232	900544	272400	2218808	2331616	
4/14/12	243560	61990	847840	1010224	307696	2471310	2590432	
4/15/12	246060	61800	846368	1006304	315624	2476156	2597248	
4/16/12	245692	598720	441216	991952	301160	2578740	2741728	RO A offline for approximately 12 hours for cleaning; Extra power usage at MF due to heating CIP water
4/17/12	244200	462370	286368	990336	303840	2287114	2436064	RO A offline for approximately 15 hours for cleaning; Extra power usage at MF due to heating CIP water
4/18/12	230128	297120	293888	349072	110408	1280616	1992000	All systems offline for approx. 3 hours; RO B offline for approximately 16 hours for cleaning; Extra power usage at MF due to heating CIP water
4/19/12	243808	125610	840291	445648	303684	1959041	2043456	RO B offline for approximately 12 hours for cleaning; Extra power usage at MF due to heating CIP water. Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/20/12	234452	55680	735254	832384	283008	2140778	2215936	All systems offline for approximately 3 hours. Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/21/12	243932	61880	840291	939776	319488	2405367	2468192	Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/22/12	239948	58080	770267	882080	300768	2251143	2332896	All systems offline for approximately 2 hours.

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
								Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/23/12	244188	61180	840291	907808	316152	2369619	2426752	Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/24/12	233512	56560	735254	779120	275896	2080342	2150784	All systems offline for approximately 3 hours. Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/25/12	243392	62030	778624	874640	302256	2260942	2376704	Power total for RO A not available, usage estimated based on runtime and typical power usage.
4/26/12	243048	61520	778928	876576	300992	2261064	2378816	
4/27/12	213289	53739	689618	774470	280018	2011134	2104597	All systems offline for approximately 3 hours. Power totals not available. Usage estimated based on runtime and typical power usage.
4/28/12	243428	61540	780128	876480	315912	2277488	2393600	
4/29/12	242632	60930	780528	877488	345992	2307570	2426432	
4/30/12	240312	56930	745024	823552	327069	2192887	2311680	All systems offline for approximately 1 hour
TOTAL (kW-h)	**7225**	**3401**	**22720**	**27345**	**8988**	**69678**	**73627**	
5/1/12	244000	61470	775296	874272	318192	2273230	2391488	
5/2/12	242880	61360	777760	879024	359032	2320056	2438208	
5/3/12	244888	61380	773072	874992	357496	2311828	2429216	
5/4/12	237040	56910	686048	794784	314104	2088886	2199936	All systems offline for approxmiately 2 hours
5/5/12	243480	60830	771648	875664	293872	2245494	2361664	
5/6/12	245480	61460	772912	879472	290848	2250172	2366720	
5/7/12	142193	35826	459745	516313	186679	1340756	1403065	All sytems offline for approximately 10 hours. Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
5/8/12	0	0	0	0	0	0	0	All systems offline all day
5/9/12	0	0	0	0	0	0	0	All systems offline all day
5/10/12	0	0	0	0	0	0	0	All systems offline all day
5/11/12	152349	38385	492584	553193	200013	1436524	1503284	All systems offline for approximately 9 hours. Power totals not available. Values estimated

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
								based on runtime and typical power usage for 24 hour period.
5/12/12	198680	62740	766224	872080	296536	2196260	2313600	
5/13/12	198380	62110	764800	873264	295544	2194098	2310528	
5/14/12	197780	61930	759328	871808	295680	2186526	2302976	
5/15/12	192988	62560	762288	876864	296528	2191228	2308544	
5/16/12	193944	62900	762416	873760	293104	2186124	2304960	
5/17/12	190600	55960	719248	789808	264656	2020272	2133408	
5/18/12	172125.3	55823.8	676644.2	775462.0	260129.8	1940185	2045652.0	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
5/19/12	197904	62310	817312	875584	293264	2246374	2360800	
5/20/12	193216	62170	814192	868608	292896	2231082	2347040	
5/21/12	200144	61940	811200	864240	297432	2234956	2351456	
5/22/12	196416	62300	818912	867536	296936	2242100	2360000	
5/23/12	196772	62270	820032	872080	280304	2231458	2345376	
5/24/12	195588	61720	819472	871952	292352	2241084	2358016	
5/25/12	197612	54280	710544	679152	237944	1879532	1982592	All systems offline for ~3 hours; ROB and UV offline for ~5 hours
5/26/12								
5/27/12	180680	35810	442816	479568	164312	1303186	1395424	All systems offline for ~11 hours
5/28/12	154347	50058	606756	695367	233262	1739790	1834364	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~ 5 hours.
5/29/12	154347	50058	606756	695367	233262	1739790	1834364	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~ 5 hours.
5/30/12	188780	231900	786720	872080	306656	2386136	2502624	Extra power usage on MF due to heating of water for UF CIP
5/31/12	177068	285150	364800	853488	279184	1959690	2113184	UF and ROA offline for ~13 hours due to UF cleaning; Extra power usage on MF due to heating of water for UF CIP
TOTAL (kW-h)	**5330**	**1942**	**19140**	**21676**	**7530**	**55617**	**58598**	
6/1/12	171593	199139	692067	844410	270463	2177671	2279565	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
6/2/12	195472	61680	789280	882624	306784	2235840	2351936	
6/3/12	192328	61660	784432	888944	307104	2234468	2357280	
6/4/12	191472	62040	780416	887264	306912	2228104	2339360	
6/5/12	192840	61440	780752	924640	306632	2266304	2382848	
6/6/12	194256	225440	783472	955936	306184	2465288	2580640	Extra power usage on MF due to heating water for ROB CIP
6/7/12	193672	206870	771984	287168	178672	1638366	1745888	MF and ROB offline for ~17 hours, UV offline for ~9 hours; Extra power usage on MF due to heating water for ROB CIP
6/8/12	81749	94873	329711	402290	128852	1037475	1086019	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~ 14 hours.
6/9/12	195800	61360	768512	914272	289416	2229360	2346176	
6/10/12	192720	62080	760928	906752	297752	2220232	2336832	
6/11/12	192160	57680	709040	847584	278160	2084624	2198144	All systems offline for ~2 hours
6/12/12	186976	44900	538336	643904	193656	1607772	1707936	All systems offline for ~7 hours
6/13/12	195144	62400	760880	911040	293600	2223064	2338880	
6/14/12	197608	61500	765648	918464	294976	2238196	2353696	
6/15/12	140856	43190	530512	637696	203840	1556094	1648640	All systems offline for ~7 hours
6/16/12	194096	63030	762384	915008	289344	2223862	2341888	
6/17/12	198912	63070	758896	912224	290128	2223230	2342144	
6/18/12	195512	62910	743760	869216	286992	2158390	2278560	
6/19/12	175960	27660	311440	370368	125976	1011404	1099520	All systems offline for ~14 hours due to leak at chlorine pump
6/20/12	185944	44850	540592	639200	212632	1623218	1728032	All systems offline for ~7 hours due to leak at chlorine pump
6/21/12	198024	62110	758400	902496	293648	2214678	2336000	
6/22/12	191312	52960	632768	748832	254056	1879928	1991200	All systems offline for ~4 hours
6/23/12	168320	52794	644640	767122	249601	1882476	1985600	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~4 hours.
6/24/12	161752	4710	4320	3904	11736	186422	254592	All systems offline all day
6/25/12	173080	26080	272048	317600	114584	903392	990816	All systems offline for ~15 hours
6/26/12	0	0	0	0	0	0	0	Power Outage plant shutdown
6/27/12	195016	61690	754192	888736	299000	2198634	2318880	
6/28/12	196408	61270	753328	888032	298856	2197894	2315232	

Table 49 Power Totals of the Various AWP Unit Processes

Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
6/29/12	172266	53739	660731	778878	262122	1927736	2030651	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~3 hours for maintenance.
6/30/12	172266	53739	660731	778878	262122	1927736	2030651	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~3 hours for maintenance.
TOTAL (kW-h)	**5294**	**2057**	**18804**	**21633**	**7214**	**55002**	**58098**	
7/1/12	196080	61530	748160	890592	305432	2201794	2321408	Shutdown for ~2hrs due to pump failure.
7/2/12	201600	61110	745968	887264	303472	2199414	2321472	
7/3/12	180859	56419	693690	817729	275197	2023894	2131943	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period. All systems offline ~2 hours.
7/4/12	193360	61200	751520	894976	894976	2796032	2318080	
7/5/12	0	0	0	0	0	0	0	Plant shutdown due to pump failures & EDR exercises
7/6/12	0	0	0	0	0	0	0	Plant shutdown all weekend due to comm. Failures
7/7/12	0	0	0	0	0	0	0	Plant shutdown all weekend due to comm. Failures
7/8/12	0	0	0	0	0	0	0	Plant shutdown all weekend due to comm. Failures
7/9/12	185136	39430	457504	540192	540192	1762454	1512256	Plant shutdown all weekend due to comm. Failures
7/10/12	193720	55610	665296	774976	774976	2464578	2076416	
7/11/12	197656	61120	738112	861312	296784	2154984	2276032	
7/12/12	196784	61480	739328	866816	294720	2159128	2281344	
7/13/12	179975.4	56228.6	676177.1	792775.5	269546.0	1974702	2086479	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
7/14/12	179975.4	56228.6	676177.1	792775.5	269546.0	1974702	2086479	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
7/15/12	198480	60740	736368	858240	293688	2147516	2265600	
7/16/12	197352	60350	738448	860032	292096	2148278	2264768	

Table 49 Power Totals of the Various AWP Unit Processes

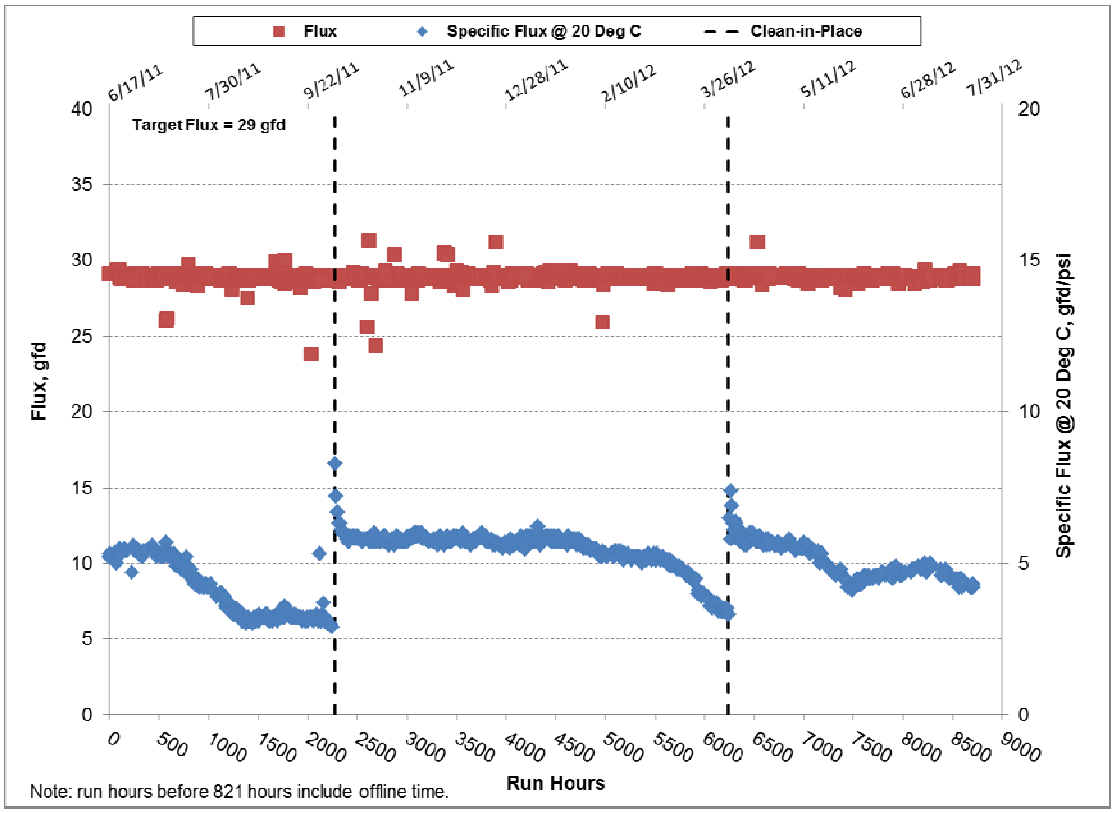
Date	Daily Power Totals (wH) from Power Meters (August 2011-July 2012)							Comments
	UF	MF	RO Train A	RO Train B	UV/AOP	Total Power Usage for AWPF Process Skids (wH)	Total AWPF Main Power Usage (wH)	
7/17/12	196960	61350	746112	870400	294984	2169806	2286592	
7/18/12	193464	60480	748800	874368	296856	2173968	2295936	
7/19/12	189304	55550	675040	786144	268320	1974358	2093056	
7/20/12	193320	60900	743360	865920	294632	2158132	2277568	
7/21/12	193320	60900	743360	865920	294632	2158132	2277568	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
7/22/12	197592	61300	743776	876040	293424	2172132	2283264	
7/23/12	194792	60420	743328	869120	291856	2159516	2279936	
7/24/12	190976	48760	588160	688096	231080	1747072	1858176	Plant shutdown ~5 hrs due to pump failure while operator not present
7/25/12	194464	60700	745968	878144	294824	2174100	2291264	
7/26/12	198288	60480	742096	871552	295184	2167600	2286208	
7/27/12	185069	56448	692623	813449	275505	2023093	2133794	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
7/28/12	185069	56448	692623	813449	275505	2023093	2133794	Power totals not available. Values estimated based on runtime and typical power usage for 24 hour period.
7/29/12	196928	60620	737920	863840	293712	2153020	2270208	
7/30/12	198392	60270	735520	862400	291488	2148070	2265408	
7/31/12	201760	60780	734832	861920	289488	2148780	2265728	
TOTAL (kW-h)	**5211**	**1577**	**19180**	**22498**	**9092**	**57558**	**59241**	

Table 50 Equipment Maintenance / Failure Log Q4 Testing Period

Month / Year	Equipment	Description of Issue	Action	Status
August 2011 – July 2012	UF System	Backwash chlorine pump loose prime.	Tubing has been rerouted and foot valve replaced. H2O Innovations looking at installing a recirculation line to prevent air locking of chemical.	open
May 2012	UVT analyzer	Lamp failed.	Replaced lamp.	closed
May 2012	Hydrogen Peroxide Pumps	Multiple no flow alarms on peroxide pumps causing a latched alarm and reactor shutdown.	Changed degas interval and length of time; Opened vent valve on peroxide pump skid.	monitoring
June 2012	Antiscalant Pump	Crack found in pump skid piping.	Replaced cracked pipe section.	closed
June 2012	Sodium Hypochlorite Pump	Pressure relief valve on pump skid steadily dripping due to a crack in the plug.	Cracked plug removed and replaced.	closed
June 2012	RO Train B	Discovered concentrate flow meter to be reading ~20 gpm higher than actual flow based on comparison to strap on flow meter and concentrate conductivity readings; This caused the calculated recovery to be lower than the actual recovery.	Scaled flow transmitter equipped on RO skid to display correct flows. Confirmed FWR based on sulfate rejection.	closed
June 2012	UV/AOP System	Ballast failure.	Replaced ballast.	Power study and failure diagnostic in progress.
July 2012	Feed Pumps	Feed pumps faulted.	Reset alarms.	closed
July 2012	Programmable Logic Controller Fault (PLC-101)	Plant continued to shut-down due to PLC communication failures.	Data transferred from PLC-101 to AWP operations computer to increase hard drive capacity. Also cleared communication ports.	closed
July 2012	Feed Pumps	No flow from Penasquitos pump station caused low flow in the North City feed pump wet wells which caused AWP feed pump to shut down.	Reset alarms.	closed
July 2012	Feed Pumps	Pumps faulted on a low wet well level alarm. North City operators discovered this caused by a PLC issue and not actual low levels.	Reset alarms.	closed

Note:

1. The table includes items from previous Testing Periods that remained open during the Q4 Reporting Period.



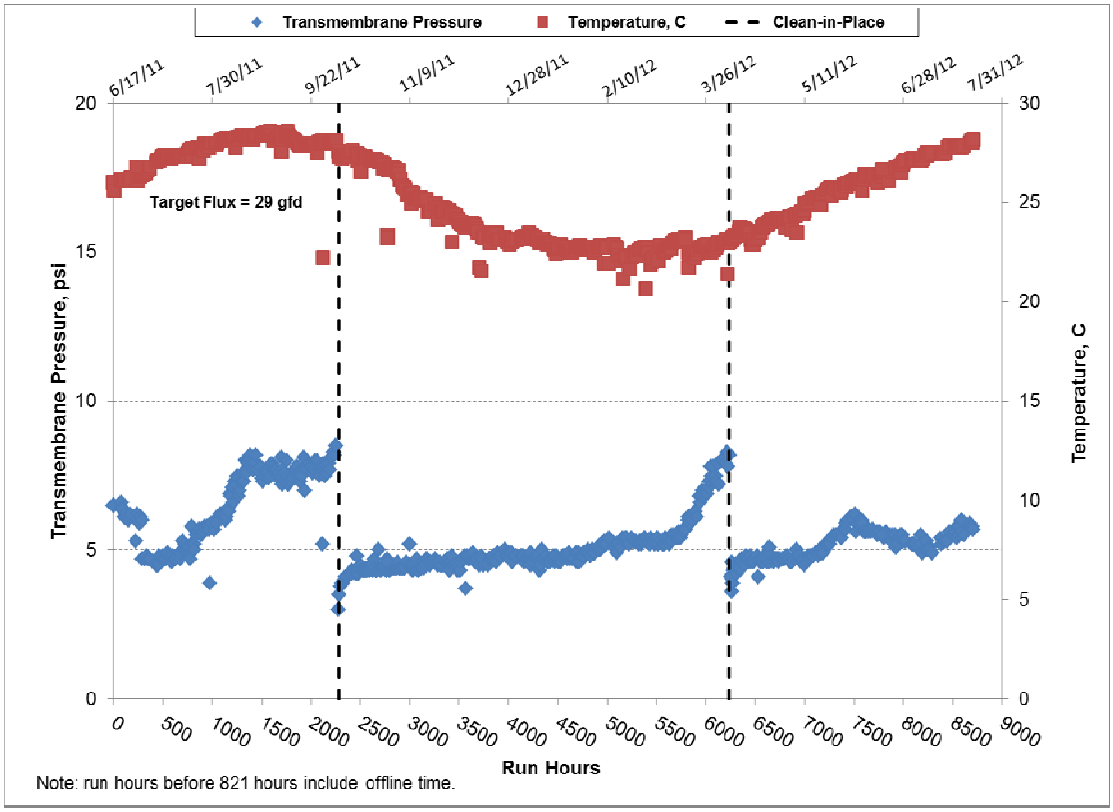
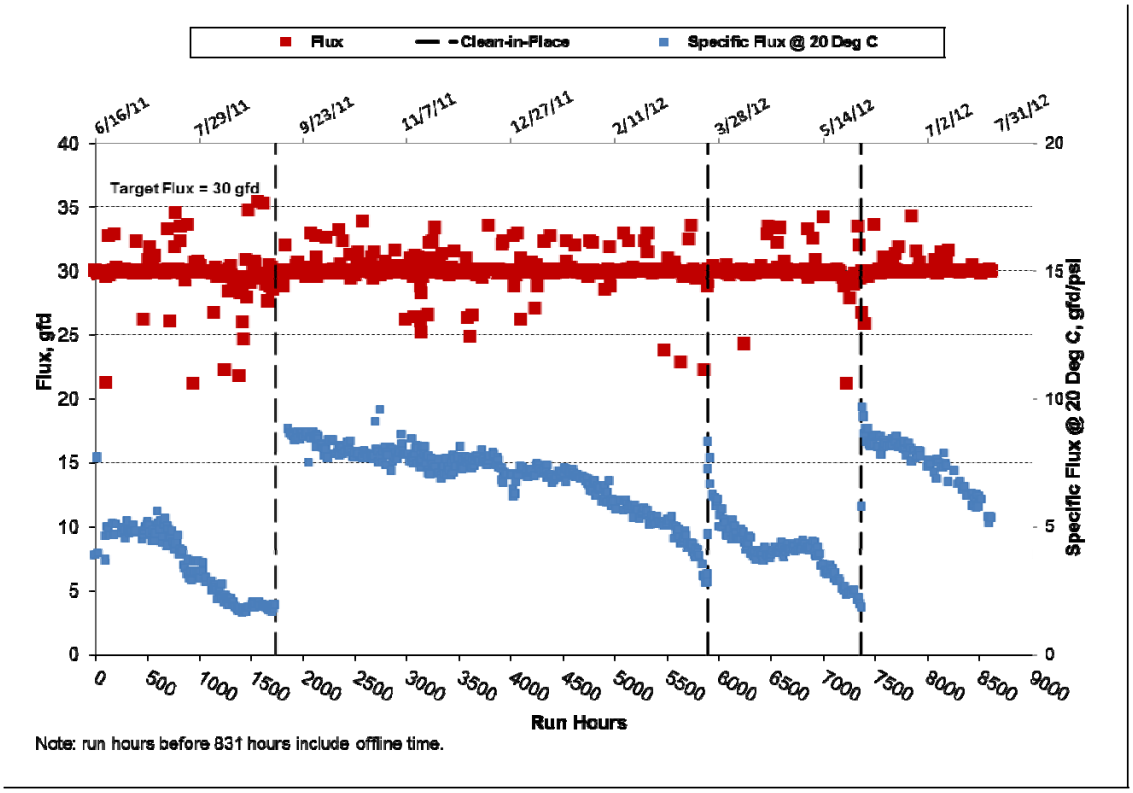


Figure 1 Pall Microfiltration System Operating Data



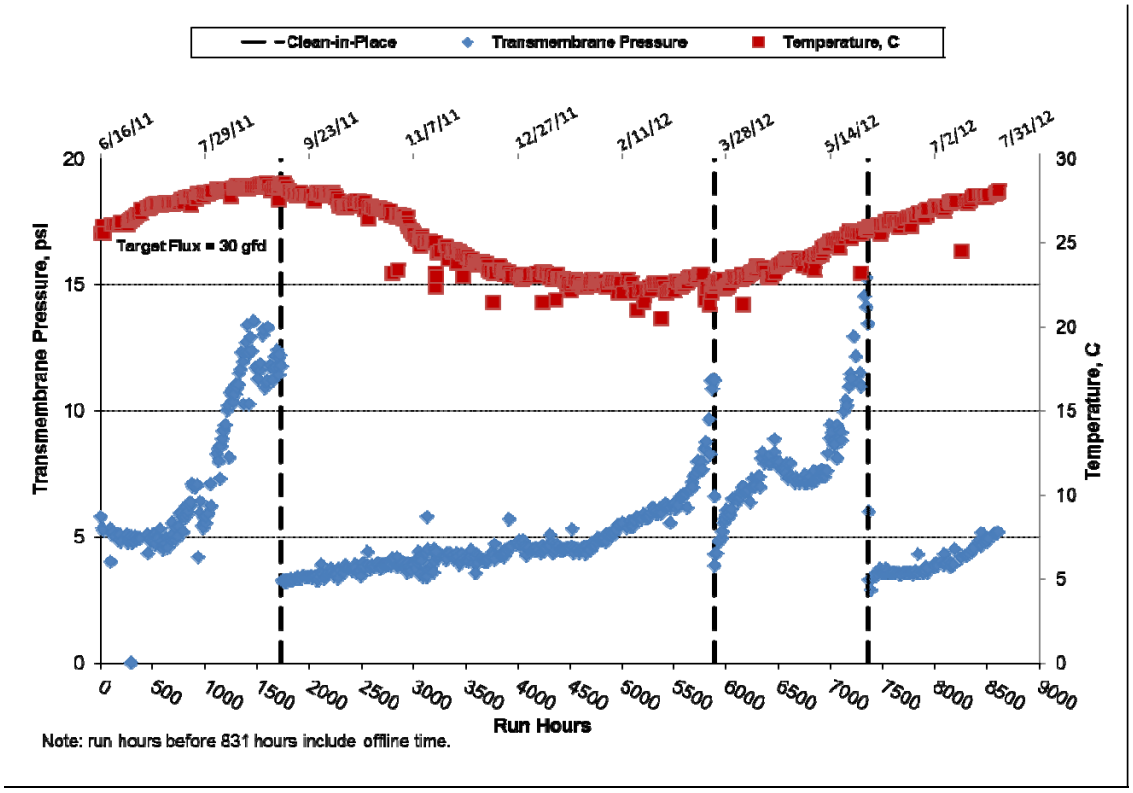
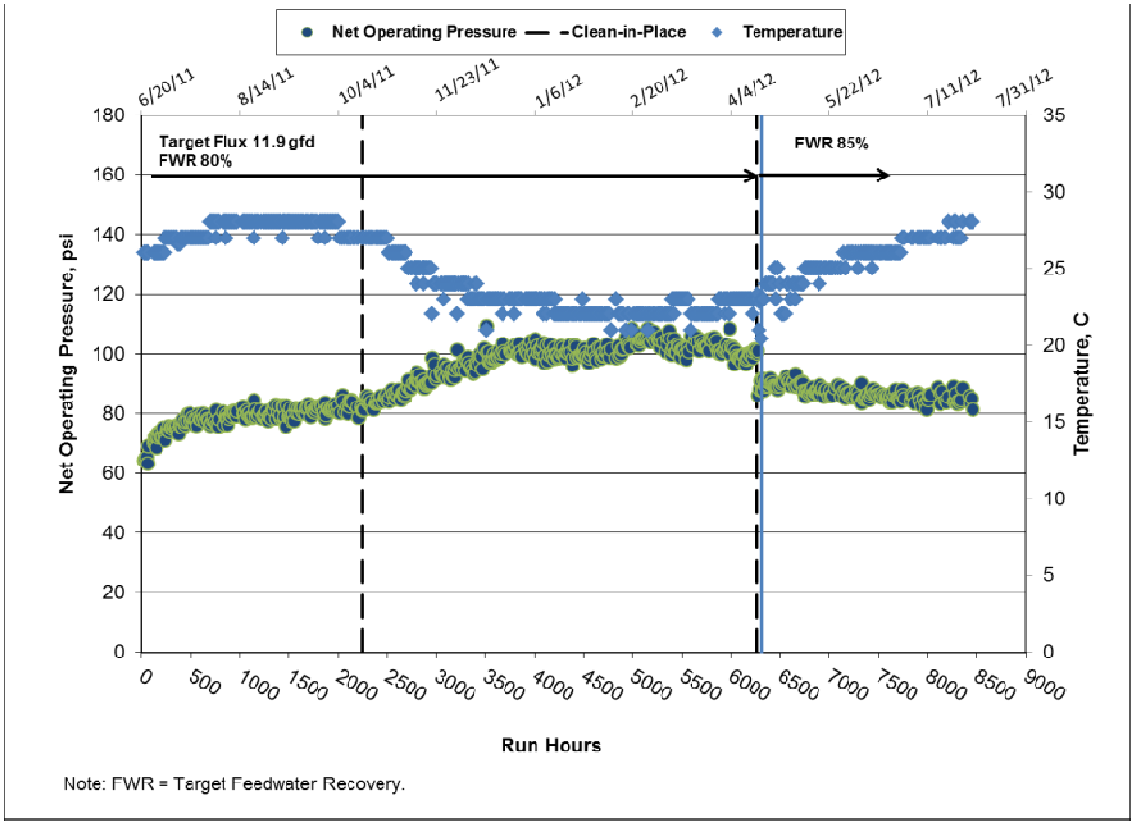


Figure 2 Toray Ultrafiltration Operating Data



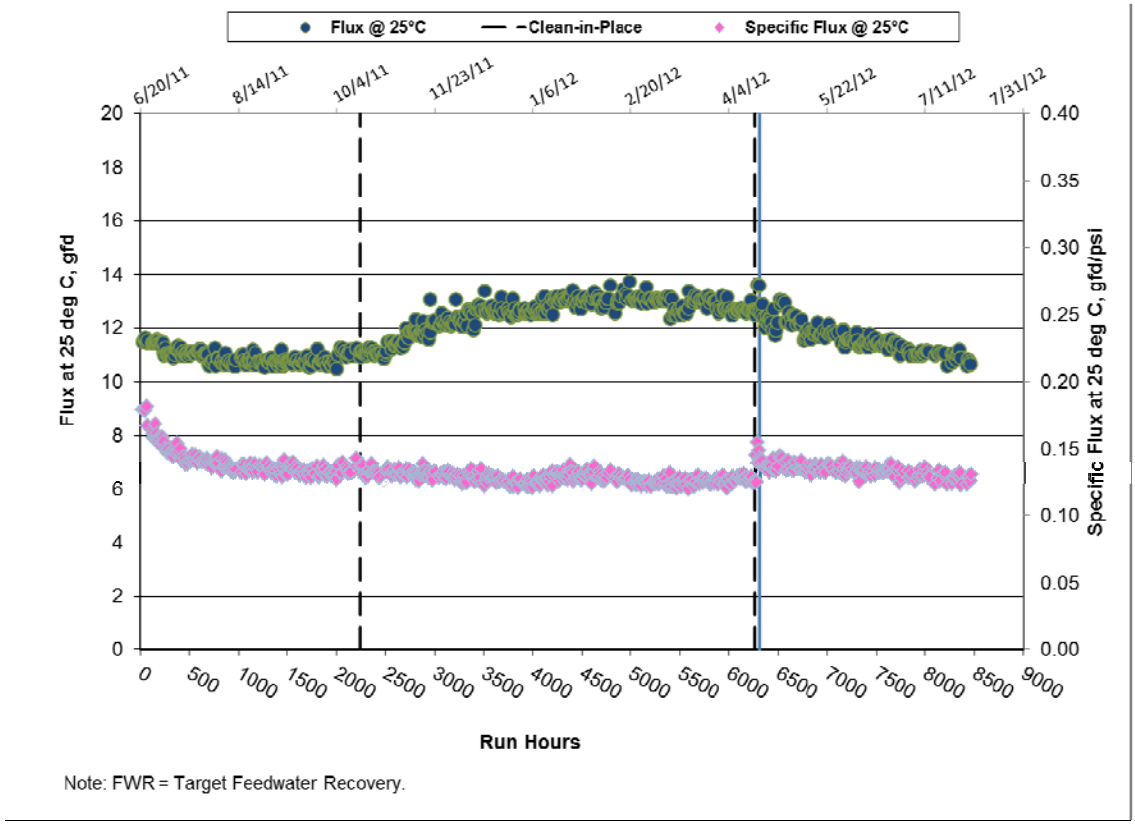


Figure 3 Membrane Performance of the Hydranautics ESPA 2 LD RO Membrane Systrem

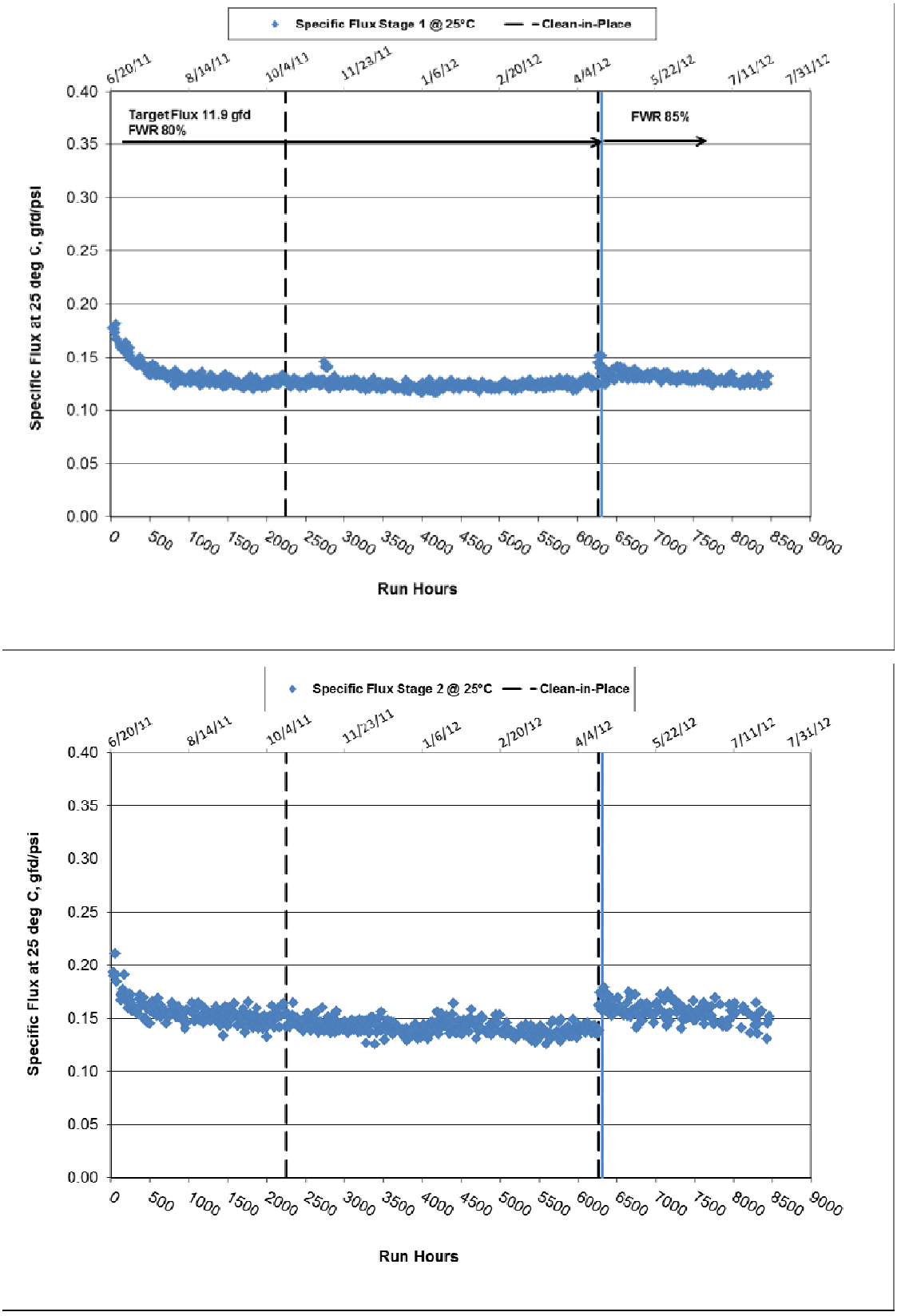


Figure 4 Comparison of Temperature Corrected Specific Flux Stage 1 (Top) and Stage 2 (Bottom) of the Hydranautics ESPA2 LD RO Membrane System

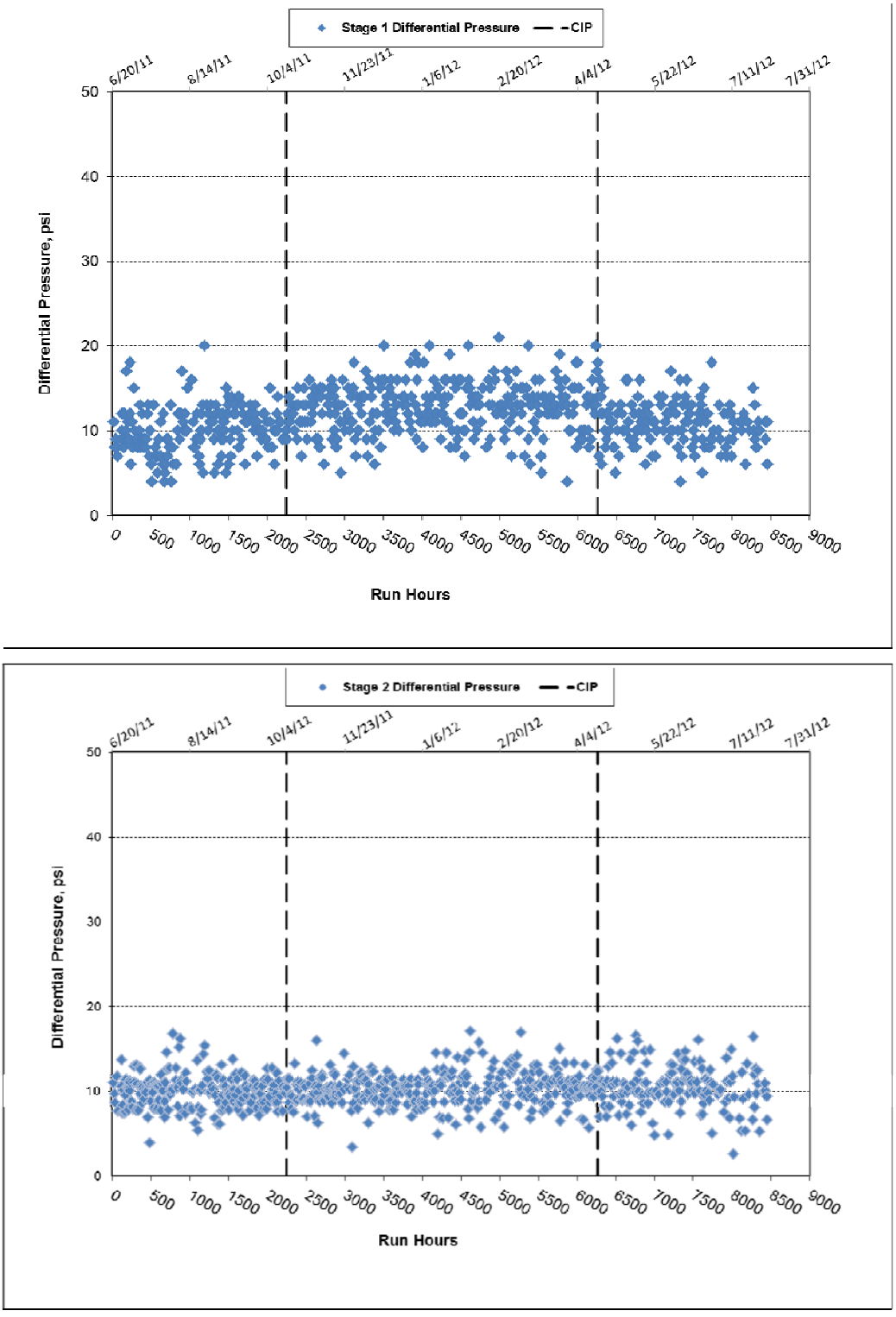


Figure 5 Differntial Pressure (DP) of the Hydranautics ESPA2 LD RO Membrane System

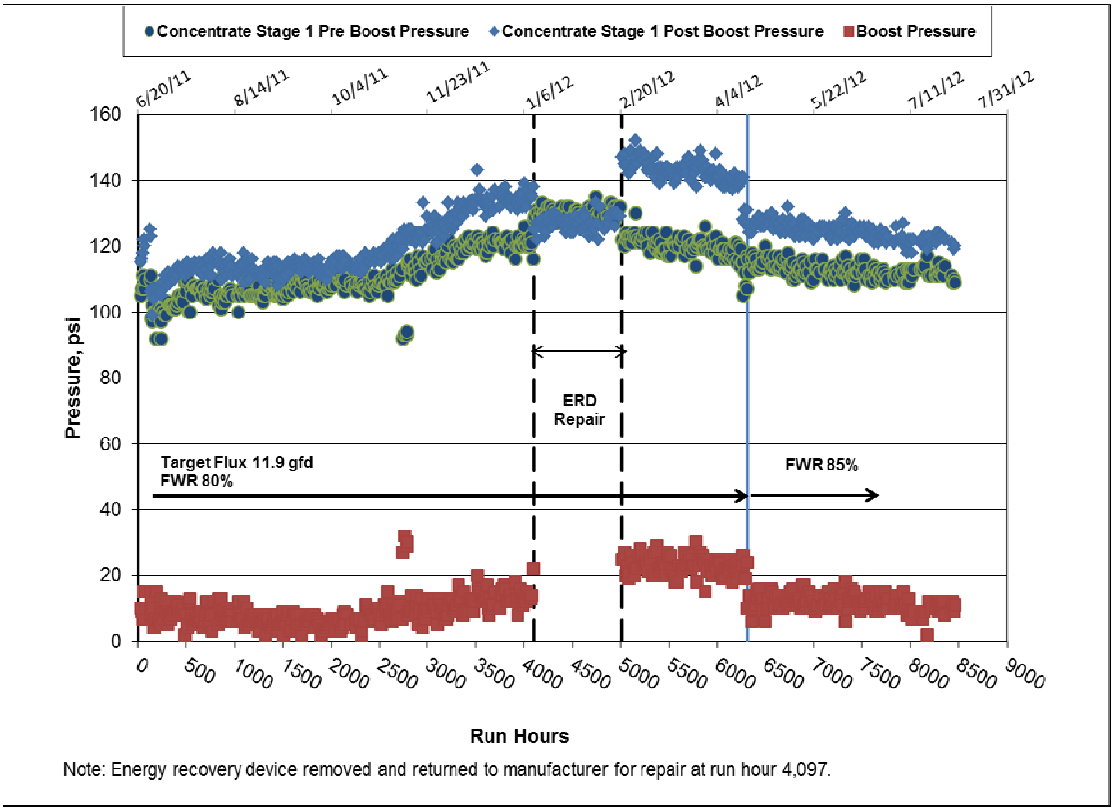


Figure 6 Energy Recovery Performance of the Hydranautics ESPA2 LD RO Membrane System

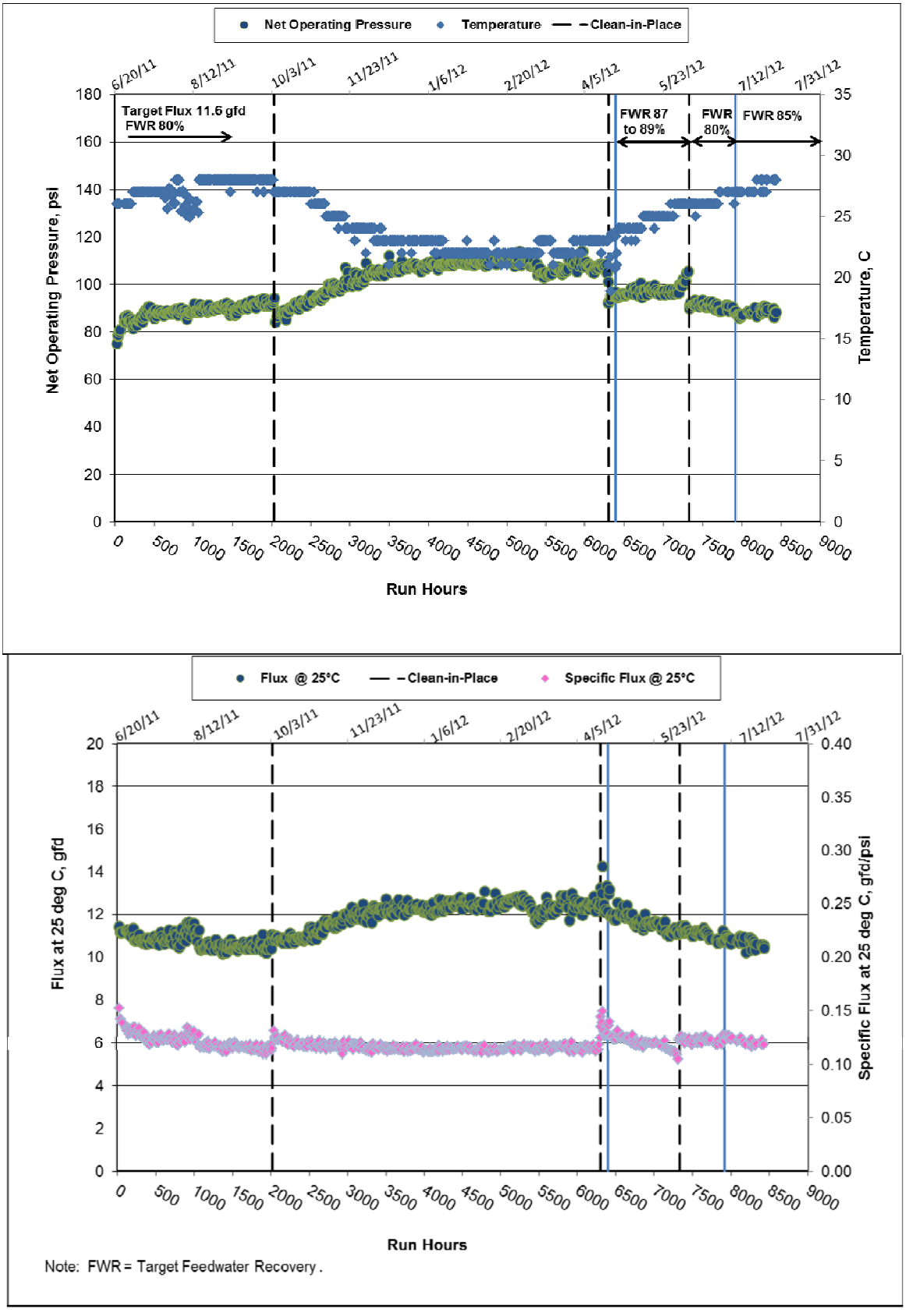


Figure 7 Membrane Performance of the Toray TML RO Membrane System

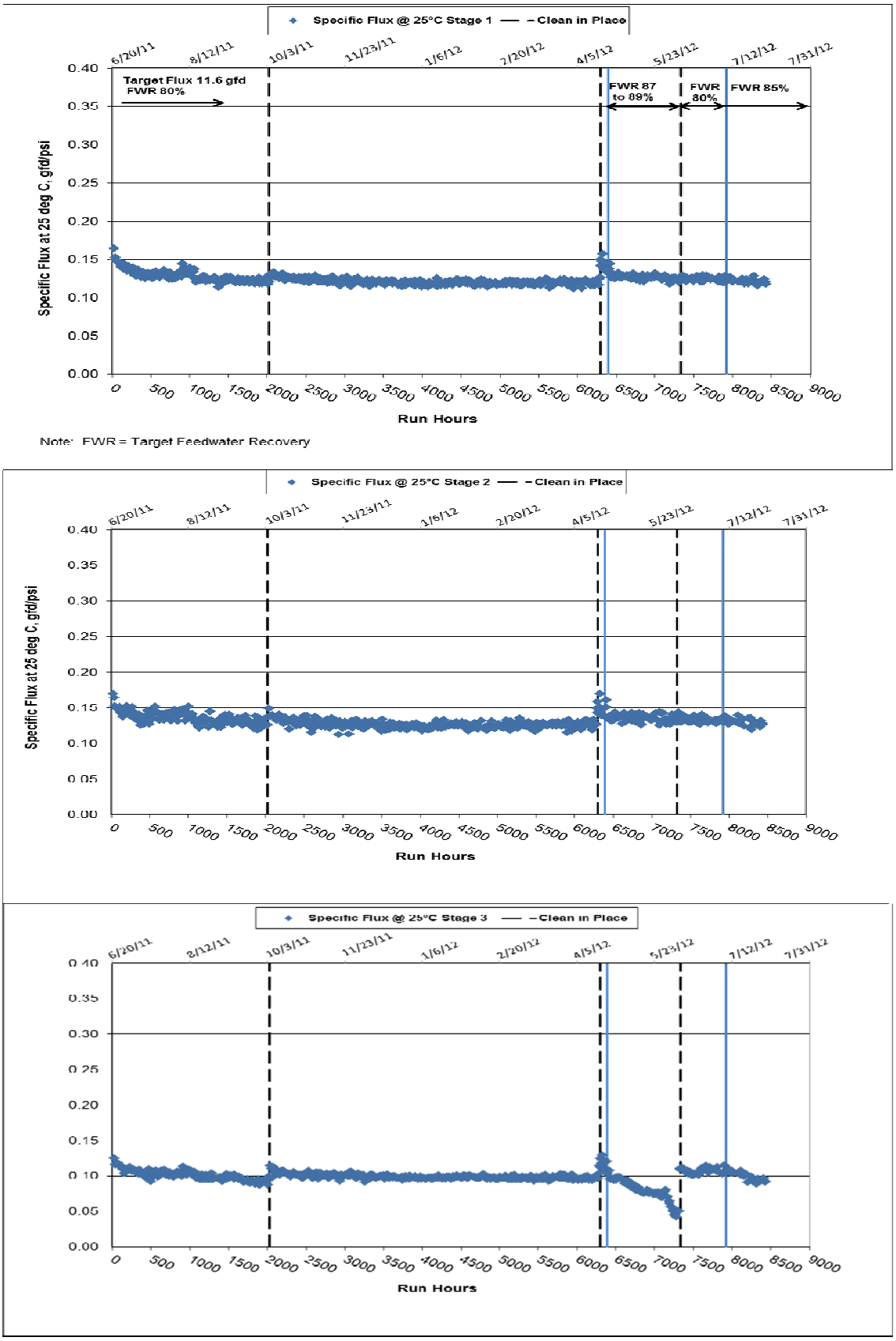


Figure 8 Comparison of Temperature Corrected Specific Flux by Stage 1 (Top), Stage 2 (Mid), Stage 3 (Bottom) of the TML RO Membrane System

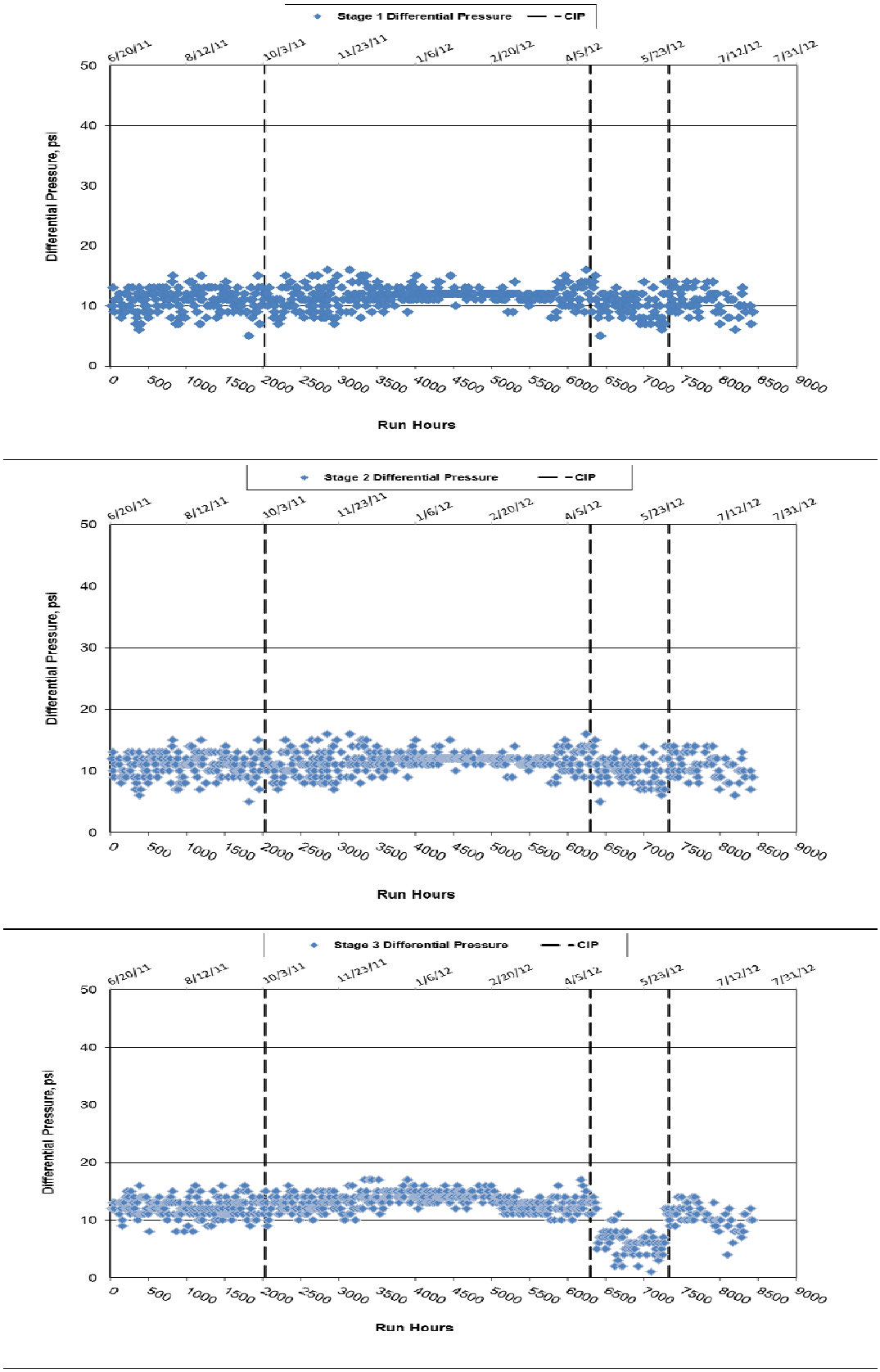


Figure 9 Differential Pressure (DP) of the Toray TML RO Membrane System

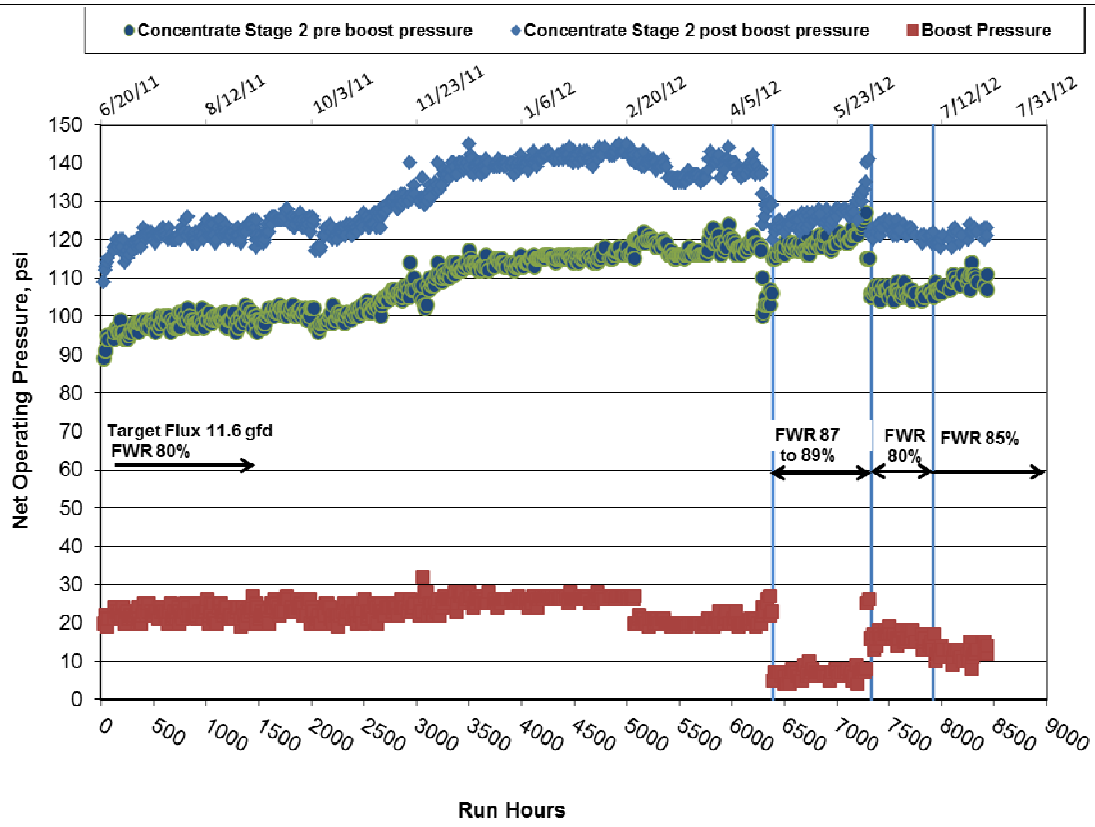


Figure 10 Energy Recovery Performance of the Toray TML RO Membrane System

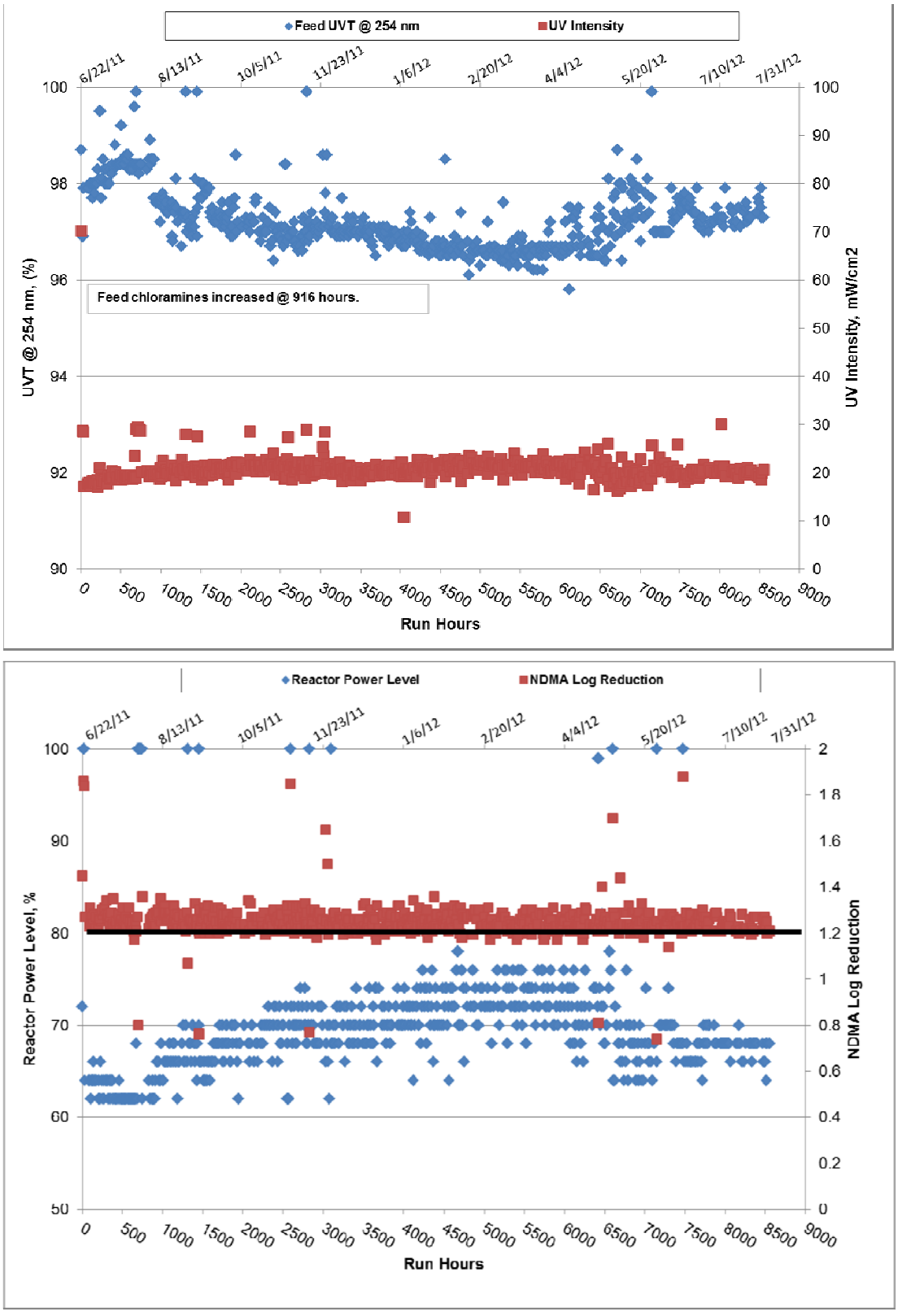


Figure 11 Trojan UV/AOP Operating Data

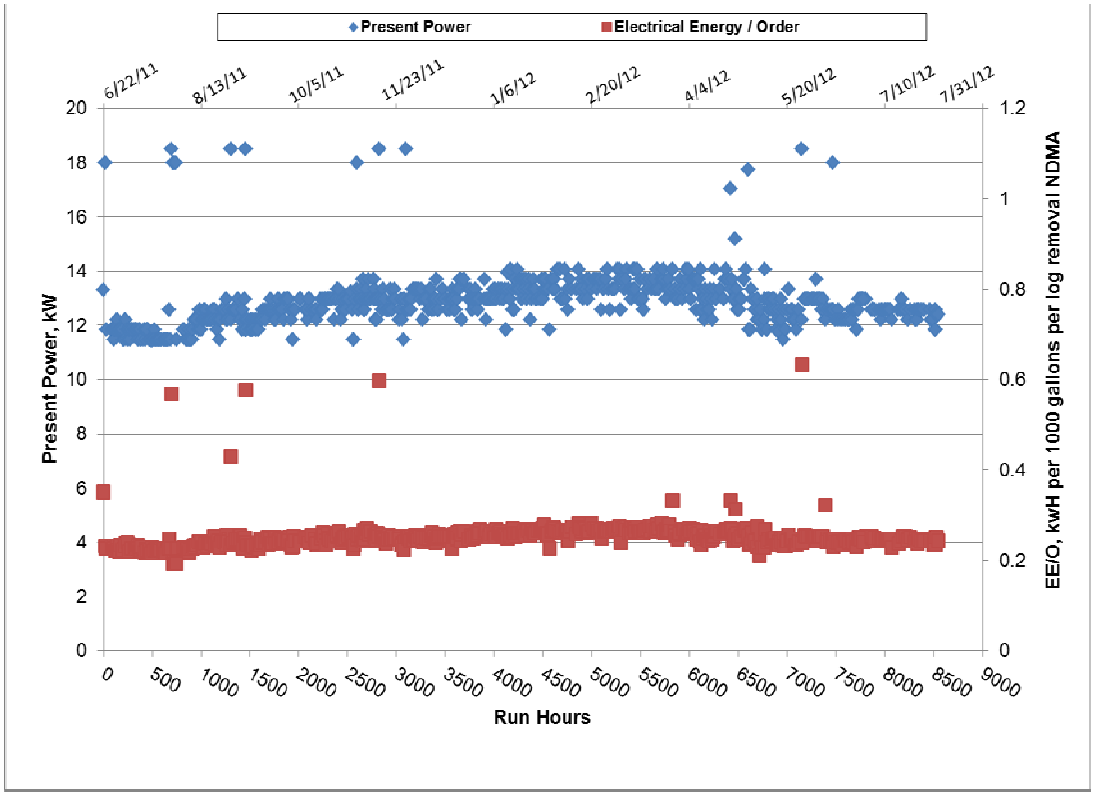


Figure 12 UV/AOP Electrical Energy per Order based on Trojan Algorithm

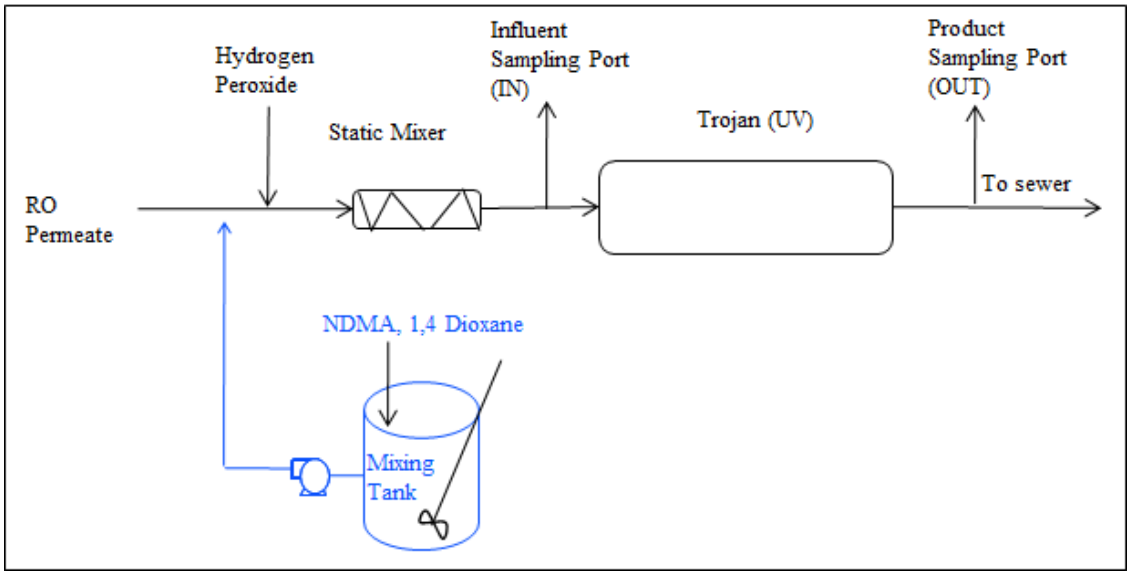
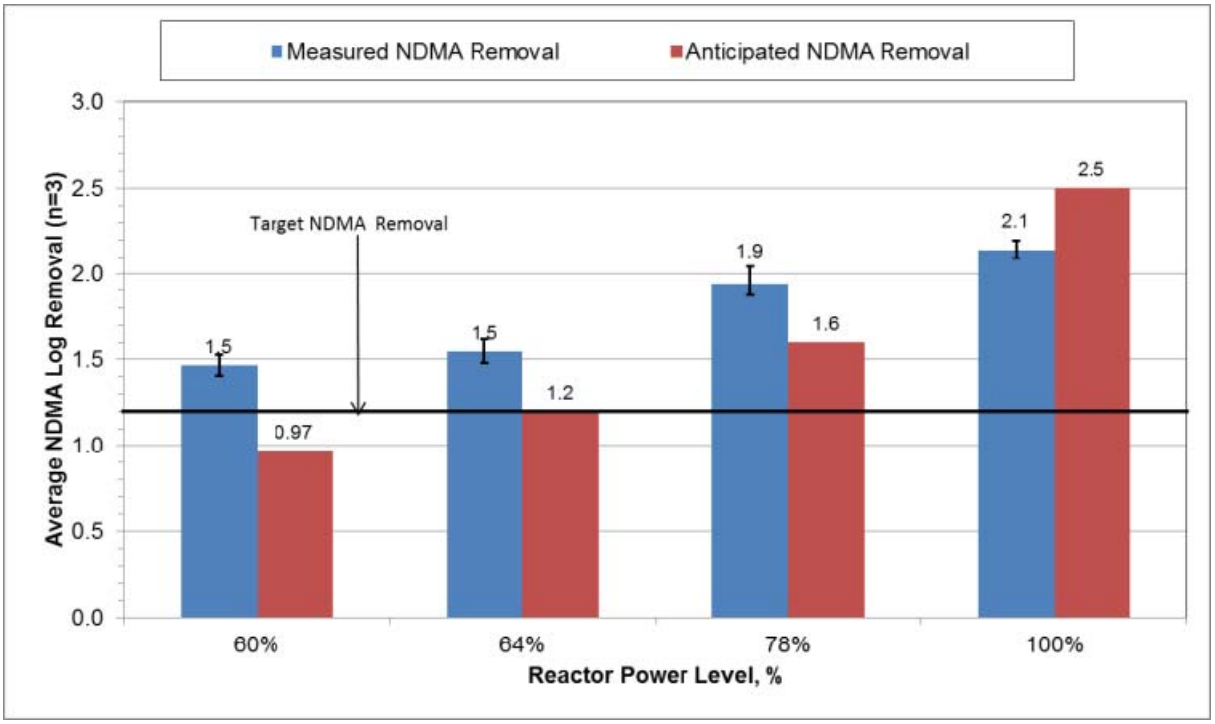
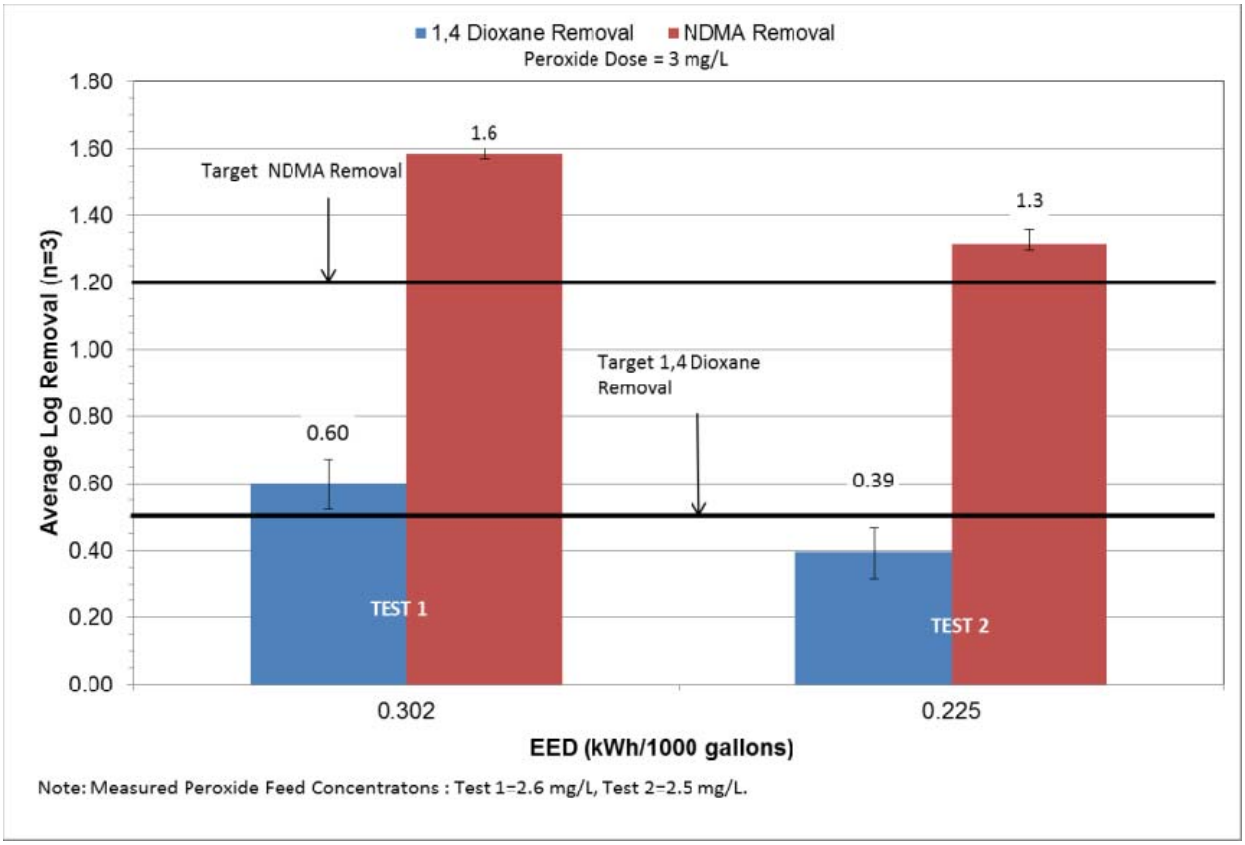


Figure 13 Spiking Experiment Set Up



Note: Log removal values were calculated as ($-LOG_{10}$(OUT/IN)) based on concentrations of IN and OUT samples provided in Table 7.

Figure 14 Trojan UV/AOP NDMA Spiking Experiment No. 1Results



Note: Log removal values were calculated as ($-LOG_{10}$(OUT/IN)) based on concentrations of IN and OUT samples provided in Table 10.

Figure 15 Trojan UV/AOP 1,4 Dioxane Spiking Experiment No. 2Results

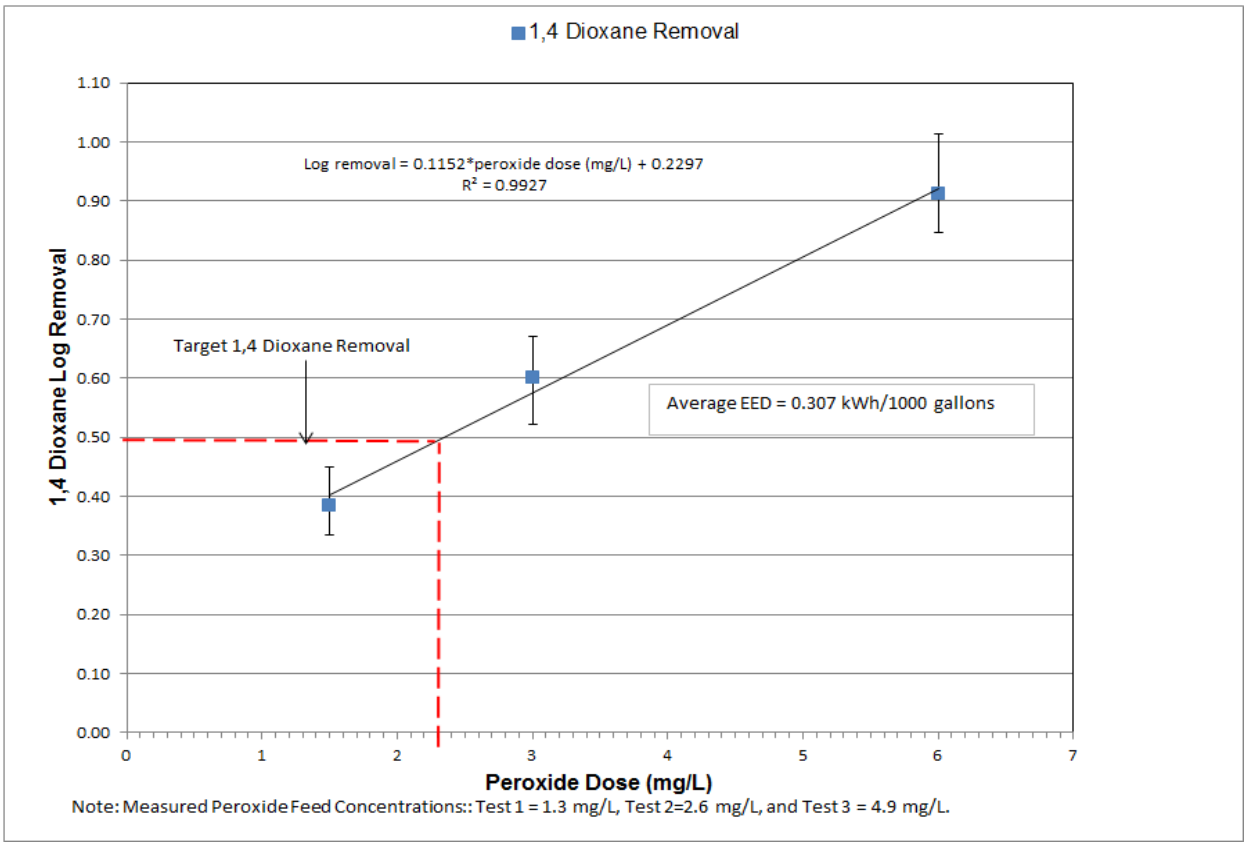


Figure 16 Trojan UV/AOP 1,4 Dioxane Spiking Experiment 2 LRV vs. Target Peroxide Dose

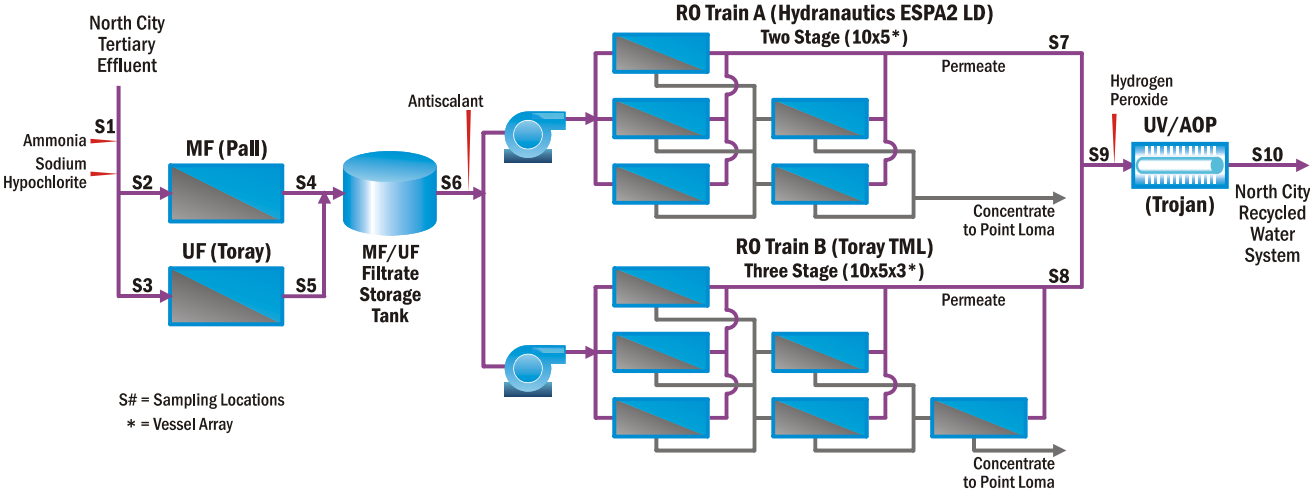


Figure 17 AWP Facility Process Schematic (S# indicates sampling location)

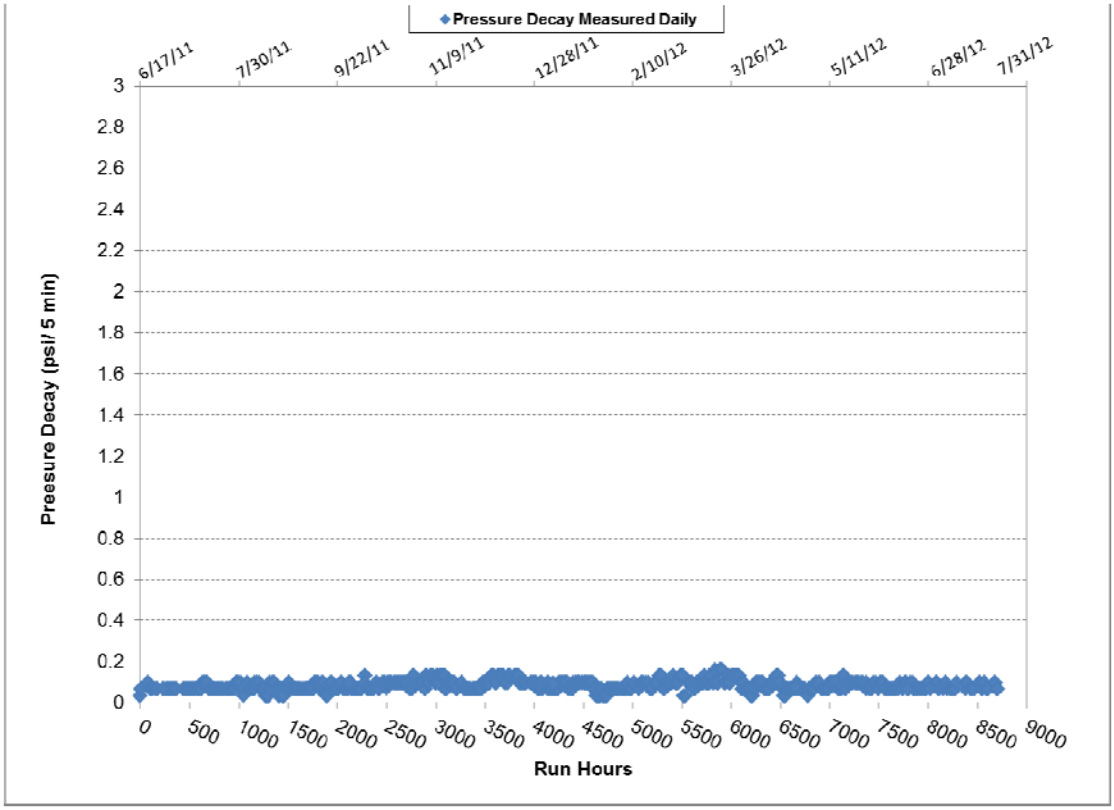


Figure 18 Pressure Decay Test (PDT) Values of the Pall Microfiltration System

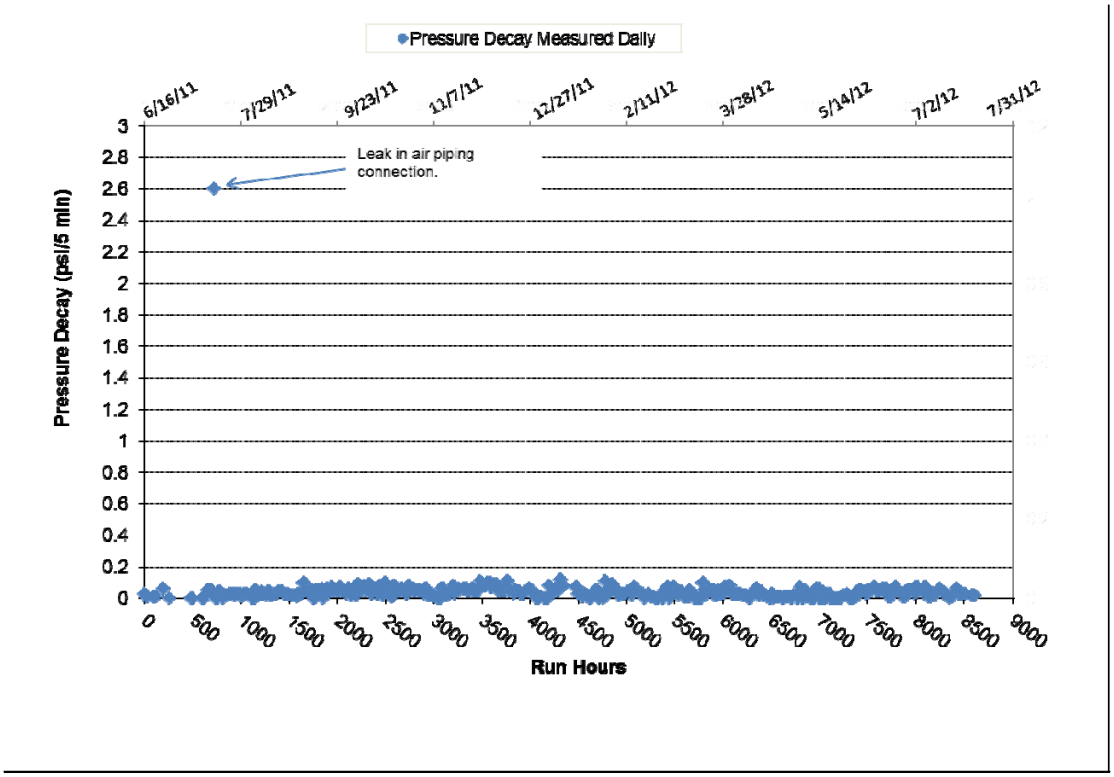


Figure 19 Pressure Decay Test (PDT) Values of the Toray Ultrafiltration System

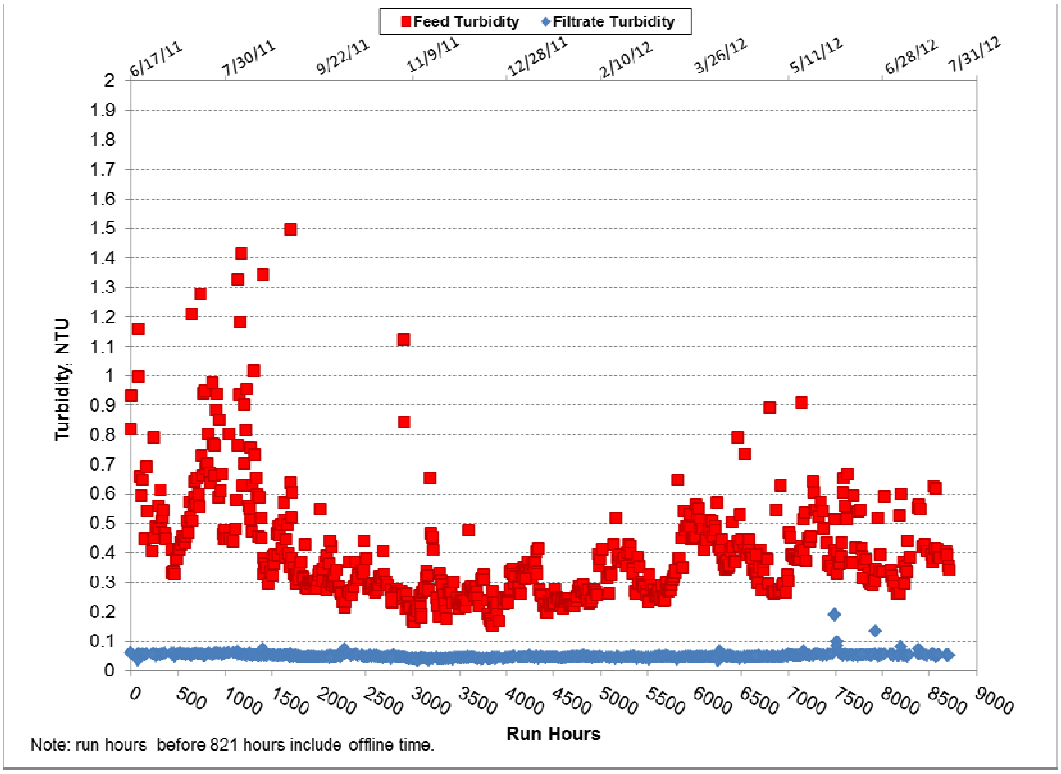


Figure 20 Turbidity Profile of the Pall Microfiltration System

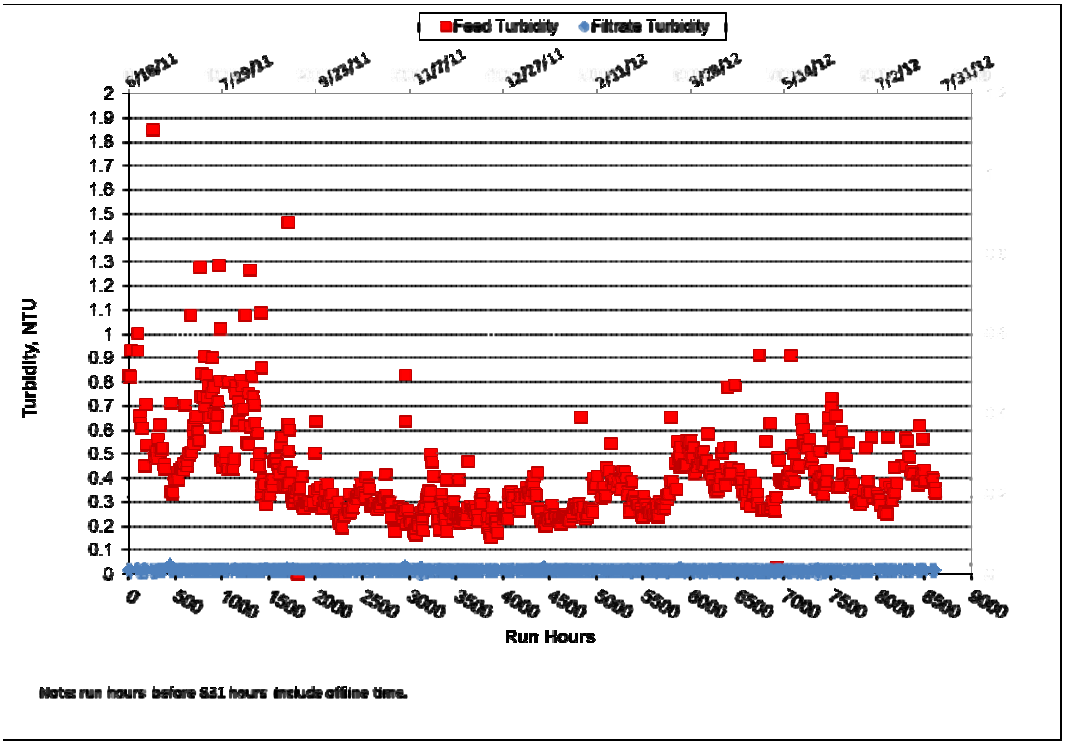


Figure 21 Turbidity Profile of the Toray Ultrafiltration System

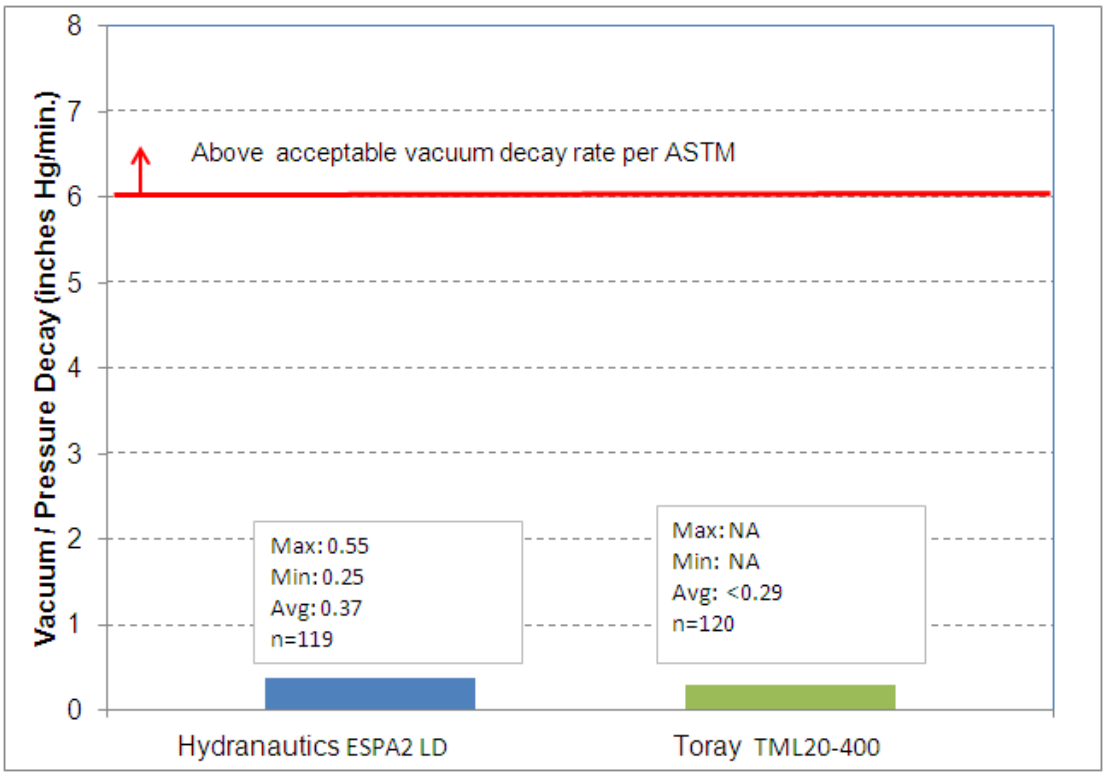


Figure 22 Pre-delivery RO Element Pressure / Vacuum Decay Test Results

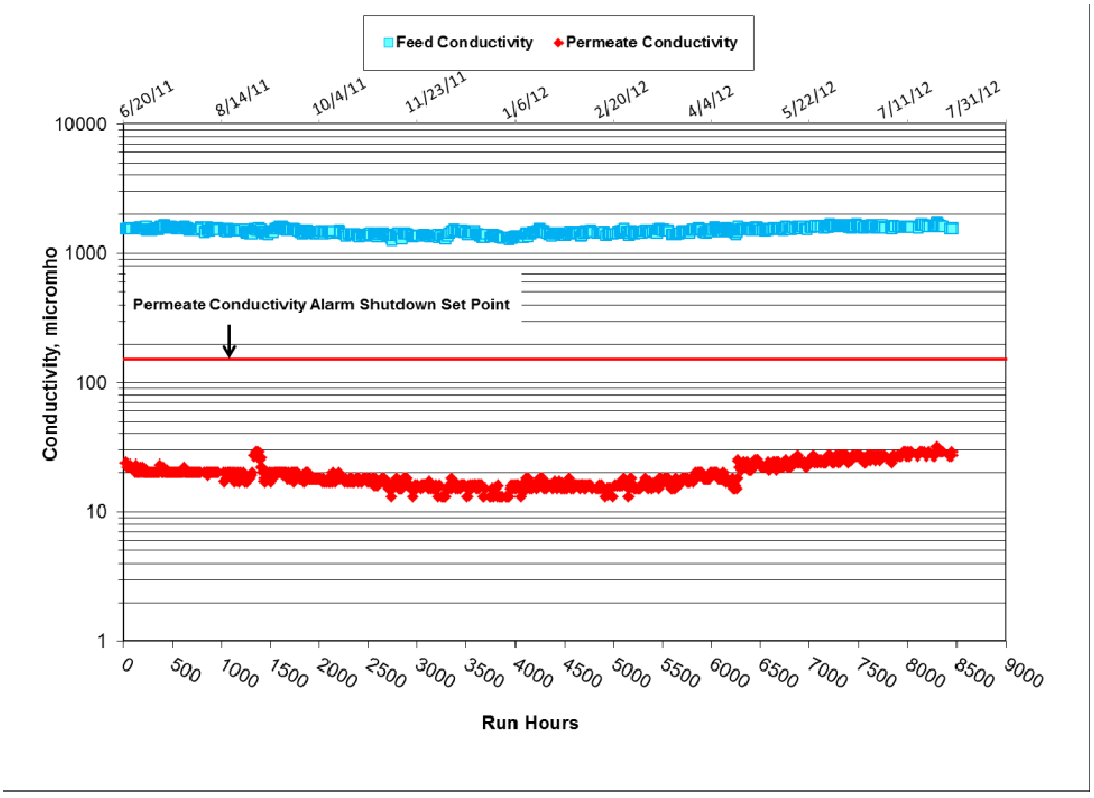


Figure 23 Conductivity Profile of the Hydranautics ESPA2 LD RO Membrane System

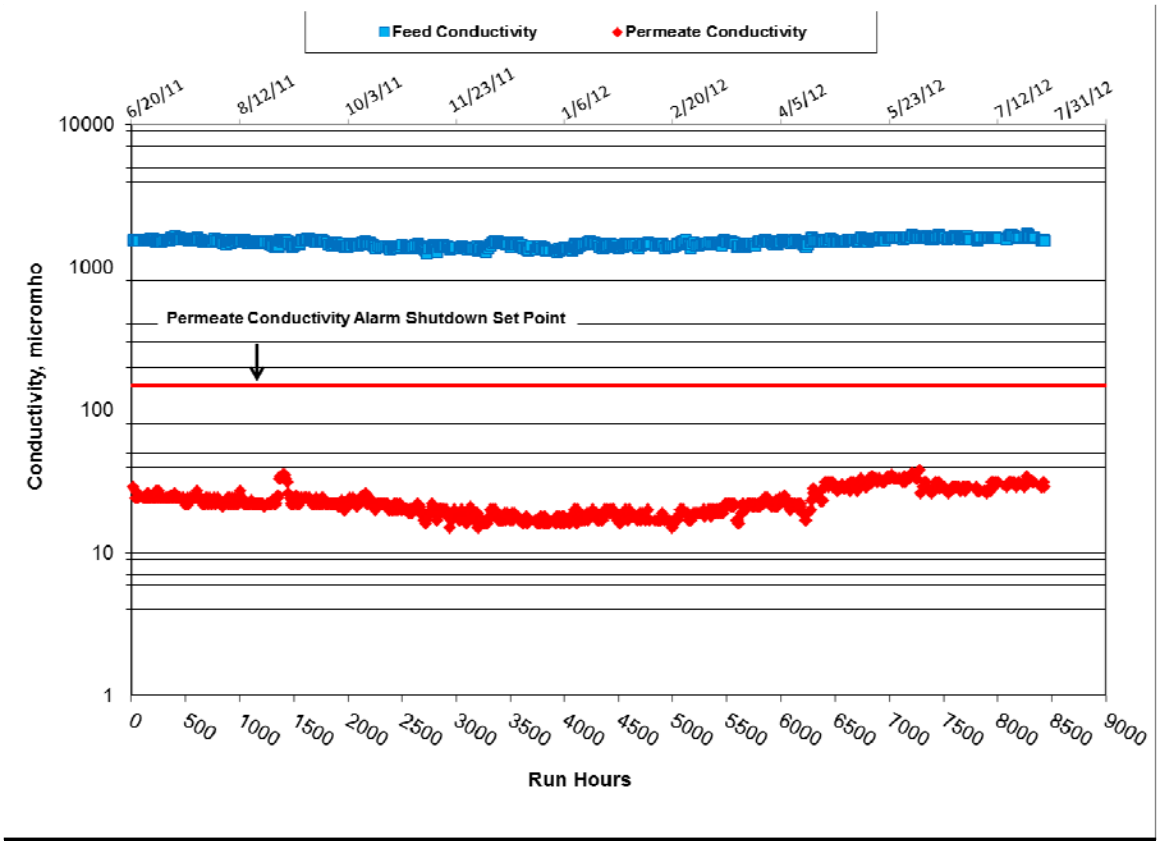


Figure 24 Conductivity Profile of the Toray TML RO Membrane System

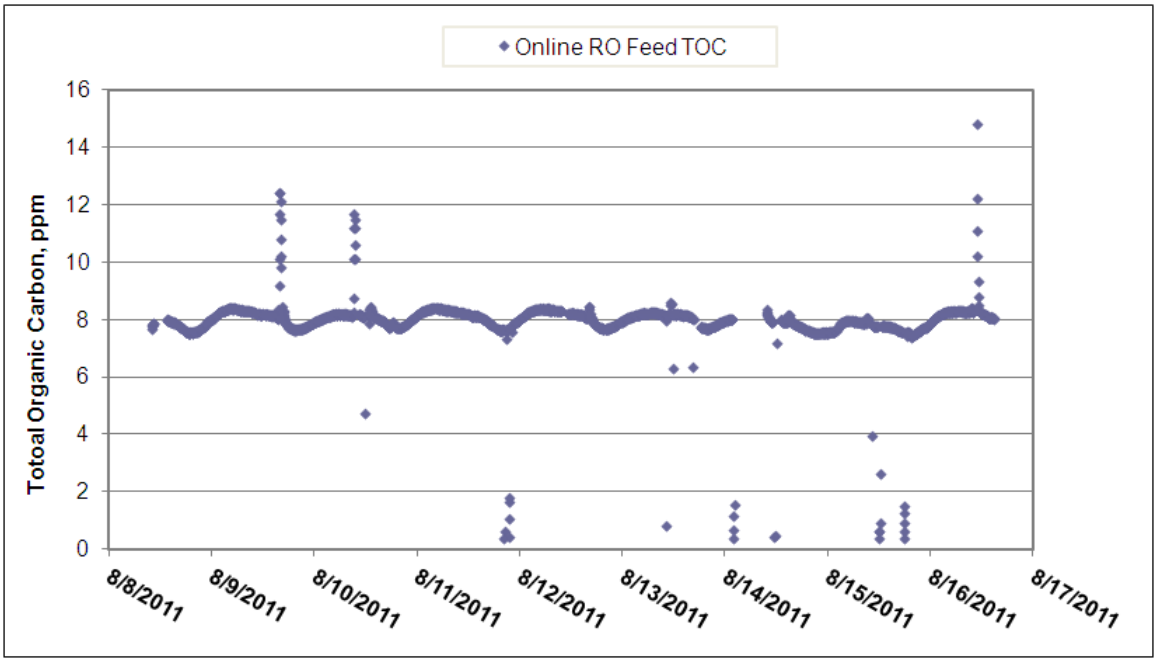
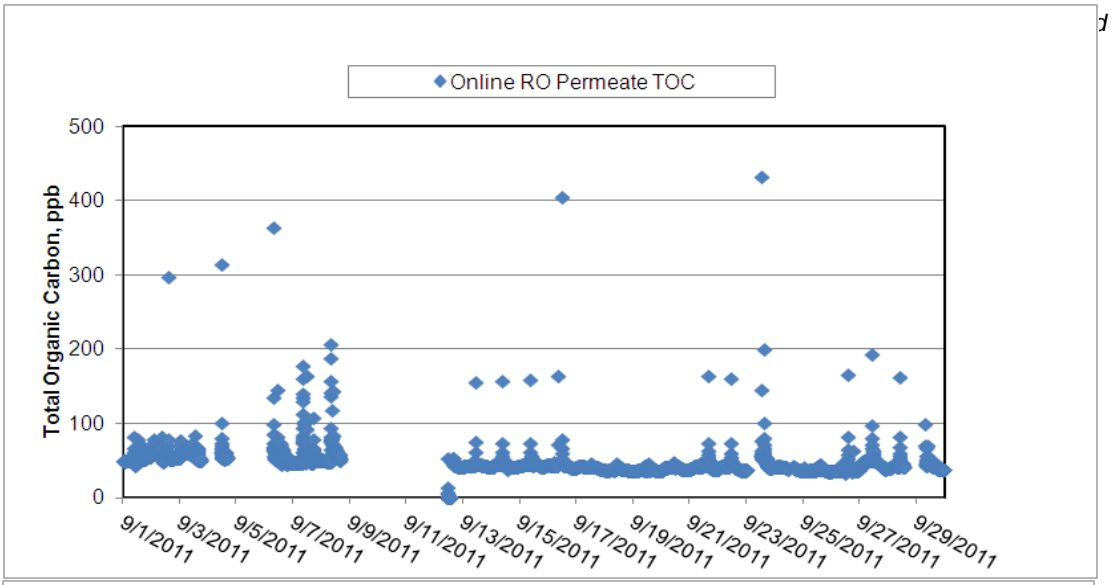
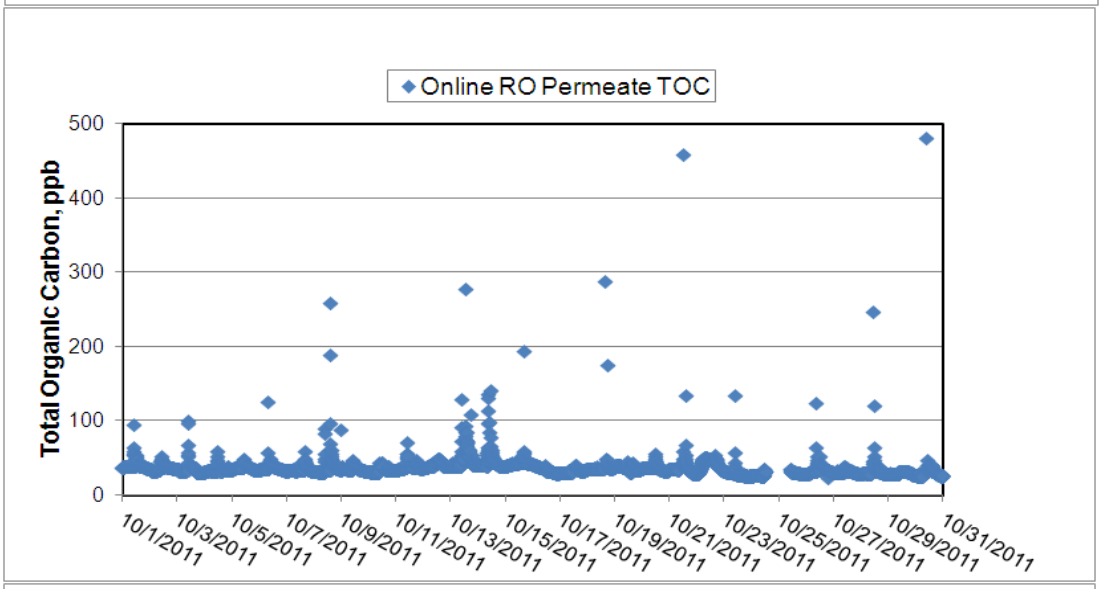


Figure 25 Online TOC Monitoring Results of RO Feed during Q1 Testing Period





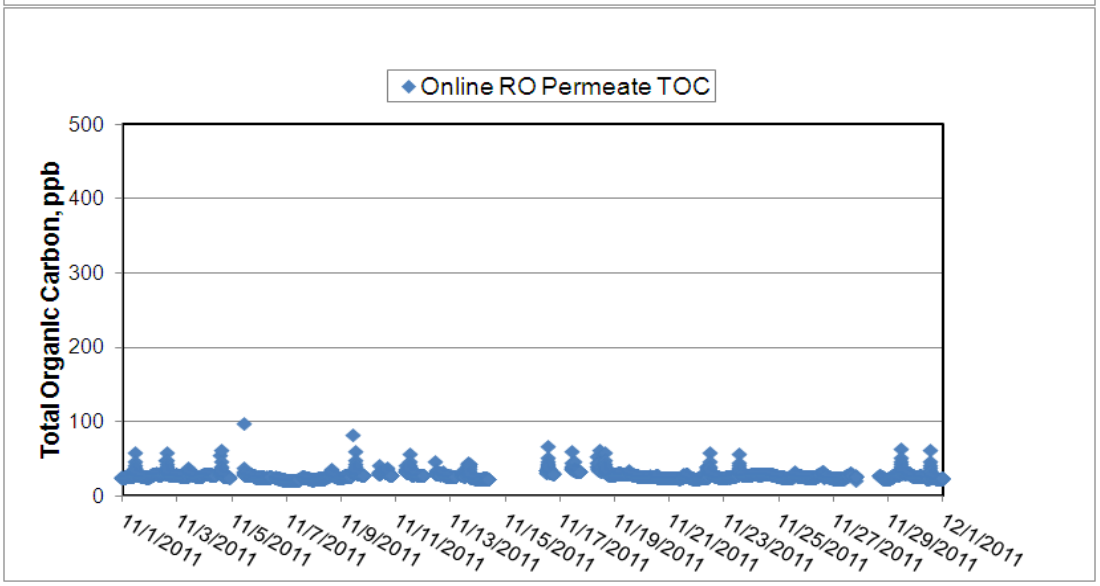


Figure 26 Online TOC Monitoring Results of RO Permeate

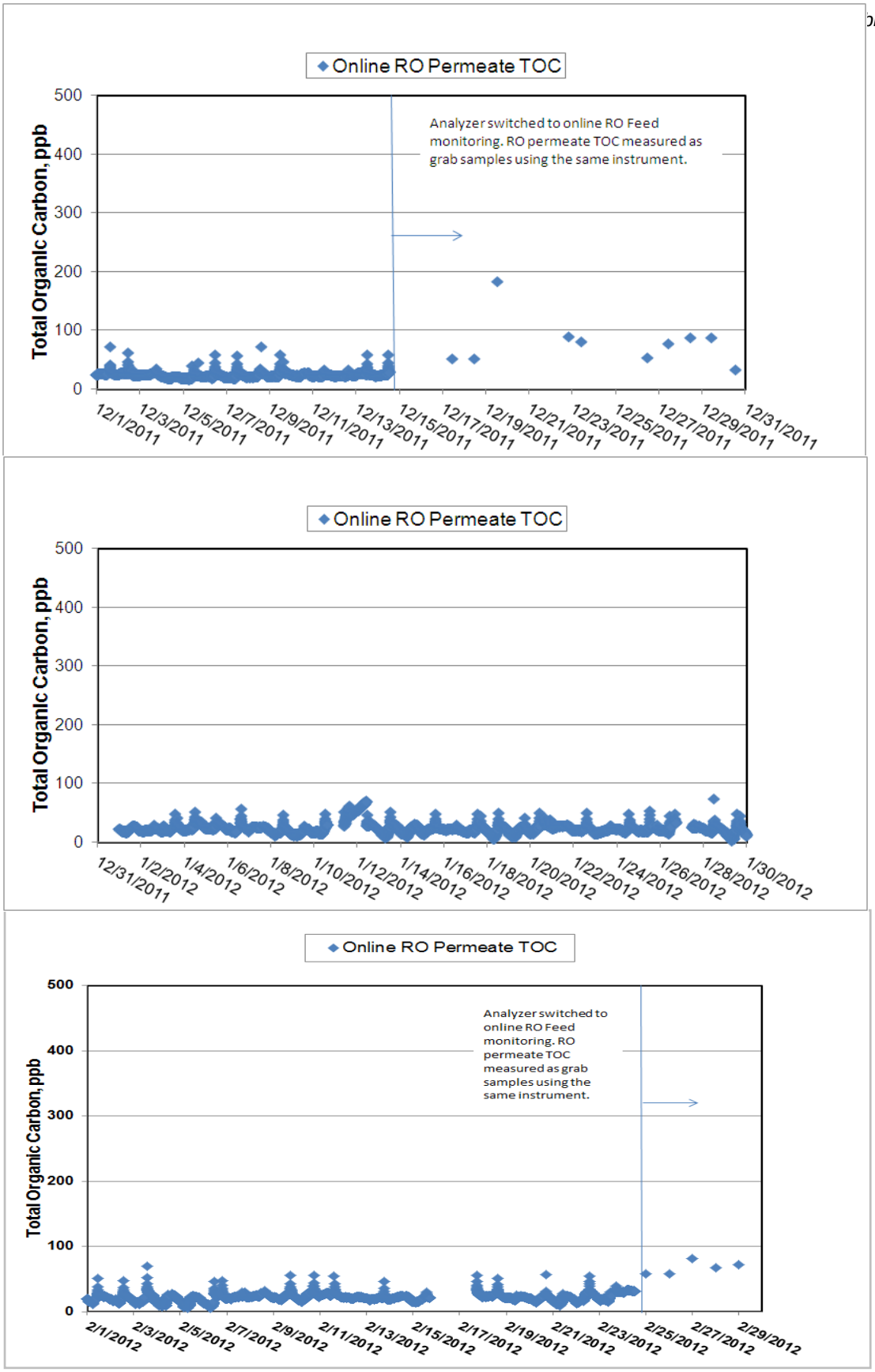


Figure 26 Online TOC Monitoring Results of RO Permeate (Cont.)

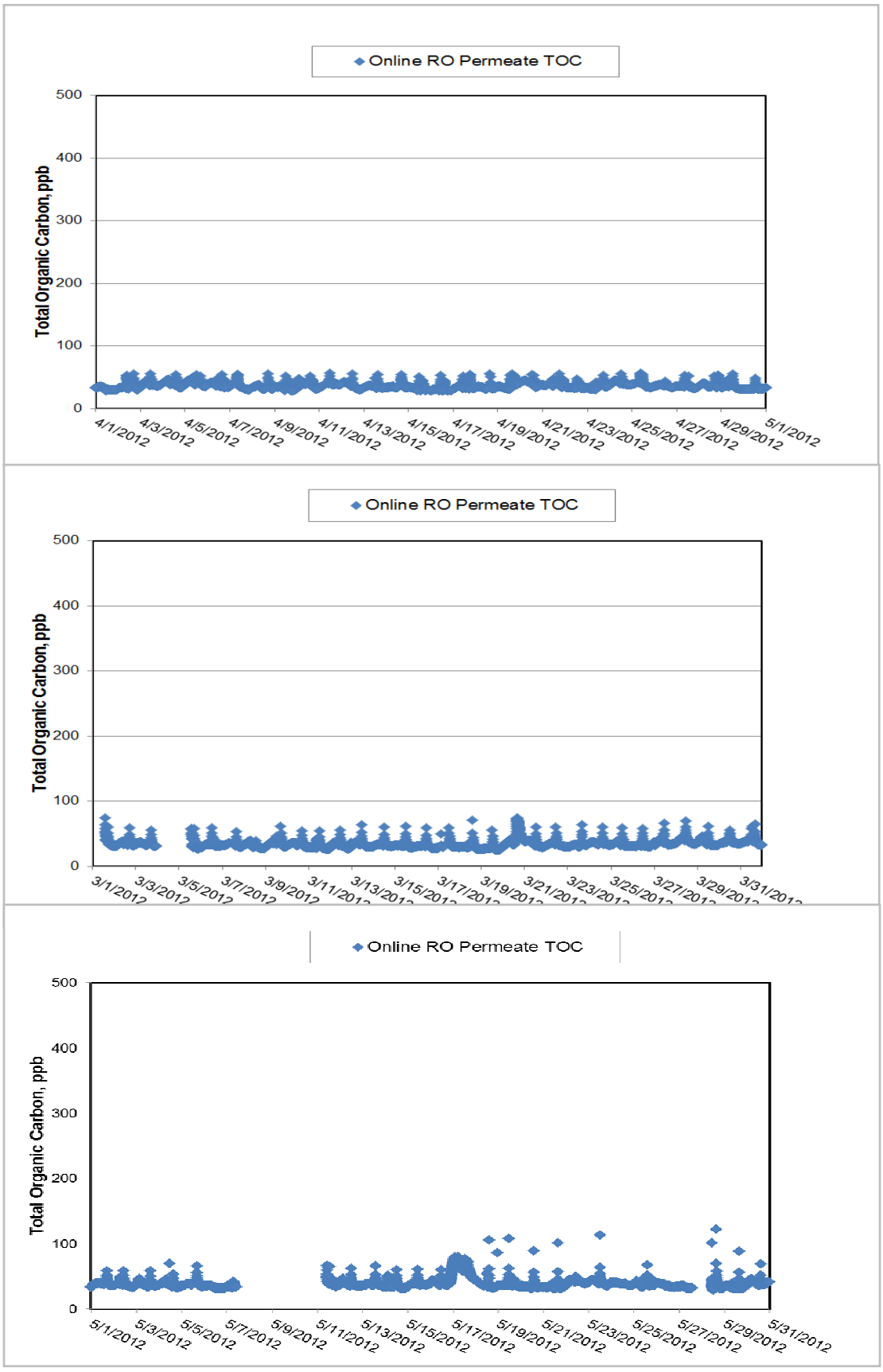


Figure 26 Online TOC Monitoring Results of RO Permeate (Cont.)

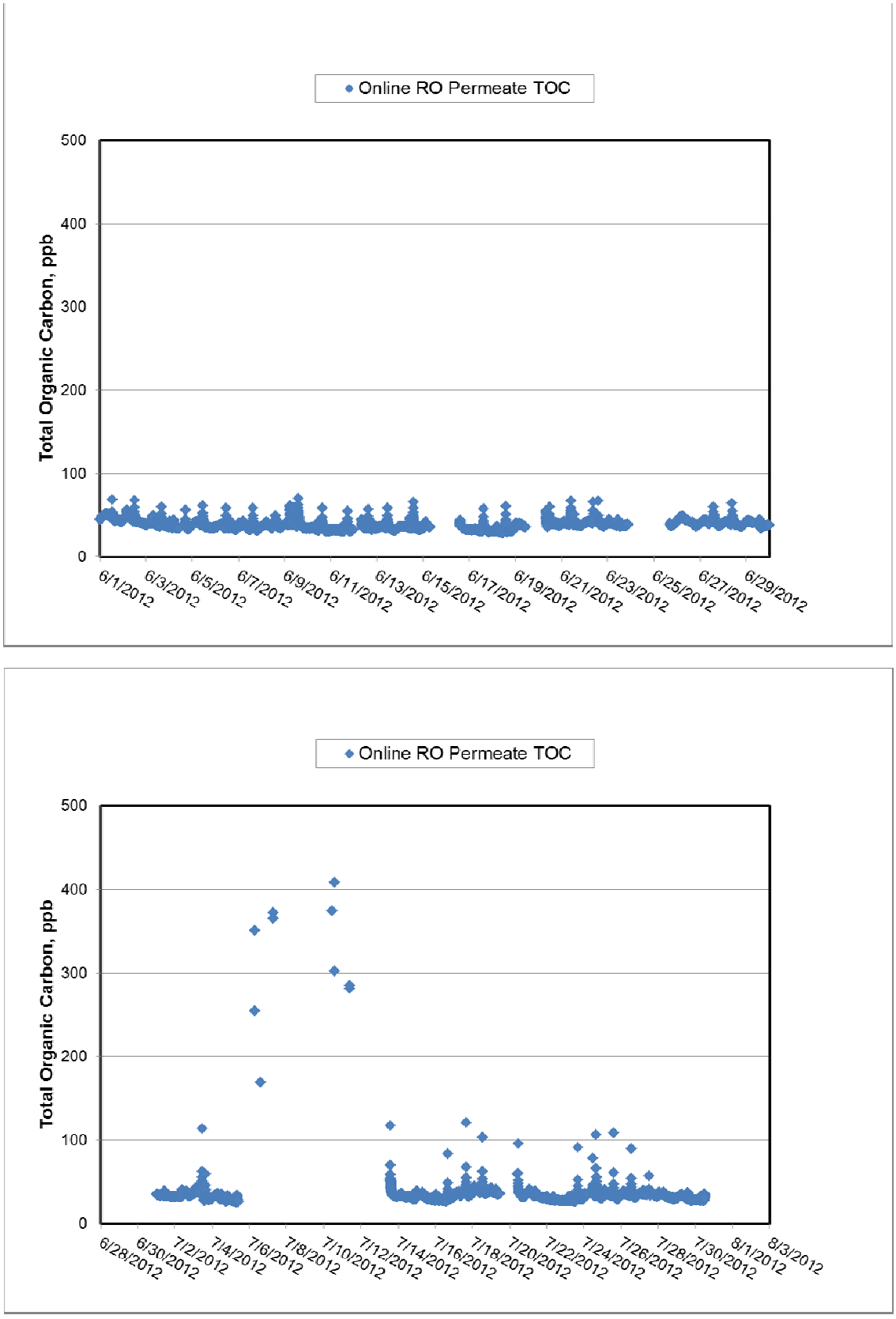


Figure 26 Online TOC Monitoring Results of RO Permeate (Cont.)

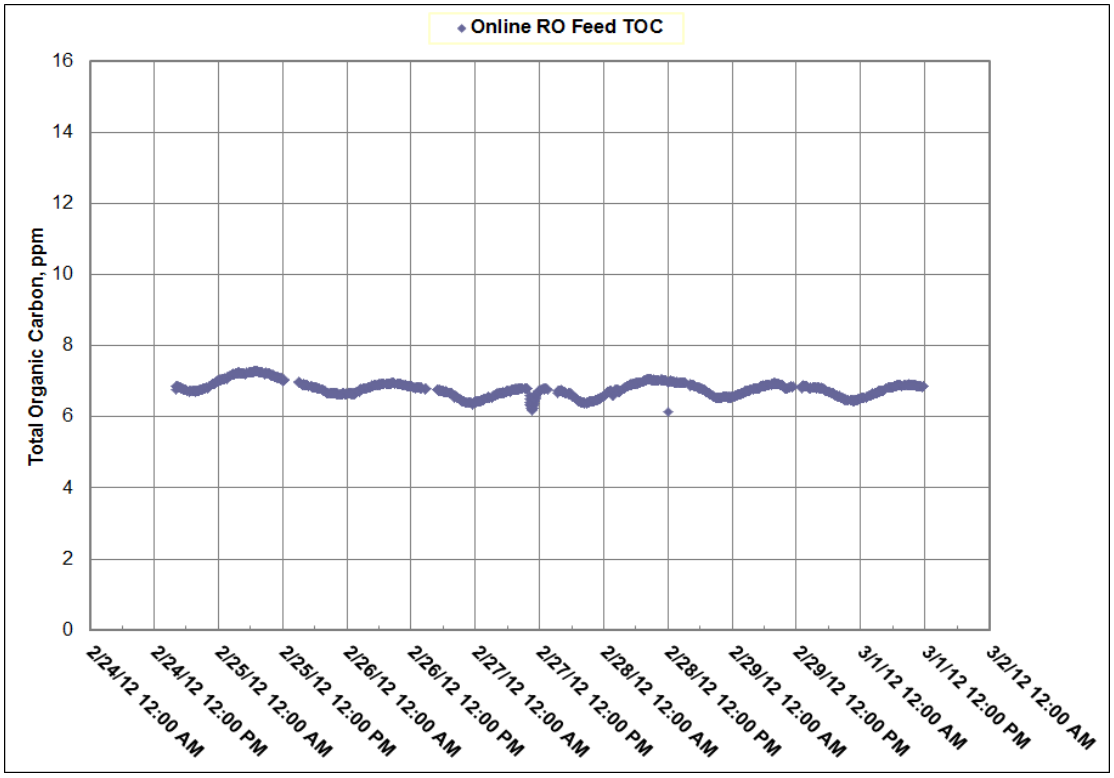


Figure 27 Online TOC Monitoring Results of RO Feed during Q3 Testing Period

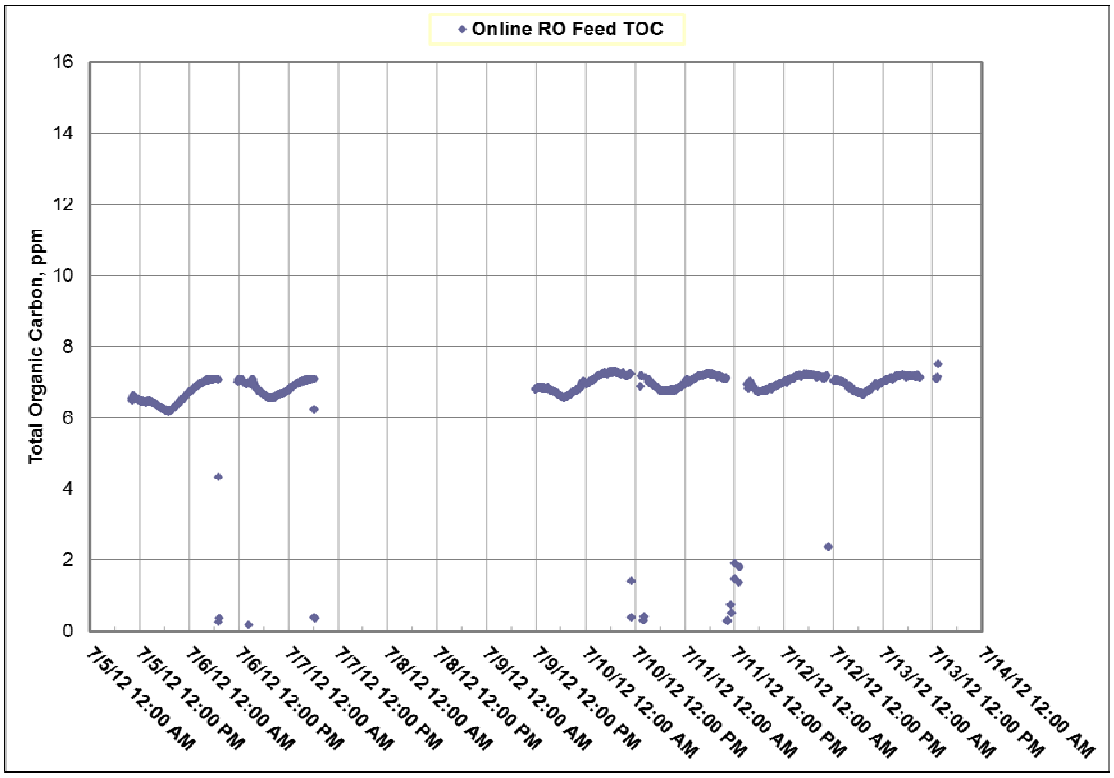


Figure 28 Online TOC Monitoring Results of RO Feed during Q4 Testing Period

Appendix A

Final Report: Toxicity Testing Results for the City of San Diego Water Purification Demonstration Project.

Nautilus Environmental

Toxicity Testing Results for the City of San Diego Water Purification Demonstration Project – Advanced Water Purification Facility (AWPF)

Monitoring Period: November 2011

Prepared for:	**MWH Americas, Inc.** **9444 Farnham Street, Ste. 300** **San Diego, CA 92117**
Test Laboratory:	**Nautilus Environmental** **4340 Vandever Avenue** **San Diego, CA 92120**
Submitted:	**December 16, 2011**

Data Quality Assurance:

- **Nautilus Environmental is a state certified laboratory under the California Department of Health Services – Environmental Laboratory Accreditation Program (ELAP), Certificate No. 1802.**
- **All test results included in this report have met internal Quality Assurance requirements, as well as all minimum acceptability criteria required by the EPA protocols. Any deviations have been noted in the report.**
- **All data have been reviewed and verified.**

Results Verified By: Steve Carlson **Date:** 12-16-11

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4340 Vandever Ave.
San Diego, CA 92120
858-587-7333
fax: 858-587-3961

British Columbia
8664 Commerce Court
Burnaby, British Columbia
V5A 4N7
604-603-9381
fax: 604-603-9381

nautilusenvironmental.com

Sample Information

Client:	MWH Americas, Inc.
Project Name:	City of San Diego Water Purification Demonstration Project – Advanced Water Purification Facility (AWPF)
Sample Collection Dates:	11/14/11, 07:20; 11/16/11, 08:50; and 11/18/11, 07:19
Sample Receipt Dates:	11/14/11, 10:55; 11/16/11, 09:25; and 11/18/11, 09:00
Sample/Test Material:	UV/advanced oxidized product (UV/AOP) water
Aqueduct/Dilution Water:	Grab sample from Lake Murray water
Sample Mixture:	The UV/AOP water was mixed with the aqueduct water to achieve a hardness of 50 mg/L. This mixture ended up being a ratio of 67% UV/AOP and 33% Aqueduct. This mixture represented the 100% sample tested.
Sample Treatment:	Prior to testing, the pH of the sample mixture was raised to approximately 8.5 by adding Sodium Hydroxide (NaOH). Then, Sodium Thiosulfate (STS) was added to remove any residual chlorine or peroxide.
Sample Receipt WQ Parameters:	Summarized in Table 1 (see Appendix C for details).
Mixture/Treatment Process:	Summarized in Table 2 (see Appendix C for details).

Table 1. Water Quality Parameters Measured upon Sample Receipt

WQ Parameters	Lake Murray Aqueduct	Sample A (11/14/11)	Sample B (11/16/11)	Sample C (11/18/11)
Nautilus Log No.	11-0952	11-0951	11-0960	11-0976
Receipt Temperature (°C)	13.8	13.5	20.6	15.6
Dissolved Oxygen (mg/L)	9.3	9.8	6.5	8.9
pH	8.00	5.68	5.61	5.27
Conductivity (µS/cm)	684	19	20	23
Alkalinity (mg/L $CaCO_3$)	95	<1	3	3
Hardness (mg/L $CaCO_3$)	170	<1	1	7
Total Chlorine (mg/L)*	0.06	0.57	0.70	0.53

* Total chlorine was measured with a HACH colorimetric meter. Therefore, readings could have picked up peroxide or other interferences, in addition to true chlorine measurements. Information provided by the client suggests that each of the A, B, and C samples contained approximately 3.0 mg/L peroxide.

Table 2. Mixture and Sample Treatment WQ Measurements

Mixing & WQ Parameters	Sample A (10/31/11)	Sample B (11/2/11)	Sample C (11/4/11)
Mixture Percentage of Aqueduct Water	33%	33%	33%
Mixture Percentage of UV/AOP Water	67%	67%	67%
Final Hardness of Mixture (mg/L)	51	52	53
Initial pH of Mixture	7.07	7.04	7.12
Final pH (after adjusting with NaOH)	8.48	8.40	8.47
Dissolved Oxygen (mg/L)	8.9	9.0	8.7
Conductivity (µS/cm)	302	294	283
Alkalinity (mg/L)	39	38	43
Total Dissolved Solids (mg/L)	145	141	131
Initial Free Chlorine (mg/L)	0.18	0.04	0.14
Final Free Chlorine (after treating with STS)*	0.02	0.02	0.03

* The STS added to the sample should have removed any residual chlorine or peroxide.

All Test Procedures

Test Concentrations:	Sample Water, Lab Control, and Reference Control
Sample Water:	Final mixture of UV/AOP water (67%) + Aqueduct water (33%)
Lab Control Water:	EPA moderately hard mineral water (20% diluted)
Reference Control Water:	Deionized water (67%) mixed with Aqueduct water (33%)
Protocols Used:	EPA/821/R-02/013 (2002) Chronic Manual EPA/821/R-02/012 (2002) Acute Manual
Statistical Analysis Software:	CETIS, version 1.8.0.12

Chronic Water Flea Test Specifications

Test Start Date, Time:	11/15/11, 15:25
Test End Date, Time:	11/22/11, 14:45
Test Organism:	*Ceriodaphnia dubia* (water flea)
Test Organism Source; Age:	In-house culture; < 24 hr
Test Acceptability Criteria:	Mean control survival ≥ 80%; mean number of offspring ≥ 15 per surviving adult female; and 60% or more of the surviving control females must produce three broods.

Chronic Larval Fish Test Specifications

Test Start Date, Time:	11/15/11, 15:25
Test End Date, Time:	11/22/11, 15:15
Test Organism:	*Pimephales promelas* (fathead minnow)
Test Organism Source; Age:	Aquatic Biosystems (Fort Collins, CO); 1 day
Test Acceptability Criteria:	Mean control survival ≥ 80% Mean control biomass ≥ 0.25 mg

Chronic Green Algae Test Specifications

Test Start Date, Time:	11/17/11, 16:35
Test End Date, Time:	11/21/11, 14:50
Test Organism:	*Selenastrum capricornutum* (green algae)
Test Organism Source; Age:	In-house Culture; 7 days old
Nutrient Addition:	A macro- and micronutrient solution was added to all sample concentrations to ensure any observed decreases in algal growth was due to toxic constituents present in the sample rather than a nutrient deficiency.
Sample Filtering:	The sample was 0.45- µm filtered prior to testing, per protocol. This is done to remove any native algae that might compete for lighting and nutrients. The unfiltered sample is also tested concurrently for comparison purposes.
Test Acceptability Criteria:	Mean control density of ≥ 1×10^6 cells/ml, and ≤ 20% variability among control replicates (CV)

Acute Water Flea Test Specifications

Test Start Date, Time:	11/15/11, 15:20
Test End Date, Time:	11/19/11, 13:45
Test Organism:	*Ceriodaphnia dubia* (water flea)
Test Organism Source; Age:	In-house culture; < 24 hr
Test Acceptability Criteria:	Mean control survival ≥ 90%

Acute Larval Fish Test Specifications

Test Start Date, Time:	11/15/11, 15:20
Test End Date, Time:	11/19/11, 14:00
Test Organism:	*Pimephales promelas* (fathead minnow)
Test Organism Source; Age:	Aquatic Biosystems (Fort Collins, CO); 10 days old
Test Acceptability Criteria:	Mean control survival ≥ 90%

Results

A summary of the statistical results are presented in Table 3, while the test data are summarized in Tables 4 and 5. In general, there was no toxicity observed in the sample with any of the acute or chronic tests performed. However, there was a statistically significant 7% decrease in the chronic fathead minnow growth endpoint, when compared to the lab control. This was not deemed as biologically relevant since it was outside the acceptable range of sensitivity (see QA section). Moreover, there was no significant difference in growth compared to the reference control (DI and Aqueduct water). Thus, there is no evidence that the sample was associated with any adverse effects.

Interestingly, the only significant effect observed during this round of testing was between the reference control and the lab control with the chronic water flea reproduction endpoint. There was a 33% decrease in reproduction found in the reference control when compared to the lab control. It is not clear whether this decrease is the result of an interaction between the deionized water and the aqueduct water, a contamination issue with the deionized water or the dilution cup used in preparing this concentration, or an intrinsic response to the aqueduct water itself. However, no adverse effects were observed with the actual sample (i.e. mixture of UV/AOP and Aqueduct water) being tested. Thus, the no observed effect concentration (NOEC) is reported as 100% sample for all acute and chronic tests performed. Raw data and statistical analyses for the chronic toxicity tests are presented in Appendix A, and the acute toxicity tests are presented in Appendix B. Sample receipt information and chain-of-custody forms can be found in Appendices C and D, respectively.

Table 3. Summary of Statistical Results for the UV/AOP Sample

Species & Endpoint	NOEC (% effluent)	LOEC (% effluent)	Toxic Units
Water Flea:			
96-hr Acute Survival	100	>100	0.41
Chronic Survival	100	>100	1.0
Chronic Reproduction	100	>100	1.0
Fathead minnow:			
96-hr Acute Survival	100	>100	0.0
Chronic Survival	100	>100	1.0
Chronic Growth (biomass)	100	>100	1.0
Green algae:			
Chronic Growth (cell density)	100	>100	1.0

NOEC = the highest Concentration tested that results in No Observed Effect
LOEC = the Lowest Observed Effect Concentration (the next concentration higher than the NOEC)
Acute Toxic Units (TU_a) = Log (100 - %survival) ÷ 1.7
Chronic Toxic Units (TU_c) = 100 ÷ NOEC

Table 4. Summary of Chronic Toxicity Test Results

Test Concentration (%)	Fathead Minnow		Water flea		Green algae
	Chronic Survival (%)	Chronic Biomass (mg)	Chronic Survival (%)	Mean No. of Offspring	Chronic Cell Density (10^6 cells/ml)
Lab Control	95.0	0.307	100	27.3	3.26
Reference	97.5	0.287 *	90	18.4 *	3.32
Sample	92.5	0.285 *	100	26.7	3.23 [a]

* An asterisk indicates a statistically significant difference compared to the lab control (see QA section)
[a] The results for the filtered sample is reported above. The cell density in the unfiltered sample was 3.26 x 10^6 cells/ml.

Table 5. Summary of Acute Toxicity Test Results

Test Concentration (%)	Fathead Minnow	Water flea
	Chronic Survival (%)	Chronic Survival (%)
Lab Control	95	100
Reference	100	100
Sample	100	95

Quality Assurance/Quality Control

All samples were received the same day as collected, and were immediately placed in cold storage until used in testing. All tests were initiated within the required 36-hour holding time. There were no deviations to the test protocol procedures, and the lab control for each test performed met the minimum acceptability criteria. Therefore, all test results were deemed valid for reporting purposes.

The chronic fathead minnow test had some unusual statistical results. The survival and mean growth data met test acceptability criteria. However, the percent minimum significant difference (PMSD) value was only 5.0%, which is below the test acceptability criteria. Due to low replicate variability, the power to detect a statistical difference for this test was greater than typical. The PMSD value, which is a measure of test sensitivity, was less than the lower 10^{th} percentile value determined by EPA for the fathead minnow test during a nationwide inter-laboratory variability study (EPA 2000 and 2002). This lower bound is used as guidance to appropriately address small differences not likely to be biologically meaningful when statistical power is greater than typical. If the PMSD for a test is below the lower limit, and the difference in biological response in a sample concentration relative to that in the control is less than the PMSD lower bound, then this difference is not considered statistically significant. The difference between fathead growth in the lab control and UV/AOP sample was only 7.0%, which is below the lower PMSD bound of 12%. Thus, this difference is not considered statistically significant according to EPA (2002), and this is deemed a false-positive test result. Therefore, this test result is being reported as no observed effect in the sample (NOEC = 100%).

A similar result occurred in the chronic *Selenastrum* algae test. The PMSD value for the test was only 5.0%, and the acceptable range is between 9.1% and 29%. Thus, we had very tight data again with the *Selenastrum* test. However, with this set of data there was less than a 3.0% difference between the sample and the lab control, and it did not result in being statistically significant. Therefore, the PMSD value does not apply in this case.

References

USEPA. 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System. United States Environmental Protection Agency Office of Wastewater Management (EPA-833-R-00-003).

USEPA. 2002. Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Pages 51-52, section 10.2.8.2.5. Fourth Edition. United States Environmental Protection Agency Office of Water, Washington DC (EPA-821-R-02-013).

Appendix A

Chronic Test Data & Statistical Analyses

Chronic Water Flea

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — Nautilus Environmental (CA)

Batch ID:	01-5082-4520	Test Type:	Reproduction-Survival (7d)	Analyst:	
Start Date:	15 Nov-11 15:25	Protocol:	EPA/821/R-02-013 (2002)	Diluent:	Diluted Mineral Water (8:2)
Ending Date:	22 Nov-11 14:45	Species:	Ceriodaphnia dubia	Brine:	Not Applicable
Duration:	6d 23h	Source:	In-House Culture	Age:	<24h

Sample ID:	13-3622-2924	Code:	11-0951	Client:	MWH Labs
Sample Date:	14 Nov-11 07:20	Material:	~~POTW~~ Effluent	Project:	
Receive Date:	14 Nov-11 10:55	Source:	MWH Labs		
Sample Age:	32h	Station:	SD AWPF		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
16-0378-0972	7d Survival Rate	100	>100	N/A	N/A	1	Fisher Exact Test
12-5459-5171	Reproduction	100	>100	N/A	14.9%	1	Wilcoxon Rank Sum Two-Sample Test

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
16-0378-0972	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
12-5459-5171	Reproduction	Control Resp	27.3	15 - NL	Yes	Passes Acceptability Criteria
12-5459-5171	Reproduction	PMSD	0.1493	0.13 - 0.47	Yes	Passes Acceptability Criteria

7d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	10	0.9	0.7819	1	0	1	0.1	0.3162	35.14%	0.0%
0	Lab Control	10	1	1	1	1	1	0	0	0.0%	-11.11%
100		9	1	1	1	1	1	0	0	0.0%	-11.11%

Reproduction Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	10	18.4	14.27	22.53	0	34	3.493	11.05	60.04%	0.0%
0	Lab Control	10	27.3	25.49	29.11	15	32	1.535	4.855	17.78%	-48.37%
100		9	26.67	24.66	28.67	14	33	1.787	5.362	20.11%	-44.93%

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Rec. Water	1	1	1	1	0	1	1	1	1	1
0	Lab Control	1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1		1	1	1	1

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Rec. Water	24	33	34	19	0	16	8	26	9	15
0	Lab Control	31	31	28	15	29	29	32	26	26	26
100		26	30	28	24	28		29	33	14	28

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental (CA)**

Analysis ID:	16-0378-0972	**Endpoint:** 7d Survival Rate	**CETIS Version:** CETISv1.8.0
Analyzed:	02 Dec-11 13:58	**Analysis:** Single 2x2 Contingency Table	**Official Results:** Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result
Untransformed		C > T	Not Run	Sample passes 7d survival rate endpoint

Fisher Exact Test

Control	vs	Conc-%	Test Stat	P-Value	Decision(0.05)
Lab Control		100	1	1.0000	Non-Significant Effect

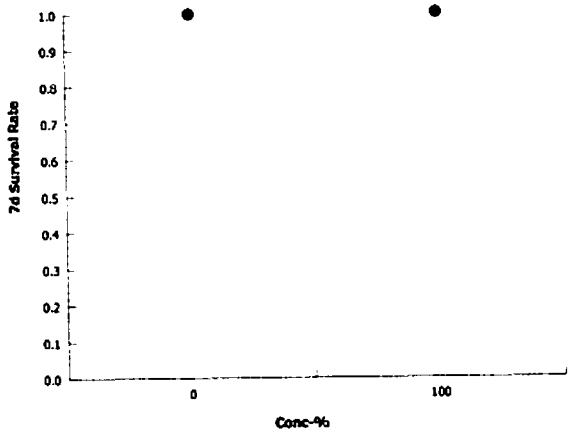
Data Summary

Conc-%	Control Type	No-Resp	Resp	Total
0	Lab Control	10	0	10
100		9	0	9

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Lab Control	1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — Nautilus Environmental (CA)

Analysis ID:	12-5459-5171	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.0
Analyzed:	02 Dec-11 13:58	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes reproduction endpoint	14.9%

Wilcoxon Rank Sum Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
Lab Control		100	85		17	3	0.3598	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.9	1.9	1	0.07306	0.7902	Non-Significant Effect
Error	442.1	26.00588	17			
Total	444	27.90588	18			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.22	6.693	0.7681	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7993	0.8605	0.0011	Non-normal Distribution

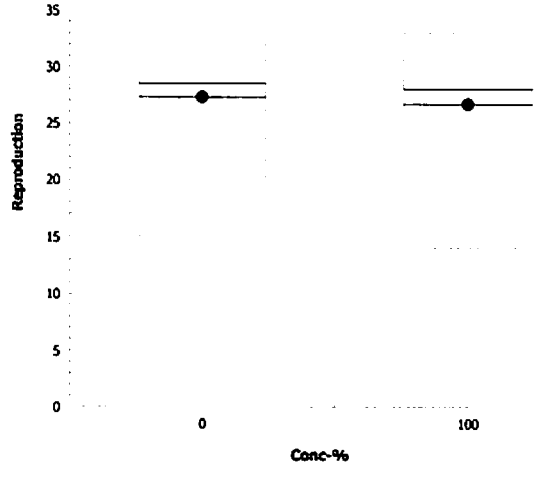
Reproduction Summary

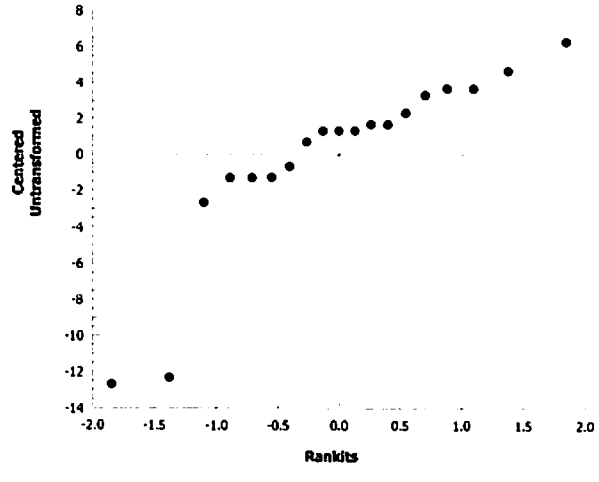
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	10	27.3	25.45	29.15	15	32	1.535	4.855	17.78%	0.0%
100		9	26.67	24.63	28.71	14	33	1.787	5.362	20.11%	2.32%

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Lab Control	31	31	28	15	29	29	32	26	26	26
100		26	30	28	24	28	29	33	14	28	

Graphics





CETIS Analytical Report (Lab Control vs Reference Control)

Nautilus Environmental (CA)

Ceriodaphnia 7-d Survival and Reproduction Test

Analysis ID: 10-6389-5593 Endpoint: Reproduction CETIS Version: CETISv1.8.0
Analyzed: 02 Dec-11 13:59 Analysis: Parametric-Two Sample Official Results: Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample fails reproduction endpoint	24.2%

Equal Variance t Two-Sample Test

Control	vs	Control	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Lab Control		Rec. Water	2.332	1.734	18	6.617	0.0157	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	396.05	396.05	1	5.44	0.0315	Significant Effect
Error	1310.5	72.80556	18			
Total	1706.55	468.8555	19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.179	6.541	0.0223	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.962	0.866	0.5845	Normal Distribution

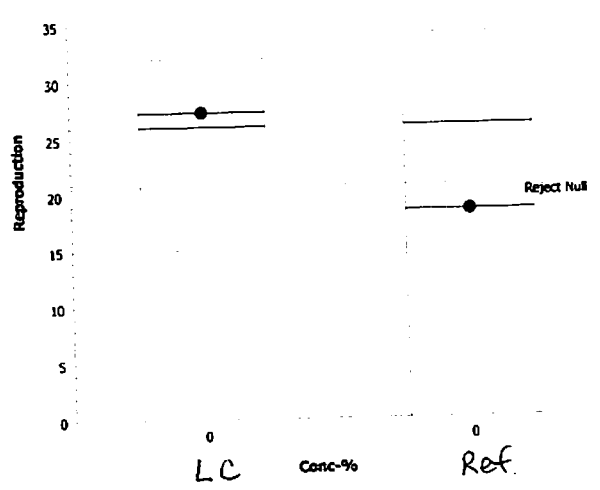
Reproduction Summary

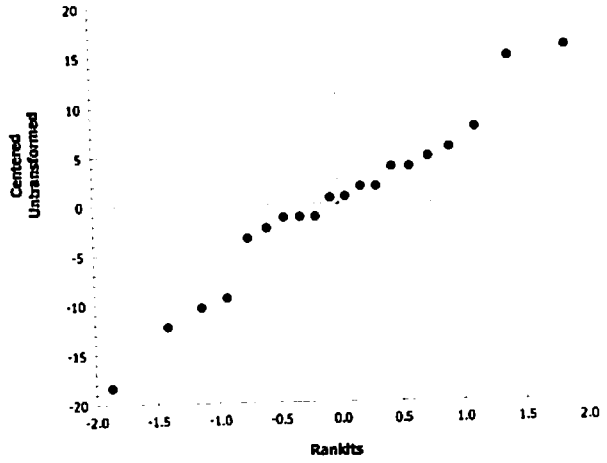
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	10	18.4	14.2	22.6	0	34	3.493	11.05	60.04%	0.0%
0	Lab Control	10	27.3	25.45	29.15	15	32	1.535	4.855	17.78%	-48.37%

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Lab Control	31	31	28	15	29	29	32	26	26	26
0	Rec. Water	24	33	34	19	0	16	8	26	9	15

Graphics





Freshwater Chronic Bioassay

Daphnid Survival and Reproduction Datasheet

Test Species: ***C. dubia***

Client/Sample ID: MWH / Effluent

Test Number: 1111-5169

Start Date/Time: 11/15/2011 1525

End Date/Time: 11/22/2011 1445

Conc.	Rep	Rand #	Daily Reproduction/ Survival 1	2	3	4	5	6	7	8	Total	QC
LC	1	8	0	0	5	0	11	15	0		31	
	2	29	0	0	4	0	11	11	16/B		31	
	3	26	0	0	0	4	9	0	15		28	
	4	14	0	0	0	4	11	0	0		15	
	5	5	0	0	0	6	10	0	13		29	
	6	27	0	0	0	3	10	0	16		29	
	7	21	0	0	4	0	10	0	18		32	
	8	6	0	0	0	4	7	0	15		26	
	9	11	0	0	0	4	11	0	11		26	11
	10	3	0	0	0	3	9	0	14		26	
		Tech:	JF	JF	AD	AD	JG	AD	JW			AD

Conc.	Rep	Rand #	Daily Reproduction/ Survival 1	2	3	4	5	6	7	8	Total	QC
~~100~~ ~~10000%~~	1	25	0	0	0	5	8	0	13		26	
	2	15	0	0	5	0	11	14	0		30	
	3	10	0	0	6	0	10	12	12/B		28	12
	4	24	0	0	0	0	11	13	0		24	
	5	2	0	0	0	4	11	0	13		28	
	6	20	0	0	LIP	—	—	—	—		LIP	ES
	7	1	0	0	2	0	8	19	0		29	
	8	19	0	0	0	6	11	16	0		33	
	9	4	0	0	0	0	4	0	10		14	
	10	17	0	0	0	3	10	0	15		28	

Conc.	Rep	Rand #	Daily Reproduction/ Survival 1	2	3	4	5	6	7	8	Total	QC
RC	1	12	0	0	0	0	4	4	16		24	
	2	16	0	0	5	0	12	16	0		33	
	3	23	0	0	0	6	11	17	0		34	
	4	13	0	0	0	3	3	13	0		19	
	5	22	0/d	—	—	—	—	—	—		0/d	
	6	28	0	0	0	0	5	0	11		16	
	7	9	0	0	0	0	2	0	0		8	
	8	7	0	0	0	6	9	11	0		26	
	9	18	0	0	0	5	0	0	4		9	
	10	30	0	0	0	0	6	0	9		15	8

Neonates for each replicate were blocked across concentrations at test initiation

Rep:	1	2	3	4	5	6	7	8	9	10
Board:	57									→
Cup:	43	44	47	48	50	53	54	57	58	60

Initiated By: JF **Verified By:** JP

Time Fed/Test Solution Renewed (day):
(0) 1525 (1) 1400 (2) 1245 (3) 1230 (4) 1335 (5) 1350 (6) 1225 (7) _____

Notes: d = dead; M = male; LIP = lost in progress; B = 4th brood (only the first 3 broods are included in total)

QC Check: 11-1-11

Final Review: VL 12-14-11

Freshwater Chronic Bioassay **Water Quality Measurements**

Client: MWH Test Species: *C. dubia*

Sample ID: ~~RO Treated~~ Effluent Start Date/Time: 11/15/2011 1525

Test No: 1111-5169 End Date/Time: 11/22/2011 1445

Concentration	Lab Control							
Day	0	1	2	3	4	5	6	7
	Initial							
pH	8.27	8.23	8.04	8.29	8.22	8.26	8.26	
DO (mg/L)	7.4	8.3	8.5	8.0	7.7	8.3	7.6	
Cond. (µmhos/cm)	193	190	195	194	193	200	196	
Temp (°C)	25.2	24.8	24.7	24.4	25.2	25.8	24.8	
	Final							
pH		8.08	8.15	8.22	8.23	8.20	8.25	8.12
DO (mg/L)		8.0	8.0	8.3	7.8	8.3	8.7	8.0
Temp (°C)		25.0	24.7	24.1	24.0	25.1	24.2	24.3

Concentration	100%							
Day	0	1	2	3	4	5	6	7
	Initial							
pH	8.56	8.54	8.40	8.48	8.51	8.40	8.45	
DO (mg/L)	8.8	8.0	9.0	8.0	8.5	8.9	8.9	
Cond. (µmhos/cm)	303	302	294	301	255	221	283	
Temp (°C)	25.2	25.7	26.0	25.8	25.4	25.9	25.0	
	Final							
pH		8.00	8.00	8.00	7.90	7.96	~~8.01~~ 8.06	7.97 7.87
DO (mg/L)		7.9	7.9	8.3	7.7	8.2	8.8	8.0
Temp (°C)		25.0	24.7	24.1	24.0	25.1	24.2	24.3

Concentration	Reference Control							
Day	0	1	2	3	4	5	6	7
			8.43	Initial				
pH	8.41	8.56	~~8.27~~	8.32	8.48	8.40	8.52	
DO (mg/L)	7.7	8.1	~~8.8~~ 8.6	8.1	8.4	8.9	9.0	
Cond. (µmhos/cm)	260	248	~~257~~ 251	251	303	247	259	
Temp (°C)	25.7	24.9	24.9	24.5	25.4	25.8	25.3	
	Final							
pH		7.89	7.90	7.90	7.98	7.86	7.93	7.82
DO (mg/L)		8.0	8.0	8.3	7.9	8.0	8.7	8.2
Temp (°C)		25.0	24.7	24.1	24.0	25.1	24.2	24.3

	0	1	2	3	4	5	6	7
Analysts: Initial:	JVV	JF	ES/JF	ES	ES	SL	ES	
Final:		JVV	JF	AD	AD	SL	AO	LN
Dilutions made by:	JF/PA	JV/JP	JF/PA	AD/ES	JF	JG	JP	
Sample Used (A, B, C):	A	A	B	B	B	C	C	

Comments:

Animal Source/Date Received: Internal / NA Animal Age at Initiation: <24 hours

Sample Log-In Numbers: A: 11-0951 B: 11-0960 C: 11-0976

QC Check: 12-1-11 Final Review: KL 12-14-11

Chronic Fathead minnow

CETIS Summary Report

Report Date: 02 Dec-11 14:20 (p 1 of 1)
Test Code: 1111-S170 | 09-6925-3834

Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental (CA)

Batch ID:	08-5879-3857	Test Type:	Growth-Survival (7d)	Analyst:	
Start Date:	15 Nov-11 15:25	Protocol:	EPA/821/R-02-013 (2002)	~~Diluent~~ Control:	Diluted Mineral Water (8:2)
Ending Date:	22 Nov-11 15:15	Species:	Pimephales promelas	Brine:	Not Applicable
Duration:	7d	Source:	Aquatic Biosystems, CO	Age:	1d

Sample ID:	07-7437-1488	Code:	11-0951	Client:	MWH Labs
Sample Date:	14 Nov-11 07:20	Material:	~~Groundwater~~ Effluent Sample	Project:	
Receive Date:	14 Nov-11 10:55	Source:	MWH Labs		
Sample Age:	32h	Station:	SD AWPF		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
06-6625-6678	7d Survival Rate	100	>100	N/A	13.9%	1	Equal Variance t Two-Sample Test
16-3753-6868	Mean Dry Biomass-mg	100 ~~<100~~	>100	N/A	4.97%	~~>1~~ 1	Equal Variance t Two-Sample Test

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
06-6625-6678	7d Survival Rate	Control Resp	0.95	0.8 - NL	Yes	Passes Acceptability Criteria
16-3753-6868	Mean Dry Biomass-mg	Control Resp	0.3065	0.25 - NL	Yes	Passes Acceptability Criteria
16-3753-6868	Mean Dry Biomass-mg	PMSD	0.04971	0.12 - 0.3	Yes	Below Acceptability Criteria*

7d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	0.975	0.9563	0.9937	0.9	1	0.025	0.05	5.13%	0.0%
0	Lab Control	4	0.95	0.9127	0.9873	0.8	1	0.05	0.1	10.53%	2.56%
100		4	0.925	0.8892	0.9608	0.8	1	0.04787	0.09574	10.35%	5.13%

Mean Dry Biomass-mg Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	0.287	0.2839	0.2901	0.276	0.296	0.004123	0.008246	2.87%	0.0%
0	Lab Control	4	0.3065	0.3013	0.3117	0.294	0.323	0.006958	0.01392	4.54%	-6.79%
100		4	0.2852	0.2826	0.2879	0.279	0.292	0.003614	0.007228	2.53%	0.61%

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Rec. Water	0.9	1	1	1
0	Lab Control	1	1	0.8	1
100		1	1	0.8	0.9

Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Rec. Water	0.288	0.276	0.288	0.296
0	Lab Control	0.323	0.296	0.313	0.294
100		0.292	0.279	0.291	0.279

*See QA section of report.

The PMSD value was only 5.0%, which is below the test acceptability range of 12–30%. This result indicates the data was very tight with low variability. This usually results in over-sensitive statistical results and leads to False Positive readings. If we look at the low bar of the PMSD acceptable range, which is 12%, we would need to see at least a 12% difference in growth to deem a result as being biologically relevant. In this case, there was less than a 7.0% difference, which we believe to be a False Positive result. Therefore, we are reporting this as no effect in the 100% sample.

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental (CA)

Analysis ID: 16-3753-6868 Endpoint: Mean Dry Biomass-mg CETIS Version: CETISv1.8.0
Analyzed: 02 Dec-11 14:18 Analysis: Parametric-Two Sample Official Results: Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample fails mean dry biomass-mg endpoint	4.97%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Lab Control		100*	2.71	1.943	6	0.01524	0.0175	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0009031296	0.0009031296	1	7.345	0.0351	Significant Effect
Error	0.0007377589	0.0001229598	6			
Total	0.001640889	0.001026089	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	3.707	47.47	0.3104	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9102	0.6451	0.3556	Normal Distribution

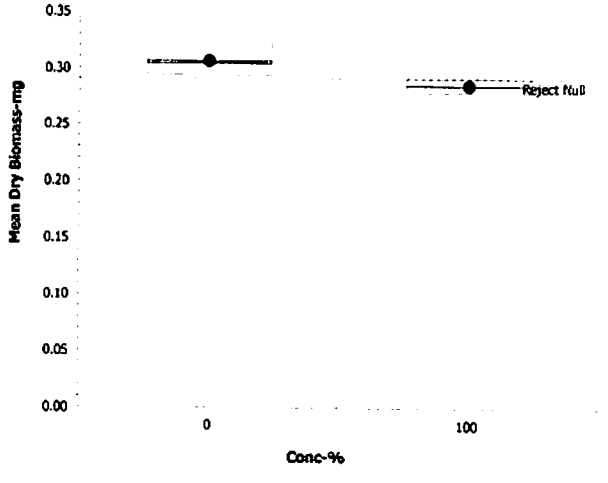
Mean Dry Biomass-mg Summary

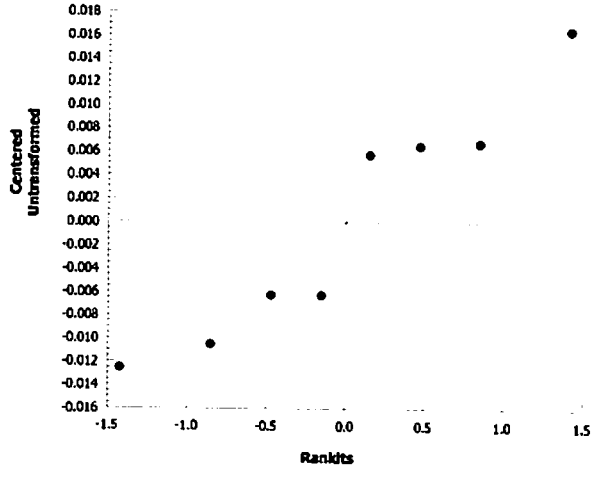
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	0.3065	0.3012	0.3118	0.294	0.323	0.006958	0.01392	4.54%	0.0%
100		4	0.2852	0.2825	0.288	0.279	0.292	0.003614	0.007228	2.53%	6.93%

Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Control	0.323	0.296	0.313	0.294
100		0.292	0.279	0.291	0.279

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental (CA)**

Analysis ID: 06-6625-6678 Endpoint: 7d Survival Rate CETIS Version: CETISv1.8.0
Analyzed: 02 Dec-11 14:17 Analysis: Parametric-Two Sample Official Results: Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 7d survival rate endpoint	13.9%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Lab Control		100	0.3848	1.943	6	0.2057	0.3568	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.003319917	0.003319917	1	0.1481	0.7136	Non-Significant Effect
Error	0.1344935	0.02241559	6			
Total	0.1378134	0.0257355	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.076	47.47	0.9534	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7948	0.6451	0.0252	Normal Distribution

7d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	0.95	0.912	0.988	0.8	1	0.05	0.1	10.53%	0.0%
100		4	0.925	0.8886	0.9614	0.8	1	0.04787	0.09574	10.35%	2.63%

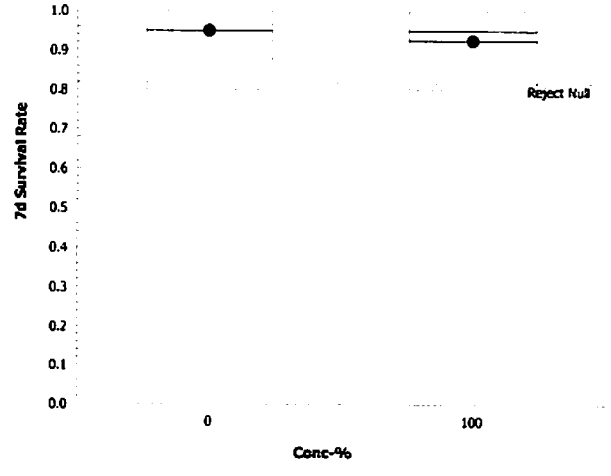
Angular (Corrected) Transformed Summary

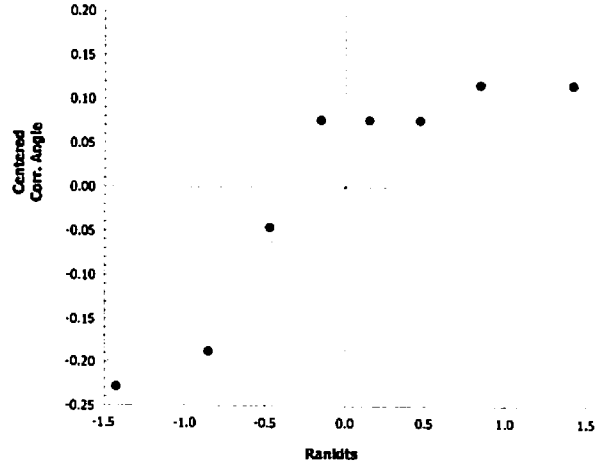
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	1.336	1.278	1.394	1.107	1.412	0.07622	0.1524	11.41%	0.0%
100		4	1.295	1.239	1.351	1.107	1.412	0.07348	0.147	11.35%	3.05%

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Control	1	1	0.8	1
100		1	1	0.8	0.9

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental (CA)

Analysis ID:	05-1519-7731	**Endpoint:** Mean Dry Biomass-mg	**CETIS Version:** CETISv1.8.0
Analyzed:	02 Dec-11 14:19	**Analysis:** Parametric-Two Sample	**Official Results:** Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample fails mean dry biomass-mg endpoint	5.13%

Equal Variance t Two-Sample Test

Control	vs	Control	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Lab Control		Rec. Water	2.411	1.943	6	0.01572	0.0263	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0007604932	0.0007604932	1	5.813	0.0525	Non-Significant Effect
Error	0.0007850142	0.0001308357	6			
Total	0.001545507	0.0008913289	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.848	47.47	0.4129	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9184	0.6451	0.4166	Normal Distribution

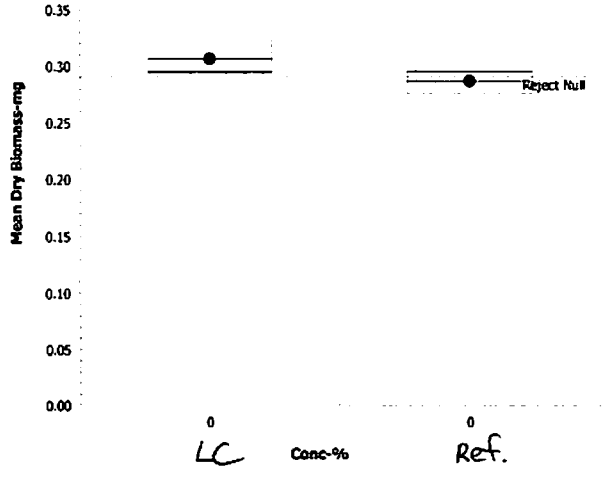
Mean Dry Biomass-mg Summary

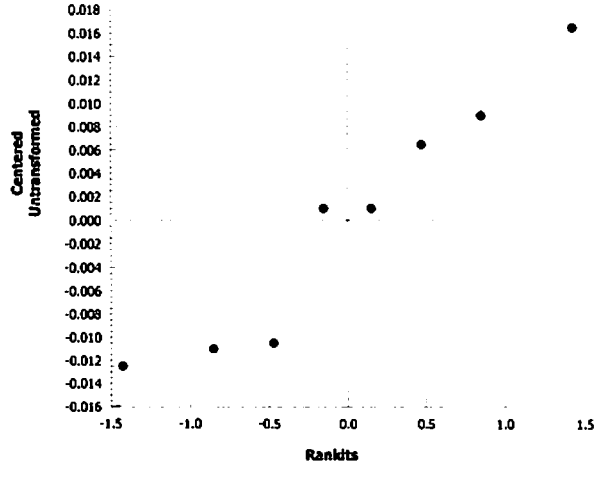
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	0.287	0.2839	0.2901	0.276	0.296	0.004123	0.008246	2.87%	0.0%
0	Lab Control	4	0.3065	0.3012	0.3118	0.294	0.323	0.006958	0.01392	4.54%	-6.79%

Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Control	0.323	0.296	0.313	0.294
0	Rec. Water	0.288	0.276	0.288	0.296

Graphics





CETIS Analytical Report (Reference Control vs 100% Sample)

Report Date: 02 Dec-11 14:20 (p 1 of 2)
Test Code: 1111-S170 | 09-6925-3834

Fathead Minnow 7-d Larval Survival and Growth Test — Nautilus Environmental (CA)

Analysis ID: 00-7707-0425 | Endpoint: Mean Dry Biomass-mg | CETIS Version: CETISv1.8.0
Analyzed: 02 Dec-11 14:19 | Analysis: Parametric-Two Sample | Official Results: Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes mean dry biomass-mg endpoin	8.71%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Rec. Water		100	0.3192	1.943	6	0.01065	0.3802	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6.12599E-06	6.12599E-06	1	0.1019	0.7604	Non-Significant Effect
Error	0.0003607558	6.012597E-05	6			
Total	0.0003668818	6.625196E-05	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.301	47.47	0.8337	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9298	0.6451	0.5141	Normal Distribution

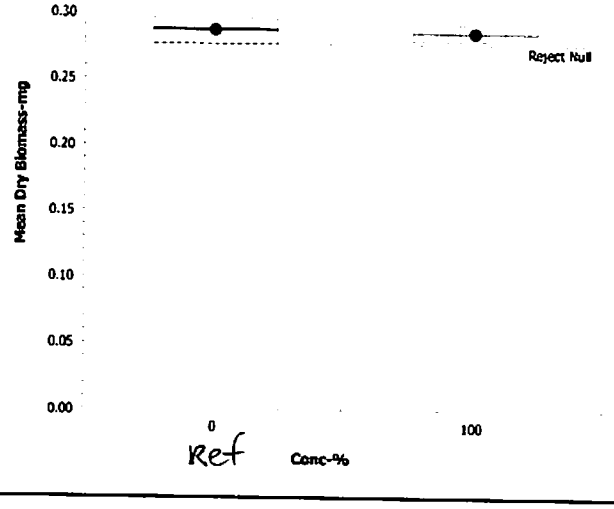
Mean Dry Biomass-mg Summary

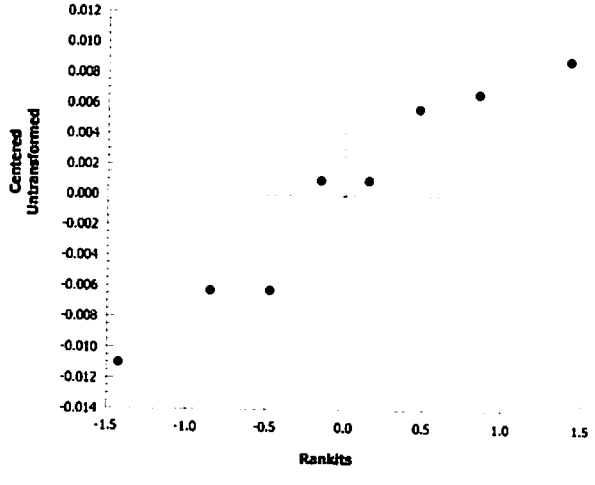
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	0.287	0.2839	0.2901	0.276	0.296	0.004123	0.008246	2.87%	0.0%
100		4	0.2852	0.2825	0.288	0.279	0.292	0.003614	0.007228	2.53%	0.61%

Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Rec. Water	0.288	0.276	0.288	0.296
100		0.292	0.279	0.291	0.279

Graphics





Analyst: SC QA: KL12-14-11

Freshwater Chronic Bioassay **Larval Fish Survival**

Client: MWH **Test Species:** *P. promelas*

Sample ID: ~~RO Treated~~ Effluent **Start Date/Time:** 11/15/2011 1525

Test No.: 1111-5170 **End Date/Time:** 11/22/2011 1515

Conc. (%)	Rep.	Rand #	Test Day / No. Organisms Alive								Percent Survival
			0	1	2	3	4	5	6	7	
Lab Control	a	6	10	10	10	10	10	10	10	10	100
	b	5	10	10	10	10	10	10	10	10	100
	c	12	10	10	10	8	8	8	8	8	80
	d	7	10	10	10	10	10	10	10	10	100
100	a	4	10	10	10	10	10	10	10	10	100
	b	3	10	10	10	10	10	10	10	10	100
	c	10	10	10	10	8	8	8	8	8	80
	d	11	10	10	10	10	9	9	9	9	90
	a	2	10	DP 9 10	10	10	10	10	9	9	90
Reference Control	b	8	10	10	10	10	10	10	10	10	100
	c	9	10	10	10	10	10	10	10	10	100
	d	1	10	10	10	10	10	10	10	10	100
Initial Counts	**Tech Initials**		JG	JP	JP	JP	JF	SL	JP	KF	
QC'd by: JF	**Time**		1525	1400	1210	1030	1335	1320	1200	1515	

Time Fed (day):	0	1	2	3	4	5	6
morning:	–	0815	0830	0830	0930	0850	0830
midday:	–	1210	1220	1220	1145	1205	1215
evening:	–	1450	1710	1500	1515	1580	1450

Drying Oven Info

Tare wt. Initials/Date: AD 11/22/11

Date/Time in: 11/22/11 1530

Date/Time out: ~~11/23/11~~ 11/28/11 1415

Temp (°C): ~~25°~~ 60

QC Check: JC 12-1-11

Final Review: VL 12-14-11

Comments:

Freshwater Chronic Bioassay **Larval Fish Weights**

Client: MWH **Test Species:** *Pimephales promelas*

Sample ID: ~~Re-treated~~ effluent EC **Start Date/Time:** ######## 11/15/11 1525

Test No.: 1111-5170 **End Date/Time:** 11/22/11 1515

Conc. (%)	Rep.	pan weight (mg)	pan + fish weight (mg)	organism weight (mg)
LC	a	30.08	33.31	3.23
	b	29.11	32.07	2.96
	c	29.44	32.57	3.13
	d	29.70	32.64	2.94
RC	a	29.61	32.49	2.88
	b	28.79	31.55	2.76
	c	29.77	32.65	2.88
	d	30.35	33.31	2.96
100	a	30.63	33.55	2.92
	b	28.95	31.74	2.79
	c	30.85	33.76	2.91
	d	31.38	34.17	2.79
	a			0
	b			0
	c			0
	d			0
	a			0
	b			0
	c			0
	d			0
	a			0
	b			0
	c			0
	d			0
	a			0
	b			0
	c			0
	d			0
Tech Initials:		AD	AG	
Date/Time:		11/22/2011 1010	11/28/2011 1415	

QC Check: [signature] 12-1-11

Final Review: [signature] 12-14-11

Freshwater Chronic Bioassay

Water Quality Measurements

Client: MWH

Test Species: *P. promelas*

Sample ID: ~~RO Treated~~ Effluent

Start Date/Time: 11/15/2011 1525

Test No: 1111-5170

End Date/Time: 11/22/2011 1515

Concentration	Lab Control							
Day	0	1	2	3	4	5	6	7
Initial					8.16			
pH	8.28	8.23	8.05	8.28	~~7.87~~ ES	8.26	8.26	
DO (mg/L)	7.3	8.3	8.5	7.4	7.6	8.3	7.6	
Cond. (µmhos/cm)	184	190	194	194	199	200	196	
Temp (°C)	25.8	24.8	24.0	25.4	25.4	25.8	24.8	
Final								
pH		8.18	8.19	7.93	7.87	8.04	7.97	7.91
DO (mg/L)		7.5	6.4	6.5	6.6	7.6	7.5	7.1
Temp (°C)		25.8	25.6	25.6	25.4	25.0	24.4	25.4

Concentration	100%							
Day	0	1	2	3	4	5	6	7
Initial								
pH	8.45	8.54	8.40	8.40	8.44	8.40	8.45	
DO (mg/L)	8.9	8.0	7.0	8.9	8.9	8.9	8.9	
Cond. (µmhos/cm) JF	~~305~~ 345	302	294	294 JVV	~~25~~ 295	221	283	
Temp (°C)	25.1	25.7	26.0	25.1	24.6	25.9	25.0	
Final								
pH		8.06	7.87	7.10	7.45	7.84	7.64	7.64
DO (mg/L)		7.9	6.5	4.8	6.4	7.5	7.1	6.8
Temp (°C)		25.6	24.7	25.1	25.3	25.1	24.4	25.2

Concentration	Reference Control							
Day	0	1	2	3	4	5	6	7
Initial								
pH	8.41	8.56	8.43	8.41	8.44	8.40	8.52	
DO (mg/L)	8.3	8.1	8.6	8.3	8.2	8.9	9.0	
Cond. (µmhos/cm)	244	248	251	250	295	247	259	
Temp (°C)	24.7	24.9	26.0	25.9	25.5	25.8	25.3	
Final								
pH		7.91	7.90	7.56	7.56	7.81	7.42	7.67
DO (mg/L)		8.0	6.6	6.5	6.2	7.1	6.5	6.7
Temp (°C)		25.5	25.1	25.5	25.5	25.0	24.6	25.4

	0	1	2	3	4	5	6	7
Analysts: Initial:	JVV	JF	JF	ES	~~ES~~ ES	SL	ES	
Final:		JF	JF	ES	ES	SL	ES	JP
Dilutions made by:	PA	JVV/JP	AD	AD	JVV	SG	JP	
Sample Used (A, B, C):	A	A	B	B	B	C	C	

Comments:

Animal Source/Date Received: ABS 11/15/11

Animal Age at Initiation: 1 Day

Sample Log-In Numbers: A: 11-0951 B: 11-0960 C: 11-0976

QC Check: JC 12-1-11

Final Review: KL 12-14-11

Chronic Green Algae

CETIS Summary Report

Selenastrum Growth Test — **Nautilus Environmental (CA)**

Batch ID:	20-8375-1066	**Test Type:**	Cell Growth	**Analyst:**	
Start Date:	17 Nov-11 16:35	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Very Hard Water
Ending Date:	21 Nov-11 14:50	**Species:**	Selenastrum capricornutum	**Brine:**	Not Applicable
Duration:	94h	**Source:**	In-House Culture	**Age:**	7d

Sample ID:	18-5518-5944	**Code:**	11-0960	**Client:**	MWH Labs
Sample Date:	16 Nov-11 08:50	**Material:**	Effluent Sample	**Project:**	
Receive Date:	16 Nov-11 09:25	**Source:**	MWH Labs		
Sample Age:	32h	**Station:**	MWH		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
13-8700-5396	Cell Density	100	>100	N/A	5.05%	1	Equal Variance t Two-Sample Test

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
13-8700-5396	Cell Density	Control CV	0.0511	NL - 0.2	Yes	Passes Acceptability Criteria
13-8700-5396	Cell Density	Control Resp	3.26E+6	1.00E+6 - NL	Yes	Passes Acceptability Criteria
13-8700-5396	Cell Density	PMSD	0.05049	0.091 - 0.29	Yes	Below Acceptability Criteria *

Cell Density Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	3.317E+6	3.301E+6	3.333E+6	3.280E+6	3.379E+6	2.151E+4	4.301E+4	1.3%	0.0%
0	Lab Control	4	3.260E+6	3.198E+6	3.322E+6	3.116E+6	3.494E+6	8.329E+4	1.666E+5	5.11%	1.72%
100		4	3.231E+6	3.219E+6	3.243E+6	3.206E+6	3.275E+6	1.542E+4	3.084E+4	0.95%	2.59%
101		4	3.259E+6	3.249E+6	3.268E+6	3.229E+6	3.289E+6	1.279E+4	2.558E+4	0.79%	1.76%

Cell Density Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Rec. Water	3.308E+6	3.301E+6	3.280E+6	3.379E+6
0	Lab Control	3.494E+6	3.172E+6	3.116E+6	3.258E+6
100		3.206E+6	3.275E+6	3.229E+6	3.214E+6
101		3.267E+6	3.229E+6	3.249E+6	3.289E+6

101 = 100% sample unfiltered

* See QA section of report.

CETIS Analytical Report

Selenastrum Growth Test — **Nautilus Environmental (CA)**

Analysis ID:	13-8700-5396	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv1.8.0
Analyzed:	02 Dec-11 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes cell density endpoint	5.05%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Lab Control		100	0.3424	1.943	6	164600	0.3719	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1682000000	1682000000	1	0.1172	0.7437	Non-Significant Effect
Error	86094000000	14349000000	6			
Total	87775990000	16031000000	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	29.17	47.47	0.0203	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8806	0.6451	0.1907	Normal Distribution

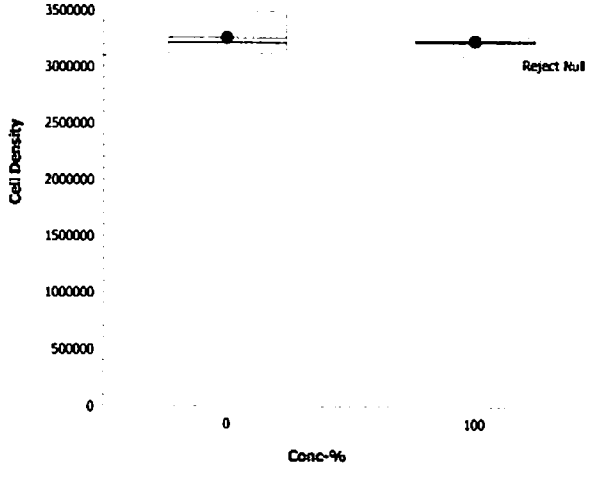
Cell Density Summary

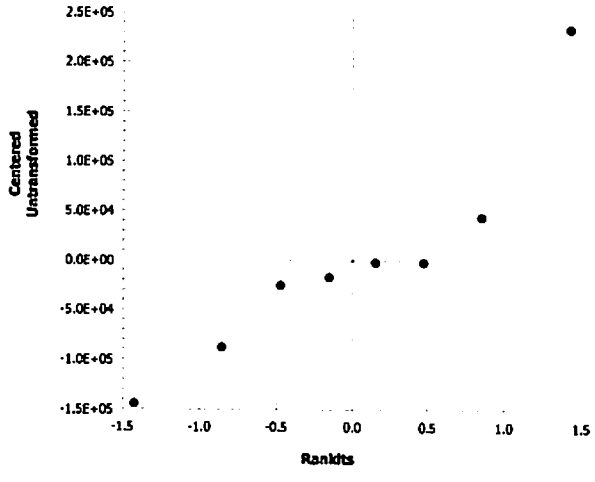
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	3.260E+6	3.197E+6	3.323E+6	3.116E+6	3.494E+6	8.329E+4	1.666E+5	5.11%	0.0%
100		4	3.231E+6	3.219E+6	3.243E+6	3.206E+6	3.275E+6	1.542E+4	3.084E+4	0.95%	0.89%

Cell Density Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Control	3.494E+6	3.172E+6	3.116E+6	3.258E+6
100		3.206E+6	3.275E+6	3.229E+6	3.214E+6

Graphics





Fluorometric & Microscopic Determination of Cell Density
Turner Fluorometer Model TD-700

Test Species: *S. capricornutum*

Client : MWH

Start Date/Time: 11/17/2011 1635

Sample ID: ~~RO-Treated~~ Effluent RC

End Date/Time: 11/21/2011 1450

Test No: 1111-5171

Analyst: VG

Random Number	Cell Density (fluorometric) (cells/ml *10^5)	Dilution	Cell Density (microscopic) (cells/ml *10^4)
Blank		NA	
Cal Check 1 (NEW, Solid)	0.00/~~2.84~~ 2.83 JG		
69	32.06		
70	32.75		
71	32.14		
72	32.58		
73	33.08		
74	32.29		
75	32.29		
76	32.89		
77	32.80		
78	33.79		
79	32.67		
80	31.72		
81	34.94		
82	32.49		
Cal Check 2 (NEW, Solid)	0.00/2.80		
100% filtered blank	0.00		
100% unfiltered blank	1.62		
83	31.16		
84	33.07		
UNFILTERED A	41.63		
UNFILT. B	42.34		
UNFILT. C	42.16		
UNFILT. D	41.13		

Comments: ALL REPS WERE SCOPED FOR ATTACHED ALGAE PRIOR TO READINGS

QC Check: JC 12-1-11

Final Review: KL 12/14/11

CETIS Test Data Worksheet

Report Date: 17 Nov-11 09:37 (p 1 of 1)
Test Code: 17-8340-7840/~~6A4CA4E0~~ 1111-5171

Selenastrum Growth Test — **Nautilus Environmental (CA)**

Start Date: 17 Nov-11 | **Species:** Selenastrum capricornutum | **Sample Code:** ~~6E93E418~~ 11-0960
End Date: 21 Nov-11 | **Protocol:** EPA/821/R-02-013 (2002) | **Sample Source:** MWH Labs
Sample Date: 16 Nov-11 | **Material:** Effluent Sample | **Sample Station:** MWH

Conc-%	Code	Rep	Pos *	Cell Density	Absorbance	Biomass	Chlorophyll a	Notes
0	LC	1	81					* random # position
0	LC	2	80					
0	LC	3	83					
0	LC	4	72					
0	R	1	73					
0	R	2	84					
0	R	3	77					
0	R	4	78					
100		1	69					
100		2	70					
100		3	74					
100		4	71					
101		1	79					
101		2	75					
101		3	82					
101		4	76					

combined sample outfall

QC-JW

Freshwater Chronic Bioassay | **Algal Growth Inhibition Worksheet**

Client/Sample ID: MWH/RO-treated Eff. | **Test Species:** *S. capricornutum*

Test No: 1111-5171 | **Start Date/Time:** 11/17/2011 1635

Analyst: AD/JW | **End Date/Time:** 11/21/2011 1450

Culture Used (circle one): Nutrient Enriched DI Water (NEW) / (Very Hard Water (VHW))

Date Stock Culture Started: 11/10/11 | Culture Age: 7d

Culture subsample inspected for algal cell health? AD/JW (initials) bacteria/invasive algal species present? Y / N

Stock Cell Density Measurements: AD ~~40.01~~ 44.86

45.53

45.65

45.94

45.53

Mean: 45.50

(mean no. * 100,000)/(500,000) = x (dilution factor): 9.1

Prepare inoculum according to the dilution factor. This yields a solution with the desired cell density of 500,000 cells/ml.

dil. factor: 9.1

-1.0 part Sele stock = 20 ml

8.1 part(s) NEW = 162 ml

Inoculate 1 ml into 3 initial count flasks containing 50 ml of NEW, stir and count on the hemacytometer. Flasks should contain a final density of 10,000 cells/ml ± 10%.

Inoculum Cell Density Confirmation Counts: 2, 1, 0 | Mean: 1

Location in Environmental Chamber (All replicates in each test must be on the same shelf; do not split up tests among shelves):

Shelf Number	Measured Light Intensity Range (must be between 360 and 440 ft-c)	Random Number Range
1	360 - 437	41 - 68
2		
3	363 - 438	25-32, 68-84
4		
5		
~~Rack~~	361 - 438	~~1 - 40~~ AD 33-40

Are lights on 24 hour cycle? (Y) / N — 24

Comments:

QC Check: JW 12-1-11 | Final Review: KL 12-14-11

Freshwater Chronic Bioassay

Water Quality Measurements
Algal Growth Inhibition

Client : MWH Labs

Test Species: *S. capricornutum*

Sample ID: ~~RO Treated~~ Effluent

Start Date/Time: 11/17/2011 1635

Sample Log No.: 11- 0960

End Date/Time: 11/21/2011 1450

Dilutions made by: JVV

Test No: 1111-5171

Concentration (%)	Initial Readings				Final Readings	
	D.O. (mg/L)	Conductivity (umhos-cm)	Alkalinity (mg/L)	Hardness (mg/L)	D.O. (mg/L)	Conductivity (umhos-cm)
Lab Control	7.1	275	98	100	8.6	165
Reference Control	6.7	325	43	70	8.6	336
Combined Sample filt	6.6	370	54	72	8.6	382
Combined Sample unfilt	6.1	372	53	72	8.6	384

		0 Hour	24 Hour Q1	48 Hour Q1	72 Hour	96 Hour
pH/Temperature (°C):	LC	8.10 /24.1	8.39 /28.4	8.75/26.9	9.04 /24.8	9.33 /24.6
pH/Temperature (°C):	RC	8.42 /24.4	8.15 /28.6	8.73/26.3	9.12 /25.6	9.53/24.8
pH/Temperature (°C):	Combined Sample filt	8.45/24.5	8.15 /28.9	8.69/27.4	9.26 /25.3	9.58 /25.0
pH/Temperature (°C):	Combined Sample unfilt	8.44/24.7	8.19 /28.9	8.71/27.7	9.25 /25.4	9.62/25.1
pH/Temperature (°C):		/	/	/	/	/
pH/Temperature (°C):		/	/	/	/	/
pH/Temperature (°C):		/	/	/	/	/
	Technician:	JVV	JP	JF	SL	JG

Comments:

QC Check: SC 12-1-11

Final Review: KL 12-14-11

Appendix B

Acute Test Data & Statistical Analyses

Acute Water Flea

CETIS Summary Report

Ceriodaphnia 96-h Acute Survival Test — **Nautilus Environmental (CA)**

Batch ID:	02-9009-2692	**Test Type:**	Survival (96h)	**Analyst:**	Control:
Start Date:	15 Nov-11 15:20	**Protocol:**	EPA/821/R-02-012 (2002)	**~~Diluent~~:**	Diluted Mineral Water (8:2)
Ending Date:	19 Nov-11 13:45	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	94h	**Source:**	In-House Culture	**Age:**	<24h

Sample ID:	16-9114-1243	**Code:**	11-0951	**Client:**	MWH Labs
Sample Date:	14 Nov-11 07:20	**Material:**	~~Stormwater~~ Effluent Sample	**Project:**	
Receive Date:	14 Nov-11 10:55	**Source:**	MWH Labs		
Sample Age:	32h	**Station:**	SD AWPF		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
12-6272-1334	96h Survival Rate	100	>100	N/A	11.2%	1	Wilcoxon Rank Sum Two-Sample Test

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
12-6272-1334	96h Survival Rate	Control Resp	1	0.9 - NL	Yes	Passes Acceptability Criteria

96h Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0	Lab Control	4	1	1	1	1	1	0	0	0.0%	0.0%
100		4	0.95	0.9127	0.9873	0.8	1	0.05	0.1	10.53%	5.0%

96h Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Rec. Water	1	1	1	1
0	Lab Control	1	1	1	1
100		1	0.8	1	1

CETIS Analytical Report

Test Code: 1111-S172 | 11-6228-7568

Ceriodaphnia 96-h Acute Survival Test — Nautilus Environmental (CA)

Analysis ID:	12-6272-1334	**Endpoint:**	96h Survival Rate	**CETIS Version:**	CETISv1.8.0
Analyzed:	02 Dec-11 14:32	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 96h survival rate endpoint	11.2%

Wilcoxon Rank Sum Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
Lab Control		100	16		6	1	0.3429	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.007088488	0.007088488	1	1	0.3559	Non-Significant Effect
Error	0.04253092	0.007088488	6			
Total	0.04961941	0.01417698	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	1	13.75	0.3559	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7065	0.6451	0.0027	Non-normal Distribution

96h Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	1	1	1	1	1	0	0	0.0%	0.0%
100		4	0.95	0.912	0.988	0.8	1	0.05	0.1	10.53%	5.0%

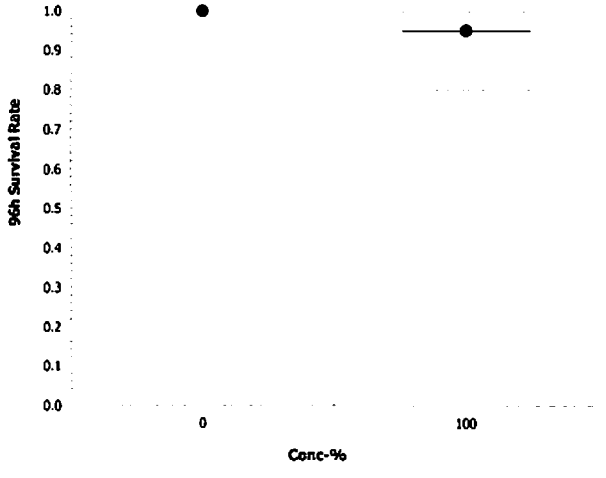
Angular (Corrected) Transformed Summary

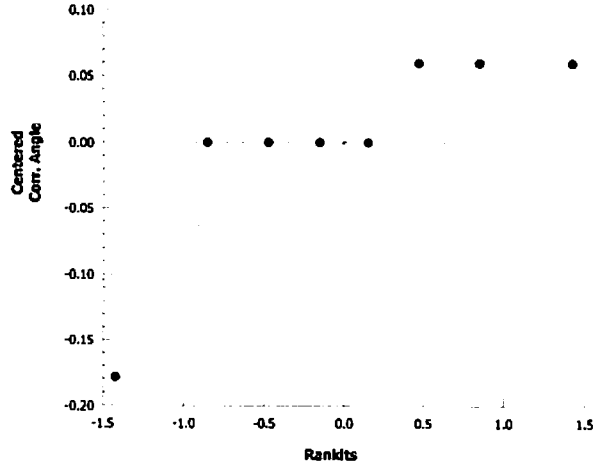
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	1.345	1.345	1.345	1.345	1.345	0	0	0.0%	0.0%
100		4	1.286	1.24	1.331	1.107	1.345	0.05953	0.1191	9.26%	4.43%

96h Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Control	1	1	1	1
100		1	0.8	1	1

Graphics





Analyst: SC QA: KL 12/14/11

96-hour Freshwater Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements
& Test Organism Survival

Client: MWH
Sample ID: ~~RO-treated~~ Effluent
Test No.: 1111-5172

Test Species: *C. dubia*
Start Date/Time: 11/15/2011 1520
End Date/Time: 11/19/2011 1345

	Tech Initials				
	0	24	48	72	96
Counts:	JP	JP	JP	ES	JW
Readings:	JW	JF	JF	ES	ES
Dilutions made by:	PA		AD		

Concentration (%)	Rep	Number of Live Organisms					Conductivity (µmhos/cm)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
	A	5	5	5	5	5	194	195	193	196	197	25.1	26.0	24.0	25.1	25.1	7.8	7.9	7.5	7.5	7.4	8.25	8.33	8.00	8.23	8.27
Lab Control	B	5	5	5	5	5			219					24.3					8.1					8.29		
	C	5	5	5	5	5																				
	D	5	5	~~4~~ 5	5	5																				
	A	5	5	5	5	5	302	306	298	320	325	25.0	26.0	24.2	24.9	25.1	8.9	8.0	8.3	7.4	7.9	8.45	8.19	8.60	8.02	8.05
100%	B	5	~~84~~ 4	4	4	4			344					24.3					8.2					8.20		
	C	5	5	5	5	5																				
	D	5	5	5	5	5																				
	A	5	5	5	5	5	249	248	246	258	256	25.9	26.0	24.8	25.3	25.4	8.0	8.0	8.4	7.6	7.6	8.41	8.04	8.46	8.01	8.04
Reference	B	5	5	5	5	5			283					24.3					8.2					8.10		
Control	C	5	5	5	5	5																				
	D	5	5	5	5	5																				
	A	~~5~~ 5							i					i					i					i		
	B	~~5~~ 5							f					f					f					f		
	C	~~5~~ 5																								
	D	~~5~~ 5																								

Initial Counts QC'd by: JF

Animal Source/Date Received: Internal / NA

Age at Initiation: < 24 hours

Feeding Times					
	0	24	48	72	96
AM:	-	-	1235	-	-
PM:	-	-	-	-	-

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal

Organisms fed prior to initiation, circle one (y / n)

QC Check: JC 12-1-11

Final Review: KL 12-14-11

Acute Fathead Minnow

CETIS Summary Report

Fathead Minnow 96-h Acute Survival Test — **Nautilus Environmental (CA)**

Batch ID:	10-6545-1767	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	15 Nov-11 15:20	**Protocol:**	EPA/821/R-02-012 (2002)	**Diluent:**	Not Applicable
Ending Date:	19 Nov-11 14:00	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	95h	**Source:**	Aquatic Biosystems, CO	**Age:**	10d

Sample ID:	01-3036-2812	**Code:**	11-0951	**Client:**	MWH Labs
Sample Date:	14 Nov-11 07:20	**Material:**	~~POTW~~ FC Effluent Sample 4	**Project:**	
Receive Date:	14 Nov-11 10:55	**Source:**	MWH Labs		
Sample Age:	32h	**Station:**	SD AWPF		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
06-3388-2429	96h Survival Rate	100	>100	N/A	10.8%	10.0	Wilcoxon Rank Sum Two-Sample Test

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
06-3388-2429	96h Survival Rate	Control Resp	0.95	0.9 - NL	Yes	Passes Acceptability Criteria

96h Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Rec. Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0	Lab Control	4	0.95	0.9127	0.9873	0.8	1	0.05	0.1	10.53%	5.0%
100		4	1	1	1	1	1	0	0	0.0%	0.0%

96h Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Rec. Water	1	1	1	1
0	Lab Control	1	1	0.8	1
100		1	1	1	1

CETIS Analytical Report

Test Code: 1111-S173 | 18-0461-7389

Fathead Minnow 96-h Acute Survival Test — Nautilus Environmental (CA)

Analysis ID:	06-3388-2429	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.8.0
Analyzed:	02 Dec-11 14:43	Analysis:	Nonparametric-Two Sample	Official Results:	Yes

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 96h survival rate endpoint	10.8%

Wilcoxon Rank Sum Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
Lab Control		100	20		6	1	0.6571	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.007088488	0.007088488	1	1	0.3559	Non-Significant Effect
Error	0.04253092	0.007088488	6			
Total	0.04961941	0.01417698	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	1	13.75	0.3559	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7065	0.6451	0.0027	Non-normal Distribution

96h Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	0.95	0.912	0.988	0.8	1	0.05	0.1	10.53%	0.0%
100		4	1	1	1	1	1	0	0	0.0%	-5.26%

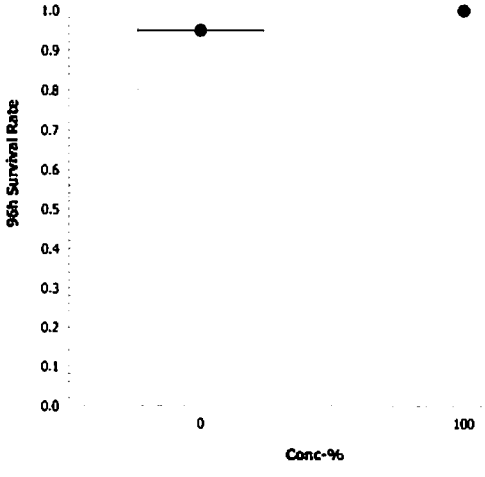
Angular (Corrected) Transformed Summary

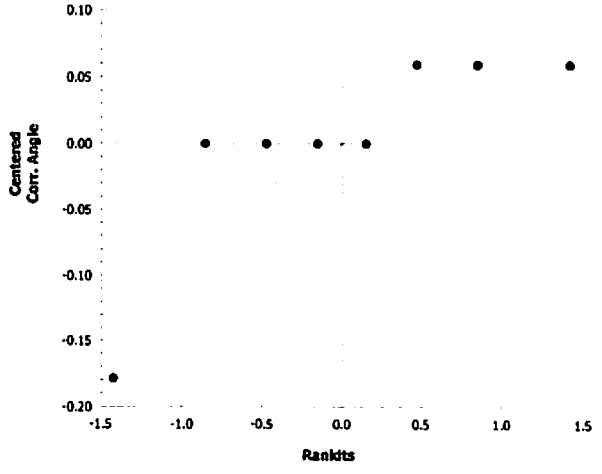
Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Control	4	1.286	1.24	1.331	1.107	1.345	0.05953	0.1191	9.26%	0.0%
100		4	1.345	1.345	1.345	1.345	1.345	0	0	0.0%	-4.63%

96h Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Lab Control	1	1	0.8	1
100		1	1	1	1

Graphics





 Analyst: SC QA: KL 12/14/11

96-hour Freshwater Acute Bioassay
Static-Renewal Conditions

Water Quality Measurements & Test Organism Survival

Client: MWH
Sample ID: ~~RO treated~~ Effluent
Test No.: 1111-S173

Test Species: *P. promelas*
Start Date/Time: 11/15/2011 1520
End Date/Time: 11/19/2011 1400

	Tech Initials				
	0	24	48	72	96
Counts:	JG	JP	JF	JP	JF
Readings:	JW	JF	JF	ES	ES
Dilutions made by:	PA		AD		

Concentration (%)	Rep	Number of Live Organisms					Conductivity (µmhos/cm)					Temperature (°C)					Dissolved Oxygen (mg/L)					pH (units)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96 (Q2)	0	24	48	72	96	0	24	48	72	96
	A	5	5	5	5	5	195	204	i 195	198	206	25.6	25.9	i 24.2	25.4	24.0	7.2	7.5	i 6.9	7.4	7.7	8.25	8.11	i 8.07	8.07	8.16
Lab Control	B	5	5	5	5	5			i 207					i 25.1					i 6.5					i 8.01		
	C	5	5	5	5	4																				
	D	5	5	5	5	5																				
	A	5	5	5	5	5	305	313	i 303	321	343	25.2	25.7	i 26.0	25.3	23.8	9.0	7.7	i 8.1	6.7	8.0	8.60	7.97	i 8.60	7.56	7.84
100%	B	5	5	5	5	5			i 317					i 25.1					i 6.4					i 7.84		
	C	5	5	5	5	5																				
	D	5	5	5	5	5																				
	A	5	5	5	5	5	247	260	i 248	265	279	25.1	25.3	i 25.3	24.9	23.8	8.2	7.8	i 8.5	7.3	7.9	8.43	7.83	i 8.46	7.79	8.03
Reference	B	5	5	5	5	5			i 217					i 25.0					i 6.6					i 7.76		
Control	C	5	5	5	5	5																				
	D	5	5	5	5	5																				
	A	~~5~~							i					i					i					i		
	B	~~5~~	JW						f					f					f					f		
	C	~~5~~																								
	D	~~5~~																								

Initial Counts QC'd by: AG
Animal Source/Date Received: ABS 11/15/11
Age at Initiation: 10 days

	Feeding Times				
	0	24	48	72	96
AM:	–	–	0830	–	–
PM:	–	–	–	–	–

Comments: i = initial reading in fresh test solution, f = final reading in test chamber prior to renewal
Organisms fed prior to initiation, circle one (y / n)

QC Check: CZ 11/21/11
Final Review: SC 12-1-11

Appendix C

Sample Receipt Information

& Mixing Worksheet

Nautilus Environmental
4340 Vandever Avenue
San Diego, CA 92120

Client: MWH
Sample ID: SanDiego AWPF
Test ID No(s).: 1111-S169+to 179

	Lake Murray	SIO Effluent	SIO Eff.	SIO Eff.
Sample (A, B, C):	Aqueduct	A	B	C
Log-in No. (11-xxxx):	0952	0951	0960	0976
Sample Collection Date & Time:	11/14/11 0928	11/14/11 0720	11/16/11 0850	11/18/11 0719
Sample Receipt Date & Time:	11/14/11 1055 →		11/16/11 0925	11/18/11 0900
Number of Containers & Container Type:	2-10L cubis	1-4L cubi	1-4L cubi	1-4L cubi
Approx. Total Volume Received (L):	~20L	~4L	~3.5L	~4L
Check-in Temperature (°C)	13.8	13.5	20.6	16.6
Temperature OK? [1]	(Y) N	(Y) N	(Y) N	(Y) N
DO (mg/L)	ES ~~6.84~~ 9.3	9.8	6.5	8.9
pH (units)	8.00	~~6~~ ES 5.68	5.61	5.27
Conductivity (µS/cm)	684	18.6	20	22.6
TDS (mg/L)	329	8.0	9.6	11.0
Alkalinity (mg/L)*	95	0.0	3	3
Hardness (mg/L)* a	170	0.0	1	7
Total Chlorine (mg/L)	0.06	0.57	0.70	0.53
Technician Initials	ES	ES	~~ES~~	LN

Test Performed: Cerio Acute & Chronic

Laboratory Control: 20% diluted mineral water (8:2) Alkalinity: 80 Hardness: 86

Reference Control: DI water + Aquaduct water Alkalinity: 41-48 Hardness: 52-54

Test Performed: Fathead Acute & Chronic

Laboratory Control: 20% diluted mineral water (8:2) Alkalinity: 80 Hardness: 86

Reference Control: DI water + Aquaduct water Alkalinity: 41-40 Hardness: 52-54

Notes: [1] Temperature of sample should be 0-6°C, if received more than 24 hours past collection time.

* = mg/L as CaCO3, a = Measured for freshwater samples only, NA = Not Applicable

Sample Check-In Information

Sample Description:
Lake Murray: colorless, clear, odorless, no debris
SIO A: colorless, clear, odorless, no debris
SIO B: Clear, colorless, odorless, no debris
SIO C: colorless, clear, odorless, no debris

COC Complete (Y/N)?
A ✓ B ✓ C ✓

Filtration? Y (N)
Pore Size: _____
Organisms or Debris

Salinity Adjustment? Y (N)
Artificial Salts: target ppt: _____
Hypersaline Brine: target ppt: _____
Tests: _____

pH Adjustment? Y N (See worksheet)

	A	B	C
Initial pH:			
Amount of HCl added:			
Final pH:			

Cl_2 Adjustment? Y N (See worksheet)

	A (SIO Eff)	B (SIO Eff)	C
Initial Free Cl_2:	0.32	~~0.70~~ 0.14	0.28
STS added:			
Final Free Cl_2:			

Additional Comments:

QC Check: BC 12-1-11
Final Review: KL 12-4-11

Nautilus Environmental
4340 Vandever Avenue
San Diego, CA 92120

Client: MWH - SD AWPF
Sample ID: MIXING WORKSHEET
Test ID No(s).: 1111-5169 to 174

Sample Check-In Information

Sample Mixtures (A, B, C):	Aquaduct + "A" Sample	Aquaduct + "B" Sample	Aquaduct + "C" Sample	Reference Control A	Reference Control B	Reference Control C
Percent Aquaduct Water (%):	33	33	33	34	34	34
Percent ~~RO treated~~ UV|AOP Sample (%): SC	67	67	67	66	66	66
Final Hardness of Mixture (aim for 50 mg/L):	51 mg/L	52 mg/L	53 mg/L	52 mg/L	53 mg/L	54 mg/L
Initial pH (units):	7.07	7.04	7.12	7.87	7.94	8.02
Adjust to pH 8.5 with NaOH	11 drops 1.0N NaOH	13 drops 1.0N NaOH	14 drops 1.0N NaOH	5 drops 1.0N NaOH	3 drops 1.0 NaOH	4 drops 1.0N NaOH
Final pH (units):	8.48	8.40	8.47	8.54	8.43	8.54
DO (mg/L)	8.9	9.0	8.7	8.0	8.6	8.5
Conductivity (µS/cm)	302	294	283	249	251	246
TDS (mg/L)	145	141	131	119	121	117
Alkalinity (mg/L)	39	JF ~~≥1000~~ 38	43	41	JF ~~46~~	48
Initial Free Chlorine (mg/L)	0.18	0.04	0.14	<0.02	<0.02	0.03
Add STS* to dechlorinate:	100mg → 4.5L	100mg → 4.5L	100mg → 4.5L	—	—	—
Final Free Chlorine (mg/L)	0.02	0.02	0.03	—	—	—
Technician Initials	[illegible]	PA/JF	[illegible]	[illegible]	PA/JF	[illegible]

Test Performed: Ceriodaphnia and Fathead (Acute + Chronic)

Laboratory Control: 20% diluted mineral water (8:2) Alkalinity: 80 Hardness: 86

Reference Control: DI water + Aquaduct water Alkalinity: 41-48 Hardness: 52-54

Additional Comments:

Test Performed: _____

Laboratory Control: 20% diluted mineral water (8:2) Alkalinity: _____ Hardness: _____

Reference Control: DI water + Aquaduct water Alkalinity: _____ Hardness: _____

Notes: _____

* Sodium Thiosulfate (STS) should remove both chlorine and peroxide.

QC Check: SC 12-1-11

Final Review: KL 12-14-11

Appendix D

Chain-of-Custody Forms

And Data Qualifier Codes

Nautilus Environmental
4340 Vandever Avenue
San Diego, CA 92120
Phone 858.587.7333
Fax 858.587.3961

Chain of Custody

Date 11/14/11 Page 1 of 1

Sample Collection By: Michelle Berens / James Wright

Report to:
- Company: MWH
- Address: 9444 Farnham St, Suite 300
- City/State/Zip: San Diego, CA 92123
- Contact: Jay DeCarolis
- Phone: 619-204-2537
- Email: james.decarolis@mwhglobal.com

Invoice To:
- Company:
- Address:
- City/State/Zip:
- Contact:
- Phone:
- Email:

ANALYSES REQUIRED

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS			WET Toxicity									Receipt Temperature (°C)
1	SID_11-14-11	11/14/11	7:20	water	1 gal	1	peroxide = 3 mg/L ; pH = 5.51			X									13.5
2					plastic		temp = 22.5°C ; Free Cl_2 = 0.05 mg/L												
3							tot Cl_2 = 1.04 mg/L ; cond = 16.89 mS/cm												
4	Lake Murray_11-14-11	11/14/11	9:28	water	3	2				X									13.8
5					2.5 gal														
6					plastic														
7																			
8																			
9																			
10																			

PROJECT INFORMATION
- Client: MWH
- PO No.:
- Shipped Via:

SAMPLE RECEIPT
- Total No. of Containers: 3
- Received Good Condition? ✓
- Matches Test Schedule? ✓

RELINQUISHED BY (CLIENT)
- (Signature) (Time): 10:55
- (Printed Name) JAMES WRIGHT (Date): 11/14/11
- (Company) MWH

RECEIVED BY (COURIER)
- (Signature) (Time):
- (Printed Name) (Date):
- (Company):

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY (COURIER)
- (Signature) (Time):
- (Printed Name) (Date):
- (Company):

RECEIVED BY (LABORATORY)
- (Signature) (Time): 1055
- (Printed Name) Elli Slaughter (Date): 11/14/11
- (Company) Nautilus Log In No. 11-0951-0952

Additional costs maybe required for sample disposal or storage.
Payment Net 30 unless otherwise contracted.

www.nautilusenvironmental.com

DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator

Nautilus Environmental
4340 Vandever Avenue
San Diego, CA 92120
Phone 858.587.7333
Fax 858.587.3961

Chain of Custody

Date 11/16/11 Page 1 of 1

Sample Collection By: Michelle Ryan / James Wright

Report to:
- Company: MNH
- Address: 9444 Farnham St Ste 300
- City/State/Zip: San Diego, CA 92123
- Contact: Jay DeCarolis
- Phone: 619-204-2537
- Email: James.decarolis@mnhg/obal.com

Invoice To:
- Company:
- Address:
- City/State/Zip:
- Contact:
- Phone:
- Email:

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: WET TOXICITY	Receipt Temperature (°C)
1	S10 - 11-16-11	11/16/2011	8:50	W	1 gal plastic	1	free Cl 0.02 mg/L	X	20.6
2							total Cl 0.39 mg/L		
3							pH 5.38		
4							conductivity 18.98 µS/cm		
5							H2O2 3 mg/L		
6									
7									
8									
9									
10									

PROJECT INFORMATION
- Client: MNH
- PO No.:
- Shipped Via:

SAMPLE RECEIPT
- Total No. of Containers: 1
- Received Good Condition?: Y
- Matches Test Schedule?: Y

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY (CLIENT)
- (Signature) (Time): 0925
- (Printed Name) James Wright (Date): 11/16/11
- (Company): MNH

RELINQUISHED BY (COURIER)
- (Signature) (Time):
- (Printed Name) (Date):
- (Company):

RECEIVED BY (COURIER)
- (Signature) (Time):
- (Printed Name) (Date):
- (Company):

RECEIVED BY (LABORATORY)
- (Signature) Jessica Anderson (Time): 0925
- (Printed Name) Jessica Andersen (Date): 11/16/11
- (Company): 11-0960

Additional costs maybe required for sample disposal or storage.
Payment Net 30 unless otherwise contracted.

DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator

Nautilus Environmental
4340 Vandever Avenue
San Diego, CA 92120
Phone 858.587.7333
Fax 858.587.3961

Chain of Custody

Date 11/18/11 Page 1 of 1

Sample Collection By: Michelle Berens

Report to:
- Company: MWH
- Address: 9444 Farnham St Ste 300
- City/State/Zip: San Diego, CA 92123
- Contact: Jay DeCarolis
- Phone: 619-204-2557
- Email: james.decarolis@mwhglobal.com

Invoice To:
- Company:
- Address:
- City/State/Zip:
- Contact:
- Phone:
- Email:

ANALYSES REQUIRED

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	NET TDX	Receipt Temperature (°C)
1	S10-11-18-11	11/16/11	0719	W	1gal pdy	1	pH = 5.60 temp = 21.1°C	X	5.6
2							free Cl_2 = 0.04 mg/L		
3							tot Cl_2 = 0.72 mg/L		
4							peroxide = 3.0 mg/L		
5							conductivity = ~~355~~ 18.44 µS/cm		
6									
7									
8									
9									
10									

PROJECT INFORMATION
- Client: MWH
- PO No.:
- Shipped Via:

SAMPLE RECEIPT
- Total No. of Containers: 1
- Received Good Condition? ✓
- Matches Test Schedule? ✓

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY (CLIENT)
- (Signature): [signature] (Time): 0500
- (Printed Name): James Wright (Date): 11/18/11
- (Company): MWH

RELINQUISHED BY (COURIER)
- (Signature) (Time)
- (Printed Name) (Date)
- (Company)

RECEIVED BY (COURIER)
- (Signature) (Time)
- (Printed Name) (Date)
- (Company)

RECEIVED BY (LABORATORY)
- (Signature): [signature] (Time): 0900
- (Printed Name): Ashley Donohue (Date): 11/18/11
- (Company): Nautilus 11-0976

Additional costs maybe required for sample disposal or storage.
Payment Net 30 unless otherwise contracted.

DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator

Nautilus Environmental

Glossary of Qualifier Codes:

Q1 - Temperatures out of recommended range; corrective action taken and recorded in Test Temperature Correction Log

Q2 - Temperatures out of recommended range; no action taken, test terminated same day

Q3 - Sample aerated prior to initiation or renewal due to dissolved oxygen (D.O.) levels below 6.0 mg/L

Q4 - Test aerated; D.O. levels dropped below 4.0 mg/L

Q5 - Test initiated with aeration due to an anticipated drop in D.O.

Q6 - Airline obstructed or fell out of replicate and replaced; drop in D.O. occurred

Q7 - Salinity out of recommended range; refer to QA section of report

Q8 - Spilled test chamber/ Unable to recover test organism(s)

Q9 - Inadequate sample volume remaining, 50% renewal performed

Q10 - Inadequate sample volume remaining, no renewal performed

Q11 - Sample out of holding time; refer to QA section of report

Q12 - Replicate(s) not initiated; excluded from data analysis

Q13 - Survival counts not recorded due to poor visibility or heavy debris

Appendix B

Quality Control Sample Results & Project Advisory Team Expert Review Memorandum Dr. Andy Eaton

Table B-1 Summary of QC Samples Collected Q1, Q2, Q3, and Q4 Testing Periods

Date	Laboratory	QC Sample Type	Sample Location (s)	Compounds
8/15/2011	CSM / MWH	split	S6, S9, S10	CEC's
8/15/2011	CSM	field blank	NA	CEC's
8/24/2011	WECK	blind duplicate	S10	Compounds monitored quarterly
8/24/2011	MWH / WECK	split	S10	Compounds monitored quarterly
9/1/2011	MWH	travel blank	NA	CEC's
9/14/2011	MWH	blind duplicate	S9	CEC's
9/14/2011	MWH	travel blank	NA	CEC's
10/17/2011	MWH	blind duplicate	S1	CEC's
10/17/2011	MWH	travel blank	NA	CEC's
11/2/2011	MWH /WECK	split	S1, S6, S7, S8, S9, S10	1,4 dioxane, NDMA
11/8/2011	WECK	blind duplicate	S1	Compounds monitored quarterly
11/8/2011	MWH	blind duplicate	S1	CEC's
11/8/3011	MWH	travel blank	NA	CEC's
11/8/2011	CSM / MWH	split	S1, S6, S9, S10, Imported	CEC's
11/8/2011	CSM	field blank	NA	CEC's
2/1/2012	CSM	field blank	NA	CEC's
2/1/2012	MWH	field blank	NA	CEC's
2/1/2012	CSM / MWH	split	S1, S6, S9, S10, Imported	CEC's
2/1/2012	MWH	blind duplicate	S6	CEC's
2/1/2012	WECK	blind duplicate	Imported Water	Compounds monitored quarterly
2/1/2012	MWH / WECK	spilt	S6, S9, S10	NDMA
2/8/2012	MWH / WECK	split	S9, S10	Formaldehyde
2/8/2012	MWH / WECK	spilt	S6, S9, S10	NDMA
2/8/2012	MWH	field blank	NA	CEC's
2/15/2012	MWH	field blank	NA	CEC's
2/15/2012	MWH / WECK	split	(S9, 10) / (S6, S9, S10)	Formaldehyde, TOC
2/22/2012	MWH	field blank	NA	CEC's
2/22/2012	MWH / WECK	split	(S9, 10) / (S10)	Formaldehyde, TOC
5/1/2012	WECK	blind duplicate	S10	Compounds monitored quarterly
5/1/2012	CSM	field blank	NA	CEC's
5/1/2012	MWH	field blank	NA	
5/1/2012	MWH	blind duplicate	S10	CEC's
5/1/2012	CSM / MWH	split	S6, S9, S10	CEC's
5/1/2012	MWH	field blank (1 L and 40 mL)	NA	CEC's
5/1/2012	MWH	duplicate (1 L and 40 mL)	S10	CEC's
7/30/2012	MWH	field blank (40 mL, 250 mL, 500 mL, 1 L)	NA	Triclosan, DEET
7/30/2012	MWH	duplicate (40 mL, 250 mL, 500 mL, 1 L)	S10	Triclosan, DEET

Table B-2 Summary of Blind Duplicate Samples from Quarterly Sampling Event Number 1 Results (8/24/11)

No.	Compound	MDL	RL	S10 Grab	Blind Duplicate	Difference	RPD (Actual)	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 2a & 2b)	Governing RPD	PASS / FAIL	NOTES
1	Bromodichloromethane	0.09	0.5	0.78	0.76	0.02	3%	32%	50%	50%	PASS	
2	Chloroform	0.12	0.5	1.4	1.5	0.1	7%	17%	20%	20%	PASS	
3	Methylene chloride	0.14	0.5	0.2	0.21	0.01	5%	122%	50%	122%	PASS	
4	THM's, Total	0.6	2	2.2	2.3	0.1	4%	44%	50%	50%	PASS	
5	2-Butanone	0.72	5	0.72	0.96	0.24	29%	298%	50%	298%	PASS	
6	Diethylphthalate	0.15	1	0.98	0.15	0.83	147%	88%	50%	88%	FAIL	Deemed acceptable as both results were below the RL.
7	Dimethylphthalate	0.07	2	0.21	0.07	0.14	100%	714%	50%	714%	PASS	
8	Di-n-butylphthalate	0.24	1	2.2	0.24	1.96	161%	41%	20%	41%	FAIL	Phthalates are prone to field and lab contamination and possible cause for poor precision.
9	Diethylphthalate	0.22	2	0.31	0.22	0.09	34%	377%	50%	377%	PASS	
10	Aluminum	0.61	5	3.6	7.5	3.9	70%	45%	50%	50%	FAIL	Original sample below the RL. Follow up with lab required.
11	Boron	0.28	1	240	240	0	0%	0%	20%	20%	PASS	
12	Calcium	0.016	0.1	0.025	0.033	0.008	28%	172%	50%	172%	PASS	
13	Lithium	1.4	10	1.4	1.4	0	0%	357%	50%	357%	PASS	
14	Lead	0.011	0.2	0.03	0.05	0.02	50%	250%	50%	250%	PASS	
15	Mercury	0.0039	0.05	0.016	0.014	0.002	13%	167%	50%	167%	PASS	
16	Potassium	0.081	0.1	0.31	0.47	0.16	41%	13%	20%	20%	FAIL	Poor precision, but difference is reasonable for the method at the low concentrations.
17	Sodium	0.015	0.5	3.2	3.3	0.1	3%	8%	20%	20%	PASS	
18	Vanadium	0.047	0.5	0.05	0.22	0.17	126%	185%	50%	185%	PASS	
19	Chloride	0.1	0.5	2.8	2.8	0	0%	9%	20%	20%	PASS	
20	Fluoride	0.02	0.1	0.025	0.02	0.005	22%	222%	50%	222%	PASS	
21	Sulfate	0.1	0.5	0.1	0.16	0.06	46%	192%	50%	192%	PASS	
22	Total anions	0.02	0.078	0.18	0.19	0.01	5%	21%	20%	21%	PASS	
23	Total cations	0.0045	0.038	0.15	0.16	0.01	6%	12%	20%	20%	PASS	
24	pH (units)	0.1	0.1	5.82	5.96	0.14	2%	1%	20%	20%	PASS	
25	Odor	1	1	1	1	0	0%	50%	50%	50%	PASS	
26	Nitrate	0.18	0.5	3.1	3.1	0	0%	8%	20%	20%	PASS	
27	Nitrite/Nitrate as N	10	100	700	700	0	0%	7%	20%	20%	PASS	
28	Total dissolved solids	4	10	16	14	2	13%	33%	50%	50%	PASS	
29	Specific Conductance	0.23	2	22	22	0	0%	5%	20%	20%	PASS	
30	Total organic carbon	0.009	0.3	0.86	0.48	0.38	57%	22%	20%	22%	FAIL	Suggests either inhomogeneity or a problem with the method at these methods. Additional split samples collected. Issue resolved.
31	Total alkalinity	0.56	2	2.6	3	0.4	14%	36%	50%	50%	PASS	
32	Bicarbonate alkalinity	0.56	2	3.2	3.6	0.4	12%	29%	50%	50%	PASS	
33	Langelier Index @20C	-10	-10	-6.64	-6.32	0.32	-5%	77%	20%	77%	PASS	
34	Langelier Index @60C	-10	-10	-6.1	-5.79	0.31	-5%	84%	20%	84%	PASS	
35	Acetaldehyde	0.34	2	0.8	0.37	0.43	74%	171%	50%	171%	PASS	
36	Cyclohexanone	0.38	2	0.72	1.1	0.38	42%	110%	50%	110%	PASS	
37	Formaldehyde	0.26	2	8.9	9.4	0.5	5%	11%	20%	20%	PASS	
38	N-Nitrosodimethylamine	0.28	2	0.35	0.28	0.07	22%	317%	50%	317%	PASS	

Note: Criteria 1 = a) If the result of the original sample was within 2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) the relative percent difference (RPD) should be 50%), whichever is higher. Criteria 2 = a) If the result of the original sample was >2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) RPD of 20%, whichever higher.

Table B-3 Summary of Blind Duplicate Samples from Quarterly Sampling Event Number 2 Results (11/8/11)

No.	Compound	MDL	RL	Units	S1 Sample	Blind Duplicate	Difference	RPD (Actual)	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 2a & 2b)	Governing RPD	PASS / FAIL	NOTES
1	Aluminum, Total	0.61	5	ug/l	8.8	9	0.2	2%	28%	50%	50%	PASS	
2	Antimony, Total	0.04	0.5	ug/l	0.53	0.52	0.01	2%	48%	50%	50%	PASS	
3	Arsenic, Total	0.036	0.4	ug/l	0.98	0.96	0.02	2%	21%	20%	21%	PASS	
4	Barium, Total	0.03	0.5	ug/l	18	18	0	0%	1%	20%	20%	PASS	
5	Chromium, Total	0.074	0.2	ug/l	0.56	0.58	0.02	4%	18%	20%	20%	PASS	
6	Copper, Total	0.27	0.5	ug/l	1.8	1.8	0	0%	14%	20%	20%	PASS	
7	Fluoride, Total	0.04	0.2	mg/l	0.63	0.63	0	0%	16%	20%	20%	PASS	
8	Gross Alpha	0	0	pCi/L	5.78+/-0.393 MDA=0.016	3.74+/-0.32 MDA=0.016	2.04	43%	0%	20%	20%	NA	Criteria not applicable results provided with different counting errors and MDAs.
9	HAA5, Total		1	ug/l	1.5	1.6	0.1	6%	32%	50%	50%	PASS	
10	Nickel, Total	0.13	0.8	ug/l	3.5	3.6	0.1	3%	11%	20%	20%	PASS	
11	Nitrate as NO3	0.36	1	mg/l	70	70	0	0%	1%	20%	20%	PASS	
12	NO2+NO3 as N	20	200	ug/l	16000	16000	0	0%	1%	20%	20%	PASS	
13	Perchlorate	0.95	2	ug/l	4.9	5.2	0.3	6%	20%	20%	20%	PASS	
14	Selenium, Total	0.28	0.4	ug/l	0.57	0.5	0.07	13%	37%	50%	50%	PASS	
15	Aluminum, Total	0.61	5	ug/l	8.8	9	0.2	2%	28%	50%	50%	PASS	
16	Chloride, Total	1	5	mg/l	240	240	0	0%	1%	20%	20%	PASS	
17	Color		3	Color Units	20	20	0	0%	8%	20%	20%	PASS	
18	Copper, Total	0.27	0.5	ug/l	1.8	1.8	0	0%	14%	20%	20%	PASS	
19	Iron, Total	1.1	10	ug/l	73	72	1	1%	7%	20%	20%	PASS	
20	Manganese, Total	0.11	0.2	ug/l	70	71	1	1%	0%	20%	20%	PASS	
21	Specific Conductance (EC)	0.23	2	umhos/cm	1100	1100	0	0%	0%	20%	20%	PASS	
22	Sulfate as SO4	1	5	mg/l	130	130	0	0%	2%	20%	20%	PASS	
23	Threshold Odor Number		1	T.O.N.	2	1	1	67%	33%	50%	50%	FAIL	Poor precision, but difference is reasonable for the method at the low concentrations.
24	Total Dissolved Solids	4	10	mg/l	760	680	80	11%	1%	20%	20%	PASS	
25	Zinc, Total	1.1	5	ug/l	48	49	1	2%	5%	20%	20%	PASS	
26	Antimony, Total	0.04	0.5	ug/l	0.53	0.52	0.01	2%	48%	50%	50%	PASS	
27	Arsenic, Total	0.036	0.4	ug/l	0.98	0.96	0.02	2%	21%	20%	21%	PASS	
28	Bromodichloromethane	0.09	0.5	ug/l	0.58	0.59	0.01	2%	43%	50%	50%	PASS	
29	Chloroform	0.12	0.5	ug/l	0.8	0.83	0.03	4%	31%	50%	50%	PASS	
30	Chromium, Total	0.074	0.2	ug/l	0.56	0.58	0.02	4%	18%	20%	20%	PASS	
31	Copper, Total	0.27	0.5	ug/l	1.8	1.8	0	0%	14%	20%	20%	PASS	
32	Nickel, Total	0.13	0.8	ug/l	3.5	3.6	0.1	3%	11%	20%	20%	PASS	
33	Selenium, Total	0.28	0.4	ug/l	0.57	0.5	0.07	13%	37%	50%	50%	PASS	
34	Zinc, Total	1.1	5	ug/l	48	49	1	2%	5%	20%	20%	PASS	
35	1,4-Dioxane	0.04	0.5	ug/l	5.6	5.8	0.2	4%	4%	20%	20%	PASS	
36	Boron, Total	0.28	1	ug/l	340	350	10	3%	0%	20%	20%	PASS	
37	Chlorate	1.9	20	ug/l	580	650	70	11%	2%	20%	20%	PASS	
38	Formaldehyde	0.26	2	ug/l	6	6.4	0.4	6%	16%	20%	20%	PASS	
39	Manganese, Total	0.11	0.2	ug/l	70	71	1	1%	0%	20%	20%	PASS	
40	N-Nitrosodiethylamine	0.72	2	ng/l	2	2.4	0.4	18%	45%	50%	50%	PASS	
41	N-Nitrosodimethylamine	0.28	2	ng/l	2	2.1	0.1	5%	49%	50%	50%	PASS	
42	N-Nitrosodi-n-propylamine	0.35	2	ng/l	2	3.4	1.4	52%	37%	50%	50%	FAIL	Sample result at RL, RPD close to criteria.
43	Lithium, Total	1.4	10	ug/l	20	22	2	10%	24%	50%	50%	PASS	

Note: Criteria 1 = a) If the result of the original sample was within 2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) the relative percent difference (RPD) should be 50%), whichever is higher. Criteria 2 = a) If the result of the original sample was >2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) RPD of 20%, whichever higher.

Table B-4 Summary of Blind Duplicate Samples from Quarterly Sampling Event Number 3 Results (2/1/12)

No.	Compound	MDL	RL	Units	Imported Aquifer Water	Blind Duplicate	Difference	RPD (Actual)	RPD (Criteria 1)	RPD (Criteria 2)	Governing RPD	PASS / FAIL	NOTES
1	Aluminum, Total	0.61	5	ug/l	29	29	0	0%	9%	20%	20%	PASS	
2	Arsenic, Total	0.036	0.4	ug/l	2	2	0	0%	10%	20%	20%	PASS	
3	Barium, Total	0.03	0.5	ug/l	47	48	1	2%	1%	20%	20%	PASS	
4	Copper, Total	0.27	0.5	ug/l	3	3.1	0.1	3%	8%	20%	20%	PASS	
5	Fluoride, Total	0.02	0.1	mg/l	0.13	0.12	0.01	8%	40%	50%	50%	PASS	
6	Gross Alpha			pCi/L	2.3+/-0.68 MDA=1	1.5+/-0.642 MDA=1	0.8	42%	0%	20%	20%	NA	Criteria not applicable results provided with different counting errors and MDAs. Results deemed acceptable.
8	HAA5, Total		1	ug/l	5.7	5.4	0.3	5%	9%	20%	20%	PASS	
9	Nickel, Total	0.13	0.8	ug/l	1.1	1.1	0	0%	36%	50%	50%	PASS	
10	Nitrate as NO3	0.18	0.5	mg/l	1.3	1.3	0	0%	19%	20%	20%	PASS	
11	NO2+NO3 as N	0.01	0.1	mg/l	0.3	0.29	0.01	3%	17%	20%	20%	PASS	
14	Selenium, Total	0.28	0.4	ug/l	0.43	0.4	0.03	7%	48%	50%	50%	PASS	
16	THMs, Total	0.6	2	ug/l	33	35	2	6%	3%	20%	20%	PASS	
18	Uranium Rad	0.019	0.13	pCi/L	1.3	1.3	0	0%	5%	20%	20%	PASS	
19	Aluminum, Total	0.61	5	ug/l	29	29	0	0%	9%	20%	20%	PASS	
20	Chloride, Total	1	5	mg/l	63	63	0	0%	4%	20%	20%	PASS	
21	Copper, Total	0.27	0.5	ug/l	3	3.1	0.1	3%	8%	20%	20%	PASS	
22	Iron, Total	1.1	10	ug/l	35	37	2	6%	14%	20%	20%	PASS	
23	Manganese, Total	0.11	0.2	ug/l	4.3	4.4	0.1	2%	2%	20%	20%	PASS	
24	Specific Conductance (EC)	0.47	4	umhos/cm	520	520	0	0%	0%	20%	20%	PASS	
25	Sulfate as SO4	1	5	mg/l	73	73	0	0%	3%	20%	20%	PASS	
26	Total Dissolved Solids	4	10	mg/l	270	270	0	0%	2%	20%	20%	PASS	
27	Turbidity	0.024	0.1	NTU	0.35	0.47	0.12	29%	12%	20%	20%	FAIL	Poor precision, but difference is reasonable for the method at the low concentrations.
28	Arsenic, Total	0.036	0.4	ug/l	2	2	0	0%	10%	20%	20%	PASS	
29	Bromodichloromethane	0.09	0.5	ug/l	11	10	1	10%	2%	20%	20%	PASS	
30	Bromoform	0.19	0.5	ug/l	4	3.8	0.2	5%	6%	20%	20%	PASS	
31	Chloroform	0.12	0.5	ug/l	4.8	4.8	0	0%	5%	20%	20%	PASS	
32	Copper, Total	0.27	0.5	ug/l	3.1	3	0.1	3%	8%	20%	20%	PASS	
33	Dibromochloromethane	0.2	0.5	ug/l	15	14	1	7%	2%	20%	20%	PASS	
34	Nickel, Total	0.13	0.8	ug/l	1.1	1.1	0	0%	36%	50%	50%	PASS	
35	Selenium, Total	0.28	0.4	ug/l	0.4	0.43	0.03	7%	48%	50%	50%	PASS	
36	Boron, Total	0.28	1	ug/l	140	140	0	0%	0%	20%	20%	PASS	
37	Formaldehyde	0.26	2	ug/l	2.7	2.4	0.3	12%	39%	50%	50%	PASS	
38	Manganese, Total	0.11	0.2	ug/l	4.3	4.4	0.1	2%	2%	20%	20%	PASS	
39	Vanadium, Total	0.047	0.5	ug/l	2.7	2.8	0.1	4%	9%	20%	20%	PASS	
40	Lithium, Total	1.4	10	ug/l	14	13	1	7%	37%	50%	50%	PASS	

Note: Criteria 1 = a) If the result of the original sample was within 2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) the relative percent difference (RPD) should be 50%), whichever is higher. Criteria 2 = a) If the result of the original sample was >2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) RPD of 20%, whichever higher.

Table B-5 Summary of Blind Duplicate Samples from Quarterly Sampling Event Number 4 Results (5/1/12)

No.	Compound	MDL	RL	Units	S10 Sample	Blind Duplicate	Difference	RPD (Actual)	RPD (Criteria 1)	RPD (Criteria 2)	Governing RPD	PASS / FAIL	NOTES
1	Aluminum, Total	0.61	5	ug/l	5	9.1	4.1	58%	35%	50%	50%	FAIL	S10 Result at RL. RPD close to acceptance criteria.
2	Alkalinity as CaCO3	0.56	2	mg/l	3.4	2	1.4	52%	37%	50%	50%	FAIL	Blind Dupe at RL. RPD close to acceptance criteria.
3	Barium, Total	0.03	0.5	ug/l	0.5	0.7	0.2	33%	42%	50%	50%	PASS	
4	Bicarbonate Alkalinity as HCO3	0.56	2	mg/l	4.1	2.4	1.7	52%	31%	20%	31%	FAIL	RPD governing criteria 2 deemed applicable
5	Boron, Total	0.28	1	ug/l	290	290	0	0%	0%	20%	20%	PASS	
6	Chloride, Total	0.1	0.5	mg/l	3.9	3.8	0.1	3%	6%	20%	20%	PASS	
7	Formaldehyde	0.26	2	ug/l	6.5	6.5	0	0%	15%	20%	20%	PASS	
8	Manganese, Total	0.11	0.2	ug/l	0.2	0.22	0.02	10%	48%	50%	50%	PASS	
9	Nitrate as NO3	0.18	0.5	mg/l	4.3	4.3	0	0%	6%	20%	20%	PASS	
11	N-Nitrosodiethylamine	0.8	2.2	ng/l	4.9	2.2	2.7	76%	31%	20%	31%	FAIL	Follow up with lab required. UV/AOP should have removed NDEA.
12	NO2+NO3 as N	0.01	0.1	mg/l	0.97	0.98	0.01	1%	5%	20%	20%	PASS	
13	pH	0.1	0.1	Units	5.89	6.09	0.2	3%	1%	20%	20%	PASS	
14	Potassium, Total	0.081	0.1	mg/l	0.5	0.47	0.03	6%	10%	20%	20%	PASS	
15	Sodium, Total	0.015	0.5	mg/l	4.1	4.1	0	0%	6%	20%	20%	PASS	
16	Specific Conductance (EC)	0.23	2	umhos/cm	26	27	1	4%	4%	20%	20%	PASS	
17	Total Anions	0.02	0.078	meq/l	0.25	0.22	0.03	13%	17%	20%	20%	PASS	
18	Total Cations	0.0045	0.038	meq/l	0.2	0.2	0	0%	10%	20%	20%	PASS	
19	Total Dissolved Solids	4	10	mg/l	11	13	2	17%	42%	50%	50%	PASS	

Note: Criteria 1 = a) If the result of the original sample was within 2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) the relative percent difference (RPD) should be 50%), whichever is higher. Criteria 2 = a) If the result of the original sample was >2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) RPD of 20%, whichever higher.

Table B-6 Summary of Blind Duplicate Samples from Monthly CEC Sampling Results

				Sample Date: 9/14/2011							
No.	Compound	MDL	RL	S9 (RO Perm. Combined)	S9 (Dupe)	RPD	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 1b & 2b)	Governing RPD	PASS / FAIL	NOTES
1	Oxolinic acid	2.46	5	5	7.1	35%	41%	50%	50%	PASS	
2	Atenolol	3.88	5	7.7	5	43%	39%	50%	50%	PASS	
3	Triclosan	6.32	10	34	10	109%	23%	40%	40%	FAIL	Additional QC sampling conducted.
4	Acesulfame-K	20	20	65	20	106%	24%	40%	40%	FAIL	Additional QC sampling conducted.
5	2,4-D	4.98	5	6.4	5	25%	44%	50%	50%	PASS	
				Sample Date: 10/17/2011							
No.	Compound	MDL	RL	S1 (tertiary effluent)	S1 (tertiary effluent DUPE)	RPD	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 1b & 2b)	Governing RPD	PASS / FAIL	NOTES
1	Butalbital	2.9	5	25	27	8%	10%	40%	40%	PASS	
2	DIA	2.45	5	5	5.7	13%	47%	50%	50%	PASS	
3	Erythromycin	4.03	10	25	32	25%	18%	40%	40%	PASS	
4	Simazine	1.23	5	11	10	10%	24%	40%	40%	PASS	
5	Primidone	5.66	5	76	70	8%	3%	40%	40%	PASS	
6	DEET	1.08	2	180	160	12%	1%	40%	40%	PASS	
7	TDCPP	5	100	710	880	21%	6%	40%	40%	PASS	
8	Lidocaine	1.11	5	90	90	0%	3%	40%	40%	PASS	
9	Diclofenac	3.3	5	59	71	18%	4%	40%	40%	PASS	
10	Albuterol	2.45	5	9.9	8.7	13%	27%	50%	50%	PASS	
11	Nifedipine	12.4	20	40	37	8%	26%	50%	50%	PASS	
12	Ketoprofen	2.59	5	38	33	14%	7%	40%	40%	PASS	
13	Naproxen	8.51	10	13	14	7%	37%	50%	50%	PASS	
14	4-nonylphenol - semi quantitative	50	100	200	230	14%	23%	50%	50%	PASS	
15	Gemfibrozil	2.47	5	34	33	3%	7%	40%	40%	PASS	
16	Amoxicillin (semi-quantitative)	6.39	20	960	800	18%	1%	40%	40%	PASS	
17	Atenolol	3.88	5	59	71	18%	4%	40%	40%	PASS	
18	Carbamazepine	1.21	5	190	200	5%	1%	40%	40%	PASS	
19	Diuron	1.8	5	74	77	4%	3%	40%	40%	PASS	
20	Triclosan	6.32	10	140	150	7%	3%	40%	40%	PASS	
21	DACT	3.92	5	26	10	89%	14%	40%	40%	FAIL	Results below or close to RL deemed acceptable.
22	Cotinine	4.85	10	25	10	86%	29%	40%	40%	FAIL	Results below or close to RL deemed acceptable.
23	Cimetidine	2.71	5	12	14	15%	19%	40%	40%	PASS	
24	TCEP	3.18	5	520	520	0%	0%	40%	40%	PASS	
25	Fluoxetine	10	10	39	43	10%	12%	40%	40%	PASS	
26	Acesulfame-K	20	20	33000	33000	0%	0%	40%	40%	PASS	
27	Sucralose	42.2	100	50000	52000	4%	0%	40%	40%	PASS	
28	Dilantin	12.6	20	110	96	14%	10%	40%	40%	PASS	
29	Meprobamate	2.03	5	92	88	4%	3%	40%	40%	PASS	
30	Caffeine	4.31	5	36	28	25%	8%	40%	40%	PASS	
31	Iohexal	7.74	10	4500	4100	9%	0%	40%	40%	PASS	
32	Dehydronifedipine	1.35	5	360	380	5%	1%	40%	40%	PASS	
33	Carbadox	4.19	5	5.7	5.7	0%	44%	50%	50%	PASS	
34	Sulfamethoxazole	2.82	5	470	490	4%	1%	40%	40%	PASS	
35	Trimethoprim	1.81	5	200	260	26%	1%	40%	40%	PASS	
36	Carisoprodol	1.19	5	62	67	8%	4%	40%	40%	PASS	

Table B-6 Summary of Blind Duplicate Samples from Monthly CEC Sampling Results (Cont.)

				Sample Date: 11/8/2011							
No.	Compound	MDL	RL	S1 (tertiary effluent)	S1 (dupe)	RPD	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 1b & 2b)	Governing RPD	PASS / FAIL	NOTES
1	Butalbital	2.9	5	21	17	21%	13%	40%	40%	PASS	
2	Acetaminophen	3.01	5	10	5	67%	33%	50%	50%	FAIL	Results below or close to RL deemed acceptable.
3	Erythromycin	4.03	10	45	55	20%	10%	40%	40%	PASS	
4	Simazine	1.23	5	7.4	8	8%	32%	50%	50%	PASS	
5	Primidone	5.66	5	65	66	2%	4%	40%	40%	PASS	
6	DEET	1.08	2	160	180	12%	1%	40%	40%	PASS	
7	TDCPP	5	100	320	260	21%	17%	40%	40%	PASS	
8	Lidocaine	1.11	5	120	140	15%	2%	40%	40%	PASS	
9	Diclofenac	3.3	5	95	65	38%	3%	40%	40%	PASS	
10	Albuterol	2.45	5	10	12	18%	23%	50%	50%	PASS	
11	Nifedipine	12.4	20	57	51	11%	19%	40%	40%	PASS	
12	Naproxen	8.51	10	19	22	15%	24%	50%	50%	PASS	
13	4-nonylphenol - semi quantitative	50	100	330	440	29%	13%	40%	40%	PASS	
14	Gemfibrozil	2.47	5	28	23	20%	10%	40%	40%	PASS	
15	Amoxicillin (semi-quantitative)	6.39	20	320	400	22%	3%	40%	40%	PASS	
16	Atenolol	3.88	5	150	140	7%	2%	40%	40%	PASS	
17	Carbamazepine	1.21	5	170	180	6%	1%	40%	40%	PASS	
18	Diuron	1.8	5	61	64	5%	4%	40%	40%	PASS	
19	Linuron	2.84	5	6.3	5.6	12%	42%	50%	50%	PASS	
20	Triclosan	6.32	10	84	78	7%	6%	40%	40%	PASS	
21	DACT	3.92	5	21	22	5%	12%	40%	40%	PASS	
22	Cotinine	4.85	10	31	37	18%	15%	40%	40%	PASS	
23	Lopressor	5.14	20	270	280	4%	4%	40%	40%	PASS	
24	TCEP	3.18	5	410	340	19%	1%	40%	40%	PASS	
25	Fluoxetine	10	10	28	35	22%	16%	40%	40%	PASS	
26	Acesulfame-K	20	20	28000	35000	22%	0%	40%	40%	PASS	
27	Sucralose	42.2	100	26000	29000	11%	0%	40%	40%	PASS	
28	Dilantin	12.6	20	130	120	8%	8%	40%	40%	PASS	
29	Meprobamate	2.03	5	120	120	0%	2%	40%	40%	PASS	
30	Caffeine	4.31	5	20	21	5%	12%	40%	40%	PASS	
31	Meclofenamic Acid	4.66	5	5	5.5	10%	48%	50%	50%	PASS	
32	Iohexal	7.74	10	4100	4700	14%	0%	40%	40%	PASS	
33	Dehydronifedipine	1.35	5	40	41	2%	6%	40%	40%	PASS	
34	Sulfamethoxazole	2.82	5	780	690	12%	0%	40%	40%	PASS	
35	Iopromide	1.59	5	27	56	70%	6%	40%	40%	FAIL	Results below or close to RL deemed acceptable.
36	Trimethoprim	1.81	5	120	120	0%	2%	40%	40%	PASS	
37	Carisoprodol	1.19	5	52	56	7%	5%	40%	40%	PASS	

Table B-6 Summary of Blind Duplicate Samples from Monthly CEC Sampling Results (Cont.)

				Sample Date: 2/1/2012							
No.	Compound	MDL	RL	S6	S6 Duplicate	RPD	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 1b & 2b)	Governing RPD	PASS / FAIL	NOTES
1	Acesulfame-K	20	20	48000	52000	8%	0%	40%	40%	PASS	
2	Albuterol	2.4	5	12	14	15%	19%	40%	40%	PASS	
3	Amoxicillin (semi-quantitative)	6.4	20	270	250	8%	4%	40%	40%	PASS	
4	Atenolol	3.9	5	42	33	24%	7%	40%	40%	PASS	
5	Butalbital	2.9	5	5	51	164%	9%	50%	50%	FAIL	Low value is suspect – not consistent with historical data.
6	Caffeine	4.3	5	9.8	10	2%	25%	50%	50%	PASS	
7	Carbamazepine	1.2	5	190	200	5%	1%	40%	40%	PASS	
8	Carisoprodol	1.2	5	780	1400	57%	0%	40%	40%	FAIL	May reflect heterogeneity between samples for this compound or possible dilution.
9	Cotinine	4.8	10	15	15	0%	33%	50%	50%	PASS	
10	DACT	3.9	5	11	8.2	29%	26%	40%	40%	PASS	
11	DEET	1.1	10	260	200	26%	2%	40%	40%	PASS	
12	Dehydronifedipine	1.4	5	140	160	13%	2%	40%	40%	PASS	
13	Diclofenac	3.3	5	18	16	12%	15%	40%	40%	PASS	
14	Dilantin	13	20	110	78	34%	11%	40%	40%	PASS	
15	Diuron	1.8	5	92	96	4%	3%	40%	40%	PASS	
16	Erythromycin	4	10	90	90	0%	6%	40%	40%	PASS	
17	Estrone	3.9	5	15	27	57%	12%	40%	40%	FAIL	No obvious reason for difference. May be inhomogeneity in sample.
18	Fluoxetine	10	10	100	92	8%	5%	40%	40%	PASS	
19	Gemfibrozil	2.5	5	79	86	8%	3%	40%	40%	PASS	
20	Iohexal	7.7	10	40000	46000	14%	0%	40%	40%	PASS	
21	Ketoprofen	2.6	5	75	60	22%	4%	40%	40%	PASS	
22	Lidocaine	1.1	5	220	260	17%	1%	40%	40%	PASS	
23	Linuron	2.8	5	210	170	21%	1%	40%	40%	PASS	
24	Lopressor	5.1	20	200	200	0%	5%	40%	40%	PASS	
25	Meprobamate	2	5	550	380	37%	1%	40%	40%	PASS	
26	Primidone	4.8	5	93	98	5%	3%	40%	40%	PASS	
27	Simazine	1.2	5	15	14	7%	17%	40%	40%	PASS	
28	Sucralose	42	100	45000	55000	20%	0%	40%	40%	PASS	
29	Sulfamethoxazole	2.8	5	1200	1200	0%	0%	40%	40%	PASS	
30	TCEP	3.2	10	400	390	3%	1%	40%	40%	PASS	
31	TCPP	20	100	1600	1900	17%	3%	40%	40%	PASS	
32	TDCPP	20	100	270	100	92%	27%	40%	40%	FAIL	Many of the flame retardants are semi-quantitative due to poor chromatographic resolutions.
33	Triclosan	6.3	10	74	69	7%	7%	40%	40%	PASS	
34	Trimethoprim	1.8	5	450	400	12%	1%	40%	40%	PASS	

Table B-6 Summary of Blind Duplicate Samples from Monthly CEC Sampling Results (Cont.)

				Sample Date: 5/1/2012							
No.	Compound	MDL	RL	S10	S10 Duplicate	RPD	RPD (Acceptance Criteria 1a & 2a)	RPD (Acceptance Criteria 1b & 2b)	Governing RPD	PASS / FAIL	NOTES
1	4-nonylphenol - semi quantitative	50	100	<50	<50	0%	NA	40%	NA	PASS	
2	Acesulfame-K	20	20	<20	<20	0%	NA	40%	NA	PASS	
3	Albuterol	2.4	5	<2.4	<5	0%	NA	40%	NA	PASS	
4	Amoxicillin (semi-quantitative)	6.4	20	<6.4	<6.4	0%	NA	40%	NA	PASS	
5	Atenolol	3.9	5	<3.9	<3.9	0%	NA	40%	NA	PASS	
6	Butalbital	2.9	5	<2.9	<2.9	0%	NA	40%	NA	PASS	
7	Caffeine	4.3	5	<4.3	<4.3	0%	NA	40%	NA	PASS	
8	Carbamazepine	1.2	5	<1.2	<1.2	0%	NA	40%	NA	PASS	
9	Carisoprodol	1.2	5	<1.2	<1.2	0%	NA	40%	NA	PASS	
10	Cotinine	4.8	10	<4.8	<4.8	0%	NA	40%	NA	PASS	
11	DACT	3.9	5	<3.9	<3.9	0%	NA	40%	NA	PASS	
12	DEET	1.1	10	<10	<10	0%	NA	40%	NA	PASS	
13	Dehydronifedipine	1.4	5	<1.4	<1.4	0%	NA	40%	NA	PASS	
14	Diclofenac	3.3	5	<3.3	<3.3	0%	NA	40%	NA	PASS	
15	Dilantin	13	20	<13	<13	0%	NA	40%	NA	PASS	
16	Diuron	1.8	5	<1.8	<1.8	0%	NA	40%	NA	PASS	
17	Erythromycin	4	10	<4	<4	0%	NA	40%	NA	PASS	
18	Estradiol	4.4	5	<4.4	<4.4	0%	NA	40%	NA	PASS	
19	Estrone	3.9	5	<3.9	<3.9	0%	NA	40%	NA	PASS	
20	Fluoxetine	10	10	<10	<10	0%	NA	40%	NA	PASS	
21	Gemfibrozil	2.5	5	<2.5	<2.5	0%	NA	40%	NA	PASS	
22	Iohexal	7.7	10	<7.7	<7.7	0%	NA	40%	NA	PASS	
23	Ketoprofen	2.6	5	<2.6	<2.6	0%	NA	40%	NA	PASS	
24	Lidocaine	1.1	5	<1.1	<1.1	0%	NA	40%	NA	PASS	
25	Linuron	2.8	5	<2.8	<2.8	0%	NA	40%	NA	PASS	
26	Lopressor	5.1	20	<5.1	<5.1	0%	NA	40%	NA	PASS	
27	Meprobamate	2	5	<2	<2	0%	NA	40%	NA	PASS	
28	Naproxen	8.5	10	<8.5	<8.5	0%	NA	40%	NA	PASS	
29	Primidone	4.8	5	<4.8	<4.8	0%	NA	40%	NA	PASS	
30	Simazine	1.2	5	<1.2	<1.2	0%	NA	40%	NA	PASS	
31	Sucralose	42	100	<42	<42	0%	NA	40%	NA	PASS	
32	Sulfamethoxazole	2.8	5	<2.8	<2.8	0%	NA	40%	NA	PASS	
33	TCEP	3.2	10	<10	<3.2	0%	NA	40%	NA	PASS	
34	TCPP	20	100	<20	<20	0%	NA	40%	NA	PASS	
35	TDCPP	20	100	<100	<20	0%	NA	40%	NA	PASS	
36	Theobromine	3.2	10	<10	<3.2	0%	NA	40%	NA	PASS	
37	Triclosan	6.3	10	<6.3	<6.3	0%	NA	40%	NA	PASS	
38	Trimethoprim	1.8	5	<1.8	<1.8	0%	NA	40%	NA	PASS	

Note: Criteria 1 = a) If the result of the original sample was within 2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) the relative percent difference (RPD) should be 50%), whichever is higher. Criteria 2 = a) If the result of the original sample was >2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) RPD of 40%, whichever higher. A total of 89 compounds were analyzed per sampling event. Results are only provided for compounds in which a value was reported above the ≥RL in the original or blind duplicate sample.

Table B-7 Summary of Split Samples from Quarterly Sampling Event Number 1 Results WECK and MWH Lab (8/24/11)

No.	Compound	MDL	RL	S10 Grab Result	DL	S10 Split Result	Difference	RPD (Actual)	RPD (Criteria 1)	RPD (Criteria 2)	Governing RPD	PASS / FAIL	NOTES
1	Bromodichloromethane	0.09	0.5	0.78	0.5	0.76	0.02	3%	32%	50%	50%	PASS	
2	Chloroform	0.12	0.5	1.4	0.5	1.3	0.1	7%	19%	20%	20%	PASS	
3	Methylene chloride	0.14	0.5	0.2	0.5	0.5	0.3	86%	71%	50%	71%	FAIL	Acceptable both results at below the RL or DL.
4	THM's, Total	0.6	2	2.2	0.5	2	0.2	10%	48%	50%	50%	PASS	
8	Diethylphthalate	0.22	2	0.31	0.5	0.5	0.19	47%	247%	50%	247%	PASS	
12	Aluminum	0.61	5	3.6	20	20	16.4	139%	21%	50%	50%	FAIL	Acceptable both results at below the RL or DL.
13	Boron	0.28	1	240	0.28	210	30	13%	0%	20%	20%	PASS	
14	Calcium	0.016	0.1	0.025	1	1	0.975	190%	10%	50%	50%	FAIL	Acceptable both results at below the RL or DL.
15	Lead	0.011	0.2	0.03	0.5	0.5	0.47	177%	38%	50%	50%	FAIL	Acceptable both results at below the RL or DL.
16	Mercury	0.0039	0.05	0.016	0.2	0.2	0.184	170%	23%	50%	50%	FAIL	Acceptable both results at below the RL or DL.
17	Potassium	0.081	0.1	0.31	1	1	0.69	105%	8%	20%	20%	FAIL	Acceptable both results at below the RL or DL.
18	Sodium	0.015	0.5	3.2	1	3.4	0.2	6%	8%	20%	20%	PASS	
21	Chloride	0.1	0.5	2.8	1	20	17.2	151%	2%	20%	20%	FAIL	Acceptable both results at below the RL or DL.
22	Fluoride	0.02	0.1	0.025	0.05	0.05	0.025	67%	133%	50%	133%	PASS	
24	Total anions	0.02	0.078	0.18	0.001	0.16	0.02	12%	23%	20%	23%	PASS	
25	Total cations	0.0045	0.038	0.15	0.001	0.15	0	0%	13%	20%	20%	PASS	
26	pH (units)	0.1	0.1	5.82	0.1	5.8	0.02	0%	1%	20%	20%	PASS	
27	Odor	1	1	1	1	1	0	0%	50%	50%	50%	PASS	
28	Nitrate	0.18	0.5	3.1	0.44	2.8	0.3	10%	8%	20%	20%	PASS	
29	Nitrite/Nitrate as N	10	100	700	100	650	50	7%	7%	20%	20%	PASS	
30	Total dissolved solids	4	10	16	10	14	2	13%	33%	50%	50%	PASS	
31	Specific Conductance	0.23	2	22	2	20	2	10%	5%	20%	20%	PASS	
32	Total organic carbon	0.009	0.3	0.86	0.3	0.3	0.56	97%	26%	20%	26%	FAIL	Difference in results warrants additional QC sampling. Completed.
33	Total alkalinity	0.56	2	2.6	2	2.3	0.3	12%	41%	50%	50%	PASS	
34	Bicarbonate alkalinity	0.56	2	3.2	2	2.9	0.3	10%	33%	50%	50%	PASS	
36	Langelier Index @60C	-10	-10	-6.1	-14	-5	1.1	-20%	90%	20%	90%	PASS	
37	Turbidity	0.024	0.1	0.024	0.05	0.068	0.044	96%	109%	50%	109%	PASS	
38	Gross Alpha	0.38	0.601	0.94	3	3	2.06	105%	15%	50%	50%	FAIL	Acceptable both results at below the RL or DL.
39	HAA5 Total		1	1	2	2	1	67%	33%	50%	50%	FAIL	Acceptable both results at below the RL or DL.
40	Acetaldehyde	0.34	2	0.8	1	1	0.2	22%	111%	50%	111%	PASS	
41	Formaldehyde	0.26	2	8.9	5	51	42.1	141%	3%	20%	20%	FAIL	Difference in results warrants additional QC sampling. Completed.
42	N-Nitrosodimethylamine	0.28	2	0.35	2	2	1.65	140%	85%	50%	85%	FAIL	Acceptable both results at below the RL or DL.

Note: Criteria 1 = a) If the result of the original sample was within 2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) the relative percent difference (RPD) should be 50%), whichever is higher. Criteria 2 = a) If the result of the original sample was >2 X RL then the difference in results between the two samples should be ± 1/2 RL or b) RPD of 20%, whichever higher.

Table B-8 Summary of Split Samples Results for CEC's (Samples Dates: 8/15/11, 11/8/11, 2/1/12, 5/1/12)

No.	Compound	Units	Sample Date												Assigned QC Assessment Category (1, 2 or 3)
			8/15/2011				11/8/2011								
			MWH Lab (RO Feed)	CSM Lab (RO Feed)	MWH-CSM S6	RPD (%)	MWH Lab (Tertiary Effluent)	CSM (Tertiary Effluent	MWH-CSM S1	RPD (%)	MWH Lab (RO Feed)	CSM Lab (RO Feed)	MWH-CSM S6	RPD	
1	4-n-Nonylphenol	ng/L	780	25	755	**188%**	330	25	305	**172%**	470	25	445	**180%**	3
2	Acetaminophen	ng/L	ND	ND		**-------**	10	1	9	**164%**	8.3	1	7.3	**157%**	3
3	Atenolol	ng/L	210	455	245	**74%**	150	172	22	**14%**	150	174	24	**15%**	2
4	Atrazine	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**------**	1
5	Caffeine	ng/L	28	50	22	**56%**	20	23.1	3.1	**14%**	6.7	17.1	10.4	**87%**	2
6	Carbamazepine	ng/L	170	243	73	**35%**	170	244	74	**36%**	160	241	81	**40%**	1
7	Cimetidine	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**------**	1
8	DEET	ng/L	180	327	147	**58%**	160	248	88	**43%**	170	255	85	**40%**	3
9	Diazepam	ng/L	ND	ND		**------**	2.06	3	0.94	**37%**	2.06	3	0.94	**37%**	1
10	Diclofenac	ng/L	58	184	126	**104%**	95	138	43	**37%**	70	139	69	**66%**	3
11	Dilantin	ng/L	82	156	74	**62%**	130	112	18	**15%**	110	113	3	**3%**	1
12	Estradiol 17B	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**------**	1
13	Estrone	ng/L	21	5	16	**123%**	ND	ND		**------**	ND	ND		**------**	2
14	Fluoexetine	ng/L	59	32.1	26.9	**59%**	28	43.4	15.4	**43%**	21	28	7	**29%**	2
15	Gemfibrizol	ng/L	62	73.9	11.9	**18%**	28	37.6	9.6	**29%**	24	36.1	12.1	**40%**	1
16	Ibuprofen	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**------**	1
17	Ketoprofen	ng/L	15	25	10	**50%**	ND	ND		**------**	ND	ND		**------**	2
18	Meprobamate	ng/L	200	295	95	**38%**	120	290	170	**83%**	120	287	167	**82%**	3
19	Methylparaben	ng/L	11.4	15.2	3.8	**29%**	11.4	8.3	3.1	**31%**	11.4	5.9	5.5	**64%**	1
20	Naproxen	ng/L	23	27.7	4.7	**19%**	19	23.5	4.5	**21%**	21	24.2	3.2	**14%**	1
21	Primidone	ng/L	96	110	14	**14%**	65	85.9	20.9	**28%**	62	88.8	26.8	**36%**	1
22	Progesterone	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**-------**	1
23	Propylparaben	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**------**	1
24	Sucralose	ng/L	20000	**------**		**------**	26000	**------**		**------**	22000	**------**		**------**	4
25	Sulfamethoxazole	ng/L	870	1563	693	**57%**	780	1630	850	**71%**	740	1310	570	**56%**	3
26	TCEP	ng/L	180	683	503	**117%**	410	401	9	**2%**	370	403	33	**9%**	1
27	TCPP	ng/L	------	------	------	**------**	------	------	------	**------**	------	------	------	**------**	4
28	TDCPP	ng/L	5	1338	1333	**199%**	320	1250	930	**118%**	130	1080	950	**157%**	3
29	Testosterone	ng/L	ND	ND		**------**	ND	ND		**------**	ND	ND		**-------**	1
30	Triclosan	ng/L	68	96.1	28.1	**34%**	84	79.3	4.7	**6%**	60	69	9	**14%**	2
31	Trimethoprim	ng/L	200	248	48	**21%**	120	153	33	**24%**	120	160	40	**29%**	1

Note: Assigned QC Assessment Categories: 1 =comparison of lab results for the given compound showed consistent agreement (i.e. RPD's < 40% or ND); 2 = comparison of lab results for the given compound showed consistent agreement for some results and discrepancies for others; possibly due to inhomogeneity in the samples and / or sample contamination. 3=comparison of lab results for the given compound showed consistent disagreement possibly due to systematic differences between laboratory analysis procedures 4) Results could not be compared due to insufficient data. 3. The potential for systematic analytical differences was evaluated by having CSM participate in a project for SAWPA that involved a total of 5 labs. Memorandum from Dr. Andy Eaton.

Table B-8 Summary of Split Samples Results for CEC's (Samples Dates: 8/15/11, 11/8/11, 2/1/12, 5/1/12) (continued)

No.	Compound	Units	2/1/2012															Assigned QC Assessment Category (1, 2 or 3)
			MWH Lab (RO Feed)	CSM Lab (RO Feed)	CSM Lab (RO Feed)	MWH-CSM	MWH Dupe-CSM	RPD (%)	RPD Dupe	MWH Lab (RO Permeate Combined)	CSM Lab (RO Permeate Combined)	MWH-CSM	RPD (%)	MWH Lab (UV/AOP Product)	CSM Lab (UV/AOP Product)	MWH-CSM	RPD (%)	
1	4-n-Nonylphenol	ng/L	ND	<100	ND			------		ND	ND		------	ND	ND		------	3
2	Acetaminophen	ng/L																3
3	Atenolol	ng/L	42	33	101	5900%	68	**83%**	1.014925373	ND	ND		-------	ND	ND		-------	2
4	Atrazine	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
5	Caffeine	ng/L	9.8	10	24.9	1510%	14.9	**87%**	0.853868195	ND	ND		-------	<5	ND		-------	2
6	Carbamazepine	ng/L	190	200	242	5200%	42	**24%**	0.190045249	<5	ND		-------	ND	ND		-------	1
7	Cimetidine	ng/L	------	------	------	------	------	------	------	------	------		-------	------	------		-------	1
8	DEET	ng/L	260	200	58.7	20130%	141.3	**126%**	1.092385002	<6	ND		-------	<6	ND		-------	3
9	Diazepam	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
10	Diclofenac	ng/L	18	16	145	12700%	129	**156%**	1.602484472	ND	ND		-------	ND	ND		-------	3
11	Dilantin	ng/L	110	78	127	1700%	49	**14%**	0.47804878	ND	ND		-------	ND	ND		-------	1
12	Estradiol 17B	ng/L	------	------	------	------	------	------	------	------	------		-------	------	------		-------	1
13	Estrone	ng/L	15	27	ND			------		ND	ND		-------	<5	ND		-------	2
14	Fluoexetine	ng/L	100	92	46.8	5320%	45.2	**72%**	0.65129683	ND	ND		-------	ND	ND		-------	2
15	Gemfibrizol	ng/L	79	86	70.1	890%	15.9	**12%**	0.203715567	ND	ND		-------	<5	ND		-------	1
16	Ibuprofen	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
17	Ketoprofen	ng/L	75	60	ND			------		ND	ND		-------	ND	ND		-------	2
18	Meprobamate	ng/L	550	380	308	24200%	72	**56%**	0.209302326	ND	ND		-------	ND	ND		-------	3
19	Methylparaben	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
20	Naproxen	ng/L	ND	ND	8.72			------		ND	ND		-------	ND	ND		-------	1
21	Primidone	ng/L	93	98	122	2900%	24	**27%**	0.218181818	ND	ND		-------	ND	ND		-------	1
22	Progesterone	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
23	Propylparaben	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
24	Sucralose	ng/L	45000	55000	-------			------	#VALUE!	<100			-------	ND			-------	4
25	Sulfamethoxazole	ng/L	1200	1200	1770	57000%	570	**38%**	0.383838384	ND	ND		-------	ND	ND		-------	3
26	TCEP	ng/L	400	390	456	5600%	66	**13%**	0.156028369	ND	ND		-------	ND	ND		-------	1
27	TCPP	ng/L	1600	1900	291	1309	1609	**138%**	1.468735737	ND	ND		-------	ND	ND		-------	4
28	TDCPP	ng/L	270	<100	156	11400%	#VALUE!	**54%**	#VALUE!	ND	ND		-------	ND	ND		-------	3
29	Testosterone	ng/L	------	------	------	------	------	------	------	------	------		-------				-------	1
30	Triclosan	ng/L	74	69	42.3	3170%	26.7	**55%**	0.479784367	13	ND		-------	17	ND		-------	2
31	Trimethoprim	ng/L	450	400	510	6000%	110	**13%**	0.241758242	<5	ND		-------	<5	ND		-------	1

Note: Assigned QC Assessment Categories: 1 =comparison of lab results for the given compound showed consistent agreement (i.e. RPD's < 40% or ND); 2 = comparison of lab results for the given compound showed consistent agreement for some results and discrepancies for others; possibly due to inhomogeneity in the samples and / or sample contamination. 3=comparison of lab results for the given compound showed consistent disagreement possibly due to systematic differences between laboratory analysis procedures 4) Results could not be compared due to insufficient data. 3. The potential for systematic analytical differences was evaluated by having CSM participate in a project for SAWPA that involved a total of 5 labs. Memorandum from Dr. Andy Eaton.

Table B-8 Summary of Split Samples Results for CEC's (Samples Dates: 8/15/11, 11/8/11, 2/1/12, 5/1/12) (continued)

No.	Compound	Units	5/1/2012												Assigned QC Assessment Category (1, 2 or 3)
			MWH Lab (RO Feed)	CSM Lab (RO Feed)	MWH-CSM	RPD (%)	MWH Lab (RO Permeate Combined)	CSM Lab (RO Permeate Combined)	MWH-CSM	RPD (%)	MWH Lab (UV/AOP Product)	CSM Lab (UV/AOP Product)	MWH-CSM	RPD (%)	
1	4-n-Nonylphenol	ng/L	520	25	495	**182%**	ND	BDL	------	**------**	ND	BDL	------	**------**	3
2	Acetaminophen	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	3
3	Atenolol	ng/L	43	74.1	31	**53%**	ND	BDL	------	**------**	ND	BDL	------	**------**	2
4	Atrazine	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
5	Caffeine	ng/L	4.3	24.5	20	**140%**	ND	BDL	------	**------**	ND	BDL	------	**------**	2
6	Carbamazepine	ng/L	210	192	18	**9%**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
7	Cimetidine	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
8	DEET	ng/L	210	222	12	**6%**	<10	BDL	------	**------**	<10	BDL	------	**------**	3
9	Diazepam	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
10	Diclofenac	ng/L	3.3	129	126	**190%**	ND	BDL	------	**------**	ND	BDL	------	**------**	3
11	Dilantin	ng/L	140	133	7	**5%**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
12	Estradiol 17B	ng/L	<5	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
13	Estrone	ng/L	<3.9	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	2
14	Fluoexetine	ng/L	31	27.1	4	**13%**	ND	BDL	------	**------**	ND	BDL	------	**------**	2
15	Gemfibrizol	ng/L	52	42.6	9	**20%**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
16	Ibuprofen	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
17	Ketoprofen	ng/L	17	5	12	**109%**	ND	BDL	------	**------**	ND	BDL	------	**------**	2
18	Meprobamate	ng/L	160	285	125	**56%**	ND	BDL	------	**------**	ND	BDL	------	**------**	3
19	Methylparaben	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
20	Naproxen	ng/L	8.5	12.8	4	**40%**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
21	Primidone	ng/L	97	112	15	**14%**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
22	Progesterone	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
23	Propylparaben	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
24	Sucralose	ng/L	48000	-	------	**------**	ND	-	------	**------**	ND	-	------	**------**	4
25	Sulfamethoxazole	ng/L	870	1130	260	**26%**	2.8	1.28	152%	**75%**	ND	BDL	------	**------**	3
26	TCEP	ng/L	270	451	181	**50%**	ND	BDL	------	**------**	<10	BDL	------	**------**	1
27	TCPP	ng/L	2300	357	1943	**146%**	ND	BDL	------	**------**	ND	BDL	------	**------**	4
28	TDCPP	ng/L	780	178	602	**126%**	ND	BDL	------	**------**	<100	BDL	------	**------**	3
29	Testosterone	ng/L	-	BDL	------	**------**	ND	BDL	------	**------**	ND	BDL	------	**------**	1
30	Triclosan	ng/L	28	36.8	9	**27%**	ND	BDL	------	**------**	ND	BDL	------	**------**	2
31	Trimethoprim	ng/L	280	298	18	**6%**	ND	BDL	------	**------**	ND	BDL	------	**------**	1

Note: Assigned QC Assessment Categories: 1 =comparison of lab results for the given compound showed consistent agreement (i.e. RPD's < 40% or ND); 2 = comparison of lab results for the given compound showed consistent agreement for some results and discrepancies for others; possibly due to inhomogeneity in the samples and / or sample contamination. 3=comparison of lab results for the given compound showed consistent disagreement possibly due to systematic differences between laboratory analysis procedures 4) Results could not be compared due to insufficient data. 3. The potential for systematic analytical differences was evaluated by having CSM participate in a project for SAWPA that involved a total of 5 labs. Memorandum from Dr. Andy Eaton.

eurofins | Eaton Analytical

Jennifer Thompson, PE
CDM-Smith
1925 Palomar Oaks Way, Suite 300
Carlsbad, CA 92008

September 10, 2012

Dear Ms. Thompson;

As part of the San Diego AWP Facility testing program, MWH Labs (now Eurofins Eaton Analytical, Inc.) tested a target list of ninety two (92) constituents of emerging concern (CEC) including those used in pesticides, herbicides, and pharmaceuticals and personal care products (PPCP) representing a wide variety of physical and chemical properties. Analysis were conducted monthly for the initial 4 months of testing on samples collected throughout the purification processes including tertiary effluent prior to chlorination, RO feed, RO permeate and UV/AOP product water and imported raw aqueduct water. Though 92 constituents were initially targeted results were only provided for 90 constituents due to poor precision on two constituents (Azithromycin and TCPP). Analysis of this many compounds in a single method requires optimization of the column and instrumentation to get consistent resolution. Azithromycin and TCPP were both added to the method after it was optimized for the other analytes however, the chromatographic performance for these compounds was determined to be inadequate to generate quantitative data and therefore removed from the target list.

Following the initial 4 months of testing a subset of constituents were selected for additional sampling due to their consistent presence in the RO feed, making them candidates to serve as performance indicators for the RO and/or UV/AOP. The subset of compounds also included CECs identified by the State Board Science Advisory Panel (SAP) prioritized for monitoring based on toxicological relevance and those identified as viable performance indicators along with surrogate parameters for surface spreading and direct injection of recycled water for groundwater recharge operations.

Overall the results of the CEC testing, including QC samples, showed the number and concentration of constituents detected at each sample location to be consistent and the overall data set is considered to be of high quality in terms of consistency, accuracy, and reproducibility. In nearly every case, where there were detections in the RO feed, there were significant decreases through the RO and into the UV/AOP influent and UV/AOP product. Of the 545 individual CEC compound measurements (i.e. 90 constituents tested monthly X 4 months + 37 constituents tested weekly X 4 weeks + 1 quarterly sampling event) for the UV/AOP product water generated during the testing period, only 5 results were reported above the associated reporting limit (RL). The results of these individual detections are summarized below, along with the concentrations measured in the RO feed and RO permeate at the same time. Additional information as well as scientific interpretation of the results for each constituent is also provided below.

Sample Date	Compound	RL (ng/L)	RO feed (ng/L)	RO permeate (ng/L)	UV/AOP product (ng/L)
9/14/11	Triclosan	10	37	34	19
9/14/11	Iohexal	10	8700	<10	19
9/14/11	Acesulfame-k	20	29000	65	50
2/1/12	Triclosan	10	74	13	17
2/15/12	Acesulfame-k	20	44000	<20	31

- **Triclosan** is used as a synthetic broad-spectrum antimicrobial agent. Triclosan is used in a variety of consumer products, such as antimicrobial hand soaps, toothpaste, and over-the-counter drugs. It also functions as a material preservative in adhesives, fabrics, vinyl, plastics (toys, toothbrushes), polyethylene, polyurethane, polypropylene, floor wax emulsions, textiles (footwear, clothing), caulking compounds, sealants, rubber, carpeting, and a wide variety of other products. While MWH Labs has not historically seen extensive issues with method blank or field blank contamination for this compound, there have been sporadic cases where it has shown up unexpectedly, which is most likely due to ambient field or lab contamination. Although it was not possible to identify specific sources of triclosan in the laboratory, the lab did determine that blanks were somewhat higher than normal on the days with two of the positive hits. It is worth noting that the SAP recommended using an RL of 50 ng/L for compliance monitoring because of the ubiquitous occurrence of triclosan. In the WateResearch Foundation (WaterRF) sponsored Project 4167, triclosan was one of only 6 compounds (out of 22) with false positive rates of >10% with RLs that ranged from 1 to 20 ng/L. In that project, MWH was not one of the labs that had false positives for triclosan, and there was also no issue with either field blanks or method blanks on another large wastewater effluent project conducted in June of 2011 and again in June of 2012. However the high blanks on several of the days associated with hits make these hits suspect.

- **Acesulfame-k** is a widely used artificial sweetener. Ace-K is used in a variety of consumables, including baked goods, soft drinks, sports drinks, chewable and liquid medications, and other foods. Ace-K was present at very high levels in the RO Feed (6400 ng/L to 48,000 ng/L). Thus the detections of 18-65 ng/L in the permeate represent an RO rejection rate exceeding 99.5%. If one also considers the other sample events where it was not detected, the rejection rate is likely even higher. The expected analytical precision of Ace-K at these levels is +/-50% (e.g. ~10 ng/L), so the values in the AOP product are very similar to those in the RO. Buerge (2009) had suggested in Germany that Ace-K was an ideal tracer of wastewater presence in groundwaters in part because of the high source concentrations and also due to its conservative behavior and lack of reactivity. Eurofins Eaton Analytical has analyzed over 2,000 samples for Ace-K (Eaton, WateReuse 2012) and found that in the U.S. concentrations in wastewater effluents are somewhat more variable than sucralose (proposed by the SAP as an indicator compound) but generally of the same order of magnitude in wastewater effluent concentration. The increased analytical sensitivity for this compound compared to sucralose makes it more likely to be detected even with high rejection rates.

- **Iohexal** This compound is used widely as an X-ray contrasting agent in a variety of hospital radiological tests, such as coronary angiographs. It is used much more frequently than iopromide, which was suggested by the SAP as a good performance indicator compound. Ioxhexal was only detected in 1 of 9 purified water samples, even though the typical RO feed water had between 5,000 and 40,000 ng/L. On the day that it was detected in the AOP product water, the RO permeate and a blind duplicate of the RO permeate had trace level detects below the RL of 10 ng/L. This suggests that the positive value in the AOP was likely impacted by analytical imprecision at that level. There is no stable isotope analog available for iohexal so it is potentially subject to signal enhancement or suppression, although there should be minimal matrix impact in RO permeate or AOP product. Again the very high influent values suggest that the removal efficiency, even if there were iohexal in the AOP product is greater than 99%.

During the testing program, RL's were adjusted for three CECs as described below.

DEET – The RL for this compound was originally 2 ng/L however, because the RL for this compound is subject to change based on concentrations detected in blanks in a given analysis batch, the RL was increased to 10 ng/L for all samples to ensure consistency and the ability to compare data.

Oxolinic Acid – The RL for this compound was originally 5 ng/L, however because this compound does not have a reliable secondary isotope for quantification, and is prone to baseline noise, increasing uncertainty in quantitation) the RL for all samples was increased to 10 ng/L.

Theobromine – The RL for this compound was originally 5 ng/L, however, because this compound does not have a reliable secondary isotope for quantification and is sensitive to matrix impacts on the signal response, the RL for all samples was increased to 10 ng/L.

As part of the overall testing program, split samples of CECs collected at various sampling locations were also analyzed by Colorado School of Mines. Comparison of results of MWH Labs and CSM Labs showed overall good agreement between results however there were some results with higher than expected discrepancies (i.e. relative percent difference > 50%). In order to investigate the potential cause of these discrepancies several steps were taken as discussed below.

- **Exchange of Standards** Both labs reviewed their raw data and exchanged and analyzed standards prepared by each other for compounds analyzed for the project. Of the standards analyzed, results were in close agreement for both labs, generally within 20%. This included those compounds where there were significant differences between the labs. CSM did determine that their sensitivity for acetaminophen might not be as good as initially through. This suggested that the cause of any discrepancy was not due to obvious calibration differences, but there could be some impact from method sensitivity.

- **Investigation of Sample Volume –** Some of the discrepancies between the lab results were associated with possible sample contamination**.** Because the labs used two different sample volumes (MWH Labs = 40 mL; CSM = 1000 mL) an investigation was undertaken to determine if the smaller sample volume was more prone to sample contamination. Results of the investigation targeting DEET and triclosan showed no conclusive evidence that sample volume impacted detections, although one round of initial testing did suggest that smaller sample volumes were more likely to be impacted by any ambient field contamination.

- **Third Part Study Participation -** In tandem with the San Diego AWP Facility testing, both MWH Labs and and CSM participated in a multi lab study conducted on behalf of the Santa Ana Watershed Project Authority (SAWPA). This study is now in its third year of sampling over twenty wastewater dischargers to the SAWPA watershed. For purposes of the San Diego IPR project however, the more important part of the study is the QC samples that are an integral part of it. Each laboratory analyzes two blind samples prepared by Environmental Resources Associates (ERA) for a set of 11 SAWPA designated contaminants of emerging concern (CECs) and also analyzes a split sample of water from the Santa Ana River collected below Prado dam (representative of a receiving water) for whatever CECs they can report with their analytical method. In 2010 and 2011, only 4 laboratories were involved in the study, but in 2012, SAWPA agreed to let CSM also analyze the ERA samples and the Prado Dam sample as a way of evaluating any systematic bias between MWH Labs and CSM that might explain some of the discrepancies in the San Diego results. Also note that the Prado Dam sample included a field blank. Detailed results from this study, including tables comparing lab performance, are available from SAWPA in their annual report on CECs (2012 report still in preparation).

  For the ERA sample, results generally agreed well among all four labs with only a few exceptions. One of these was acetaminophen, where CSM had unusually low recovery on a low level spike sample. In the San Diego split samples there were three compounds: Acetaminophen, DEET, and sulfamethoxazole, that had significant differences on one or more of the split samples. Thus the low bias from CSM may at least partially explain the San Diego differences, although one PT sample is insufficient to demonstrate a systematic issue and could instead indicate a one-time error. Since acetaminophen was not detected by either lab in the Prado Dam sample, it is not possible to determine if there was also a matrix issue. Results for DEET and Sulfamethoxazole generally agreed amongst all labs. This indicates that there are no obvious differences in analytical methods in clean matrices such as proficiency testing samples or river water, but because CSM did not test any of the effluent samples from the SAWPA project we cannot use these data to determine if there are possible method differences on more complex matrices such as the RO feed water.

Based on the investigation measures described above it seems that the most likely cause for the differences in results between MWH and CSM on some of the San Diego splits may well be sample inhomogeneity for the RO feedwater (S6), where there are solids present that might impact either the analytical methods themselves or the representativeness of the split itself.

There is no obvious explanation for the differences at purified water sites as both labs have demonstrated the ability to produce accurate results. It is worth noting that PPCP studies occasionally have apparent outliers on individual samples, particularly when measurements are near the reporting limit. This is likely because measurements are being made in the low ng/L level, where there are a myriad of potential sources for lab or field contamination. One of the reasons the SAP recommended reporting limits as high as 50 ng/L for triclosan was just that reason.

If you have any questions about these data do not hesitate to contact me.

Sincerely yours,

Andrew Eaton

Andrew Eaton, PhD
Vice President/Technical Director

Appendix C

Technical Memorandum: Summary of Third Party Data Validation of AWP Facility Quarterly Sampling Event Results.

· T E C H N I C A L M E M O R A N D U M

To:	Anthony Van	**Date:**	**7**/31/12
From:	Jay DeCarolis, PE	**CC:**	Marsi Steirer Bill Pearce

Subject: Summary of AWPF Third Party Data Validation of Quarterly Sampling Event Number 1 Results

Background.
Per the QA/QC plan outlined in the Final T&M Plan third-party validation was performed on the water quality data produced from WECK Laboratories, Inc. (WECK) and MWH Laboratories, Inc. (MWH) for samples collected during the first Quarterly sampling event conducted on 8/24/11. The purpose of the validation was to determine the data quality and review laboratory procedures in order to identify possible procedural alterations to be implemented for subsequent sampling events.

Data validation was performed was on results from samples collected from the UV/AOP product water (S10). These included original samples analyzed by WECK and split samples analyzed by MWH along with blind duplicate samples analyzed by WECK labs only. The specific fractions analyzed by each lab are provided in Appendix A and Appendix B, respectively.

Benefits of Third Party Validation

Third party validation is beneficial whenever analytical data may be subject to intense scrutiny that could result in the accuracy of the reported data being challenged in a court of law. The USEPA issued guidance documents1,2 detailing analytical data evaluation and review processes for inorganic and organic data produced under the EPA Contract Lab Program (CLP). The CLP supports a major portion of the sample analysis needs of the EPA Superfund Program. Due to the potential for legal challenges, samples submitted under this program must be analyzed in conformance with specified analytical protocols and the assembled data package must go through a technical quality assurance review (validation) prepared by an independent third party. In 1986, the Director of the Office of Emergency and Remedial Response proposed several levels of data validation.

Commercial third party specialists performing water quality data validation utilize the guidance issued under the EPA CLP program. Level IV review is the most rigorous and is characterized by quality assurance / quality control (QA/QC) protocols and documentation resulting in a complete qualitative and quantitative analysis of the

[1] www.epa.gov/superfund/programs/clp/download.fgorg.pdf
[2] www.epa.gov/superfund/programs/clp/download/fginor.pdf

analytical data3. Data that fulfills the requirements of this level of third party validation fulfills the minimum data quality standards needed to allow the data to be used for its intended objective.

Selection and Credentials of Third Party Validation Firm

Many commercial firms are available to perform third party validations. Laboratory Data Consultants, Inc. (LDC) was selected to review the City's water quality data because they fulfill the following criteria:

- located locally in Carlsbad, CA
- disadvantaged business, 8(a) certified under Small Business Administration
- staffing capacity to meet rapid turn-around-time request
- previous experience validating WECK & MWH data
- wealth of prior water/wastewater laboratory experience in California firm
- subcontractor for EPA, Army Corps, AFCEE, Navy, DOE, DOD, and private consultants.

Protocols.
Laboratory Data Consultants, Inc. (LDC) performed all data validation analysis under EPA Level IV guidelines. Level IV review is the most rigorous and is characterized by QA/QC protocols and documentation resulting in a complete qualitative and quantitative analysis of the analytical data. Data that fulfills the requirements of this level of third party validation fulfills the minimum data quality standards needed to allow the data to be used for its intended objective. The analyses were validated using the following documents applicable to each method

- USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.
- USEPA, CLP National Functional Guidelines for Inorganic Superfund Data Review, January 2010.
- USEPA, CLP National Functional Guidelines for Polychlorinated Dioxins / Dibenzofurans Data Review, Review, September 2005.
- Multiple Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual, July 2004.

Summary of Results
The third party validation process confirmed that the majority of the data met the strict analytical standards of the USEPA CLP. Given the large number of parameters and control statistics analyzed, it is always likely that a handful of parameters will not quite fulfill all of the validation criteria. Since split samples were collected for analysis by each of the laboratories, this summary section only calls out the sample

[3] EPA 540/G 87/003A, Data Quality Objectives For Remedial Response Activities, March 1987)

parameter results that ended up being flagged and qualified for both laboratories or were flagged and only analyzed by one of the laboratories. Flagging of data is performed to denote lack of fulfillment with one or more of the CLP review criteria that could impact data detection or quantization. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature. Flagged data is qualified to provide information on how the finding impacted the results. The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

NJ Presumptive evidence of presence of the compound at an estimated quantity.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

All of the exceptions for either laboratory are detailed in the subsequent section. The project team contacted each laboratory to discuss the findings of the data validation and requested that any necessary procedural changes be implemented for analysis conducted In future sampling events.

Presentation and Interpretation of Third Party Validation Findings

WECK analyzed samples two sample sets utilizing 45 analytical methods as detailed in **Table A-1.** MWH analyzed samples from one sample location utilizing 56 analytical methods as detailed in **Table A-2**. Brief summaries of the items reviewed for each analytical methodology and description of the samples not fully meeting the analytical method requirements are provided below.

EPA Method 524.2 (Volatiles)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations

5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no volatile contaminants
7. Surrogate spikes were within acceptable surrogate recoveries
8. Laboratory control samples (LCS) were within acceptable percent recoveries
9. Internal standards were within QC limits
10. Target compound identification were within validation criteria
11. Compound quantification and Reporting Limits were within validation criteria
12. System performance was acceptable
13. Overall assessment data
14. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two (2) samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.

The exceptions include:

- **Method Blanks** – No volatile contaminants were detected in the method blanks with the exception of bromodichloromethane (BDCM). As a result, the reported concentrations of BDCM were flagged as not detected at or above the stated values.
- **Laboratory Control Samples (LCS) –** All LCS's were within QC limits with the exception of dichlorofluoromethane. As a result the reported concentrations were flagged as estimates.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA SRL 524.2 M (1,2,3 Trichloropropane)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations

4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no volatile contaminants
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two (2) samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified

EPA 625 (Semi-volatiles)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no volatile contaminants
7. Surrogate spikes were within acceptable surrogate recoveries
8. Laboratory control samples (LCS) were within acceptable percent recoveries
9. Internal standards were within QC limits
10. Target compound identification were within validation criteria
11. Compound quantification and Reporting Limits were within validation criteria
12. System performance was acceptable
13. Overall assessment data
14. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two (2) samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. The only exception was that the continuing calibration differences (%D) for the following compounds: **hexachlorocyclopentadiene, ideno (1,2,3 –cd) pyrene, dibenzoa (a,h) anthracene, and benzo (g,h,i) perylene** were above the acceptable value of 20%. Therefore, all reported results for these compounds were flagged as estimated values (all detects) or with estimated detection limits (all non detects).

MWH Laboratories

The sample fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.

The exceptions include:

- **Continuing Calibration** – All continued calibration was performed at the required frequencies. However, the difference (%D) for one compound (benzidine) was greater than 20% on two occasions. Therefore, the result for this parameter was flagged with an estimated detection limit.
- **Laboratory Control Samples (LCS) –** All LCS's were within QC limits with the exception of one compound (**benzidine**). Therefore, the result for this parameter was flagged with an estimated detection limit.

EPA 525.2 (Semi-volatiles)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no volatile contaminants
7. Surrogate spikes were within acceptable surrogate recoveries
8. Laboratory control samples (LCS) were within acceptable percent recoveries
9. Internal standards were within QC limits

10. Target compound identification were within validation criteria
11. Compound quantification and Reporting Limits were within validation criteria
12. System performance was acceptable
13. Overall assessment data
14. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two (2) samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. The only exception was that the acceptable percent recovery (%R) and relative percent difference (RPD), respectively for LCS's of two compounds were not met. The compounds included **disulfoton** and **diazinon**. Therefore, all reported results for these compounds were flagged as estimated values (all detects) or with estimated detection limits (all non detects).

MWH Laboratories

The sample fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.
The exception follows:

- **Continuing Calibration** – All continued calibration was performed at the required frequencies. However, the values of the difference (%D) between calibrations for three compounds (**aldrin, endrin aldehyde and permitrin)** were greater than 30% on one occasion. Therefore, all reported results for these compounds were flagged as estimated values (all detects) or with estimated detection limits (all non-detects).

EPA SW 486 Method 8270M (1,4 Dioxane)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no trace of the target compound

7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Internal standards were within QC limits
9. Target compound identification were within validation criteria
10. Compound quantification and Reporting Limits were within validation criteria
11. System performance was acceptable
12. Overall assessment data
13. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The S10 sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. The Blind Duplicate sample also fulfilled all of the stated requirements within the exception that one of the internal standards **(1,4 Dioxane-d8)** was outside the QC requirements. Therefore, the reported result for this sample location had to be flagged with an estimated detection limit.

MWH Laboratories

This analysis was not performed by the MWH Laboratories. Instead 1,4 dioxane was analyzed using EPA Method 522.

EPA 522 (1,4 Dioxane)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no trace of the target compound
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Internal standards were within QC limits
9. Target compound identification were within validation criteria
10. Compound quantification and Reporting Limits were within validation criteria
11. System performance was acceptable
12. Overall assessment data
13. Field duplicate relative percent difference for detected compounds

WECK Laboratories

This analysis was not performed by the WECK Laboratories. Instead 1,4 dioxane was analyzed using EPA SW 486 Method 8270M.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 508 (Chlorinated Pesticides and PCBs)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no trace of the target compound(s)
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Internal standards were within QC limits
9. Target compound identification were within validation criteria
10. Compound quantification and Reporting Limits were within validation criteria
11. System performance was acceptable
12. Overall assessment data
13. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two (2) samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.

The exceptions include:

- **Continuing Calibration –** All continued calibration was performed at the required frequencies. However, the values of the difference (%D) between calibrations for two compounds (**alpha-BHC, hexachlorocyclopentadiene)** were greater than 20% and results for both sample locations were flagged as

estimated values (all detects) or with estimated detection limits (all non-detects).

- **Surrogate Spikes** – The recovery (%R) of surrogate spikes for all compounds were within the QC limits for the S10 sample. However, the %R for the surrogate compound **decachlorobipheny**l was just outside the QC limits making it necessary to flag results as estimates.

MWH Laboratories

This analysis was not performed by the MWH Laboratories. Instead chlorinated pesticides and PCBs were analyzed using EPA Method 508 and 608.

EPA 505&608 (Chlorinated Pesticides and PCBs)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no trace of the target compound(s)
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Internal standards were within QC limits
9. Target compound identification were within validation criteria
10. Compound quantification and Reporting Limits were within validation criteria
11. System performance was acceptable
12. Overall assessment data
13. Field duplicate relative percent difference for detected compounds

WECK Laboratories

This analysis was not performed by the WECK Laboratories. Instead chlorinated pesticides and PCBs were analyzed using EPA Method 508.

MWH Laboratories

The sample fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.
The exception follows:

- **Initial Calibration** – Relative standard deviations associated with the initial calibration of the column for all required compounds were less than or equal to 10% with the exception of **delta-BHC and 4,4 DDT**. . Therefore, all reported results for these compounds were flagged as estimated values (all detects) or with estimated detection limits (all non-detects).

EPA 200.7, 200.8, and 245.1 (Metals)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Instrument performance check met
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no trace of the target compound(s)
7. Matrix spikes %R and RPD were within QC limits
8. Laboratory control samples (LCS) were within acceptable percent recoveries
9. Internal standards were within QC limits
10. Target compound identification were within validation criteria
11. Compound quantification and Reporting Limits were within validation criteria
12. System performance was acceptable
13. Overall assessment data
14. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. The first exception was the detection of **aluminum and mercury** in the S10 sample method blank where concentrations in the samples were detected at values less than 5 X the concentration measured in the method blank. The second exception was the detection of **mercury** in the Blind duplicate sample method blank where concentrations in the samples were detected at values less than 5 X the concentration measured in the method blank. For both occurrences results were flagged as being analyzed but not detected at or above the stated limit.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 515.3 / 515.4 (Herbicides)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Matrix spikes %R and RPD were within QC limits
7. Duplicate samples analyses were reviewed for each matrix as applicable to assess if QC limits were met
8. Laboratory control samples (LCS) were within acceptable percent recoveries
9. Internal standards were within QC limits
10. Target compound identification were within validation criteria
11. Compound quantification and Reporting Limits were within validation criteria
12. System performance was acceptable
13. Overall assessment data
14. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

SM 2320 B (Alkalinity)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The two samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. The exceptions were the detection of alkalinity and bicarbonate alkalinity in both the S10 and Blind Duplicate samples method blanks where concentrations in the sample were detected at concentration less than 5 X the concentration measured in the method blank. Therefore these results had to be flagged as being analyzed but not detected at or above the stated limit.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 100.2 (Asbestos)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations

4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 326.0 / 317.0 (Bromate)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable

11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

Bromate analysis was performed using EPA 326.0. The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

Bromate analysis was performed using EPA 317.0. The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 300.1 (Chlorate and Chlorite)
Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

Chlorate analysis of the sample using EPA 300.1 fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified. MWH Laboratories analyzed chlorite using EPA Method 300.0.

EPA 300.0 (Chloride, Chlorite, Nitrate, Nitrite, Fluoride, Sulfate)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK Laboratories used EPA 300.0 to analyze chloride, fluoride and sulfate. The two samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. The only exception was the detection of fluoride in the S10 sample method blank where concentrations in the sample were detected at concentration less than 5 X the concentration measured in the method blank. Therefore these result had to be flagged as being analyzed but not detected at or above the stated limit.

MWH Laboratories

MWH Laboratories used EPA 300.0 to analyze chloride, chlorite, nitrate, nitrite and sulfate. The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

SM 2120 B (Color)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

SM 2150 B (Conductivity)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 335.4 / SM 4500 CN-F (Total Cyanide)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

Calculation for Hardness, Total Nitrogen, Total Anions, Total Cations)

EPA 218.6 (Hexavalent Chromium)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

SM 2330 B (Langlier Index)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 353.2 (Nitrate, Nitrite as Nitrogen, Nitrate/Nitrite as Nitrogen)
Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.
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MWH Laboratories

MWH Laboratories used EPA 300.0 to analyze nitrate and nitrite.

EPA 140.1 / SM 2150 B (Odor)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

Odor analysis was performed using EPA 140.1. The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010). No sample data was qualified.

MWH Laboratories

Odor analysis was performed using SM-2150 B. The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010). No sample data was qualified.

EPA 314.0 (Perchlorate)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

SM 4500 B (pH)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 365.1 (Total Phosphorus)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled most of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
The only exception was the detection of phosphorus in the Blind Duplicate sample method blank where concentrations in the sample were detected at concentration less than 5 X the concentration measured in the method blank. Therefore these result had to be flagged as being analyzed but not detected at or above the stated limit.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

SM 5540 C / EPA 425.1 (Surfactants)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

Surfactant analysis was performed using SM 5540C. The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010). No sample data was qualified.

MWH Laboratories

Surfactant analysis was performed using SM 5540C & EPA 425.1. The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010). No sample data was qualified.
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SM 2540 C / EPA 160.1 (Total Dissolved Solids)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

SM 5310 C / EPA 415.3 (Total Organic Carbon)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 351.2 (Total Kjeldahl Nitrogen)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 180.1 (Turbidity)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The samples fulfilled all of the review requirements of the modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified

EPA 504.1 (1,2 Dibromoethane, 1,2-Dibromo-3-chloropropane)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. Internal standards were within QC limits
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA SW 836 Method 1613B (2,3,7,8-TCDD)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. HRGC/HRMS Instrument Performance Checked at required frequency
4. Initial calibration performed with required standard concentrations
5. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
6. Method blanks contained no trace of the target compound(s)
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Internal standards were within QC limits
9. Target compound identification were within validation criteria
10. Compound quantification and Reporting Limits were within validation criteria
11. System performance was acceptable
12. Overall assessment data
13. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Polychlorinated 2, 3, 7, 8-TCDD Data Review, (September 2005). No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Polychlorinated 2, 3, 7, 8-TCDD Data Review, (September 2005). No sample data was qualified.

EPA 900.0 (Gross Alpha and Beta Radioactivity)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All minimum detectable activities met required detection limits.
8. Internal standards were within QC limits
9. Target compound identification were within validation criteria
10. Compound quantification and Reporting Limits were within validation criteria
11. System performance was acceptable
12. Overall assessment data
13. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
. No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 903.0 (Radium 226)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All minimum detectable activities met required detection limits.
8. Sample result verifications were acceptable
9. System performance was acceptable
10. Overall assessment data
11. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

MWH Laboratories

The sample fulfilled most of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
The only exception was that the acceptable percent recovery (%R) and relative percent difference (RPD), respectively for LCS was not met. Therefore, the reported result for this parameter was flagged with an estimated detection limit.

EPA Ra-05 / EPA 904.0 (Radium 228)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All carrier recoveries were within validation criteria.
8. All minimum detectable activities met required detection limits.
9. Sample result verifications were acceptable
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK analyzed Radium 228 using EPA Method Ra-05. The samples fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010). No sample data was qualified.

MWH Laboratories

MWH analyzed Radium 228 using EPA Method 904.0. The sample fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010). No sample data was qualified.

EPA 906.0 (Tritium)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All carrier recoveries were within validation criteria.
8. All minimum detectable activities met required detection limits.
9. Sample result verifications were acceptable
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled most of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
The only exception was that the acceptable percent recovery (%R) and relative percent difference (RPD), respectively for the LCS was not met. Therefore, the reported results were flagged to indicate the isotope was analyzed but not detected and the detection limit is estimated.

MWH Laboratories

The sample fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 901.1 (Gamma Spectroscopy)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All carrier recoveries were within validation criteria.
8. All minimum detectable activities met required detection limits.
9. Sample result verifications were acceptable
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).

MWH Laboratories

MWH Laboratories did not perform this analysis.

EPA SW 846 Method 8330 (Explosives)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

MWH Laboratories analyzed explosives using LCMS.

LCMS (Explosives)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK Laboratories analyzed explosives using EPA SW 846 Method 8330.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA SW 846 Method 8015 B / 8270C (Ethylene Glycol)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK Laboratories analyzed Ethylene Glycol using EPA SW 846 Method 8015B. The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

MWH Laboratories analyzed Ethylene Glycol using EPA SW 846 Method 8270C. The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 552.2 / 6251B (Haloacetic Acids)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK Laboratories analyzed Haloacetic Acids using EPA Method 552.2. The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

MWH Laboratories analyzed Haloacetic Acids using EPA Method 6251 B. The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 905.0 (Strontium-90)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All carrier recoveries were within validation criteria.
8. All minimum detectable activities met required detection limits.
9. Sample result verifications were acceptable
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled most of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
The only exception was that the acceptable percent recovery (%R) and relative percent difference (RPD), respectively for the LCS's were not met. Therefore, the reported results were flagged to indicate the isotope was analyzed but not detected and the detection limit is estimated.

MWH Laboratories

The sample fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).
No sample data was qualified.

EPA 556 (Aldehydes)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.
The only exception was the detection of acetaldehyde in both the S10 and Blind Duplicate sample method blank where concentrations in the sample were detected at concentration less than 5 X the concentration measured in the method blank. Therefore, the reported result had to be flagged and was modified as being analyzed but not detected at or above 2.0 ug/L.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 521 (Nitrosamines)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled most of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008.
The only exception was the detection of N-nitrosdimethylamine (NDMA) in the S10 sample method blank where the concentration in the sample was detected at a concentration less than 5 X the concentration measured in the method blank. Therefore the reported result had to be flagged and modified as being analyzed but not detected at or above 2.0 ug/L.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 531.1 / 531.2 (Carbamate & Urea Pesticides)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK Laboratories analyzed Carbamate & Urea pesticides using EPA Method 531.1. The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

MWH Laboratories analyzed Carbamate & Urea pesticides using EPA Method 531.2. The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 549.2 (Diquat)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 547 (Glyphosphate)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 548.1 (Endothall)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained no trace of the target compound(s)
6. Surrogate recoveries were added to samples and blanks as required by the method.
7. Laboratory control samples (LCS) were within acceptable percent recoveries
8. Target compound identification were within validation criteria
9. Compound quantification and Reporting Limits were within validation criteria
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

The samples fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

MWH Laboratories

The sample fulfilled all of the review requirements in the USEPA, Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, June 2008. No sample data was qualified.

EPA 901.1 (Gamma Emitting Radionuclides / Cesium 137)

Data review verified the following items:

1. Technical holding time requirements met
2. Cooler temperature requirements met
3. Initial calibration performed with required standard concentrations
4. Continuing calibration (CC) was performed at the required frequency and the difference between the initial and repeated calibrations were within QC limits.
5. Method blanks contained less than the minimum detectable activity (MDA)
6. Laboratory control samples (LCS) were within acceptable percent recoveries
7. All carrier recoveries were within validation criteria.
8. All minimum detectable activities met required detection limits.
9. Sample result verifications were acceptable
10. System performance was acceptable
11. Overall assessment data
12. Field duplicate relative percent difference for detected compounds

WECK Laboratories

WECK lab utilized Eberline Services to analyze for gamma emitting radionuclides using EPA 901.1. The samples fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).

MWH Laboratories

MWH lab utilized GEL Laboratories to analyze for Cesium 137 using EPA 901.1. The samples fulfilled all of the review requirements of the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004) and a modified outline of the USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Review (January 2010).

Table A-1: Sample Analyses Performed by WECK Laboratories, Inc.

Sample Location	Collection Date	Method
UV/AOP Product Water (S10) Blind Duplicate (S10)	8/24/2011	EPA 524.2 (Volatiles) EPA SRL 524.2 M (1,2,3 Trichloropropane) EPA 625 (Semi-volatiles) EPA 525.2 (Semi-volatiles) EPA SW 486 Method 8270M (1,4 Dioxane) EPA 508 (Chlorinated Pesticides and PCBs) EPA 200.7, 200.8, and 245.1 (Metals) EPA 515.3 (Herbicides) SM 2320 B (Alkalinity) EPA 100.2 (Asbestos) EPA 326.0 (Bromate) EPA 300.1 (Chlorate and Chlorite) EPA 300 (Chloride, Fluoride and Sulfate) SM 2120 B (Color) SM 2150 B (Conductivity) EPA 335.4 (Total Cyanide,) Calculation for Hardness, Total Nitrogen, Total Anions, Total Cations) EPA 218.6 (Hexavalent Chromium) SM 2330 B (Langlier Index) EPA 353.2 (Nitrate, Nitrite as Nitrogen, Nitrate/Nitrite as Nitrogen) EPA 140.1 (Odor) EPA 314.0 (Perchlorate) SM 4500 B (pH) EPA 365.1 (Total Phosphorus) SM 5540 C (Surfactants) SM 2540 C (Total Dissolved Solids) SM 5310 C (Total Organic Carbon) EPA 351.2 (Total Kjeldahl Nitrogen) EPA 180.1 (Turbidity) EPA 504.1 (1,2 Dibromoethane, 1,2-Dibromo-3-chloropropane) EPA SW 836 Method 1613B (2,3,7,8-TCDD) EPA 900.0 (Gross Alpha and Beta Radioactivity) EPA 903.0 (Radium 226) Method Ra-05 (Radium 228) EPA 906.0 (Tritium)

Table A-1: Sample Analyses Performed by WECK Laboratories, Inc. (cont'd)

Sample Location	Collection Date	Method
UV/AOP Product Water (S10) Blind Duplicate (S10)	8/24/2011	EPA 901.1 (Gamma Spectroscopy) EPA SW 846 Method 8330 (Explosives) EPA SW 846 Method 8015 B (Ethylene Glycol) EPA 552.2 (Haloacetic Acids) EPA 905.0 (Strontium-90) EPA 556 (Aldehydes) EPA 521 (Nitrosamines) EPA 531.1 (Carbamate & Urea Pesticides) EPA 549.2 (Diquat) EPA 547 (Glyphosphate) EPA 548.1 (Endothall)

Table A-2: Sample Analyses Performed by MWH Laboratories, Inc.

Sample Location	Collection Date	Method
UV/AOP Product Water (S10)	8/24/2011	EPA 524.3 (Volatiles) EPA SRL 524.2 M (1,2,3 Trichloropropane) EPA 524.2 (Volatiles) EPA 524.2 using Selected Ion Monitoring (t-Butyl Alcohol) EPA 624 (Volatiles) EPA 624 (2-Chloroethylvinyl ether) EPA 625 (Semi-volatiles) EPA 525.2 (Semi-volatiles) EPA 522 (1,4 Dioxane) EPA SW 846 Method 8270 C (Ethylene Glycol) EPA 505 (Chlorinated Pesticides and PCBs) EPA 608 (Chlorinated Pesticides and PCBs) EPA 200.7, 200.8, and 245.1 (Metals) EPA 515.4 (Herbicides) SM 2320 B (Alkalinity) EPA 100.2 (Asbestos) EPA 317.0 (Bromate) EPA 300.1 (Chlorate) EPA 300 (Chloride, Chlorite, Nitrate, Nitrite, and Sulfate) SM 9223 (Coliform SM 2120 B (Color) SM 2150 B (Conductivity) SM 4500 CN-F (Cyanide) SM 4500 C02-D (Free Carbon Dioxide) SM 2340B (Hardness) EPA 218.6 (Dissolved Hexavalent Chromium) SM 2330 B (Langlier Index & pH) Calculation Method Nitrate, Nitrite/Nitrate, Total Nitrogen) EPA 2150B (Odor) EPA 314.0 (Perchlorate) SM 4500-PE & EPA 365.1 (Total Phosphorus and Phosphorus) SM 5540 C & EPA 425.1 (Surfactants) EPA 160.1 & SM 2540 C (Total Dissolved Solids) SM 5310 C & EPA 415.3 (Total Organic Carbon) EPA 351.2 (Total Kjeldahl Nitrogen) SM 1030 E (Total Anions, Total Cations, and Cation/Anion Difference)

Table A-2: Sample Analyses Performed by MWH Laboratories, Inc. (cont'd)

Sample Location	Collection Date	Method
UV/AOP Product Water (S10)	8/24/2011	EPA 180.1 (Turbidity) Calculation Method (Aggressiveness Index) SM 4500F-C (Fluoride) EPA 551.1 (Dibromochloropropane & Ethylene Dibromide) EPA SW 836 Method 1613B (2,3,7,8-TCDD) EPA 900.0 (Gross Alpha and Beta Radioactivity) EPA 903.0 (Radium 226) EPA 904.0 (Radium 228) EPA 906.0 (Tritium) LCMS (Explosives: 2,4,6-Trinitrotoluene, HMX and RDX) SM 6251 B (Haloacetic Acids) EPA 905.0 (Strontium-90) EPA 902 & SM 7500-IB (Iodine-131) EPA 556 (Acetaldehyde & Formaldehyde) LC-MS-MS (Hydrazines) EPA 521 (Nitrosoamines) EPA 531.2 (Carbamate & Urea Pesticides) EPA 549.2 (Diquat & Paraquat) EPA 547 (Glyphosphate) EPA 548.1 (Endothall) EPA 901.1 (Cesium 137) EPA 537 (Perfluorinated Chemicals) EPA 539 (Hormones) DX_ABI_NEG & POS (Pharmaceutical and Personal Care Products and Endocrine Disrupting Compounds)

Appendix D

Expert Report: In review of Data for City of San Diego AWP Facility prepared by Shane Snyder, PhD

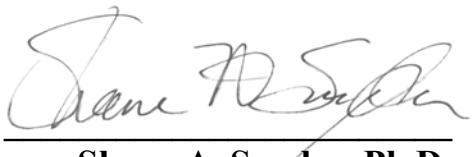
EXPERT REPORT

OF

SHANE A. SNYDER, Ph.D.

In review of data for City of San Diego AWPF provided by CDM-Smith / MWH consultants

13th October 2012



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13th October 2012

1.0 INTRODUCTION

During a telephone discussion with CDM-Smith/MWH (consultant team) including Jennifer Thompson, Greg Wetterau and James DeCarolis, I became aware of detectable substances in the finished water of the AWPF in San Diego. I have discussed some of these "anomalies" previously with the consultant team; however, on the 21st of June call (taken by me in Singapore) I became aware of additional information relevant to the project. On the 24th of July, the consultant team provided me data and a specific list of issues to be addressed in my expert report. The data I reviewed in preparing my report is included in the Quarterly Testing Report No. 4 (Q4 Testing Report) as referenced in subsequent sections of this report.

The consultant team specifically asked me to provide expert opinions on:

1. The statistical significance of the detection of certain unregulated contaminants in product water and likelihood of being true occurrence values rather than false positives (Type 1 error),

2. Comparison of the results of the unregulated detected contaminants compounds in product water to those occurrences reported in the blanks of other studies (i.e., USGS),

3. Public health relevance of occurrence of the unregulated contaminants at the concentrations reported in product water,

4. Compare/contrast the analytical values provided by the three laboratories involved in the study,

5. Opinion on role of sample volume on method report limits between MWH Labs and Colorado School of Mines.

Data has been provided to me indicated the presence of said unregulated contaminants in advanced treated water. I understand that my evaluation includes those data provided along with peer-reviewed data from other studies and my expert opinion.

While I have been asked to provide opinions regarding sampling techniques, quality assurance, quality control, and representativeness of analytical measurements related to the detections reported, it is important to state upfront that I have had no direct (hands on) experience with the sampling that took place in San Diego. Therefore, my expert opinion is based on the facts provided to me and limits the scope of my expert opinion. In order to develop my expert opinion, I have relied upon water quality monitoring data by the consultant team, peer-reviewed published literature, federal and state government documents, electronic media, and my own academic and professional experience.

1.1 QUALIFICATIONS

A current curriculum vitae (CV) containing publications and research projects is provided in Attachment A. I am the Vice-President and Director of Total Environmental Solutions, Inc. (TES), in Boulder City, Nevada. I am also a Professor of Chemical and Environmental Engineering at the University of Arizona and the Co-Director of the Arizona Laboratory for Emerging Contaminants also at the University of Arizona. I have conducted environmental research for more than 15 years and have acted as an environmental consultant for over a decade. My career has focused on understanding the occurrence, fate, and transport of contaminants in water. I am the Principal Investigator for several projects related to emerging contaminants in water and serve on several expert panels and committees related to water quality in the United States (US). I was a member of the recent National Academy of Science's National Research Council expert panel on water reuse. I have served on two US EPA advisory committees on endocrine disrupting chemicals and was a member of two US EPA expert panels for the Contaminant Candidate List 3. I have conducted extensive research related to trace contaminants in water supplies and have authored or co-authored over 100 manuscripts, reports, and book chapters during my career. I am a well-established expert on contaminant occurrence, treatment, and distribution in municipal drinking and waste water. In 2011 alone, I delivered more than a dozen invited presentations in five countries. The US Senate Committee on Environment and Public Works invited me to testify in April of 2008 as one of six national experts on the occurrence and relevance of trace pharmaceuticals in US drinking water. I have provided briefings for the US Congress three additional times. I was appointed twice to the California State Water Resources Control Board's Blue Ribbon Panels on emerging water quality issues.

Prior to my current employment, I was the Research and Development Project Manager for the Southern Nevada Water Authority (SNWA) in Las Vegas, Nevada from 2000 through 2010. The SNWA provides public water services for nearly 2,000,000 permanent residents and up to 40,000,000 visitors per year. My primary role at SNWA is to lead a group of researchers to determine occurrence and treatment efficacy of emerging environmental contaminants. The SNWA relies on both surface and groundwater to supply water within Clark County, Nevada. With over ten years of experience at the SNWA, I became proficient in the issues surrounding the federal and state regulations that govern the supply, treatment, and delivery of municipal water.

For the purposes of this report, I am acting solely on behalf of TES.

1.1.1 **Academic Credentials**

I have received the following degrees from accredited colleges and universities:

1. Bachelor of Arts (B.A.) degree in Chemistry with a minor in Medical Biology from Thiel College in Greenville, Pennsylvania

2. Doctor of Philosophy (Ph.D.) in Zoology and Environmental Toxicology from Michigan State University in East Lansing, Michigan

2.0 BACKGROUND AND SUMMARY

Water Quality Constituents and Influences

Water inherently contains a variety of organic, inorganic, and biological constituents. In fact, pure water, being two hydrogen atoms covalently bonded to an oxygen atom, does not naturally exist as a liquid on earth. All water contains some degree of dissolved and solid materials that comprise the complex aqueous mixture. In fact, all water systems will endogenously contain various salts, elements, and organic constituents. Beyond endogenous/natural constituents, a diversity of contaminants, including pharmaceuticals, have been reported in drinking water (Benotti, Trenholm et al. 2009), municipal wastewater (Nelson, Do et al. 2011), and in septic systems (Conn, Barber et al. 2006). Fortunately, essentially all public water systems in the United States regularly monitor water quality and perform extensive maintenance procedures to ensure regulatory compliance and reliability.

Accuracy and Precision of Water Quality Data

In environmental monitoring, there are seven key steps (Figure 1) to consider, namely: problem definition, sample program design, field sampling, sample preparation, chemical analysis, data analysis, and reporting (Batley 1999). If these seven steps are not considered, data collected may lead to erroneous conclusions. Problem definition involves defining the purpose of the monitoring program and questions to be answered by the acquired data. For San Diego, this is most likely a question of is the advanced treatment process being piloted tested robust and reliable for the production of exemplary water quality. Sample program design involves establishment of a testing plan that allows the problem definition to be adequately addressed. This will involve consideration of diurnal, spacial, and temporal variability as well as providing the necessary statistical power to demonstrate trends and to have confidence in representativeness of data to estimate the true population. Of critical importance are field sampling protocols and blanks. How a sample is collected and stored can have a dramatic impact on the resulting data. Blanks provide a measure of knowledge as to the trueness of an analytical measurement. For environmental measurements, field blanks, method blanks, and instruments blanks are of paramount importance. For aqueous sampling, a field blank requires the transporting ultrapure, previously characterized, water to the field site and passing this water through all sampling devices and collecting in a sample bottle exactly in the same way that an actual sample is collected and handled, and ultimate analyzed. A method blank evaluates the cleanliness of the analytical procedure and thus involves ultrapure water processed in the laboratory in exactly the same manner as a sample. The final type of blank that is critical for environmental analysis is an instrument blank, which involves the analysis of a blank matrix (water or solvent depending on analysis) which provides a measure of instrument cleanliness. These are just three types of blanks that should be included in any environmental

sampling event. Failure to include these types of blanks will draw the resulting data into serious question. For instance, the issue of blanks is paramount when analyzing for ubiquitous substances such as bis(2-ethylhexyl)phthalate (DEHP). As a ubiquitous contaminant in laboratory and field sampling settings, DEHP sampling and analysis requires that the amount of DEHP contributed by sampling equipment, laboratory facilities, and other routes of contamination be accurately accounted for through blanks (Connelly ; Tienpont, David et al. 2005; Fankhauser-Noti and Grob 2007). The use of plastics and polymers, for instance the plastic bucket and polymeric tubing must be avoided when sampling for trace levels of DEHP in water. The issue with personal care products is similar in that people handling aqueous samples should avoid using products such as sunscreen, antimicrobial soaps, and insect repellent.

In 2002, the USGS published one of the most impactful reports on pharmaceuticals in US water systems (Kolpin, Furlong et al. 2002). However, later review of this report indicated that many of the steroid hormone data were at concentrations that were far higher than any other studies in the world. For instance, Kolpin purported a maximum ethynylestradiol (birthcontrol) concentration of 831 ng/L, yet another study from the USA published earlier showed a maximum concentration of just 0.759 ng/L. Later, the USGS issued an errata on their website (http://toxics.usgs.gov/regional/est_errata.html) lowering the maximum concentration by one order of magnitude. Regardless, the corrections were not made to the published article and the US EPA used those data in the development of the CCL3 and later the UCMR3. Had it not been for the faulty USGS data used by the EPA in the dossier for the CCL3, it is highly unlikely that steroid hormones would have made the CCL3 and perhaps would not have also appeared on the UMCR3. In addition, the USGS provided no QA/QC data within Kolpin 2002, yet on the USGS website it is obvious that there were problems in achieving clean blanks. For instance, the USGS reports that acetaminophen occurred in 59% of all blanks in the Kolpin study, while diethyl phthalate occurred at concentrations up to 74,000 ng/L. Thus these sage examples shows how inaccurate analytical data can influence public policy.

Acesulfame K

Acesulfame is an artificial sweetener with the "K" standing for potassium. Acesulfame K is around 200x sweeter than sucrose (table sugar) and is often blended with other artificial sweeteners which has been reported to have a synergistic effect on the sweetness. It is a bit unique compared to other artificial sweeteners as it is stable under elevated temperatures and can be used in baking. Acesulfame K is approved as a food additive in the US, Europe, and other countries, thus, health relevance at ng/L in water is assumed to be *de minimis*.

According to Table 41 of the Q4 Testing Report , Acesulfame K was detected two times in the UV-AOP product. On the 15th of February 2012, Acesulfame K demonstrated a concentration of 31 ng/L, yet, was undetectable (<20 ng/L) in the RO permeate. My guess is that the sample was miss-labeled and switched with the post-RO sample, since in all other events, the post-RO sample had between 30-40 ng/L. These post-RO values for Acesulfame K are expected, as rejection of organic constituents should not exceed the

rejection for TDS. In other words, 99% rejection of Acesulfame K would still result in detectable concentrations considering the feed concentration. Acesulfame K also was detected in product water on 9/14/2011 at 50 ng/L as shown in Table 36 of the Q4 Testing Report. In this sampling event, Acesulfame K was present at 65 ng/L in the RO permeate, this the 50 ng/L in the UV-AOP effluent would indicate a low degree of oxidation. Indeed, Acesulfame K is only moderately removed by UV-AOP, which would be relatively consistent with this finding. However, as mentioned above, in all other samples Acesulfame K is removed to less than detection. However, the 65 ng/L RO permeate is one of the higher feed concentrations entering the UV-AOP. Thus, there is no clear reason for the detection in the product water, but it is not entirely surprising to me.

Bromochloromethane (BCM)

Bromochloromethane was used in fire extinguishers (Halon 1011), but has not been widely used since the 1960's. Passage through RO is expected due to low molecular weight and neutral charge. The US EPA has calculated a reference dose for bromochloromethane of 0.01 mg/kg-day, thus for a 70 Kg human drinking 2L of water per day, an estimated drinking water equivalent level (DWEL) would be around 35 ug/L. As shown in Table 45 of the Q4 Testing Report, the maximum concentration of BCM reported in the purified water was 0.25 ug/L, which is >100 X lower than the DWEL. Considering the detected concentration of BCM is two orders of magnitude lower than the DWEL calculated from an EPA reference dose, I would not expect any relevance to public health from this concentration.

IOHEXAL

Iohexal is an iodinated contrast media applied intravenously before certain medical procedures. Since it is approved for intravenous application in high-doses, it is not a highly toxic agent and not likely to have any meaningful health relevance at ng/L. However, recent studies have shown that iohexal can contribute to iodinated disinfection byproducts when oxidized during water treatment. The detection of iohexal at 19 ng/L in the product water on the 14th of September (Table 36 of the Q4 Testing Report) seems to be an analytical artifact. There is no detection of iohexal in the RO permeate that feeds the UV-AOP reactor, yet it is detectable post UV-AOP. I do not believe this is accurate and I am strongly of the opinion that this singe detection is an artifact and can be discarded due to lack of detection in the RO permeate and lack of other detections in UV-AOP product water.

Triclosan

Triclosan is a commonly used anti-microbial agent that is used in a variety of household and personal care products. For instance, triclosan is approved as an additive for toothpaste at %triclosan by product weight. Obviously triclosan is not considered to be relevant to human health at nanograms when it is approved as an additive in toothpaste in milligrams. Additionally, triclosan is often used in hand soaps also at percent by weight,

thus, hand washing provides another significant source to humans. These common uses also lead to higher propensity in blanks. In the USGS study by Kolpin in 2002, triclosan was detected in blanks up to 560 ng/L. Triclosan has been shown to be highly rejected by RO and extremely susceptible to UV oxidation (Snyder, Adham et al. 2006; Snyder, Wert et al. 2007). Thus, the two detections of triclosan (sample date 9/14/11 = 19 ng/L and sample date 2/1/12 = 17 ug/L) in UV-AOP product water are highly unlikely due to rejection by RO and oxidation by UV-AOP. Moreover, triclosan is very common in laboratory blanks. At the laboratory at SNWA, we have established a reporting limit of 50 ng/L due to challenges of achieving consistently clean blanks below 30 ng/L.

Formaldehyde

Formaldehyde is a naturally occurring compound that is a gas at room temperature. Formaldehyde also is formed during oxidative processes and is considered the last transformation product of carboneous molecules before mineralization to carbon dioxide. Because it is volatile and relatively soluble in water, it is difficult to remove during water treatment. It will pass through RO membranes to some extent and is formed by UV and ozone AOPs (Trenholm, Rosario-Ortiz et al. 2008). At other reuse facilities using UV-AOP, I have observed formation of formaldehyde, at times with concentrations exceeding 100 ug/L. Thus, I am not surprised to see formaldehyde in the produce water here. On the contrary, if formaldehyde were not observed, it would indicate either over or under dosing of the UV-AOP system. However, I find the analytical data provided to be concerning since one laboratory differs from another by one order of magnitude. From the information provided, it appears both laboratories used the same method (EPA 556) and that both laboratories achieved spiked recoveries well within the acceptable range. Therefore, I can find no plausible explanation for the large discrepancy between the two laboratories. Regardless, formaldehyde is not considered to be highly toxic to human health by ingestion. The US EPA (IRIS) determined the NOAEL in rats to be 82 mg/kg-day, which equates to 5.7 g/day for an adult. Even if the uncertainty factor would be 1000, this equates to levels far above those levels detectable in product water here, regardless of laboratory providing analysis.

OPINION OF ROLE OF SAMPLE VOLUME ON METHOD REPORTING LIMITS AND BLANKS BETWEEN MWH LABS AND COLORADO SCHOOL OF MINES LAB.

I was asked to provide expert opinion regarding the impact of a 40 mL sample volume versus 1 L sample volume in the laboratories performing analyses for this study. In theory, the sample volume is critical depending on instrument sensitivity, operating conditions, and instrument/method blanks. In other words, one cannot judge a methods reporting limits or robustness simply on sample volume. Indeed, on-line solid-phase extraction methods have allowed trace organic analysis in very low volumes of water (Trenholm, Vanderford et al. 2009). In the cases here, I do not have sufficient information to thoroughly evaluate the two methods in dispute. However, I do believe the MWH method using 40 mL is an on-line SPE method. Again, we can assume that the concentration of analytes in water samples are the sample regardless of sample volume.

However, in analytical chemistry, the mass injected on-column is usually the most critical parameter in the method sensitivity on a given instrument. Thus, on-line SPE can accomplish a similar on-column mass by "injecting" the complete mass extracted in a small water volume while a 1 L sample would be extracted conventionally off-line, then usually 5-50 uL injected out of the resulting 1 mL extract. Thus, the 1000x concentration factor with off-line SPE actually results in a relatively small mass injected since only a few uL of the 1 mL extract are actually used. Thus, MRLs involve more than just the sample volume. In terms of blanks; however, there can be large differences between on-line and off-line SPE methods. For instance, we recently discovered that bisphenol A cannot reliably be analyzed using off-line SPE since the SPE cartridges are made of plastic that results in significant blank contamination. This contamination is not observed with on-line SPE since no plastic cartridges are used. On the contrary, if there are any issues with instrument blanks, such as carry over, solvent contamination, or leaching from instrument parts, the concentration calculated to the field blanks will be exaggerated. This is because the instrument reports a mass. This mass is then back calculated to the injection volume and later to the volume of water. Therefore, a systematic issue with blanks within the instrument system will calculate to a much higher concentration in a lower sample volume as compared to a large sample volume. Thus, instrumental blanks are even more important with on-line SPE techniques.

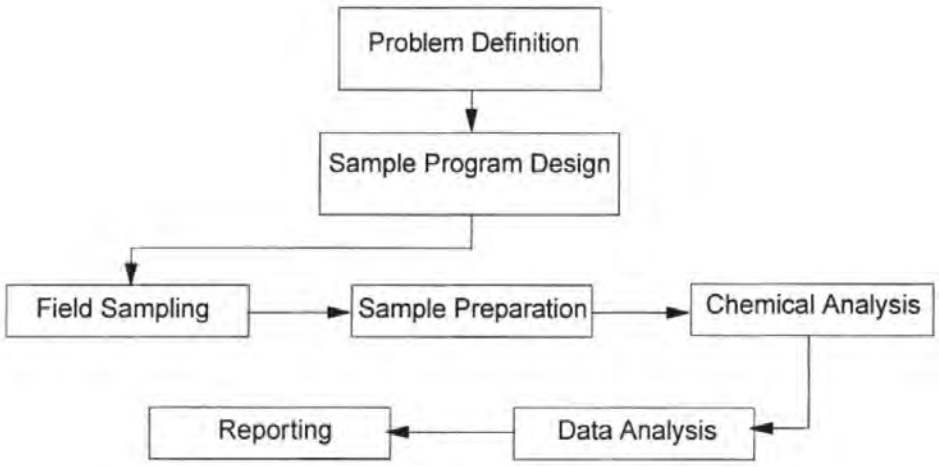

Figure 1. Seven Key Steps in Environmental Monitoring (from Batley, G. E. (1999). "Quality assurance in environmental monitoring." Marine Pollution Bulletin 39(1-12): 23-31.)

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Education

1994-2000	**Michigan State University, East Lansing, Michigan** Doctorate of Philosophy Environmental Toxicology and Zoology Dissertation Title: ***Instrumental and Bioanalytical Measures of Endocrine Disruptors in Water*** *Advisor:* Dr. John P. Giesy (Distinguished Professor)
1990-1994	**Thiel College, Greenville, Pennsylvania** Department of Chemistry Bachelor of Arts: *Magna Cum Laude* Major: Chemistry Minor: Medical Biology

Funded Research Projects

2011-2013	**Co-Principal Investigator – WateReuse Research Foundation:** "Development of Bio-Analytical Techniques to Assess the Potential Human Health Impacts of Recycled Water" – Project# 10-07
2010-2011	**Principal Investigator – WateReuse Research Foundation:** "Use of UV and Fluorescence Spectra as Surrogate Measures for Contaminant Oxidation and Disinfection in the Ozone/H2O2 Advanced Oxidation Process" – Project# 09-10
2010-2011	**Co-Principal Investigator – WateReuse Research Foundation:** "Effect of Prior Knowledge of Unplanned Potable Reuse on the Acceptance of Planned Potable Reuse" – Project# 09-01
2009-2011	**Principal Investigator – WateReuse Research Foundation: "**Use of Ozone in Water Reclamation for Contaminant Oxidation" – Project# 08-05
2009-2011	**Co-Principal Investigator – Water Environment Research Foundation:** "Trace Organic Compounds Removal during Wastewater Treatment – Categorizing Wastewater Treatment Processes by their Efficacy in Reduction of a Suite of Indicator TOrCs" – Project# CEC4R08
2009-2011	**Principal Investigator (with Brett Vanderford – SNWA Research Chemist) – Water Research Foundation:** "Evaluation of Analytical Methods for EDCs and PPCPs via Interlaboratory Comparison" – Project# 4167
2009-2011	**Principal Investigator (with Benjamin Stanford – SNWA Post-Doctoral Researcher) – WateReuse Foundation:** "Pilot-Scale Oxidative Technologies for Reducing Fouling Potential in Water Reuse and Drinking Water Treatment Membrane Systems" – Project# 08-008
2008-2009	**Principal Investigator – American Water Works Association/American Water Works Association Research Foundation:** "Hypochlorite – An Assessment of Factors That Influence the Formation of Perchlorate and Other Contaminants" – Project# 712/4147
2008-2010	**Principal Investigator – American Water Works Association Research Foundation:** "Role of bromamines on disinfection byproduct formation and impact on application of chloramination and

	ozonation" – Project# 4159
2007-2009	**Principal Investigator – WateReuse Foundation:** "Comparisons of Chemical Composition of Reclaimed and Conventional Waters" Project# 06-006
2007-2008	**Principal Investigator – WateReuse Foundation:** "Identifying Hormonally Active Compounds, Pharmaceutical Ingredients, and Personal Care Product Ingredients of Most Health Concern From Their Potential Presence in Water Intended for Indirect Potable Reuse" Project# 05-005
2007-2009	**Principal Investigator (with Fernando Rosario – SNWA Post-Doctoral Researcher) – WateReuse Foundation:** "Optimization of Advanced Water Treatment Processes for Water Reuse" Project# 06-012
2006-2009	**Co-Principal Investigator – WateReuse Foundation:** "Development of Surrogates To Determine The Efficacy Of Groundwater Recharge Systems For The Removal Of Trace Organic Chemicals" Project# 05-004
2007-2009	**Co-Principal Investigator – American Water Works Association Research Foundation:** "Low Dose Risks from Bromate: The Relationship between Drinking Water Concentrations and the Actual Dose to Susceptible Organs in Rats and Humans" Project#4042
2005-2007	**Co-Principal Investigator – WateReuse Foundation:** "Reaction Rates and Mechanisms of Advanced Oxidation Processes for Water Reuse" Project# 04-017
2005-2006	**Principal Investigator – American Water Works Association Research Foundation:** "Comprehensive Utility Guide for Endocrine Disruptors and Pharmaceuticals in Drinking Water" Project# 3033
2004-2006	**Principal Investigator – American Water Works Association Research Foundation and WateReuse Foundation:** "Toxicological Relevance of EDC and Pharmaceuticals in Drinking Water" AwwaRF # 3085 & WRF 04-003
2004-2006	**Co-Principal Investigator – WateReuse Foundation:** *Colorado School of Mines as PI* "Development of Indicators and Surrogates for Chemical Contaminant Removal during Wastewater Treatment and Reclamation" Project# WRF-03-014
2004-2006	**Co-Principal Investigator – WateReuse Foundation:** *Carollo Engineers as PI* "Reclaimed Water Aquifer Storage and Recovery: Potential Changes in Water Quality" Project# WRF-03-009
2004-2006	**Co-Principal Investigator – Water Environment Research Foundation:** *Colorado School of Mines as PI.* "Contributions of Household Chemicals to Sewage and their Relevance to Municipal Wastewater Systems and the Environment" Project# 03-CTS-21UR
2002-2005	**Principal Investigator - American Water Works Association Research Foundation:** "Evaluation of Conventional and Advanced Treatment Processes to Remove Endocrine Disruptors and Pharmaceutically Active Compounds" Project #2758
2001-2004	**Principal Investigator - Strategic Environmental Research and Development Program (for Department of Defense):** "Toxicological Impact of Ammonium Perchlorate on Fish" Project# 1222
1998-2000	**Principal Investigator - Southern Nevada Water Authority/U.S. Bureau of Reclamation/National Park Service:** "Toxicity Identification and Evaluation of Xenobiotic Compounds in Lake Mead, Nevada"
1998-2000	**Principal Author - Chemical Manufacturers Association:** "Identification and Quantitation of Alkylphenols from Fish Tissues"
1997	**Principal Author - Las Vegas Valley Water District:** "Screening of Drinking Water for Possible Endocrine Disrupting Compounds"
1997	**Principal Author - Chemical Manufacturers Association:** Instrument grant for alkylphenol analyses

Recent Volunteer Efforts

2008-2011	**National Academy of Science – National Research Council**: Member of Water Reuse expert panel
2010-Present	**WateReuse Association:** Member of the Board of Directors
2009-2010	**National Association of Clean Water Agencies and Association of Metropolitan Water Agencies**: Co-chair of expert panel to author ***Pharmaceuticals in the Water Environment***
2008-2011	**Water Research Foundation**: Member of EDC Strategic Initiative Expert Panel
2008-2011	**American Water Works Association:** Appointed Trustee of the Water Science & Research Division
2008-Present	**WateReuse Research Foundation:** Research Advisory Council (RAC) member
2008-2010	**United Nations University & Gwangju Institute of Science and Technology:** Science Advisory Committee member.
2008-2009	**American Water Works Association**: Chair of the Planning Committee for the Organic Contaminants Research Symposium – Austin Texas February 2009
2006	**Expert Panel Member:** US EPA Contaminant Candidate List Classification Process Meeting
2004-2006	**Federal Advisory Committee Member:** Endocrine Disruptor Methods Validation Advisory Committee (EDMVAC)
2004-Present	**American Water Works Association:** Source Water Protection Committee – (Vice-Chair 2004-2006)
2002-Present	**American Water Works Association:** Organic Contaminants Research Committee – (Chair 2005-2008)
2002-2005	**Henderson Blue Ribbon Commission:** Member of special committee to promote educational excellence in Southern Nevada
2001-2004	**National Advisory Council for Environmental Policy and Technology:** Member of the US EPA Federal Advisory Committee "*Endocrine Disruptor Methods Validation Subcommittee* (EDMVS)"
2000-2001	**American Water Works Association:** Endocrine Disruptor & the Water Industry Symposium planning committee

Employment Experience

2010-Present	**University of Arizona – Professor of Chemical and Environmental Engineering.** Provide leadership and teaching in the areas of water treatment, contaminant fate and transport, and public/environmental health implications of water pollution.
2010-Present	**Arizona Laboratory for Emerging Contaminants (ALEC) – Co-Director.** State-of-the-art analytical facility at University of Arizona with a focus on identification and quantification of emerging contaminants, such as pharmaceutical, endocrine disrupting compounds, and nanoparticles.
2000-2010	**Research and Development – Project Manager.** Southern Nevada Water Authority, Las Vegas, Nevada. Develop and manage diversity of drinking and wastewater projects related to emerging contaminants, conventional and advanced treatment technologies, and modern analytical method development. Achieve external research funding to support team of chemists, engineers, graduate students, and post-doctoral researchers.
1998 – Present	**Owner/Consultant.** Total Environmental Solutions Inc., Boulder City, Nevada. Provide professional consultation, expert witness services, and build teams of experts capable of solving a diversity of challenging environmental issues.
1994-2000	**Graduate Student.** Michigan State University, East Lansing, Michigan. Department of Zoology

	and Institute of Environmental Toxicology. Developed novel analytical and bioanalytical approaches to identify and quantitate endocrine disrupting compounds and pharmaceuticals in the aquatic environment.
Summer 1995	**Research Internship.** Bayer Corp., Biotechnology Division, Leverkuesen, Germany. Synthesized and analyzed DNA and PNA strains for pharmaceutical discovery. Utilized DNA/PNA synthesizers and sequences. Purified strains using HPLC and verified molecular weights using Time of Flight Mass Spectrometry.
Summer 1994	**Research Internship.** Bayer Corp., New Martinsville, West Virginia. Developed spectral library using newly developed open-path FTIR instrumentation used to monitor potential leaks at industrial sites.

Additional Relevant Experience

2011-Present	**Chair.** National Water Research Institute. Expert Panel on Water Reuse in Tucson, Arizona
2011-2015	**Visiting Professor.** National University of Singapore – National Environmental Research Institute.
2010-Present	**Science Advisory Panel Member.** King Abdullah University of Science and Technology, Saudi Arabia.
2010-Present	**Science Advisory Panel Member.** Southern California Coastal Water Research Program. *Constituents of Emerging Concern in Coastal and Marine Ecosystems*
2010-Present	**Adjunct Professor.** Environmental Science & Engineering, Gwangju Institute of Science and Technology, South Korea
2009-2010	**Science Advisory Panel Member.** California Water Resources Control Board. *Constituents/Contaminants of Emerging Concern in Recycled Water*
2009	**Effective Media Communications.** Professional training for communicating with news media. *The Ammerman Experience.* Houston, Texas
2009	**Advanced Presentations Training.** Professional training in presentation of data in public forums
2008-Present	**Fellow.** University of California, Santa Cruz. Center for Integrated Water Research
2007-2008	**West Basin Water District Expert Panel**. Provide expert advice regarding water quality and technology issues related to water reuse operations at West Basin, California
2006-2011	**Pepsi Corporation Water Quality Advisory Council.** Provide expert advice and scientific opinion regarding global water quality and treatment technology issues
2000 – 2010	**Adjunct Faculty.** University of Nevada, Las Vegas. Act as a committee member for various graduate research programs. Aid in research efforts of faculty and students. Instruct classes and serve as a visiting lecturer
2000 – 2007	**Adjunct Faculty.** State College of Southern Nevada, Las Vegas, Nevada. Instruct undergraduate science classes. Work with other faculty on local environmental issues
1997 – Present	**Peer Reviewer.** Peer reviewer for several journals including: *Analytical Chemistry, Environmental Science and Technology, Water Research, Journal of the American Water Works Association, Chemosphere, and others*
2000 & 2008	**Invited Speaker.** National Public Radio (NPR) recorded in Las Vegas, Nevada. Interview regarding pharmaceuticals and personal care products in Lake Mead, Nevada

Invited Presentations and Seminars (Previous Years Available on Request)

December 2011	**Las Vegas, Nevada –** Invited speaker at Agilent Technologies Annual Meeting
December 2011	**Flagstaff, Arizona –** Invited speaker and panel member for public meeting on water reuse
November 2011	**Genoa, Italy –** Invited speaker for symposium on EDCs in water supplies
November 2011	**Santa Clara, California –** Invited seminar for Agilent Technologies

November 2011	**Phoenix, Arizona –** Invited speaker for Water Quality Technology Conference (WQTC) – reuse special session
October 2011	**Phoenix, Arizona –** Invited speaker for Western Coalition of Arid States (WESTCAS)
September 2011	**Barcelona, Spain** – Invited keynote presentation at International Water Association Water Reclamation and Reuse Conference
August 2011	**Dallas, Texas** – Invited presentation for EPA Region 9 Workshop
July 2011	**Singapore** – Invited presentation at the Singapore International Water Week
June 2011	**Amsterdam Netherlands** – IWA Leading Edge Technology meeting – Invited Keynote on Water Reuse and Emerging Water Quality Issues
May 2011	**Beijing China –** Peking University – Invited Presentation on Water Reuse
May 2011	**Beijing China –** Tsinghua University – Invited Plenary Presentation at Symposium EDCs, PPCPs, and DBPs in Water
April 2011	**Cambridge MA –** Harvard University – Invited Presentation at Symposium on R&D and Technology for Water
February 2011	**Northridge CA –** University of California, Northridge – Invited Presentation on PPCPs iN Water Supplies: Sustainable Solutions
November 2010	**Raleigh NC –** US EPA Research Triangle Park – Invited Presentation on Emerging Contaminants and Water Reuse
September 2010	**Washington DC –** Congressional Briefing on Pharmaceuticals in the Environment
July 2010	**Singapore – Singapore International Water Week.** Invited Session Chair and Speaker
June 2010	**Holderness, NH –** Gordon Research Conference: Water – Invited Presentation regarding Water Reuse and Emerging Water Quality Challenges
May 2010	**Racine, WI –** Wingspread Meeting on Environmental Estrogens – Invited Panelist
May 2010	**Cape Cod, MA –** Waquoit Bay Reserve – Invited Presentation regarding Emerging Contaminants in Septic Systems and Groundwater
March 2010	**Boston, MA** – Tufts University – Invited Presentation for the National Academy of Engineering
November 2009	**Gwangju, S. Korea –** United Nations University – Science Advisory Board
November 2009	**Boston, MA –** Harvard School of Public Health – Invited Presentation on DBPs
October 2009	**Princeton, NJ** – FASTRAC Meeting – Invited Presentation
September 2009	**Brisbane, Australia –** International Water Association WRRS – Invited Keynote
September 2009	**Tokyo, Japan –** International Ozone Association – Invited Keynote
August 2009	**Washington, DC** – ACS National Conference – Invited Keynote
August 2009	**Mount Holyeoke, MA** – Gordon Research Conference on Disinfection Byproducts
June 2009	**Singapore –** IWA Leading Edge Technology Meeting – Invited Keynote
June 2009	**San Francisco, CA –** IWA Micropol Meeting – Invited Keynote Presentation
June 2009	**Toronto, Canada –** Ontario Ministry of the Environment – Invited Presentation
May 2009	**Boise, ID –** Idaho Water Reuse Symposium – Invited Presentation
May 2009	**Salem, OR –** Pacific Northwest Awwa meeting – Invited Presentation
April 2009	**Costa Mesa, CA –** So. Cal. Coastal Water Research Program – Invited Presentation
March 2009	**Boston, MA –** Harvard University's School of Public Health – Invited Seminar

March 2009	**Washington, DC –** US Senate – Invited Briefing
March 2009	**New York, NY –** Hazen & Sawyer – Invited Seminar
March 2009	**San Diego, CA –** Association of Environmental Health Sciences – Invited Keynote
March 2009	**Las Vegas, NV –** US/Japan Joint Water Conference – Invited Presentation
February 2009	**Washington DC –** US House of Representatives – Invited Briefing
February 2009	**Phoenix, Arizona –** Arizona Water Association – Invited Seminar
February 2009	**Austin, Texas** – Awwa Emerging Contaminant Symposium – Conference Chair
January 2009	**Delft, The Netherlands –** Vakantiecursus in Drinkwatervoorziening – Invited Presentation
January 2009	**Greenville, South Carolina –** Southeastern Regional Water Technology Transfer Conference – Invited Presentation
November 2008	**East Lansing, Michigan** – Michigan State University – Invited Seminar
November 2008	**Cincinnati, Ohio –** Water Quality Technology Conference – Invited Presentation
October 2008	**Monterey, California** – WateReuse Foundation – Invited Presentation on agricultural water reuse
October 2008	**Gwangju, S. Korea** – United Nations University – Science Advisory Board Meeting
September 2008	**Tucson, Arizona** – University of Arizona – Invited Seminar
August 2008	**Orlando, Florida** – International Ozone Association – Invited Plenary Presentation
June 2008	**Singapore –** Invited delegate for World Water Leaders Summit
March 2008	**Long Beach, California –** California Water Environment Association – Invited Presentation
March 2008	**Cork, Ireland –** Invited presentation on emerging water quality issues
March 2008	**Zurich, Switzerland –** Invited Seminar for EAWAG on emerging contaminants
March 2008	**Lyon, France –** Invited speaker for EU NORMAN meeting on bioassay techniques
February 2008	**Mumbai, India –** Invited expert panel member for Pepsi Corporation FEMA meeting
December 2007	**University of California, Berkeley** – Invited Seminar for Department of Engineering
November 2007	**Canberra, Australia**: EDC/PPCPs in Australia – Invited Keynote Presentation
November 2007	**Brisbane, Australia** – Invited Seminar for Queensland Water
November 2007	**Gwangju, South Korea** – Invited Presentation at Opening of National Desalination Program (SeaHERO)
October 2007	**Costa Mesa, California**: National Groundwater Association – Keynote Presentation
October 2007	**Seattle, Washington**: Association of Metropolitan Water Agencies – Invited Presentation
September 2007	**University of Massachusetts, Amherst** – Invited Seminar in Water Sustainability Lecture Series
September 2007	**Tampa, Florida**: WateReuse Association – Invited Panelist in Closing Plenary Session
August 2007	**Los Angeles, California**: International Ozone Association – Invited Keynote Presentation
August 2007	**Carson City, Nevada**: Nevada Water Resources Association – Invited Keynote Presentation
August 2007	**Water Environment Federation** – Webcast on Emerging Issues – Invited Presentation
July 2007	**Flagstaff, Arizona**: Arizona Water Reuse Association – Invited Presentation
July 2007	**Los Angeles, California**: California Urban Water Association – Invited Seminar
May 2007	**Sacramento, California**: California EPA DTSC – Invited Presentation
May 2007	**Tampa, Florida**: World Environmental & Water Resources Congress – Keynote Presentation
April 2007	**Santa Rosa, California** – Invited Seminar for the Public Utilities Board

April 2007	**Greensboro, North Carolina** – Syngenta's Distinguished Speaker Series
April 2007	**Athens, Georgia**: Society for Environmental Toxicology and Chemistry – Invited Lecturer
February 2007	**Sacramento, California**: California DHS Meeting – Invited Seminar
February 2007	**New York, New York**: AwwaRF/KIWA CEO Conference – Invited Presentation
January 2007	**Okinawa, Japan**: Japanese-U.S. Conference on Water Quality and Wastewater Control – Invited Presentation

Publications

114.	2011	Stanford BD, Pisarenko AN, Holbrook RD, **Snyder SA.** *Preozonation Effects on the Reduction of Reverse Osmosis Membrane Fouling in Water Reuse.* Ozone: Science & Engineering. **33**(5):379-388.
113.	2011	Holbrook RD, Motabar D, Quinones O, Stanford BD, **Snyder SA**. *Titanium distribution in a swimming pool - The case for dissolution*. Geochimica et Cosmochimica Acta. **74**(12): A410-A410.
112.	2011	Gerrity D, Gamage S, Holady JC, Mawhinney DB, Quinones O, Trenholm RA, **Snyder SA.** *Pilot-scale evaluation of ozone and biological activated carbon for trace organic contaminant mitigation and disinfection.* Water Research 45(5):2155-2165.
111.	2011	Laws BV, Dickenson ERV, Johnson TA, **Snyder SA**, Drewes JE. *Attenuation of contaminants of emerging concern during surface-spreading aquifer recharge*. Science of the Total Environment. 409:1087-1094.
110.	2011	Gerrity D and **Snyder SA.** *Review of Ozone for Water Reuse Applications: Toxicity, Regulations, and Trace Organic Contaminant Oxidation.* Ozone Science and Engineering. 33:253-266.
109.	2011	Mawhinney DB, Young RB, Vanderford BJ, Borch T, **Snyder SA**. *The Artificial Sweetener Sucralose in U.S. Drinking Water Systems.* Environmental Science and Technology. *In press*
108.	2011	Sarp S, Stanford B, **Snyder SA**, Cho J. *Ozone oxidation of desalinated seawater, with respect to optimized control of boron and bromate.* Desalination and Water Treatment. 27:308-312.
107.	2011	Gerrity D, Trenholm RA, **Snyder SA**. *Temporal variations in pharmaceuticals and illicit drugs in wastewater during a major sporting event.* Water Research. 45(17):5399-5411.
106.	2011	Gerrity D and **Snyder SA**. *The Economic Value of Water in Metropolitan Areas of the United States*. Water Policy. 13:443-458.
105.	2011	Vanderford BJ, Mawhinney DB, Trenholm RA, Zeigler-Holady JC, **Snyder SA**. *Assessment of sample preservation techniques for pharmaceuticals, personal care products, and steroids in surface and drinking water.* Analytical and Bioanalytical Chemistry. 339:2227-2234.
104.	2011	Stanford BD, Pisarenko AN, **Snyder SA**, Gordon G. *Perchlorate, bromate, and chlorate in hypochlorite solutions: guidelines for utilities*. Journal of the American Water Works Association. 103(6):71-83.
103.	2011	Dickenson ERV, **Snyder SA,** Sedlak DL, Drewes JE. *Indicator Compounds for Assessment of Wastewater Effluent Contributions to Flow and Water Quality.* Water Research 45:1199-1212.
102.	2010	Makris KC and **Snyder SA.** *Screening of pharmaceuticals and endocrine disrupting compounds in water supplies of Cyprus*. Water Science & Technology 62.11:2720-2728.
101.	2010	Bruce GM, Pleus RC, **Snyder SA.** *Toxicological Relevance of Pharmaceuticals in Drinking Water*. Environmental Science & Technology. 41(14):5619-5626.
100.	2010	Stanford BD, Trenholm RA, Holady JC, Vanderford BJ, **Snyder SA**. *Estrogenic Activity of US Drinking Waters: A Relative Exposure Comparison*. Journal of the American Water Works Association. 110(11):55-65.
99.	2010	Stanford BD, Benotti MJ, **Snyder SA**. *"Impact of Endocrine Disruptors on the Water Industry"* In Endocrine Toxicology. J.T. Stevens and J.C. Eldridge (Editors). In Press.
98.	2010	Gerrity D, Benotti MJ, Reckhow DA, **Snyder SA**. *Pharmaceuticals and Potential Endocrine*

		Disrupting Compounds in Drinking Water. In Biophysio-Chemical Processes of Anthropogenic Compounds in Environmental Systems, Volume 3. B. Ying (eds.), IUPAC-Wiley. Accepted for Publication.
97.	2010	**Snyder SA** and Benotti MJ. *Endocrine Disruptors and Pharmaceuticals: Implications for Water Sustainability*. Water Science and Technology. 61.1:145-154.
96.	2010	Anderson P, Denslow N, Drewes JE, Oliveri A, Schlenk D, **Snyder SA**. *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water*. A report for the State of California – State Water Resources Control Board. 220 pgs.
95.	2010	Rosario-Ortiz FL, Wert EC, **Snyder SA.** *Evaluation of UV/H_2O_2 Treatment for the Oxidation of Pharmaceuticals in Wastewater.* Water Research. 44:1440-1448.
94.	2010	Gerrity D, Stanford BD, Trenholm RA, **Snyder SA**. *An Evaluation of a Pilot-Scale Nonthermal Plasma Advanced Oxidation Process for Trace Organic Compound Degradation*. Water Research. 44(2):493-504.
93.	2010	Yoon Y, Ryu J, Oh J, Choi BG, **Snyder SA.** *Occurrence of Endocrine Disrupting Compounds, Pharmaceuticals, and Personal Care Products in the Han River (Seoul, South Korea)*. Science of the Total Environment. 408(3):636-643.
92.	2010	Benotti MJ, Stanford BD, **Snyder SA**. *Impact of Drought on Wastewater Contaminants in an Urban Water Supply*. Journal of Environmental Quality. 39(4):1196-1200.
91.	2009	Pisarenko AN, Stanford BD, Quiñones O, Pacey GE, Gordon G, **Snyder SA.** *Rapid Analysis of Perchlorate, Chlorate and Bromate Ions in Concentrated Sodium Hypochlorite Solutions.* Analytica Chimica Acta. 659:216-223.
90.	2009	Stanford BD, Leising JF, Bond RG, **Snyder SA.** *Inland Desalination: Current Practices, Environmental Implications, andCase Studies in LasVegas, NV.* In Sustainable Water for the Future: Water Recycling Versus Desalination. Escobar I and Schäfer A (eds). Elsevier, The Netherlands. Chapter 11 pages 327-350.
89.	2009	Lavado R, Loyo-Rosales JE, Floyd E, Kolodziej EP, **Snyder SA**, Sedlak DL, Schlenk D. *Site-Specific Profiles of Estrogenic Activity in Agricultural Areas of California's Inland Waters*. Environmental Science & Technology. 43(24):9110-9116.
88.	2009	Quiñones O and **Snyder SA**. *Occurrence of Perfluoroalkyl Carboxylates and Sulfonates in Drinking Water Utilities and Related Waters from the United States*. Environmental Science & Technology. 43(24):9089-9095.
87.	2009	Redding AM, Cannon FS, **Snyder SA**, Vanderford BJ. *A QSAR-Like Analysis of the Adsorption of Endocrine Disrupting Compounds, Pharmaceuticals, and Personal Care Products on Modified Activated Carbons*. Water Research. 43(15):3849-3861.
86.	2009	**Snyder SA**, Stanford BD, Pisarenko AN, Gordon G, Asami M. *Hypochlorite – An Assessment of the Factors That Influence the Formation of Perchlorate and Other Contaminants.* American Water Works Association. 141 pgs.
85.	2009	Even-Ezra I, Mizrahi A, Gerrity D, **Snyder SA**, Salveson A, Lahav O. *Application of a novel plasma-based advanced oxidation process for efficient and cost effective destruction of refractory organics in tertiary effluents and contaminated groundwater.* Desalination and Water Treatment. 11:236-244.
84.	2009	Dickenson ERV, Drewes JE, Sedlak DL, Wert EC, **Snyder SA.** *Applying Surrogates and Indicators to Assess Removal Efficiency of Trace Organic Chemicals during Chemical Oxidation of Wastewaters*. Environmental Science & Technology 43(16):6242-6247.
83.	2009	Benotti MJ and **Snyder SA.** *Pharmaceuticals and Endocrine Disrupting Compounds: Implications for Ground Water Replenishment with Recycled Water*. Ground Water 47(4):499-502.
82.	2009	Mawhinney DB, Rosario FL, Baik S, Vanderford BJ, **Snyder SA**. *Characterization of Fulvic Acids by Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry*. Journal of

		Chromatography A 1216(9):1319-1324.
81.	2009	Wang Q, **Snyder SA**, Kim J, Choi H. *Aqueous Ethanol modified Nanoscale Zerovalent Iron in Bromate Reduction: Synthesis, Characterization, and Reactivity*. Environmental Science & Technology. 43(9):3292-3299.
80.	2009	Benotti MJ, Trenholm RA, Vanderford BJ, Holady JC, Stanford BD, **Snyder SA**. *Pharmaceuticals and Endocrine Disrupting Compounds in U.S. Drinking Water*. Environmental Science & Technology. 43(3):597-603.
79.	2009	Rossner A, **Snyder SA**, Knappe DRU. *Removal of Emerging Contaminants by Alternative Absorbents*. Water Research. 43:3787-3796.
78.	2009	Park N, Vanderford BJ, **Snyder SA**, Sarp S, Kim SD, Cho J. *Effective Controls of Micropollutants included in Wastewater Effluent using Constructed Wetlands under Anoxic Condition*. Ecological Engineering. 35:418-423.
77.	2009	Wert EC, Rosario FL, **Snyder SA**. *Effect of Ozone Exposure on the Oxidation of Trace Organic Contaminants in Water*. Water Research. 43:1005-1014.
76.	2009	Trenholm RA, Vanderford BJ, **Snyder SA**. *On-line Solid Phase Extraction LC-MS/MS Analysis of Pharmaceutical Indicators in Water: A Green Alternative to Conventional Methods*. Talanta. 79:1425-1432.
75.	2009	Benotti MJ, Stanford BD, Wert EC, **Snyder SA**. *Evaluation of a Photocatalytic Reactor Membrane Pilot System for the Removal of Pharmaceuticals and Endocrine Disrupting Compounds from Water*. Water Research. 43:1513-1522.
74.	2009	Wert EC, Rosario FL, **Snyder SA.** *Using UV Absorbance and Color to Assess Pharmaceutical Oxidation during Ozonation of Wastewater*. Environmental Science & Technology. 43(13):4858-4863.
73.	2008	**Snyder SA,** Trenholm RA, Snyder EM, Bruce GM, Pleus RC, and Hemming JDC. *Toxicological Relevance of EDCs and Pharmaceuticals in Drinking Water.* American Water Works Association Research Foundation. Project 3085.
72.	2008	Rosario FL, Mezyk SP, Doud DFR, **Snyder SA**. *Quantitative Correlation of Absolute Hydroxyl Radical Rate Constants with Non-Isolated Effluent Organic Matter Bulk Properties in Water*. Environmental Science and Technology. 42(16):5924-5930.
71.	2008	Lim MH, **Snyder SA**, Sedlak DL. *Use of Biodegradable Dissolved Organic Carbon (BDOC) to Assess the Potential for Transformation of Wastewater-Derived Contaminants in Surface Waters.* Water Research. 42:2943-2952.
70.	2008	Trenholm RA, Rosario FL, **Snyder SA**. *Analysis of Formaldehyde Formation in Wastewater using On Fiber Derivatization Solid Phase Microextraction Gas Chromatography Mass Spectrometry.* Journal of Chromatography A. 1210:25-29.
69.	2008	**Snyder SA**. *Occurrence, Treatment, and Toxicological Relevance of EDCs and Pharmaceuticals in Water*. Ozone Science & Engineering. 30:65-69
68.	2008	**Snyder SA**, Vanderford BJ, Drewes J, Dickenson E, Snyder EM, Bruce GM, Pleus RC. *State of Knowledge of Endocrine Disruptors and Pharmaceuticals in Drinking Water*. American Water Works Association Research Foundation Report #91228
67.	2008	Ikehata K, El-Din MG, **Snyder SA**. *Ozonation and Advanced Oxidation Treatment of Emerging Organic Pollutants in Water and Wastewater*. Ozone Science & Engineering. 30(1):21-26.
66.	2008	Rosario-Ortiz FL, Mezyk SP, Doud DFR, Wert EC, **Snyder SA**. *Effect of Ozone Oxidation on the Molecular and Kinetic Properties of Effluent Organic Matter.* Journal of Applied Oxidation Technologies. 11(3):529-535
65.	2008	Trenholm RA, Vanderford BJ, Drewes JE, **Snyder SA.** *Analysis of Household Chemicals Using Gas Chromatography and Liquid Chromatography with Tandem Mass Spectrometry*. Journal of Chromatography A. 1190(1-2):253-262.

64.	2008	Vanderford BJ, Mawhinney DB, Rosario-Ortiz FL, **Snyder SA.** *Real-Time Detection and Identification of Emerging Contaminant Transformation Products by QTOF-MS.* Analytical Chemistry. 80(11):4193-4199
63.	2008	**Snyder SA**, Lei H, Wert EC. *"Removal of Endocrine Disruptors and Pharmaceuticals during Water Treatment"* In Fate of Pharmaceuticals in the Environment and in Water Treatment Systems. Diane S. Aga (Editor), CRC Press, Taylor & Francis Books, FL, USA. Chapter 11:229-259
62.	2007	Lei H and **Snyder SA**. *3D QSPR models for the removal of trace organic contaminants by ozone and free chlorine*. Water Research 41:3271-3280
61.	2007	**Snyder SA**, Lei H, Wert EC, Yoon Y, Westerhoff P. *Removal of EDCs and Pharmaceuticals in Drinking and Reuse Treatment Processes*. American Water Works Association Research Foundation Report #91188
60.	2007	Vanderford BJ, Rosario-Ortiz FL, **Snyder SA**. *Analysis of p-Chlorobenzoic Acid in Water by Liquid Chromatography/Tandem Mass Spectrometry*. Journal of Chromatography A. 1164(1-2):219-223
59.	2007	Rosario-Ortiz FL, **Snyder SA**, Suffet IH. *Characterization of the Polarity of Natural Organic Matter under Ambient Conditions by the Polarity Rapid Assessment Method (PRAM)*. Environmental Science & Technology. 41:4895-4900
58.	2007	Knappe DRU, Rossner A, **Snyder SA**, Strickland, C. *Alternative Adsorbents for the Removal of Polar Organic Contaminants.* American Water Works Association Research Foundation Report #91172
57.	2007	Yoon Y, Westerhoff P, **Snyder SA**, Wert EC, Yoon J. *Removal of endocrine disrupting compounds and pharmaceuticals by nanofiltration and ultrafiltration membranes.* Desalination 202(1-3):16-23
56.	2007	Rosario-Ortiz FL, **Snyder SA**, Suffet IH. *Characterization of Dissolved Organic Matter in Drinking Water Sources Impacted by Multiple Tributaries.* Water Research. 41:4115-4128
55.	2007	Drury D, **Snyder SA**, Wert EC. *Investigation Ozone.* Water Environment & Technology. May issue:56-60
54.	2007	Quiñones O, Oh JE, Vanderford BJ, Kim JH, Cho J. **Snyder SA**. *Perchlorate in the Nakdong and Yeongsan Watersheds, South Korea*. Environmental Toxicology and Chemistry. 26(7):1349-1354.
53.	2007	Wert EC, Rosario-Ortiz FL, Drury DD, **Snyder SA**. *Formation of Oxidation Byproducts from Ozonation of Wastewater*. Water Research. 41:1481-1490
52.	2007	Kim SD, Cho J, Kim IS, Vanderford BJ, **Snyder SA**. *Occurrence and removal of pharmaceuticals and endocrine disruptors in South Korean surface, drinking, and waste waters*. Water Research 41(5):1013-1021
51.	2006	**Snyder SA**, Wert EC, Rexing DJ, Zegers RE, Drury DD. *Ozone Oxidation of Endocrine Disruptors and Pharmaceuticals in Surface Water and Wastewater.* Ozone Science & Engineering. 28:445-460
50.	2006	Vanderford BJ and **Snyder SA**. *Analysis of Pharmaceuticals in Water by Isotope Dilution Liquid Chromatography/Tandem Mass Spectrometry.* Environmental Science & Technology. 40(23):7312-7320
49.	2006	**Snyder SA**, Pleus RC, Vanderford BJ, Holady JC. *Perchlorate and Chlorate in Dietary Supplements and Flavor Enhancing Ingredients.* Analytica Chimica Acta 567:26-32
48.	2006	**Snyder SA**, Adham S, Redding AM, Cannon FS, DeCarolis J, Oppenheimer J, Wert EC, Yoon Y. *Role of Membranes and Activated Carbon in the Removal of Endocrine Disruptors and Pharmaceuticals*. Desalination. 202:156-181
47.	2006	Yoon Y, Westerhoff P, **Snyder SA**, Wert EC, Yoon J. *Removal of Endocrine Disrupting Compounds and Pharmaceuticals by Nanofiltration and Ultrafiltration Membranes*. Desalination. 202:16-23
46.	2006	Quiñones, O, **Snyder SA**, Cotruvo JA, Fisher JW. *Analysis of Bromate and Bromide in Blood*.

		Toxicology. 221:229-234
45.	2006	Kim SD, Cho J, Kim IS, Vanderford BJ, **Snyder SA.** *Occurrence and Removal of Pharmaceuticals and Endocrine Disruptors in South Korean Surface, Drinking, and Waste Waters*. Water Research 41:1013-1021
44.	2006	Trenholm RA, Vanderford BJ, Holady JC, Rexing DJ, **Snyder SA**. *Broad Range Analysis of Endocrine Disruptors and Pharmaceuticals Using Gas Chromatography and Liquid Chromatography Tandem Mass Spectroscopy*. Chemosphere. 65:1990-1998
43.	2006	Kim HB, Oh JE, Lee SY, Cho JW, **Snyder SA**. *The Analysis of Perchlorate in Nakdong River and Tap Water*. Journal of Korean Society of Environmental Engineers 28(7):776-781
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41.	2006	Shon HK, Vigneswaran S, **Snyder SA**. *Effluent Organic Matter (EfOM) in Wastewater: Constituents, Effects, and Treatment*. Critical Reviews in Environmental Science and Technology. 36(4):327-374
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38.	2005	**Snyder SA**, Vanderford BJ, Rexing DJ. *Trace Analysis of Bromate, Chlorate, Iodate, and Perchlorate in Natural and Bottled Waters*. Environmental Science and Technology 39(12):4586-4593.
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33.	2005	Yoon Y, Westerhoff P, **Snyder SA**. *Adsorption of ^{3}H-labeled 17-β Estradiol on Powdered Activated Carbon.* Water, Air, and Soil Pollution 166:343-351.
32.	2005	Westerhoff P, **Snyder SA**, Yoon Y, Wert EC. *Endocrine Disruptor, Pharmaceutical, and Personal Care Product Fate During Simulated Drinking Water Treatment Processes.* Environmental Science and Technology 39(17):6649-6663.
31.	2005	Scruggs C, Hunter G, Snyder EM, Long B, and **Snyder SA**. *EDCs in Wastewater: What's the Next Step?* Water Environment & Technology 17(3):24-31.
30.	2004	**Snyder SA**, Leising J, Westerhoff P, Yoon Y, Mash H, Vanderford BJ. *Biological Attenuation of EDCs and PPCPs: Implications for Water Reuse*. Ground Water Monitoring and Remediation 24 (2):108-188.
29.	2004	Yoon Y, Westerhoff P, Yoon J, **Snyder SA**. *Removal of 17-β Estradiol and Fluoranthene by*

		Nanofiltration and Ultrafiltration. Journal of Environmental Engineering-ASCE 130 (12):1460:1467
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27.	2003	**Snyder SA**, Vanderford BJ, Pearson RA, Quinones O, Yoon Y. *Analytical Methods to Measure Endocrine Disrupting Compounds in Water.* Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management 7(4):224-234
26.	2003	**Snyder SA**, Westerhoff P, Yoon Y, Sedlak DL. *Pharmaceuticals, Personal Care Products, and Endocrine Disruptors in Water: Implications for the Water Industry*. Environmental Engineering Science 20 (5):449-469
25.	2003	Vanderford BJ, Pearson RA, Rexing DJ, **Snyder SA**. *Analysis of Endocrine Disruptors, Pharmaceuticals, and Personal Care Products in Water using Liquid Chromatography/Tandem Mass Spectrometry.* Analytical Chemistry 75 (22):6265-6274
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23.	2003	Yoon Y, Westerhoff P, **Snyder SA**, Esparza M. *HPLC-Fluorescence Detection and Adsorption of Bisphenol A, 17β-Estradiol, and 17α-Ethynyl Estradiol on Powdered Activated Carbon.* Water Research 37(14):3530-3537
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20.	2002	**Snyder SA**, Vanderford BJ, Pearson R, Rexing DJ. *Analytical Methods for Measuring Endocrine Disruptors in Water.* Water Quality Technology Conference Proceedings 2002.
19.	2001	**Snyder SA**, Keith TL, Snyder EM, Giesy JP. *Bioconcentration of Nonylphenol in Fathead Minnows (Pimephales promelas)*. Chemospere 44(8):1697-1702.
18.	2001	**Snyder SA**, Villeneuve DL, Snyder EM, Giesy JP. *Identification and Quantification of Estrogen Receptor Agonists in Wastewater Effluents.* Environmental Science and Technology 35(18):3620-3625.
17.	2001	**Snyder SA**, Keith TL, Naylor CG, Staples CA, Giesy JP. *Identification and Quantification Method for Nonylphenol and Lower Oligomer Nonylphenol Ethoxylates in Fish Tissues*. Environmental Toxicology and Chemistry 20(9):1870-1873.
16.	2001	**Snyder SA**, Kelly KL, Grange AH, Sovocool GW, Snyder EM, Giesy JP. "*Pharmaceuticals and Personal Care Products in the Environment: Methods, Analyses, and Sources*." In Pharmaceuticals and Personal Care Products in the Environment: Scientific and Regulatory Issues, Daughton, C.G. and Jones-Lepp, T. (eds.), *Symposium Series 791*; American Chemical Society, Washington, DC, Chapter 7:116-139.
15.	2001	Nichols KM, Snyder EM, **Snyder SA**, Miles-Richardson SR, Pierens S, Giesy JP. *Effects of Nonylphenol Ethoxylate (NPEO) Exposure on Reproductive Output and Bioindicators of Environmental Estrogen Exposure in Fathead Minnows, Pimephales promelas*. Environmental Toxicology and Chemistry 20(3):510-522.
14.	2001	Keith TL, **Snyder SA**, Naylor CG, Staples CA, Summer CL, Kannan K, Giesy JP. *Identification*

		and Quantitation of Nonylphenol Ethoxylates and Nonylphenol in Fish Tissues from Michigan. Environmental Science and Technology 35(2):10-13.
13.	2000	**Snyder SA**, Snyder EM, Villeneuve DL, Kannan K, Villalobos SA, Blankenship A, Giesy JP. "*Instrumental and Bioanalytical Measures of Endocrine Disruptors in Water."* In Analysis of Environmental Endocrine Disruptors, Keith, L.H., Jones-Lepp, T.L., and Needham, L.L. (eds.), *Symposium Series 747*, American Chemical Society, Washington, DC, Chapter 6:73-95.
12.	2000	Roefer PA, **Snyder SA**, Zegers RE, Rexing DJ, Fronk JL. *Endocrine-Disrupting Chemicals in a Source Water*. Journal of the American Water Works Association 92(8):52-58.
11.	2000	Giesy JP, Pierens SL, Snyder EM, Miles-Richardson S, Kramer VJ, **Snyder SA**, Nichols KM, Villeneuve DL. *Effects of 4-Nonylphenol on Fecundity and Biomarkers of Estrogenicity in Fathead Minnows (Pimephales promelas)*. Environmental Toxicology and Chemistry 19(5):1368-1377.
10.	2000	Snyder EM, **Snyder SA**, Giesy JP, Blonde SA, Hurlburt GK, Summer CL, Mitchell RR, Bush DM. *SCRAM: A Scoring and Ranking System for Persistent, Bioaccumulative and Toxic Substances for the North American Great Lakes. Part I. Structure of the Scoring and Ranking System*. Environmental Science & Pollution Research 7(1):51-61.
9.	2000	Snyder EM, **Snyder SA**, Giesy JP, Blonde SA, Hurlburt GK, Summer CL, Mitchell RR, Bush DM. *SCRAM: A Scoring and Ranking System for Persistent, Bioaccumulative and Toxic Substances for the North American Great Lakes. Part II. Bioaccumulation Potential and Persistence*. Environmental Science & Pollution Research 7(2):116-221.
8.	2000	Snyder EM, **Snyder SA**, Giesy JP, Blonde SA, Hurlburt GK, Summer CL, Mitchell RR, Bush DM. *SCRAM: A Scoring and Ranking Model for Persistent, Bioaccumulative and Toxic Substances for the North American Great Lakes. Part III. Acute and Subchronic or Chronic Toxicity*. Environmental Science & Pollution Research 7(3):176-184.
7.	2000	Snyder EM, **Snyder SA**, Giesy JP, Blonde SA, Hurlburt GK, Summer CL, Mitchell RR, Bush DM. *SCRAM: A Scoring and Ranking Model for Persistent, Bioaccumulative and Toxic Substances for the North American Great Lakes. Part IV. Results from Representative Chemicals, Sensitivity Analysis, and Discriminatory Power*. Environmental Science & Pollution Research 7(4):219-224.
6.	1999	**Snyder SA**, Keith TL, Verbrugge DA, Snyder EM, Gross TS, Kannan K, Giesy JP. *Analytical Methods for Detection of Selected Estrogenic Compounds in Aqueous Mixtures*. Environmental Science and Technology 33(16):2814-2820.
5.	1999	**Snyder SA** and Snyder EM. *Bad Medicine.* Resource 6(5):7-8.
4.	1999	Khim JS, Villeneuve DL, Kannan K, Lee KT, **Snyder SA**, Koh CH, Giesy JP. *Akylphenols, Polycyclic Aromatic Hydrocarbons (PAHs), and Organochlorines in Sediment from Lake Shihwa, Korea: Instrumental and Bioanalytical Characterization*. Environmental Toxicology and Chemistry 18(11):2424-2432.
3.	1999	Miles-Richardson SR, Pierens SL, Nichols KM, Kramer VJ, Snyder EM, **Snyder SA**, Render JA, Fitzgerald SD, Giesy JP. *Effects of Waterborne Exposure to 4-Nonylphenol and Nonylphenol Ethoxylate on Secondary Sex Characteristics and Gonads of Fathead Minnows* (*Pimephales promelas*). Environmental Research A 80:S122-S137.
2.	1997	Froese KL, Verbrugge DA, **Snyder SA**, Tilton F, Tuchman M, Ostaszewski A, Giesy JP. *PCBs in the Detroit River Water Column*. Journal of Great Lakes Research 23(4):440-449.
1.	1997	Froese KL, Verbrugge DA, **Snyder SA**, Tilton F, Tuchman M, Ostaszewski A, Giesy JP. *PCBs in the Detroit River Water Column*. Journal of Great Lakes Research 23(4):440-449.

Deposition, Testimony, and Briefings

2010	*United States House of Representatives – Science and Technology Committee.* Invited briefing entitled "*Pharmaceuticals in Our Water: Concerns and Responses."* Sponsored by the American Chemical Society

2009	*United States Senate – Committee on Environment and Public Works.* Invited briefing entitled *"Pharmaceuticals and Endocrine Disruptors in US Drinking Water: Occurrence, Treatment, & Relevance."* Sponsored by the Water Research Foundation.
2009	*Richard A. Rowe, et al. vs. E.I. du Pont de Nemours.* US District Court – District of New Jersey.
2009	*United States House of Representatives.* Invited briefing entitled *"Pharmaceuticals in Drinking Water."* Sponsored by the Water Research Foundation.
2009	*William R. Rhodes, et al. vs. E.I. du Pont de Nemours.* US District Court – Southern District of West Virginia.
2008	*United States Senate – Committee on Environment and Public Works.* Invited testimony at hearing entitled *"Pharmaceuticals in the Nation's Water: Assessing Potential Risks and Actions to Address the Issue."*
2005	*Jayne Palmisano and Richard Palmisano vs. Olin Corporation and Standard Fusee Corporation.* US District Court – San Jose California.

Professional Affiliations

2003 - Present	Water Environment Federation
2000 – Present	American Water Works Association
2000 – Present	International Ozone Association
2000 – Present	International Water Association
1997 – Present	American Association for the Advancement of Science
1996 – Present	Sigma Xi
1995 – Present	Society of Environmental Toxicology and Chemistry
1991 – Present	American Chemical Society

Students Mentored

2011-Current	**Shimin Wu – University of Arizona** – Current enrolled in Ph.D. program.
2011-Current	**Christopher Deason – University of Arizona** – Currently enrolled in M.Sc. program.
2011-Current	**Xu Li – University of Arizona** – Currently enrolled in Ph.D. program.
2010-Current	**Tarun Anumol - University of Arizona –** Currently enrolled in Ph.D. program.
2010-Current	**Darryl Jones – University of Arizona –** Currently enrolled in Ph.D. program.
2010	**Sujanie Gamage – University of Nevada, Las Vegas** – Currently enrolled in Ph.D. program in Vern Hodge's research group.
2010	**Dongxu Yan – University of Arizona** – Currently enrolled in Ph.D. program in Wendell Ella's research group.
2009	**Ludwig Kim – Texas A&M University** – Currently enrolled in Ph.D. program in Robin Autenreith's research group.
2009-2010	**Robert Young – Colorado State University** – Currently enrolled in Ph.D. program in Thomas Borch's research group.
2008-2009	**Sarper Sarp – Gwangju Institute of Science & Technology, Korea** – Currently enrolled in Ph.D. program in Jaeweon Cho's research group.
2008-2009	**Aleks Pisarenko – Miami University of Ohio** – Currently enrolled in Ph.D. program in Gilbert Pacey's research group.
2008-2010	**Susanna Blunt – University of Nevada, Las Vegas & Desert Research Institute** – Currently enrolled in M.S. program in Duane Mosher's research group.
2008-2009	**Deborah Dryer – University of Washington** - Currently enrolled in Ph.D. program in Gregory Korshin's research group.

2007-2008	**Seungyun Baik – State University of New York, Buffalo –** Currently enrolled in Ph.D. program in Diana Aga's research group.
2006-2008	**Mei Xin – University of Nevada, Reno –** Ph.D. granted in 2008; currently employed by Norit Carbon, Dallas Texas.
2005-2010	**Christy Meza – University of Nevada, Las Vegas** – Undergraduate research intern, B.S. awarded in 2008.
2005-2009	**Elaine Go – University of Nevada, Las Vegas** – Undergraduate research intern, B.S. expected in 2009.
2004-2006	**Fernando Rosario-Ortiz – University of California, Los Angeles –** D.Env. granted in 2006..
2003-2006	**Yixin Wei – University of Nevada, Las Vegas** – Ph.D. granted in 2006.
2000-2004	**Elisa Nemr – University of Nevada, Las Vegas** – M.S. granted in 2004**.**

Post-Doctoral Researchers Mentored

2010-Current	**Ai Jia** – Ph.D. from Peking University, China, with Professor Jianying Hu.
2010-2012	**Bradley Clarke** – Ph.D. from RMIT, Australia, with Professor Judy Blackbeard.
2010-Current	**Sylvain Merel –** Ph.D. from University of Rennes, France, with Professor Oliver Thomas
2009-2010	**Aleks Pisarenko** – Ph.D. from Miami University of Ohio with Professor Gilbert Gordon.
2008-2010	**Daniel Gerrity –** Ph.D. from Arizona State University with Professors John Crittenden and Morteza Abbaszadegan as advisors.
2008-2010	**Yongui Tan –** Ph.D. from Rensselaer Polytechnic Institute with Professor James Kilduff as primary advisor.
2007-2009	**Benjamin Stanford –** Ph.D. from University of North Carolina, Chapel Hill with Professor Howard Weinberg as primary advisor. Currently employed as Director of R&D, Hazen and Sawyer, New York.
2007-2009	**Mark Benotti –** Ph.D. from State University of New York, Stoney Brook with Professor Bruce Brownawell as primary advisor. Currently employed as private consultant.
2006-2008	**Fernando Rosario-Ortiz –** D.Env. from University of California, Los Angeles with Professor Mel Suffet as primary advisor. Currently employed as Assistant Professor at the University of Colorado, Boulder.
2005-2007	**Hongxia Lei –** Ph.D. from University of Illinois with Professor Benito J. Mariñas as primary advisor. Currently employed by Golden State Water, California.

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