# Chapter 5

# Water Quality Assessment

## 5.0 Introduction

This chapter describes the quality of the surface water supplies in the Hodges, Miramar, San Diego River and Otay/Cottonwood Watersheds from 2011 through 2015. This includes all of the source (raw) water data collected by the CSD - both reservoir/watershed data, as well as, Miramar, Alvarado and Otay WTP influent/effluent data (**Appendix 5, see page A5.1**). Miramar, Alvarado and Otay WTP influent water sources include water imported from San Diego County Water Authority.

As part of the assessment, raw water quality parameters are compared to drinking water standards for the constituents currently regulated. This includes constituents with primary and secondary Maximum Contaminant Levels (MCLs & SMCLs) and unregulated constituents that have Detection Limits for Reporting (DLRs) set by the State Water Resources Control Board. Exceeding drinking water MCLs, or SMCL in raw source water is NOT a drinking water violation. This evaluation technique indicates which raw water quality parameters require some form of treatment to achieve the current drinking water standards. The goal of this water quality analysis is to evaluate spatial and temporal variability of the key water quality constituents to identify significant changes that have occurred in the five-year period covered by this study (2011 to 2015), and to identify potential actions that can be taken to improve source water quality.

## 5.1 Summary of Monitoring Program

**Table 5.1** summarizes the CSD's monitoring efforts, which for the purpose of this report include two types of monitoring programs: source waters (reservoirs and streams) and water treatment (influent and effluent). Water quality data associated with each of the CSD's nine reservoirs was collected as near to the outlet structure (Station "A") as feasible. There are also several stream sampling points within the CSD's watersheds, of which, twenty-one were chosen to present based on the amount of data available. Those sites having fewer than five data points during the past five years were deemed to be unrepresentative of a five year period. Finally, the CSD has sampling points at the influent and effluent of each WTP.

In addition to grab samples the CSD also conducted water quality profiles, at our streams and reservoirs, with the use of in situ instruments (Hydrolab mini sonde 4 and YSI EXO 2 data sonde) to monitor the following parameters: temperature, pH, conductivity, total dissolved solids (TDS), dissolved oxygen, oxidation reduction potential, chlorophyll and blue green algae concentrations.

Table 5.1
City of San Diego,
Public Utilities Department
Water Quality Monitoring Frequency [1]

| Parameter | Source Waters | | | Water Treatment Plants | |
|---|---|---|---|---|---|
| | Streams | Primary Reservoirs | Secondary Reservoirs | Influent | Effluent |
| Bacteriological (total and fecal coliform) | S | W | NS | D | 5D |
| *Cryptosporidium* & *Giardia* | NS | 2Y | NS | M | NS |
| Other Physical/Chemical[2] | S | 2W | NS | W | W |
| General Minerals | S | Q | Q | M | M |
| Nutrients | S | M | Q | W | W |
| Organics | S | Q | Q | Q | Q |
| Metals | S | Q | Q | Q | Q |
| Radiation | NS | A | NS | A | A |
| MIB & Geosmin | S | W | NS | W | W |
| WQ Profile[3] | S | W | M | NS | NS |

[1] D=daily,5D= five days a week, W=weekly, 2W= every two weeks, M=monthly, Q=quarterly, S=seasonally, A=annually, 2Y= twice a year, NS= not sampled
[2] Temperature, Color, Turbidity, Specific Conductance, pH
[3]Following Data collected with a YSI EXO 2 Data Sonde or Hydrolab MiniSonde 4: Temperature, pH, Dissolved oxygen, Specific conductivity, Chlorophyll, Blue green algae

## 5.2 San Diego River System Water Quality Review

Streams, reservoirs and treatment plant influent/effluent were monitored for general physical characteristics, microbiological, metals, organic and inorganic constituents. El Capitan, Murray, and San Vicente Reservoirs and Alvarado WTP influent were also sampled for radiation. Streams, Sutherland Reservoir and Alvarado WTP effluent were not monitored for radiation.

**Tables 5.2 – 5.14** contain the mean water quality values from the 2010 and 2015 WSS for comparison purposes. These tables do not contain constituents whose levels were below the MDL during the past two WSSs. See **Appendix 5 (see pages A5.1 thru A5.18)** for a summary of all water quality data. The Drinking Water Standards used in **Appendix 5 (see pages A5.1 thru A5.18)** apply to treated, potable water, and are listed for reference only.

### Source Water Review

### General Physical Parameters

General/physical source water quality parameters for the San Diego River System were within the standards for drinking water except for pH, color, TDS, specific conductance (E.C.), and turbidity. The water quality is typical of raw water streams and reservoirs in Southern California. Since the streams and reservoirs contain raw water, and the standards are for treated water, the comparison is for reference only.

The maximum pH level was 9.92, above the SMCL range of 6.5 – 8.5. The maximum Turbidity level was 10.5 NTU, where the SMCL is 5 NTU. The maximum TDS level was 3,980 mg/L and the maximum Conductivity level was 5,950 µS/cm. Both the TDS and Conductivity levels exceeded the SMCL of 1,000 mg/L and 1,600 µS/cm, respectively. The maximum Color level was 59 cu, exceeding the SMCL of 15 cu. TDS, pH, Color, and Conductivity are addressed in the water treatment process. **Table 5.2** highlights the changes that have occurred since the 2010 WSS.

**Table 5.2**
**General/Physical Water Quality Constituents Review for the Source Waters of the San Diego River System**

| | | Stream Data[a] | | |
|---|---|---|---|---|
| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
| General Physical | | Mean | Mean | |
| Conductivity | µS/cm | 1100 | 1320 | 220 |
| pH | pH | 7.88 | 7.69 | -0.19 |
| Total Dissolved Solids | mg/L | 704 | 839 | 135 |
| Total Suspended Solids | mg/L | 16.5 | 12.4 | -4.1 |
| | | | | |

## Table 5.2
## General/Physical Water Quality Constituents Review for the Source Waters of the San Diego River System (contd)

| El Capitan Reservoir Data[a] | | | | |
|---|---|---|---|---|
| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
| General Physical | | Mean | Mean | |
| Calcium Hardness (CaCO3) | mg/L | 136 | 90.7 | -45.3 |
| Color | Color | 13 | 9.53 | -3.47 |
| Conductivity | µmho/cm | 701 | 589 | -112 |
| Total Alkalinity | mg/L | 146 | 129 | -17 |
| Total Dissolved Solids | mg/L | 400 | 361 | -39 |
| Total Hardness (CaCO3) | mg/L | 206 | 185 | -21 |
| Turbidity | ntu | 1.61 | 0.844 | -0.766 |
| pH | pH | 8.1 | 8.14 | 0.04 |
| Murray Reservoir Data[a] | | | | |
| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
| General Physical | | Mean | Mean | |
| Calcium Hardness (CaCO3) | mg/L | 150 | 131 | -19 |
| Color | Color | 8.47 | 7.03 | -1.44 |
| Conductivity | µmho/cm | 982 | 783 | -199 |
| Total Alkalinity | mg/L | 110 | 110 | 0 |
| Total Dissolved Solids | mg/L | 555 | 475 | -80 |
| Total Hardness (CaCO3) | mg/L | 242 | 226 | -16 |
| Turbidity | ntu | 1.22 | 0.83 | -0.39 |
| pH | pH | 8.28 | 8.23 | -0.05 |
| San Vicente Reservoir Data[a] | | | | |
| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
| General Physical | | Mean | Mean | |
| Calcium Hardness (CaCO3) | mg/L | 133 | 116 | -17 |
| Color | Color | 14 | 10.3 | -3.7 |
| Conductivity | µmho/cm | 872 | 719 | -153 |
| Total Alkalinity | mg/L | 120 | 114 | -6 |
| Total Dissolved Solids | mg/L | 486 | 446 | -40 |
| Total Hardness (CaCO3) | mg/L | 213 | 210 | -3 |
| Turbidity | ntu | 2.17 | 1.15 | -1.02 |
| pH | pH | 8.42 | 8.43 | 0.01 |

## Table 5.2
## General/Physical Water Quality Constituents Review for the Source Waters of the San Diego River System (contd)

| Parameters | Units | Sutherland Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| General Physical | | Mean | Mean | |
| Calcium Hardness (CaCO3) | mg/L | 102 | 80.4 | -21.6 |
| Color | Color | 27.5 | 32.3 | 4.8 |
| Conductivity | µmho/cm | 456 | 485 | 29 |
| Total Alkalinity | mg/L | 125 | 129 | 4 |
| Total Dissolved Solids | mg/L | 285 | 300 | 15 |
| Total Hardness (CaCO3) | mg/L | 146 | 150 | 4 |
| Turbidity | Ntu | 3.34 | 4.04 | 0.7 |
| pH | pH | 8.35 | 8.47 | 0.12 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Indicator Organisms and Pathogens**

Perhaps the most important group of parameters with respect to public health is microbiological organisms. Source waters may be contaminated with a number of pathogenic bacteria, viruses, and protozoan's, along with non-pathogenic naturally occurring microorganisms. The presence of these constituents in the raw water governs the overall treatment requirements for the WTPs. Routine monitoring for all possible pathogens is impractical. The CSD's monitoring program is focused on indicator bacteria (total coliform, fecal (Enterococcus) coliform and *Escherichia coli [E. coli]*) and the pathogenic protozoan's (*Giardia* and *Cryptosporidium).*

## Table 5.3
## Pathogens and Indicator Organisms Review for the Source Waters of the San Diego River System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 137 | 173 | 36 |
| E Coli | /100 mL | 249 | 258 | 9 |
| Total Coliform | /100 mL | 7760 | 5160 | -2600 |

**El Capitan Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 3.03 | 1 | -2.03 |
| E Coli | /100 mL | <10 | <10 | 0 |
| Total Coliform | /100 mL | 3660 | 3692 | 32 |
| Crypto TC | / L | 0 | 0 | 0 |
| Giardia TC | / L | 0 | 0 | 0 |

**Murray Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 29.1 | 26.7 | -2.4 |
| E Coli | /100 mL | 93.2 | 111 | 17.8 |
| Total Coliform | /100 mL | 2660 | 2850 | 190 |
| Crypto TC | / L | 0 | 0 | 0 |
| Giardia TC | / L | 0 | 0 | 0 |

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 1.77 | 2.09 | 0.32 |
| E Coli | /100 mL | 10.4 | <10 | 0.4 |
| Total Coliform | /100 mL | 963 | 4270 | 3307 |
| Crypto TC | / L | 0 | 0 | 0 |
| Giardia TC | / L | 0 | 0 | 0 |

## Table 5.3
## Pathogens and Indicator Organisms Review for the Source Waters of the San Diego River System (contd)

| Sutherland Reservoir Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 3.18 | 22.4 | 19.22 |
| E Coli | /100 mL | 11.2 | 7.21 | -3.99 |
| Total Coliform | /100 mL | 3540 | 1880 | -1660 |
| Crypto TC | / L | ns | ns | 0 |
| Giardia TC | / L | ns | ns | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

Streams and Reservoirs of the San Diego River System were monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions. *Enterococcus levels* ranged from <1 /100mL to >2400/100mL, *E. coli* levels ranged from <10 /100mL to 5900 /100mL, and total coliform levels ranged from <10 /100mL to >240,000 /100mL. Wide ranges in microbiological results are expected in raw water streams and reservoirs. *Cryptosporidium* and *Giardia* were monitored in the primary reservoirs and all samples were reported as ND.

**Nutrient Parameters**

Nutrients are required for the proper functioning of aquatic ecosystems but high concentrations can result in a number of adverse impacts. High levels of Nitrogen and Phosphorus in waters can produce algal blooms that cause taste and odor in drinking water, add organic carbon, obstruct water conveyance facilities, and clog filters. Measurement of nutrient concentrations provides an indicator of the potential for algal and vascular plant growth in systems that are not limited by other factors, such as light availability or adverse temperatures. Nitrogen and phosphorus are the most important required nutrients and is the subject of this analysis.

Nitrogen in the aquatic environment can be present in several biochemically inter-convertible forms including organic nitrogen, ammonia, nitrite, nitrate, and gaseous nitrogen. Although gaseous (atmospheric) nitrogen is actually part of the biochemical cycle, its relationship to the other nitrogen forms is complex. Total nitrogen (TN) is the summation of the nitrogen forms measured and include nitrate, nitrite, ammonia, and organic nitrogen.

Phosphorus is present in both dissolved and particulate forms. Particulate phosphorus consists of organic phosphorus incorporated in planktonic organisms, inorganic mineral phosphorus in suspended sediments, and phosphate adsorbed to inorganic particles and colloids. The dissolved forms include dissolved organic phosphorus, *ortho-P*hosphate, and polyphosphates. Dissolved *ortho*-phosphate is the only form that is generally available for algal and plant uptake, and is the subject of this report.

The USEPA has established nitrogen and phosphorus reference conditions for streams and reservoirs for Ecoregion III, which includes San Diego County. The stream reference concentration for TN is 0.38 mg/L, and for total phosphorus (TP) is 0.022 mg/L. The reservoir reference concentration for TN is 0.40 mg/L, and for TP is 0.017 mg/L, (USEPA, 2001).

TN levels for streams ranged from ND to 7.4 mg/L, while *ortho*-Phosphate levels ranged from non-detect to 3.25 mg/L. Reservoir TN levels ranged from ND to 1.44 mg/L, and *ortho*-Phosphate levels ranged from ND to 0.437 mg/L.

Mean values for *ortho*-Phosphate and TN for streams and reservoirs within the San Diego River System decreased or experienced no change since the 2010 WSS (**Table 5.4**). However, mean TN values for the streams exceed EPA's reference concentrations.

## Table 5.4

## Nutrient Review for the Sources Waters of the San Diego River System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Total Nitrogen | mg/L | 1.12 | 0.838 | -0.282 |
| Ortho Phosphate | mg/L | 0.086 | 0 | -0.086 |

**El Capitan Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Total Nitrogen | mg/L | 0.45 | 0 | -0.45 |
| Ortho phosphates | mg/L | 0 | 0 | 0 |

**Murray Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Total Nitrogen | mg/L | 0.323 | 0 | -0.323 |
| Ortho phosphates | mg/L | 0 | 0 | 0 |

## Table 5.4
## Nutrient Review for the Sources Waters of the San Diego River System (contd)

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Total Nitrogen | mg/L | 0.399 | 0 | -0.399 |
| Ortho phosphates | mg/L | 0 | 0 | 0 |

**Sutherland Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Total Nitrogen | mg/L | 0.599 | 0.351 | -0.248 |
| Ortho phosphates | mg/L | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Metal Parameters**

The effects of metals in water are varied. Some metals have caused concern due to their physiological and other human health effects while others affect the aesthetics of water. Two of these metals, Iron and Manganese, are nuisance constituents that affect the aesthetic properties of water. Iron and Manganese are of interest since they have aesthetic impacts if left untreated, exert an oxidant demand, and serve as indicators as to reservoir dynamics. The SMCLs for Iron and Manganese are 300 and 50 µg/L, respectively. Both Iron and Manganese are naturally occurring constituents, but can be elevated by contribution from potential contaminating activities, such as landfills, mines, industrial wastes and urban runoff. Conventional water treatment is very effective at removing both Iron and Manganese.

When using ozonation in water treatment, there is a risk of completely oxidizing the Manganese to Permanganate which could result in pink water. Reports suggest that raw or settled water with levels of Manganese exceeding 100 µg/L could form Permanganate at levels sufficiently high enough to create problems, especially if the ozone dosages are high enough to achieve pathogen inactivation. With the addition of ozone disinfection at the Alvarado and Miramar WTP's, Manganese levels in the CDS's raw water will become more of a concern.

Water samples collected from the San Diego River Watershed streams were analyzed for twenty-two metals. The concentrations were ND for most metals except Manganese which had a

maximum value of 323 µg/L and exceeded the SMCL of 50 µg/L (**Appendix 5, see pages A5.1 thru A5.18**).

Water samples were collected from the four San Diego River Watershed Reservoirs and analyzed for twenty-four metals. While most values where non-detect, maximum manganese values at El Capitan, San Vicente and Sutherland Reservoirs exceed the SMCL value of 50 µg/L. Maximum values of Aluminum and Iron at Sutherland Reservoir also exceeded the SMCL's of 200 µg/L and 300 µg/L **(Appendix 5, see pages At.1 thru A5.18**). **Table 5.5** highlights the changes that have occurred since the 2010 WSS.

**Table 5.5**

**Metal Constituents Review for the Sources Waters of the San Diego River System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 4490 | 0 | 4490 |
| Arsenic | µg/L | 1.08 | 0 | 1.08 |
| Barium | µg/L | 120 | 0 | 120 |
| Boron | µg/L | 88.2 | 0 | 88.2 |
| Chromium | µg/L | 3.53 | 0 | 3.53 |
| Copper | µg/L | 8.22 | 0 | 8.22 |
| Lead | µg/L | 3.73 | 0 | 3.73 |
| Manganese | µg/L | 309 | 82.2 | 226.8 |
| Nickel | µg/L | 3.38 | 0 | 3.38 |
| Selenium | µg/L | 0.489 | 0 | 0.489 |
| Silver | µg/L | 0.069 | 0 | 0.069 |
| Vanadium | µg/L | 26.9 | 18.4 | 8.5 |
| Zinc | µg/L | 16.6 | 0 | 16.6 |
| **El Capitan Reservoir Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Magnesium | mg/L | 16.7 | 21.5 | 4.8 |
| Manganese | µg/L | 25 | 20.9 | -4.1 |
| Sodium | mg/L | 50.7 | 55.6 | 4.9 |
| Vanadium | µg/L | 4.78 | 4.69 | -0.09 |
| **Murray Reservoir Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Boron | µg/L | 127 | 122 | -5 |
| Iron | µg/L | 100 | 101 | 1 |

## Table 5.5
## Metal Constituents Review of the Sources Waters of the San Diego River System (contd)

| | | | | |
|---|---|---|---|---|
| Magnesium | mg/L | 22.6 | 23 | 0.4 |
| Manganese | µg/L | 33.6 | 21.2 | -12.4 |
| Sodium | mg/L | 85.8 | 78.9 | -6.9 |

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Boron | µg/L | 113 | 0 | -113 |
| Magnesium | mg/L | 19.2 | 22.5 | 3.3 |
| Sodium | mg/L | 79.3 | 73.8 | -5.5 |

**Sutherland Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 71.4 | 97.6 | 26.2 |
| Iron | µg/L | 156 | 161 | 5 |
| Magnesium | mg/L | 10.6 | 16.9 | 6.3 |
| Manganese | µg/L | ND | 62.7 | #VALUE! |
| Sodium | mg/L | 30.1 | 43.7 | 13.6 |
| Vanadium | µg/L | 5.59 | 6.51 | 0.92 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Inorganic Parameters**

The CSD measured inorganic parameters at the streams and source water reservoirs of the San Diego River System. Maximum stream values for Chloride (1120 mg/L) and Sulfate (1380 mg/L) exceeded the SMCL of 50 mg/L. None of the reservoir levels exceeded the MCLs or SMCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.6** highlights the changes that have occurred since the 2010 WSS.

## Table 5.6
## Inorganic Constituents Review for the Sources Waters of the San Diego River System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia_N | mg/L | 0.066 | 0 | -0.066 |
| Bromide | µg/L | 0.241 | 0.184 | -0.057 |
| Chloride | mg/L | ns | 369 | 0 |
| Nitrate | mg/L | 3.01 | 3.39 | 0.38 |
| Nitrite | mg/L | 0.024 | 0 | -0.024 |
| Phoshorus | mg/L | 0.084 | 0 | -0.084 |
| Sulfate | mg/L | ns | 415 | 0 |

**El Capitan Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Bicarbonate | mg/L | 173 | 156 | -17 |
| Bromide | mg/L | 0.141 | 0 | -0.141 |
| Calcium | mg/L | 54.4 | 36.3 | -18.1 |
| Carbonate | mg/L | 2.66 | 0.8 | -1.86 |
| Chloride | mg/L | 60.4 | 68.1 | 7.7 |
| Fluoride | mg/L | 0.239 | 0.239 | 0 |
| Potassium | mg/L | 4.28 | 4.77 | 0.49 |
| Silica | mg/L | 13.6 | 13.7 | 0.1 |
| Sulfate | mg/L | 84.3 | 73.7 | -10.6 |
| Total Nitrogen | mg/L | 0.45 | 0 | -0.45 |

**Murray Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.032 | 0.033 | 0.001 |
| Bicarbonate | mg/L | 130 | 131 | 1 |
| Bromide | mg/L | 0.18 | 0 | -0.18 |
| Calcium | mg/L | 60 | 52.2 | -7.8 |
| Carbonate | mg/L | 2.27 | 1.42 | -0.85 |
| Chloride | mg/L | 107 | 93.9 | -13.1 |
| Fluoride | mg/L | 0.239 | 0.253 | 0.014 |
| Potassium | mg/L | 4.42 | 4.31 | -0.11 |
| Silica | mg/L | 8.45 | 9 | 0.55 |

## Table 5.6
## Inorganic Constituents Review for the Sources Waters of the San Diego River System (contd)

| | | | | |
|---|---|---|---|---|
| Sulfate | mg/L | 172 | 151 | -21 |
| Total Nitrogen | mg/L | 0.323 | 0 | -0.323 |

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.033 | 0 | -0.033 |
| Bicarbonate | mg/L | 138 | 133 | -5 |
| Bromide | mg/L | 0.147 | 0 | -0.147 |
| Calcium | mg/L | 53.2 | 46.6 | -6.6 |
| Carbonate | mg/L | 4.15 | 2.64 | -1.51 |
| Chloride | mg/L | 88.1 | 85.2 | -2.9 |
| Fluoride | mg/L | 0.245 | 0.247 | 0.002 |
| Potassium | mg/L | 4.71 | 4.75 | 0.04 |
| Silica | mg/L | 10.8 | 11 | 0.2 |
| Sulfate | mg/L | 143 | 137 | -6 |
| Total Nitrogen | mg/L | 0.399 | 0 | -0.399 |

**Sutherland Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Bicarbonate | mg/L | 145 | 157 | 12 |
| Bromide | mg/L | 0.109 | 0 | -0.109 |
| Calcium | mg/L | 40.7 | 31.6 | -9.1 |
| Carbonate | mg/L | 4.09 | 2.6 | -1.49 |
| Chloride | mg/L | 36.4 | 46 | 9.6 |
| Fluoride | mg/L | 0.195 | 0.244 | 0.049 |
| Potassium | mg/L | 4.12 | 5.4 | 1.28 |
| Silica | mg/L | 21.9 | 18 | -3.9 |
| Sulfate | mg/L | 37 | 40.1 | 3.1 |
| Total Nitrogen | mg/L | 0.599 | 0.351 | -0.248 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Radiological Parameters**

Most drinking water sources have very low levels of radioactive parameters ("radionuclide's"), most of which are naturally occurring, although contamination of drinking water sources from human-made nuclear materials could also occur. Most radioactive contaminants are at levels that are low enough to not be considered a public health concern. At higher levels, long-term exposure to radionuclides in drinking water may cause cancer. In addition, exposure to Uranium in drinking water may cause toxic effects to the kidney.

To protect public health, EPA has established drinking water standards for several types of radioactive parameters including combined Radium 226/228 (5 pCi/L), beta particles (50 pCi/L), gross alpha standard (15 pCi/L), and Uranium (20pCi/L).

Primary reservoirs of the San Diego River System were monitored for gross *alpha* and *beta* particles and Uranium. All measurements were below the MCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.7** highlights the changes that occurred since the 2010 WSS.

**Table 5.7**
**Radiological Constituents Review for the Source Waters of the San Diego River System**

**El Capitan Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 2.56 | 3.47 | 0.91 |
| Beta Radiations | pCi/L | 3.19 | 0 | -3.19 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.333 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 2.9 | 1.3 | -1.6 |

**Murray Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 3.28 | 3.23 | -0.05 |
| Beta Radiations | pCi/L | 0 | 0 | 0 |
| Combined Radium-226 & Radium-228 | pCi/L | 0 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 4.3 | 2.3 | -2 |

## Table 5.7
## Radiological Constituents Review for the Source Waters of the San Diego River System (contd)

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 0 | 4.14 | 4.14 |
| Beta Radiations | pCi/L | 0 | 0 | 0 |
| Combined Radium-226 & Radium-228 | pCi/L | 0 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 2.58 | 1.7 | -0.88 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Regulated and Unregulated Organic Parameters**

All organic compounds contain carbon in combination with one or more elements. Naturally occurring compounds often contain low levels of Nitrogen, Phosphorous and Sulfur, while synthetic organic compounds may contain halogens. Organic compounds can find their way into water from humic materials from plant and algae, microorganisms and their secretions, and hydrocarbons; commercial and domestic activities and effluent from waste-water treatment plants and industries into surface waters; and reactions that occur during the treatment of water.

The USEPA has designated three health effects categories for organic chemicals: Category 1- It is known, or there is strong evidence, that the chemical is a carcinogen; Category 2- There is limited but not positive evidence that the chemical is a carcinogen, and there are other known adverse health effects; and Category 3- There is no firm evidence that the chemical is a carcinogen, but there are other known adverse health effects.

MCLs have been established by USEPA and CDHS for a number of organic chemicals that pose a risk in drinking water supplies. Most of these chemicals have never been detected in the CSD's watersheds. The CSD conducted quarterly monitoring for chlorinated organic chemicals, organo-phosphorus pesticides, herbicides, carbamate pesticides, and a variety of other synthetic organics throughout its watersheds, reservoirs and WTP influent and effluent waters. q

The source waters of the San Diego River System were monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants.

None exceeded the MCL, and the majority of the seventy constituents were not detected during this survey (**Appendix 5, see pages A5.1 thru A5.18**).

TOC is a precursor to Trihalomethanes (THMs) and Haloacetic acids (five) (HAA-5), which are formed as by-products predominantly when chlorine is used to disinfect water for drinking. THMs and HAAs result from the reaction of chlorine and/or bromine with organic matter present in the water being treated. THMs and HAAs have been associated through epidemiological studies with some adverse health effects.

Stream TOC levels ranged from 1.81 mg/L to 26.8 mg/L, while reservoir TOC levels ranged from 2.93 mg/L to 7.63 mg/L. **Tables 5.8 & 5.9** highlight the changes that have occurred since the 2010 WSS.

**Table 5.8**

**Regulated Organic Constituents Review for the Source Waters of the San Diego River System**

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Total Organic Carbon (TOC) | mg/L | 4.65 | 5.9 | 1.25 |

**El Capitan Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Total Organic Carbon | mg/L | 5.53 | 5.62 | 0.09 |

**Murray Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 1.91 | 1.48 | -0.43 |
| Bromoform | µg/L | 0.621 | 0 | -0.621 |
| Chlorodibromomethane | µg/L | 2.17 | 1.85 | -0.32 |
| Chloroform | µg/L | 1.69 | 1.23 | -0.46 |
| Total Organic Carbon | mg/L | 4.4 | 3.76 | -0.64 |
| Total THMs | µg/L | 7.39 | 5.6 | 0 |

## Table 5.8
## Regulated Organic Constituents Review for the Source Waters of the San Diego River System

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Total Organic Carbon | mg/L | 5.62 | 5.18 | -0.44 |

**Sutherland Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| None-All Parameters ND | µg/L | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

## Table 5.9
## Unregulated Organic Constituents Review for the Source Waters of the San Diego River System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| Carbaryl | µg/L | 0.062 | 0 | -0.062 |

**El Capitan Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 7.53 | 0 | -7.53 |

## Table 5.9
## Regulated Organic Constituents Review for the Source Waters of the San Diego River System (contd)

**Murray Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 6.25 | 0 | -6.25 |

**San Vicente Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| Geosmin | ng/L | 0 | 5.46 | 5.46 |
| Dissolved Organic Carbon | µg/L | 0 | 4.12 | 4.12 |

**Sutherland Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | ng/L | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Water Treatment Plant Influent/Effluent Review**

**General Physical Parameters**

The monitored general physical parameters for Alvarado WTP influent (**Appendix 5, see pages A5.1 thru A5.18**) were within the standards for drinking water except for Threshold Odor Number (TON), pH and Turbidity. Since the plant influent contains raw water, and the standards are for treated water, the comparison is for reference only. The maximum Turbidity level was 5.6 NTU, where the MCL is for 95% of the filtered water samples to have a Turbidity level $\leq$ 0.5 NTU. The maximum pH level was 8.52 where the SMCL is 8.5. The maximum TON level was 3 odor units, equaling the SMCL of 3 odor units.

The monitored physical parameters for Alvarado WTP effluent (**Appendix 5, see pages A5.1 thru A5.18**) were within the standards for drinking water. To comply with regulatory plant monitoring requirements, plant operators frequently monitors for both the Turbidity and pH – every 15 minutes for Turbidity, and every two hours for pH at the WTP effluent. Those monitoring results were used for the WTP effluent review. All measurements met Turbidity and pH requirements. **Table 5.10** highlights the changes that have occurred since the 2010 WSS.

## Table 5.10
## General/Physical Water Quality Parameter Review for the Alvarado Water Treatment Plant

**Influent (Untreated Raw Water) Data[a]**

| Parameter | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 150 | 141 | -9 |
| Color | Color | 7.63 | 6.1 | -1.53 |
| Conductivity | µmho/cm | 879 | 870 | -9 |
| Corrosivity | -- | 0.47 | 0.17 | -0.3 |
| Threshold odor number (TON) | Odor | 1.7 | 2.14 | 0.44 |
| Total Alkalinity | mg/L | 121 | 113 | -8 |
| Total Dissolved Solids (TDS) | mg/L | 501 | 519 | 18 |
| Total Hardness (CaCO3) | mg/L | 233 | 226 | -7 |
| Total Suspended Solids (TSS) | mg/L | 1.92 | 1.77 | -0.15 |
| Turbidity | ntu | 0.851 | 0.792 | -0.059 |
| pH | pH | 8.04 | 7.68 | -0.36 |

**Effluent (Treated Water) Data[a]**

| Parameter | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 152 | 144 | -8 |
| Color | Color | 3.01 | 0.895 | -2.115 |
| Conductivity | µmho/cm | 904 | 898 | -6 |
| Corrosivity | -- | 0.712 | 0.508 | -0.204 |
| Threshold odor number (TON) | Odor | 1 | 1.01 | 0.01 |
| Total Alkalinity | mg/L | 122 | 116 | -6 |
| Total Dissolved Solids (TDS) | mg/L | 507 | 523 | 16 |
| Total Hardness (CaCO3) | mg/L | 230 | 230 | 0 |
| Total Suspended Solids (TSS) | mg/L | 0.947 | 1 | 0.053 |
| Turbidity | ntu | 0.096 | 0.09 | -0.006 |
| pH | pH | 8.26 | 8.03 | -0.23 |

## Table 5.10
## General/Physical Water Quality Parameter Review for the Alvarado Water Treatment Plant (contd)

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: n sampled; Constituents reported as ns in either WSS were also reported as "na" change.

**Indicator Organisms and Pathogens**

Raw waters entering Alvarado WTP were monitored, at the plant influent, for *E. coli*, fecal coliform, heterotrophic bacteria (HPC), and total coliform to obtain a representation of microbiological conditions **(Appendix 5, see pages A5.1 thru A5.18)**. *E. coli* levels ranged from 1/100mL to 390/100mL, fecal coliform levels ranged from 1.8/100 mL to 1600/100 mL, HPC levels ranged from 1cfu/mL to 12,000cfu/mL and total coliform levels ranged from 1.8 /100mL to 2,400/100mL. Wide ranges in microbiological results are expected in the raw waters entering Alvarado WTP. Elevated total coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* were monitored 59 times and all were ND (**Table 5.11)**.

Treated water from Alvarado WTP was monitored, at the plant effluent, for *E. coli*, HPC and total coliform to ascertain compliance with regulations. *E. coli* was reported as absent for all samples while total coliform was reported as absent for all but one of the 1,226 samples for this five year period. HPC values ranged from <1 cfu/mL to 6 cfu/mL.

## Table 5.11
## Pathogens and Indicator Organisms Review for Alvarado Water Treatment Plant

| | | Influent Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| E Coli | /100 mL | 22.1 | 34.7 | 12.6 |
| Fecal Coliform | /100 mL | 39 | 39.8 | 0.8 |
| Heterotrophic Bacteria (HPC) | cfu/mL | 89.8 | 170 | 80.2 |
| Total Coliform | /100 mL | 181 | 206 | 25 |
| Crypto TC | mg/L | 0.057 | 0 | -0.057 |
| Giardia TC | mg/L | 0.121 | 0 | -0.121 |

## Table 5.11
## Pathogens and Indicator Organisms Review for Alvarado Water Treatment Plant (contd)

| Parameters | Units | Effluent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| E Coli | /100 mL | 0 | 0 | 0 |
| Heterotrophic Bacteria (HPC) | cfu/mL | 1.01 | 1.06 | 0.05 |
| Total Coliform | /100 mL | 0 | 0 | 0 |
| | | | | |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Metal Parameters**

Water samples were analyzed for twenty-one metal parameters at both the influent and effluent sample points of the Alvarado WTP (**Appendix 5, see pages A5.1 thru A5.18**). Most values were ND with none exceeding there MCL's. Plant Influent maximum level for Manganese was 132 µg/L, which exceeded the SMCL of 50 µg/L; however the mean value of 22.5 µg/L was below the SMCL. **Table 5.12** highlights the changes since the 2010 WSS.

## Table 5.12
## Metal Constituents Review for the Alvarado Water Treatment Plant

| Parameters | Units | Influent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 11.1 | 0 | -11.1 |
| Arsenic | µg/L | 1.05 | 0 | -1.05 |
| Barium | µg/L | 93.4 | 0 | -93.4 |
| Boron | µg/L | 117 | 113 | -4 |
| Copper | µg/L | 6.13 | 0 | -6.13 |
| Iron | µg/L | 45.9 | 0 | -45.9 |
| Magnesium | mg/L | 20.5 | 21.6 | 1.1 |
| Manganese | µg/L | 33 | 22.5 | -10.5 |
| Nickel | µg/L | 1.73 | 0 | -1.73 |
| Selenium | µg/L | 0.228 | 0 | -0.228 |

## Table 5.12
## Metal Constituents Review for the Alvarado Water Treatment Plant (contd)

| | | | | |
|---|---|---|---|---|
| Sodium | mg/L | 78.6 | 73.4 | -5.2 |
| Vanadium | µg/L | 0.666 | 0 | -0.666 |
| | | | | |
| | | **Effluent Data[a]** | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 1.06 | 0 | -1.06 |
| Barium | µg/L | 89.8 | 0 | -89.8 |
| Boron | µg/L | 121 | 107 | -14 |
| Copper | µg/L | 6.05 | 0 | -6.05 |
| Iron | µg/L | 6.64 | 0 | -6.64 |
| Magnesium | mg/L | 20.4 | 21.6 | 1.2 |
| Manganese | µg/L | 0.661 | 0 | -0.661 |
| Nickel | µg/L | 2.06 | 0 | -2.06 |
| Selenium | µg/L | 0.203 | 0 | -0.203 |
| Sodium | mg/L | 84 | 77.8 | -6.2 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Inorganic Parameters Including Nutrients**

The CSD measured twenty-one inorganic parameters at the influent and effluent sample locations of the Alvarado WTP. None of the levels exceeded the MCLs or SMCLs (, **Appendix 5, see pages A5.1 thru A5.18**). **Table 5.13** highlights the changes that have occurred since the 2010 WSS.

## Table 5.13

## Inorganic Constituents Review for the Alvarado Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.005 | 0 | -0.005 |
| Bicarbonate | mg/L | 137 | 132 | -5 |
| Bromide | mg/L | 0.157 | 0 | -0.157 |
| Calcium | mg/L | 57.9 | 51.8 | -6.1 |
| Carbonate | mg/L | 0 | 0.236 | 0.236 |
| Chloride | mg/L | 85.7 | 83.6 | -2.1 |
| Fluoride | mg/L | 0.224 | 0.229 | 0.005 |
| MBAS (Detergents) | mg/L | 0.014 | 0 | -0.014 |
| Nitrate | mg/L | 1.16 | 0.87 | -0.29 |
| Nitrite (NO2) | mg/L | 0.001 | 0 | -0.001 |
| Ortho phosphates | mg/L | 0.011 | 0 | -0.011 |
| Phosphorus | mg/L | 0.001 | 0 | -0.001 |
| Potassium | mg/L | 4.21 | 4.18 | -0.03 |
| Silica | mg/L | 10.1 | 10.2 | 0.1 |
| Sulfate | mg/L | 159 | 148 | -11 |
| Total Nitrogen | mg/L | 0.452 | 0.283 | -0.169 |
| UV254 Filtered | ABS | 0.024 | 0.037 | 0.013 |

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| ammonia-N | mg/L | 0.6 | 0.73 | 0.13 |
| Bicarbonate | mg/L | 138 | 132 | -6 |
| Bromide | mg/L | 0.012 | 0 | -0.012 |
| Calcium | mg/L | 57.8 | 51.6 | -6.2 |
| Carbonate | mg/L | 0.83 | 0.378 | -0.452 |
| Chloride | mg/L | 93.3 | 90.7 | -2.6 |
| Fluoride | mg/L | 0.226 | 0.668 | 0.442 |
| MBAS (Detergents) | mg/L | 0.016 | 0 | -0.016 |
| Nitrate | mg/L | 1.02 | 0.788 | -0.232 |
| Nitrite (NO2) | mg/L | 0.006 | 0 | -0.006 |
| Potassium | mg/L | 4.27 | 4.18 | -0.09 |

| | | | | |
|---|---|---|---|---|
| Silica | mg/L | 9.8 | 10 | 0.2 |

**Table 5.13**
**Inorganic Constituents Review for the Alvarado Water Treatment Plant (contd)**

| | | | | |
|---|---|---|---|---|
| Sulfate | mg/L | 163 | 148 | -15 |
| Total Nitrogen | mg/L | 0.873 | 0.721 | -0.152 |
| | | | | |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Radiological Parameters**

Alvarado WTP influent was not monitored for radiological parameters while the effluent was monitored four times for gross *alpha* and *beta* particles and Uranium. All levels were below the MCLs. **Table 5.14** highlights the changes that have occurred since the 2010 WSS.

**Table 5.14**

**Radiological Constituents Review for Alvarado Water Treatment Plant**

| Influent Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 1.97 | ns | 0 |
| Beta Radiations | pCi/L | 5.16 | ns | 0 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.58 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 2.04 | ns | 0 |
| **Effluent Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 2.45 | 3.2 | 0 |
| Beta Radiations | pCi/L | 2.51 | 0.971 | 0 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.378 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |

## Table 5.14

## Radiological Constituents Review for Alvarado Water Treatment Plant (contd)

| | | | | |
|---|---|---|---|---|
| Uranium | pCi/L | 2.26 | 2.03 | 0 |
| | | | | |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Regulated and Unregulated Organic Parameters**

The Alvarado WTP influent was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**).

The Alvarado WTP influent TOC levels ranged from 1.96 mg/L to 4.54 mg/L. TOC is a precursor to Trihalomethanes (THMs) and Haloacetic acids (five) (HAA-5). Total THMs (TTHMs) and HAAs are formed from the reaction of chlorine and/or bromine with organic matter present in the water being treated. They are predominately formed as by-products when chlorine is used to disinfect water for drinking. The THMs and HAAs produced have been associated through epidemiological studies with some adverse health effects.

Alvarado WTP influent TTHM levels ranged from ND to 62.3 µg/L, with a mean of 21 µg/L. The mean TTHM value increased by 5 µg/L from the 2010 WSS (**Table 5.15**). Total HAA-5 levels ranged from ND to 4.73 µg/L, with a mean of ND.

Alvarado WTP effluent was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**).

Alvarado WTP effluent TOC levels ranged from 1.14 mg/L to 3.99 mg/L. Alvarado WTP effluent TTHM levels ranged from ND to 72.9 µg/L, with a mean of 43.3 µg/L, a decrease of 19.8 µg/L from the 2010 WSS (**Table 5.15**). Total HAA-5 levels ranged from 2.68 to 17.7 µg/L, with a mean value of 9.15 µg/L, a decrease of 10.45 µg/L. The MCL for TTHM is a distribution system RRA of 80.0 µg/L, and the MCL for HAA-5 is a distribution system RAA of 60.0 µg/L. These MCLs are not based on an individual sample. Plant effluent samples are not included in the distribution system RAAs.

## Table 5.15

## Regulated Organic Constituents Review for Alvarado Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 5.26 | 7.35 | 2.09 |
| Bromoform | µg/L | 1.9 | 2.02 | 0.12 |
| Chlorodibromomethane | µg/L | 4.92 | 6.01 | 1.09 |
| Chloroform | µg/L | 3.59 | 5.27 | 1.68 |
| Dibromoacetic acid | µg/L | 0.088 | 0 | -0.088 |
| Dichloroacetic acid | µg/L | 0.584 | 0 | -0.584 |
| Haloacetic Acids (five) | µg/L | 0.716 | 0 | -0.716 |
| Total Organic Carbon | mg/L | 3.17 | 3.07 | -0.1 |
| Total THMs | µg/L | 15.8 | 21 | 5.2 |
| Trichloroacetic acid | µg/L | 0.029 | 0 | -0.029 |

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 20.5 | 13.2 | -7.3 |
| Bromoform | µg/L | 6.37 | 6.1 | -0.27 |
| Chlorodibromomethane | µg/L | 21.2 | 15.5 | -5.7 |
| Chloroform | µg/L | 15.7 | 8.37 | -7.33 |
| Dibromoacetic acid | µg/L | 4.52 | 2.6 | -1.92 |
| Dichloroacetic acid | µg/L | 8.89 | 4.65 | -4.24 |
| Haloacetic acids (five) | µg/L | 19.6 | 9.15 | -10.45 |
| Monobromoacetic acid | µg/L | 0.125 | 0 | -0.125 |
| Total Organic Carbon | mg/L | 2.94 | 2.71 | -0.23 |
| Total THMs | µg/L | 63.1 | 43.3 | -19.8 |
| Trichloroacetic acid | µg/L | 6 | 1.83 | -4.17 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

## Table 5.16
## Unregulated Organic Constituents Review for Alvarado Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 2.1 | 0 | -2.1 |
| Dissolved Organic Carbon | mg/L | 2.19 | 2.4 | 0.21 |
| Geosmin | ng/L | 0.919 | 0 | -0.919 |

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 2.18 | 0 | -2.18 |
| Dissolved Organic Carbon | mg/L | 2.24 | ns | 0 |
| Geosmin | ng/L | 1.08 | 0 | -1.08 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

### 5.3 Otay Cottonwood System Water Quality Review

Streams, reservoirs and treatment plant influent/effluent were monitored for general physical characteristics, microbiological, organic and inorganic constituents. Additionally, Otay Reservoir and Otay WTP influent were sampled for radiation.

**Tables 5.17 – 5.31** contain the mean water quality values from the 2010 and 2015 WSS for comparison purposes. These tables do not contain constituents whose levels were below the MDL. See **Appendix 5 (see pages A5.1 thru A5.18)** for a summary of all water quality data. The Drinking Water Standards used in **Appendix (see pages A5.1 thru A5.18) 5** apply to treated, potable water, and are listed for reference only.

**Source Water Review**

**General Physical Parameters**

General/physical source water quality parameters for the Otay Cottonwood System were within the standards for drinking water except for pH, Color, TDS, Conductivity and Turbidity **(Appendix 5, see pages A5.1 thru A5.18)**. The maximum pH level was 9.12, and is above the SMCL range of 6.5 – 8.5. The maximum Turbidity level was 26.4 NTU, where the SMCL is 5 NTU. The maximum TDS level was 8,270 mg/L and exceeded the SMCL of 1000 mg/L, while the maximum Conductivity level was 12,100 µS/cm and exceeded the SMCL of 1,600 mg/L. The maximum Color level was 113 cu and exceeded the SMCL of 15 cu. TDS, Color, pH and Turbidity are treated in the WTP. The water quality is typical of raw water streams and reservoirs in Southern California. Since the streams and reservoirs contain raw water, and the standards are for treated water, the comparison is for reference only. **Table 5.17** highlights the changes that have occurred since the 2010 WSS.

**Table 5.17**
**General/Physical Water Quality Constituents Review for the Source Waters of the Otay Cottonwood System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Conductivity | µS/cm | 3920 | 5320 | 1400 |
| pH | pH | 7.76 | 7.71 | -0.05 |
| Total Dissolved Solids | mg/L | 2430 | 3330 | 900 |
| Total Suspended Solids | mg/L | 7.56 | 8.84 | 1.28 |

| Barrett Reservoir Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 89.4 | 87.7 | -1.7 |
| Color | Color | 33.2 | 36.8 | 3.6 |
| Conductivity | µmho/cm | 668 | 779 | 111 |
| Total Alkalinity | mg/L | 164 | 210 | 46 |
| Total Dissolved Solids | mg/L | 417 | 474 | 57 |
| Total Hardness (CaCO3) | mg/L | 171 | 211 | 40 |
| Turbidity | ntu | 3.94 | 3.77 | -0.17 |
| pH | pH | 8.47 | 8.51 | 0.04 |

**Table 5.17**
**General/Physical Water Quality Constituents Review for the Source Waters of the Otay Cottonwood System (contd)**

**Morena Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 124 | 94.7 | -29.3 |
| Color | Color | 41.7 | 43.4 | 1.7 |
| Conductivity | µmho/cm | 790 | 1030 | 240 |
| Total Alkalinity | mg/L | 269 | 268 | -1 |
| Total Dissolved Solids | mg/L | 566 | 618 | 52 |
| Total Hardness (CaCO3) | mg/L | 268 | 278 | 10 |
| Turbidity | ntu | 27.7 | 9.41 | -18.29 |
| pH | pH | 8.56 | 8.47 | -0.09 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 140 | 117 | -23 |
| Color | Color | 11.1 | 7.55 | -3.55 |
| Conductivity | µmho/cm | 973 | 957 | -16 |
| Total Alkalinity | mg/L | 135 | 150 | 15 |
| Total Dissolved Solids | mg/L | 355 | 589 | 234 |
| Total Hardness (CaCO3) | mg/L | 240 | 248 | 8 |
| Turbidity | ntu | 1.21 | 0.772 | -0.438 |
| pH | pH | 8.19 | 8.07 | -0.12 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Indicator Organisms and Pathogens**

Streams and Otay Reservoir of the Otay Cottonwood System were monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions **(Appendix 5, see pages A5.1 thru A5.18)**. *Enterococcus levels* ranged from 1/100mL to >2,400/100mL, *E. coli* levels ranged from <1/100mL to 52,000/100mL, and total coliform levels ranged from <1/100 mL to >240,000/100 mL. Wide ranges in microbiological results are

expected in raw water streams and reservoirs. *Cryptosporidium* and *Giardia* were monitored at Otay Reservoir and all values were ND. **Table 5.18** highlights the changes that have occurred since the 2010 WSS.

**Table 5.18**
**Review of Pathogens and Indicator Organisms of the Otay Cottonwood System - Sources Waters**

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 468 | 831 | 363 |
| E Coli | /100 mL | 317 | 1030 | 713 |
| Total Coliform | /100 mL | 24500 | 50900 | 26400 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 14.1 | 37.6 | 23.5 |
| E Coli | /100 mL | 64.3 | 71 | 6.7 |
| Total Coliform | /100 mL | 2840 | 4410 | 1570 |
| Crypto TC | / L | 0 | 0 | 0 |
| Giardia TC | / L | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Nutrient Parameters**

Streams and Reservoirs of the Otay Cottonwood System were monitored for TN and *ortho*-Phosphate. TN levels in streams ranged from ND to 20.6 mg/L, while *ortho*-Phosphate levels ranged from ND to 0.533 mg/L. Reservoir TN levels ranged from ND to 2.24 mg/L, while *ortho*-Phosphate levels ranged from ND to 0.43 mg/L.

Mean Values for TN, for streams within the Otay Cottonwood System, increased slightly since the 2010 WSS (**Table 5.19**) while *ortho*-Phosphate values decreased. The mean TN levels for the streams and Barrett and Morena Reservoirs exceeded EPA's reference concentrations.

## Table 5.19
## Inorganic Constituents Review for the Source Waters of the Otay Cottonwood System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ortho Phosphate | mg/L | 0.064 | 0 | -0.064 |
| Total Nitrogen | mg/L | 5.47 | 6.73 | 1.26 |

**Barrett Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ortho phosphates | mg/L | 0.05 | 0 | -0.05 |
| Total Nitrogen | mg/L | 0.585 | 0.569 | -0.016 |

**Morena Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ortho phosphates | mg/L | 0.05 | 0 | -0.05 |
| Total Nitrogen | mg/L | 0.585 | 0.752 | 0.167 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ortho phosphates | mg/L | 0.05 | 0 | -0.05 |
| Total Nitrogen | mg/L | 0.585 | 0.125 | -0.46 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Metal Parameters**

Water samples from the streams in the Otay-Cottonwood System and Barrett, Morena and Otay Reservoirs were monitored for seventeen Metal Parameters (**Appendix 5, see pages A5.1 thru A5.18**).

Due to the historically dry weather conditions that persisted in the San Diego region during the time frame of this sanitary survey only one sampling event consisting of two creeks were sampled for metals in the Otay-Cottonwood System. The concentrations were ND for all metals except Arsenic which had a maximum value of 28.6 µg/L which exceeded the MCL of 10 µg/L.

Most reservoir values where non-detect, maximum values of aluminum, iron and manganese at Barrett and Morena Reservoirs exceed the associated SMCL values of 200 µg/L, 300ug/ L and 50 µg/L. Maximum values of Manganese at Otay Reservoir also exceeded the SMCL 50 µg/L. **Table 5.20** highlights the changes that have occurred since the 2010 WSS.

**Table 5.20**
**Metal Constituents Review for the Source Waters of the Otay Cottonwood System**

| | | Stream Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 55.1 | 0 | -55.1 |
| Antimony | µg/L | 0.35 | 0 | -0.35 |
| Arsenic | µg/L | 13 | 23.6 | 10.6 |
| Barium | µg/L | 186 | 240 | 54 |
| Boron | µg/L | 327 | 573 | 246 |
| Chromium | µg/L | 0.323 | 0 | -0.323 |
| Copper | µg/L | 16.4 | 0 | -16.4 |
| Lead | µg/L | 0.099 | 0 | -0.099 |
| Manganese | µg/L | 151 | 0 | -151 |
| Nickle | µg/L | 7.65 | 11.5 | 3.85 |
| Selenium | µg/L | 17.2 | 28.7 | 11.5 |
| Silver | µg/L | 0.081 | 0 | -0.081 |
| Vanadium | µg/L | 32.9 | 51.8 | 18.9 |
| Zinc | µg/L | 2.76 | 0 | -2.76 |

| | | Barrett Reservoir Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Barium | µg/L | 34.9 | 0 | -34.9 |
| Boron | µg/L | 61.9 | 0 | -61.9 |
| Magnesium | mg/L | 19.5 | 30.2 | 10.7 |
| Manganese | µg/L | 57.5 | 76.5 | 19 |
| Sodium | mg/L | 68.8 | 91.4 | 22.6 |
| Vanadium | µg/L | 0 | 4.13 | 4.13 |

## Table 5.19
## Metal Constituents Review for the Source Waters of the Otay Cottonwood System (contd)

**Morena Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 112 | 390 | 278 |
| Arsenic | µg/L | 4.77 | 4.27 | -0.5 |
| Barium | µg/L | 77.5 | 0 | -77.5 |
| Boron | µg/L | 134 | 177 | 43 |
| Iron | µg/L | 105 | 255 | 150 |
| Magnesium | mg/L | 34.2 | 45.6 | 11.4 |
| Manganese | µg/L | 50.6 | 65.9 | 15.3 |
| Sodium | mg/L | 102 | 126 | 24 |
| Vanadium | µg/L | 13.7 | 16.5 | 2.8 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Boron | µg/L | 128 | 136 | 8 |
| Magnesium | mg/L | 24.1 | 31.5 | 7.4 |
| Manganese | µg/L | 21.9 | 22.4 | 0.5 |
| Sodium | mg/L | 89.1 | 105 | 15.9 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Inorganic Parameters**

The CSD measured inorganic parameters at the streams and source water reservoirs of the Otay Cottonwood System. Maximum stream values for Chloride (4910 mg/L), Fluoride (2.2 mg/L) and Nitrate (84.6 mg/L) exceeded the SMCL of 500 ug/L and MCLs of 2 mg/L and 45 mg/L respectfully. None of the reservoir levels exceeded the MCLs or SMCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.21** highlights the changes that have occurred since the 2010 WSS.

## Table 5.21
## Inorganic Constituents Review for the Source Waters of the Otay Cottonwood System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia_N | mg/L | 0.03 | 0 | -0.03 |
| Bromide | µg/L | Ns | 4.59 | 0 |
| Chloride | mg/L | Ns | 1920 | 0 |
| Nitrate | mg/L | 22.7 | 25.6 | 2.9 |
| Nitrite | mg/L | 0.038 | 0 | -0.038 |
| Total Nitrogen | mg/L | 5.47 | 6.73 | 1.26 |
| Ortho Phosphate | mg/L | 0.064 | 0 | -0.064 |
| Phoshorus | mg/L | 0.053 | 0 | -0.053 |
| Sulfate | mg/L | Ns | 250 | 0 |

**Barrett Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Bicarbonate | mg/L | 158 | 253 | 95 |
| Bromide | mg/L | 0.248 | 0.297 | 0.049 |
| Calcium | mg/L | 35.7 | 37.2 | 1.5 |
| Carbonate | mg/L | 14.4 | 6.53 | -7.87 |
| Chloride | mg/L | 75.2 | 101 | 25.8 |
| Fluoride | mg/L | 0.318 | 0.406 | 0.088 |
| Ortho phosphates | mg/L | 0.267 | 0 | -0.267 |
| Phosphorus | mg/L | 0.267 | 0 | -0.267 |
| Potassium | mg/L | 5.07 | 6.75 | 1.68 |
| Silica | mg/L | 14.7 | 17.6 | 2.9 |
| Sulfate | mg/L | 41.7 | 50.5 | 8.8 |
| Total Nitrogen | mg/L | 0.841 | 0.569 | -0.272 |

**Morena Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.311 | 0.294 | -0.017 |
| Bicarbonate | mg/L | 305 | 315 | 10 |
| Bromide | mg/L | 0.484 | 0.458 | -0.026 |
| Calcium | mg/L | 49.7 | 40.4 | -9.3 |
| Carbonate | mg/L | 12.7 | 8.62 | -4.08 |

## Table 5.21
## Inorganic Constituents Review for the Source Waters of the Otay Cottonwood System
## (contd)

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| Chloride | mg/L | 34 | 127 | 93 |
| Fluoride | mg/L | 0.383 | 0.578 | 0.195 |
| Phosphorus | mg/L | 0.228 | 0.11 | -0.118 |
| Potassium | mg/L | 8.4 | 9.49 | 1.09 |
| Silica | mg/L | 3.1 | 3.71 | 0.61 |
| Sulfate | mg/L | 68.2 | 78.7 | 10.5 |
| Total Nitrogen | mg/L | 1.22 | 0.752 | -0.468 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0 | 0.031 | 0.031 |
| Bicarbonate | mg/L | 158 | 178 | 20 |
| Bromide | mg/L | 0.248 | 0.225 | -0.023 |
| Calcium | mg/L | 55.9 | 46.7 | -9.2 |
| Carbonate | mg/L | 12.7 | 1.78 | -10.92 |
| Chloride | mg/L | 99.7 | 140 | 40.3 |
| Fluoride | mg/L | 0.493 | 0.435 | -0.058 |
| Phosphorus | mg/L | 0.228 | 0 | -0.228 |
| Potassium | mg/L | 8.4 | 5.19 | -3.21 |
| Silica | mg/L | 3.1 | 7.32 | 4.22 |
| Sulfate | mg/L | 68.2 | 120 | 51.8 |
| Total Nitrogen | mg/L | 1.22 | 0.125 | -1.095 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Radiological Parameters**

Primary reservoirs of the Otay Cottonwood System were monitored for gross *alpha* and *beta* particles and Uranium **(Appendix 5, see pages A5.1 thru A5.18)**. All measurements were below the MCLs. **Table 5.22** highlights the changes that have occurred since the 2010 WSS.

**Table 5.22**
**Radiological Constituents Review for the Source Waters of the Otay Cottonwood System**

| Parameters | Units | Otay Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 4.78 | 0 | -4.78 |
| Beta Radiations | pCi/L | 3.72 | 0 | -3.72 |
| Combined Radium-226 & Radium-228 | pCi/L | 1.05 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 3.84 | 1.5 | -2.34 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Regulated and Unregulated Organic Parameters**

The source waters of the Otay Cottonwood System were monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None exceeded the MCL, and the majority of the seventy constituents were not detected during this survey (**Appendix 5, see pages A5.1 thru A5.18**).

Stream TOC levels ranged from 3.53 mg/L to 15 mg/L, and reservoir levels ranged from 4.61 mg/L to 8.42 mg/L. **Tables 5.23 & 5.24** highlight the changes that have occurred since the 2010 WSS.

## Table 5.23

## Regulated Organic Constituents Review for the Source Waters of the Otay Cottonwood System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bis-(2-ethylhexyl) phthalate | µg/L | 0.788 | 0 | -0.788 |
| Total Organic Carbon (TOC) | mg/L | 6.49 | 8.76 | 2.27 |

**Barrett Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | µg/L | 0 | 0 | 0 |

**Morena Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | µg/L | 0 | 0 | 0 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Total Organic Carbon | mg/L | 5.69 | 6.42 | 0.73 |
| Total THMs | µg/L | 10.6 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

## Table 5.24

## Unregulated Organic Constituents Review for the Source Waters of the Otay Cottonwood System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | µg/L | 0 | 0 | 0 |

**Barrett Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | µg/L | 0 | 0 | 0 |

**Morena Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | µg/L | 0 | 0 | 0 |

**Otay Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 8.33 | 0 | -8.33 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Otay Water WTP Influent/Effluent Review**

**General Physical Parameters**

The monitored general physical parameters for Otay WTP influent (**Appendix 5, see pages A5.1 thru A5.18**) were within the standards for drinking water except for Color, pH and Turbidity. Since the plant influent contains raw water, and the standards are for treated water, the comparison is for reference only. The maximum Turbidity level was 2.7 NTU, where the MCL is for 95% of the filtered water samples to have a Turbidity level $\leq$ 0.5 NTU. The maximum pH level was 8.8 above the SMCL range of 6.5 to 8.5. The maximum Color reading was 22 cu above the SMCL of 15 cu.

The monitored physical parameters for Otay WTP effluent (**Appendix 5, see pages A5.1 thru A5.18**) were within the standards for drinking water except for Threshold Odor Number (TON), and pH. The maximum pH level was 8.86 above the SMCL range of 6.5 to 8.5.

The maximum TON level was 4 odor units, above SMCL of 3 odor units.

To comply with regulatory plant monitoring requirements, plant operators frequently monitors for both the Turbidity and pH – every 15 minutes for Turbidity, and every two hours for pH at the WTP effluent. Those monitoring results were used for the WTP effluent review. All measurements met Turbidity and pH requirements. **Tables 5.25** highlight the changes that have occurred since the 2010 WSS.

**Table 5.25**
**General/Physical Water Quality Constituents Review for Otay Water Treatment Plant**

| | | Influent Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 137 | 135 | -2 |
| Color | Color | 8.86 | 4.82 | -4.04 |
| Conductivity | µmho/cm | 902 | 862 | -40 |
| Corrosivity | -- | 0.338 | 0.355 | 0.017 |
| Total Alkalinity | mg/L | 121 | 130 | 9 |
| Total Dissolved Solids | mg/L | 526 | 540 | 14 |
| Total Hardness (CaCO3) | mg/L | 228 | 241 | 13 |
| Total Suspended Solids (TSS) | mg/L | 1.38 | <1 | 0 |
| Turbidity | ntu | 0.74 | 0.558 | -0.182 |
| pH | pH | 7.93 | 8.05 | 0.12 |

## Table 5.25
## General/Physical Water Quality Constituents Review for Otay Water Treatment Plant (contd)

| Parameters | Units | Effluent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 139 | 134 | -5 |
| Color | Color | 0.967 | 1.18 | 0.213 |
| Conductivity | µmho/cm | 932 | 908 | -24 |
| Corrosivity | -- | 0.571 | 0.507 | -0.064 |
| Threshold odor number | Odor | 1.04 | 1.03 | -0.01 |
| Total alkalinity | mg/L | 118 | 127 | 9 |
| Total Dissolved Solids | mg/L | 534 | 558 | 24 |
| Total Hardness (CaCO3) | mg/L | 233 | 243 | 10 |
| Total Suspended Solids (TSS) | mg/L | 1.13 | <1 | 0 |
| Turbidity | ntu | 0.086 | 0.08 | -0.006 |
| pH | pH | 8.16 | 8.17 | 0.01 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Indicator Organisms and Pathogens**

Raw waters entering Otay WTP were monitored, at the plant influent, for *E. coli*, fecal coliform, heterotrophic bacteria (HPC), and total coliform in order to obtain a representation of microbiological conditions (**Appendix 5, see pages A5.1 thru A5.18**). *E. coli* levels ranged from 1/100 mL to 100/100 mL, fecal coliform levels ranged from <1.8/100 mL to 130/100 mL, HPC levels ranged from 1cfu/mL to 3,200 cfu/mL and total coliform levels ranged from <1/100mL to >2,400/100mL. Wide ranges in microbiological results are expected in the raw waters entering the Otay WTP. Elevated total coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* were monitored, and all *Cryptosporidium* values were ND while *Giardia* values ranged from ND to 0.1/100 L.

Treated water from Otay WTP was monitored, at the plant effluent, for *E. coli*, HPC and total coliform to ascertain compliance with regulations. *E. coli* was reported as absent for all 1,016 samples, while total Coliform was report as absent for all but one sample during this five year period. HPC values ranged from ND to 4 cfu/mL. **Table 5.26** highlights the changes that have occurred since the 2010 WSS.

## Table 5.26
## Pathogens and Indicator Organisms Review for Otay Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| E Coli | /100 mL | 18.5 | 9 | -9.5 |
| Fecal Coliform | /100 mL | 30.5 | 1.64 | -28.86 |
| Heterotrophic Bacteria (HPC) | cfu/mL | 267 | 219 | -48 |
| Total Coliform | /100 mL | 442 | 71.8 | -370.2 |
| Crypto TC | mg/L | 0.018 | 0 | -0.018 |
| Giardia TC | mg/L | 0.028 | 0 | -0.028 |

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| E Coli | /100 mL | 0 | 0 | 0 |
| Heterotrophic Bacteria (HPC) | cfu/mL | 1.26 | 0 | -1.26 |
| Total Coliform | /100 mL | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Metal Parameters**

Water samples were analyzed for twenty-one Metal Parameters at both the influent and effluent sample points of the Otay WTP. Most levels were ND with none of the levels exceeded the MCLs (**Appendix 5, see pages A5.1 thru A5.18**). Otay WTP influent maximum level for Manganese, was 108 µg/L, exceeded the SMCL of 50 µg/L. **Table 5.27** highlights the changes that have occurred since the 2010 WSS.

## Table 5.27 – Metal Constituents Review for Otay Water Treatment Plant

| Parameters | Units | Influent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 6.68 | 0 | -6.68 |
| Arsenic | µg/L | 0.304 | 0 | -0.304 |
| Barium | µg/L | 88.4 | 0 | -88.4 |
| Boron | µg/L | 133 | 128 | -5 |
| Copper | µg/L | 4 | 0 | -4 |
| Iron | µg/L | 55.5 | 0 | -55.5 |
| Magnesium | mg/L | 22.3 | 25.5 | 3.2 |
| Manganese | µg/L | 33.5 | 0 | -33.5 |
| Nickel | µg/L | 1.92 | 0 | -1.92 |
| Sodium | mg/L | 84.9 | 90.3 | 5.4 |
| Vanadium | µg/L | 0.15 | 0 | -0.15 |
| Zinc | µg/L | 0.338 | 0 | -0.338 |

| Parameters | Units | Effluent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 1.78 | 0 | -1.78 |
| Barium | µg/L | 83.6 | 0 | -83.6 |
| Boron | µg/L | 134 | 129 | -5 |
| Copper | µg/L | 2.64 | 0 | -2.64 |
| Iron | µg/L | 12.3 | 0 | -12.3 |
| Lead | µg/L | 0.016 | 0 | -0.016 |
| Magnesium | mg/L | 22.4 | 26.1 | 3.7 |
| Manganese | µg/L | 0.37 | 0 | -0.37 |
| Nickel | µg/L | 2.15 | 0 | -2.15 |
| Sodium | mg/L | 90.2 | 97.1 | 6.9 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Inorganic Parameters Including Nutrients**

The CSD measured twenty-two inorganic constituents at the Otay WTP influent, and effluent. None of the levels exceeded the MCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.28** highlights the changes that have occurred since the 2010 WSS.

**Table 5.28 – Inorganic Constituents Review for Otay Water Treatment Plant**

| | | Influent Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.045 | 0 | -0.045 |
| Bicarbonate | mg/L | 146 | 156 | 10 |
| Bromide | mg/L | 0.165 | 0.123 | -0.042 |
| Calcium | mg/L | 56.2 | 54.2 | -2 |
| Carbonate | mg/L | 0.387 | 0.493 | 0.106 |
| Chloride | mg/L | 96.8 | 111 | 14.2 |
| Fluoride | mg/L | 0.25 | 0.324 | 0.074 |
| MBAS (Detergents) | mg/L | 0.048 | 0 | -0.048 |
| Nitrate | mg/L | 0.692 | 0 | -0.692 |
| Nitrite (NO2) | mg/L | 0.006 | 0 | -0.006 |
| Ortho phosphates | mg/L | 0.005 | 0 | -0.005 |
| Potassium | mg/L | 4.45 | 4.64 | 0.19 |
| Silica | mg/L | 7.85 | 7.94 | 0.09 |
| Sulfate | mg/L | 154 | 149 | -5 |
| Total Nitrogen | mg/L | 0.383 | 0.181 | -0.202 |
| | | | | |
| | | **Effluent Data[a]** | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.503 | 0.687 | 0.184 |
| Bicarbonate | mg/L | 140 | 152 | 12 |
| Bromide | mg/L | 0.038 | 0 | -0.038 |
| Calcium | mg/L | 55.7 | 54 | -1.7 |
| Carbonate | mg/L | 0.84 | 0.494 | -0.346 |
| Chloride | mg/L | 108 | 126 | 18 |
| Fluoride | mg/L | 0.256 | 0.52 | 0.264 |
| MBAS (Detergents) | mg/L | 0.022 | 0 | -0.022 |
| Nitrate | mg/L | 0.656 | 0 | -0.656 |

| Table 5.28 – Inorganic Constituents Review for Otay Water Treatment Plant (contd) | | | | |
|---|---|---|---|---|
| Nitrite (NO2) | mg/L | 0.003 | 0 | -0.003 |
| Potassium | mg/L | 4.52 | 4.75 | 0.23 |
| Silica | mg/L | 7.4 | 7.47 | 0.07 |
| Sulfate | mg/L | 157 | 148 | -9 |
| Total Nitrogen | mg/L | 0.82 | 0.625 | -0.195 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Radiological Parameters**

Otay WTP influent was not monitored for radiological parameters while the effluent was monitored two times for gross *alpha* and *beta* particles and Uranium. All levels were below the MCLs. **Table 5.29** highlights the changes that have occurred since the 2010 WSS.

**Table 5.29 - Radiological Constituents Review for Otay Water Treatment Plant**

| | | Influent Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 1.9 | ns | 0 |
| Beta Radiations | pCi/L | 0 | ns | 0 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.83 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 2.14 | ns | 0 |

| Table 5.29 - Radiological Constituents Review for Otay Water Treatment Plant (contd) | | | | |
|---|---|---|---|---|
| | Effluent Data[a] | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 0.873 | 0 | -0.873 |
| Beta Radiations | pCi/L | 1.78 | 0 | -1.78 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.398 | Ns | 0 |
| Strontium 90- | pCi/L | 0 | Ns | 0 |
| Tritium | pCi/L | 0 | Ns | 0 |
| Uranium | pCi/L | 1.86 | 1.5 | -0.36 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Regulated and Unregulated Organic Parameters**

Otay WTP influent was monitored for both regulated and non-regulated organic parameters including herbicides, pesticides, and synthetic contaminants, of which none exceed the MCLs. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**).

The Otay WTP influent TOC levels ranged from 1.83 mg/L to 7.31 mg/L. TOC is a precursor to Trihalomethanes (THMs) and Haloacetic acids (five) (HAA-5). Total THMs (TTHMs) and HAAs are formed from the reaction of chlorine and/or bromine with organic matter present in the water being treated. They are predominately formed as by-products when chlorine is used to disinfect water for drinking. The THMs and HAAs produced have been associated through epidemiological studies with some adverse health effects.

The Otay WTP influent TTHMs levels ranged from ND to 66.1 µg/L, with a mean of 18.1 µg/L. The mean TTHM value increased by 4.2 µg/L from the 2010 WSS (**Table 5.28**). Total HAA-5 levels ranged from ND to 8.3 µg/L, with a mean of 2.1 µg/L

The Otay WTP effluent was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**).

The Otay WTP effluent TOC levels ranged from 1.69 mg/L to 6.69 mg/L. The Otay WTP effluent TTHM levels ranged from 19 µg/L to 85.6 µg/L, with a mean of 47 µg/L, a decrease of 13.1 µg/L from the 2010 WSS (**Table 5.30**). Total HAA-5 levels ranged from 1.07 µg/L to 15.7 µg/L, with a mean of 8.82 µg/L a decrease of 7.98 µg/L from the 20100 WSS. The MCL for TTHM is a distribution system RRA of 80.0 µg/L, and the MCL for HAA-5 is a distribution system RAA of 60.0 µg/L. These MCLs are not based on an individual sample. Plant effluent samples are not included in the distribution system RAAs.

**Table 5.30 – Regulated Organic Constituents Review for Otay Water Treatment Plant**

| Influent Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 3.76 | 5.77 | 2.01 |
| Bromoform | µg/L | 1.89 | 1.98 | 0.09 |
| Chlorodibromomethane | µg/L | 4.74 | 5.68 | 0.94 |
| Chloroform | µg/L | 2.42 | 4.22 | 1.8 |
| Dibromoacetic acid | µg/L | 0.24 | 0 | -0.24 |
| Dichloroacetic acid | µg/L | 0.692 | 0 | -0.692 |
| Haloacetic Acids (five) | µg/L | 1.43 | 2.1 | 0.67 |
| Monobromoacetic acid | µg/L | 0.033 | 0 | -0.033 |
| Total Organic Carbon | mg/L | 4.07 | 4.44 | 0.37 |
| Total THMs | µg/L | 13.9 | 18.1 | 4.2 |
| Trichloroacetic acid | µg/L | 0.436 | 0 | -0.436 |
| | | | | |
| **Effluent Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 20.1 | 9.97 | -10.13 |
| Bromoform | µg/L | 5.64 | 14.4 | 8.76 |
| Chlorodibromomethane | µg/L | 21 | 19 | -2 |
| Chloroform | µg/L | 14.9 | 4.59 | -10.31 |
| Dibromoacetic acid | µg/L | 3.78 | 6.17 | 2.39 |
| Dichloroacetic acid | µg/L | 7.14 | 2.26 | -4.88 |
| Haloacetic acids (five) | µg/L | 16.8 | 8.82 | -7.98 |
| | | | | |
| Monobromoacetic acid | µg/L | 0.135 | 0 | -0.135 |

| | | | | |
|---|---|---|---|---|
| Styrene | µg/L | 0.444 | 0 | -0.444 |

**Table 5.30 – Regulated Organic Constituents Review for Otay Water Treatment Plant (contd)**

| | | | | |
|---|---|---|---|---|
| Total Organic Carbon | mg/L | 3.39 | 3.71 | 0.32 |
| Total THMs | µg/L | 60.1 | 47 | -13.1 |
| Trichloroacetic acid | µg/L | 5.99 | 0 | -5.99 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Table 5.31 - Unregulated Organic Constituents for Otay Water Treatment Plant**

| Influent Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 3.76 | 0 | -3.76 |
| Bromochloromethane | µg/L | 0.014 | 0 | -0.014 |
| Dissolved Organic Carbon | mg/L | 3.81 | 0 | -3.81 |
| Geosmin | ng/L | 0.919 | 0 | -0.919 |

| Effluent Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 3.27 | 0 | -3.27 |
| Dichloroacetonitrile | mg/L | 0 | 2.17 | 2.17 |
| Geosmin | ng/L | 1.09 | 0 | -1.09 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

## 5.4 Miramar System Water Quality Review

The Miramar Reservoir and WTP influent/effluent were monitored for general physical characteristics, microbiological, metals, organic and inorganic constituents. Additionally, Miramar Reservoir and Miramar WTP influent were sampled for radiation.

**Tables 5.32 – 5.46** contain the mean water quality values from the 2010 and 2015 WSS for comparison purposes. These tables do not contain constituents whose levels were below the MDL. See **Appendix 5, (see pages A5.1 thru A5.18)** for a summary of all water quality data. The Drinking Water Standards used in **Appendix 5 (see pages A5.1 thru A5.18)** apply to treated, potable water, and are listed for reference only.

**Source Water Review**

**General Physical Parameters**

General/physical sources water quality parameters for Miramar Reservoir were within the standards for drinking water. The water quality is typical of raw water reservoirs in Southern California. Since the reservoir contains raw water and the standards are for treated, the comparison is for reference only. **Table 5.32** highlights the changes that have occurred since the 2010 WSS.

**Table 5.32 - General/Physical Water Quality Constituents Review for Miramar Reservoir**

| | | Reservoir Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 156 | 136 | -20 |
| Color | Color | 2.8 | 2.8 | 0 |
| Conductivity | µmho/cm | 938 | 817 | -121 |
| Total Alkalinity | mg/L | 110 | 122 | 12 |
| Total Dissolved Solids | mg/L | 548 | 505 | -43 |
| Total Hardness (CaCO3) | mg/L | 246 | 229 | -17 |
| Turbidity | ntu | 0.354 | 0.266 | -0.088 |
| pH | pH | 8.05 | 7.97 | -0.08 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Indicator Organisms and Pathogens**

Miramar Reservoir was monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions. *Enterococcus levels* ranged from <1/100 mL to 73/100 mL, *E. coli* levels ranged from <10/100 mL to 350 /100 mL, and total coliform levels ranged from 10/100 mL to 20,000 /100 mL. Wide ranges in microbiological results are expected in raw water reservoirs. *Cryptosporidium* and *Giardia* were monitored nine times at Miramar Reservoir with all samples being ND.

**Table 5.33 - Pathogens and Indicator Organisms Review for Miramar Reservoir**

| | Reservoir Data[a] | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 4.36 | 8.37 | 4.01 |
| E Coli | /100 mL | 16.2 | 23 | 6.8 |
| Total Coliform | /100 mL | 726 | 454 | -272 |
| Crypto TC | / L | 0 | 0 | 0 |
| Giardia TC | / L | 0.25 | 0 | -0.25 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Nutrient Parameters**

Miramar Reservoir was monitored for TN and *ortho*-Phosphate. TN levels ranged from ND to 0.597 mg/L, and *ortho*-Phosphate values were all ND. **Table 5.34** highlights the changes that have occurred since the 2010 WSS.

## Table 5.34 - Nutrient Constituents Review for Miramar Reservoir

| Parameters | Units | Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Nutrient Constituents** | | **Mean** | **Mean** | |
| Ortho phosphates | mg/L | 0.002 | 0 | -0.002 |
| Total Nitrogen | mg/L | 0.368 | 0 | 0.229 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Metal Parameters**

The effects of metals in water are varied. Some metals have caused concern due to their physiological and other human health effects while others affect the aesthetics of water. Two of these metals, Iron and Manganese, are nuisance constituents that affect the aesthetic properties of water. Iron and Manganese are of interest since they have aesthetic impacts if left untreated, exert an oxidant demand, and serve as indicators as to reservoir dynamics.

Both Iron and Manganese are naturally occurring constituents, but can be elevated by contribution from potential contaminating activities, such as landfills, mines, industrial wastes and urban runoff. Conventional water treatment is very effective at removing both Iron and Manganese. .

When using ozonation in water treatment, there is a risk of completely oxidizing the Manganese to Permanganate which could result in pink water. Reports suggest that raw or settled water with levels of Manganese exceeding ug/L could form Permanganate at levels sufficiently high enough to create problems, especially if the ozone dosages are high enough to achieve pathogen inactivation. With the addition of ozone treatment at Miramar WTP's, Manganese levels in the CDS's raw water will become more of a concern.

Miramar Reservoir was monitored for twenty-two Metal Parameters with none of the reservoir samples exceeding the MCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.35** highlights the changes that have occurred since the 2010 WSS.

## Table 5.35 - Metal Constituents Review for Miramar Reservoir

| Parameters | Units | Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 5.03 | 0 | -5.03 |
| Barium | µg/L | 105 | 0 | -105 |
| Boron | µg/L | 125 | 126 | 1 |
| Copper | µg/L | 2.16 | 0 | -2.16 |
| Iron | µg/L | 39 | 0 | -39 |
| Magnesium | mg/L | 22.1 | 22.5 | 0.4 |
| Manganese | µg/L | 24.3 | 0 | -24.3 |
| Nickel | µg/L | 2.11 | 0 | -2.11 |
| Sodium | mg/L | 82.8 | 77.6 | -5.2 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Inorganic Parameters**

The CSD measured inorganic parameters at Miramar Reservoir. None of the reservoir levels exceeded the MCLs or SMCLs (**Appendix 5**). **Table 5.36** highlights the changes that have occurred since the 2010 WSS.

## Table 5.36 - Inorganic Constituents Review for Miramar Reservoir

| Parameters | Units | Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.02 | 0 | -0.02 |
| Bicarbonate | mg/L | 132 | 148 | 16 |
| Bromide | mg/L | 0.08 | 0 | -0.08 |
| Calcium | mg/L | 62.4 | 54.2 | -8.2 |
| Carbonate | mg/L | 1.17 | 0.231 | -0.939 |
| Chloride | mg/L | 91 | 92.3 | 1.3 |
| Fluoride | mg/L | 0.245 | 0.253 | 0.008 |
| MBAS (Detergents) | mg/L | 0.057 | 0 | -0.057 |
| Nitrate & Nitrite | mg/L | 0.739 | | -0.739 |

| Table 5.36 – Inorganic Constituents Review for Miramar Reservoir (contd) | | | | |
|---|---|---|---|---|
| Nitrate | mg/L | 0.727 | 0 | -0.727 |
| Nitrite (NO2) | mg/L | 0.001 | 0 | -0.001 |
| Ortho phosphates | mg/L | 0.002 | 0 | -0.002 |
| Potassium | mg/L | 4.2 | 4.12 | -0.08 |
| Silica | mg/L | 7.9 | 8.4 | 0.5 |
| Sulfate | mg/L | 187 | 162 | -25 |
| Total Nitrogen | mg/L | 0.368 | 0 | -0.368 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Radiological Parameters**

Miramar Reservoir was monitored for gross *alpha* and *beta* particles and Uranium. All measurements were below the MCLs. **Table 5.37** highlights the changes that have occurred since the 2010 WSS.

**Table 5.37 - Radiological Constituents Review for Miramar Reservoir**

| | | Reservoir Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 3.14 | 0 | -3.14 |
| Beta Radiations | pCi/L | 2.59 | 0 | -2.59 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.221 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 3.83 | 2.2 | -1.63 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Regulated and Unregulated Organic Parameters**

Miramar Reservoir was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**). **Tables 5.38 and 5.39** highlight the changes that have occurred since the 2010 WSS.

Reservoir TOC levels ranged from 2.39 mg/L, to 3.46 mg/L.

**Table 5.38 - Regulated Organic Constituents Review for Miramar Reservoir**

| | | Reservoir Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 1.29 | 1.57 | 0.28 |
| Bromoform | µg/L | 0.658 | 0 | -0.658 |
| Chlorodibromomethane | µg/L | 1.61 | 2.11 | 0.5 |
| Chloroform | µg/L | 0.923 | 0 | -0.923 |
| HAA5 | µg/L | 1.45 | 1.18 | 0 |
| Total Organic Carbon | mg/L | 2.79 | 2.82 | 0.03 |
| Total THMs | µg/L | 8.84 | 7.11 | 0 |
| Trichloroacetic acid | µg/L | 1.45 | 1.18 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituients reported as ns in either WSS were also reported as 0 change.

**Table 5.39 - Unregulated Organic Constituents Review for the Source Waters of the Miramar System**

| | | Reservoir Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 2.4 | 0 | -2.4 |
| Geosmin | ng/L | 4.05 | 0 | -4.05 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Miramar WTP Influent/Effluent Review**

**General Physical Parameters**

The monitored physical parameters for the Miramar WTP influent (**Appendix 5, see pages A5.1 thru A5.18**) were within the standards for drinking water except pH. Since the plant influent contains raw water, and the standards are for treated, the comparison is for reference only. The maximum pH value was 8.69 where the SMCL is 8.5.

The monitored physical parameters for the Miramar WTP effluent (**Appendix 5, see pages A5.1 thru A5.18**) were within the standards for drinking water.

To comply with regulatory plant monitoring requirements, plant operators frequently monitor both the Turbidity and pH – every 15 minutes for Turbidity, and every two hours for pH at the WTP effluent. Those monitoring results were used for the WTP effluent review. All measurements met Turbidity and pH requirements. **Table 5.40** highlights the changes that have occurred since the 2010 WSS.

## Table 5.40 -- General/Physical Water Quality Constituents Review for Miramar Water Treatment Plant

| | | Influent Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 146 | 138 | -8 |
| Color | Color | 5.61 | 3.04 | -2.57 |
| Conductivity | µmho/cm | 810 | 763 | -47 |
| Corrosivity | -- | 0.425 | 0.25 | -0.175 |
| Threshold odor number | Odor | 1.49 | 1.58 | 0.09 |
| Total Alkalinity | mg/L | 108 | 105 | -3 |
| Total Dissolved Solids | mg/L | 532 | 484 | -48 |
| Total Hardness (CaCO3) | mg/L | 232 | 223 | -9 |
| Total Suspended Solids (TSS) | mg/L | 2.71 | <1 | 0 |
| Turbidity | Ntu | 0.658 | 0.533 | -0.125 |
| pH | pH | 7.97 | 7.99 | 0.02 |
| | | **Effluent Data[a]** | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 150 | 136 | -14 |
| Color | Color | 0.441 | 0 | -0.441 |

| Table 5.40 – General/Physical Water Quality Constituents Review for Miramar Water Treatment Plant (contd) | | | | |
|---|---|---|---|---|
| Conductivity | µmho/cm | 894 | 764 | -130 |
| Corrosivity | -- | 0.415 | 0.312 | -0.103 |
| Threshold odor number | Odor | 1 | <1 | 0 |
| Total alkalinity | mg/L | 107 | 106 | -1 |
| Total Dissolved Solids | mg/L | 539 | 488 | -51 |
| Total Hardness (CaCO3) | mg/L | 236 | 220 | -16 |
| Total Suspended Solids (TSS) | mg/L | 1.11 | <1 | 0 |
| Turbidity | Ntu | 0.082 | 0.067 | -0.015 |
| pH | pH | 8.11 | 8.14 | 0.03 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Indicator Organisms and Pathogens**

Raw waters entering Miramar WTP were monitored, at the plant influent, for *E. coli*, fecal coliform, heterotrophic bacteria (HPC), and total coliform to obtain a representation of microbiological conditions (**Appendix 5, see pages A5.1 thru A5.18**). *E. coli* levels ranged from <1/100 mL to 42/100 mL, fecal coliform levels ranged from <1.8/100 mL to 240/100 mL, HPC levels ranged from <1cfu/mL to 3,800 cfu/mL and total coliform levels ranged from <1/100 mL to 2700/100 mL. Wide ranges in microbiological results are expected in the raw waters entering the Miramar WTP. Elevated total coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* were monitored, with all *Cryptosporidium* samples being ND and *Giardia* levels ranged from ND to 0.1/100 L.

Treated water from Miramar WTP was monitored, at the plant effluent, for *E. coli*, HPC and total coliform to ascertain compliance with regulations. *E. coli* was reported as absent for all but one while total coliform was reported as absent for all but two of the 2,370 samples for this five year period. HPC levels ranged from <1 cfu/mL to 63 cfu/mL. *Cryptosporidium* and *Giardia* were monitored once and the levels were ND. **Table 5.41** highlights the changes that have occurred since the 2010 WSS.

**Metal Parameters**

Water samples were analyzed for twenty-one metal parameters at both the influent and effluent sample points of the Miramar WTP. None of the levels exceeded the MCL's or SMCL's (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.42** highlights the changes that have occurred since the 2010 WSS.

## Table 5.41 - Pathogens and Indicator Organisms Review for Miramar Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| E Coli | /100 mL | 5.43 | 3.9 | -1.53 |
| Fecal Coliform | /100 mL | 5.55 | 4.1 | -1.45 |
| Heterotrophic Bacteria (HPC) | cfu/mL | 259 | 189 | -70 |
| Total Coliform | /100 mL | 136 | 56.1 | -79.9 |
| Crypto TC | mg/L | 0.078 | 0 | -0.078 |
| Giardia TC | mg/L | 0.091 | 0 | -0.091 |

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| E Coli | /100 mL | 0 | 0 | 0 |
| Heterotrophic Bacteria (HPC) | cfu/mL | 1.09 | <1 | 0 |
| Total Coliform | /100 mL | 0.001 | 0 | -0.001 |
| Crypto TC | /L | 0 | 0 | 0 |
| Giardia TC | /L | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Inorganic Parameters**

The CSD measured twenty Inorganic Parameters at the Miramar WTP influent, and twenty-one inorganic parameters at the effluent of the Miramar WTP (**Appendix 5, see pages A5.1 thru A5.18**). None of the levels exceeded the MCLs or SMCL's. **Table 5.43** highlights the changes that have occurred since the 2010 WSS.

## Table 5.42 - Metal Constituents Review for Miramar Water Treatment Plant

| Parameters | Units | Influent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 20.3 | 0 | -20.3 |
| Arsenic | µg/L | 0.693 | 0 | -0.693 |
| Barium | µg/L | 105 | 0 | -105 |
| Boron | µg/L | 125 | 125 | 0 |
| Chromium | µg/L | 0.071 | 0 | -0.071 |
| Copper | µg/L | 4.29 | 0 | -4.29 |
| Iron | µg/L | 41.8 | 0 | -41.8 |
| Magnesium | mg/L | 20.8 | 21.3 | 0.5 |
| Manganese | µg/L | 15.3 | 0 | -15.3 |
| Nickel | µg/L | 2.41 | 0 | -2.41 |
| Sodium | mg/L | 80.3 | 74.6 | -5.7 |
| Vanadium | µg/L | 0.116 | 0 | -0.116 |
| Zinc | µg/L | 11 | 0 | -11 |

| Parameters | Units | Effluent Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 0.355 | 0 | -0.355 |
| Barium | µg/L | 101 | 0 | -101 |
| Boron | µg/L | 126 | 118 | -8 |
| Copper | µg/L | 8.04 | 0 | -8.04 |
| Iron | µg/L | 5.87 | 0 | -5.87 |
| Magnesium | mg/L | 20.7 | 21.4 | 0.7 |
| Manganese | µg/L | 0.605 | 0 | -0.605 |
| Nickel | µg/L | 2.42 | 0 | -2.42 |
| Selenium | µg/L | 0.2 | 0 | -0.2 |
| Sodium | mg/L | 83.3 | 78 | -5.3 |
| Zinc | µg/L | 17.4 | 0 | -17.4 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

## Table 5.43 - Inorganic Constituents Review for Miramar Water Treatment Plant

| Influent Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.007 | 0 | -0.007 |
| Bicarbonate | mg/L | 131 | 127 | -4 |
| Bromide | mg/L | 0.035 | 0 | -0.035 |
| Calcium | mg/L | 59.8 | 54.8 | -5 |
| Carbonate | mg/L | 0.259 | 0.304 | 0.045 |
| Chloride | mg/L | 84.5 | 80.4 | -4.1 |
| Fluoride | mg/L | 0.234 | 0.242 | 0.008 |
| MBAS (Detergents) | mg/L | 0.012 | 0 | -0.012 |
| Nitrate | mg/L | 1.04 | 0 | -1.04 |
| Nitrite (NO2) | mg/L | 0.003 | 0 | -0.003 |
| Phosphorus | mg/L | 0.004 | 0 | -0.004 |
| Potassium | mg/L | 4.1 | 4.04 | -0.06 |
| Silica | mg/L | 8.47 | 8.79 | 0.32 |
| Sulfate | mg/L | 180 | 164 | -16 |
| Total Nitrogen | mg/L | 0.412 | 0.224 | -0.188 |
| **Effluent Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.502 | 0.649 | 0.147 |
| Bicarbonate | mg/L | 128 | 126 | -2 |
| Bromide | mg/L | 0.008 | 0 | -0.008 |
| Calcium | mg/L | 60 | 54.4 | -5.6 |
| Carbonate | mg/L | 0.517 | 1.06 | 0.543 |
| Chloride | mg/L | 90.9 | 87.4 | -3.5 |
| Fluoride | mg/L | 0.236 | 0.719 | 0.483 |
| MBAS (Detergents) | mg/L | 0.02 | 0 | -0.02 |
| Nitrate | mg/L | 1.04 | 0 | -1.04 |
| Potassium | mg/L | 4.13 | 4.04 | -0.09 |
| Silica | mg/L | 8.24 | 8.86 | 0.62 |
| Sulfate | mg/L | 180 | 163 | -17 |
| Total Nitrogen | mg/L | 0.754 | 0.637 | -0.117 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Radiological Parameters**

Miramar WTP effluent was monitored for gross *alpha* and *beta particles* and Uranium. All measurements were well below the MCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.44** highlights the changes that have occurred since the 2010 WSS.

## Table 5.44 - Radiological Constituents Review for Miramar Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 2.93 | ns | 0 |
| Beta Radiations | pCi/L | 4.45 | ns | 0 |
| Combined Radium-226 & Radium-228 | pCi/L | 0 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 2.36 | ns | 0 |

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Radiological** | | **Mean** | **Mean** | |
| Alpha Radiations | pCi/L | 1.65 | 3.53 | 1.88 |
| Beta Radiations | pCi/L | 1.59 | 0 | -1.59 |
| Combined Radium-226 & Radium-228 | pCi/L | 0.449 | ns | 0 |
| Strontium 90- | pCi/L | 0 | ns | 0 |
| Tritium | pCi/L | 0 | ns | 0 |
| Uranium | pCi/L | 2.16 | 2.05 | -0.11 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Regulated and Unregulated Organic Parameters**

Miramar WTP influent was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**).

The Miramar WTP influent TOC levels ranged from 2.12 mg/L, to 4.45 mg/L. TTHMs levels ranged from ND to 76.1 µg/L, with a mean value of 35.5 µg/L. The mean TTHM value increased by 11.3 µg/L from the 2010 WSS (**Table 5.45**). There was little change, with the exception of TTHM, in the levels of regulated and unregulated organic constituents since the 2010 WSS (**Tables 5.45 & 5.46**).

The Miramar WTP effluent was monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. None of the levels exceeded the MCL with most at ND levels (**Appendix 5, see pages A5.1 thru A5.18**).

The Miramar WTP effluent TOC levels ranged from 1.88 mg/L, to 3.86 mg/L. The Miramar WTP effluent TTHM levels ranged from 14.8 µg/L to 89 µg/L, with a mean value of 46.4 µg/L. The mean TTHM value decreased by 5.3 µg/L from the 2010 WSS (**Table 5.45**). Total HAA-5 levels ranged from 8.25 to 23.3 µg/L, with a mean value of 14.5 µg/L. The mean HAA-5 value decreased by 3.2 µg/L since the 2010 WSS.

The MCL for TTHM is a distribution system RRA of 80.0 µg/L, and the MCL for HAA-5 is a distribution system RAA of 60.0 µg/L. These MCLs are not based on an individual sample, but as a Distribution System RAA Plant effluent samples are not included in the distribution system RAAs.

**Table 5.45 - Regulated Organic Constituents Review for Miramar Water Treatment Plant**

| | | Influent Data[a] | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 6.83 | 10.8 | 3.97 |
| Bromoform | µg/L | 3.75 | 4.52 | 0.77 |
| Chlorodibromomethane | µg/L | 8.94 | 12.5 | 3.56 |
| Chloroform | µg/L | 4.35 | 7.22 | 2.87 |
| Dibromoacetic acid | µg/L | 0.689 | 0 | -0.689 |
| Dichloroacetic acid | µg/L | 1.24 | 2.2 | 0.96 |
| Endothall | µg/L | 0.211 | 0 | -0.211 |
| Haloacetic Acids (five) | µg/L | 3.43 | 5.33 | 1.9 |
| Monobromoacetic acid | µg/L | 0.021 | 0 | -0.021 |
| Total Organic Carbon | mg/L | 2.56 | 2.62 | 0.06 |
| Total THMs | µg/L | 24.2 | 35.5 | 11.3 |
| Trichloroacetic acid | µg/L | 1.35 | 2.25 | 0.9 |

## Table 5.45 – Regulated Organic Constituents Review for Miramar Water Treatment Plant (contd)

**Effluent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Bromodichloromethane | µg/L | 15.8 | 14.7 | -1.1 |
| Bromoform | µg/L | 6.04 | 5.37 | -0.67 |
| Chlorodibromomethane | µg/L | 18.4 | 16.3 | -2.1 |
| Chloroform | µg/L | 12.7 | 11.1 | -1.6 |
| Dibromoacetic acid | µg/L | 4.12 | 3.11 | -1.01 |
| Dichloroacetic acid | µg/L | 8.25 | 7.75 | -0.5 |
| Haloacetic acids (five) | µg/L | 17.7 | 14.5 | -3.2 |
| Monobromoacetic acid | µg/L | 0.149 | 0 | -0.149 |
| Total Organic Carbon | mg/L | 2.34 | 2.38 | 0.04 |
| Total THMs | µg/L | 51.7 | 46.4 | -5.3 |
| Trichloroacetic acid | µg/L | 5.1 | 3.46 | -1.64 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

## Table 5.46 - Unregulated Organic Constituents Review for Miramar Water Treatment Plant

**Influent Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 2.56 | 0 | -2.56 |
| Dissolved Organic Carbon | mg/L | 2.29 | 0 | -2.29 |
| Geosmin | ng/L | 1.52 | 0 | -1.52 |

| Table 5.46 - Unregulated Organic Constituents Review for Miramar Water Treatment Plant (contd) | | | | |
|---|---|---|---|---|
| | Effluent Data[a] | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 1.86 | 0 | -1.86 |
| Dissolved Organic Carbon | mg/L | 2.16 | 0 | -2.16 |
| Geosmin | ng/L | 1.21 | 0 | -1.21 |
| | | | | |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

### 5.5 Hodges System Water Quality Review

Streams and reservoirs were monitored for general physical, microbiological, organic and inorganic parameters. Since the Hodges System streams and Hodges Reservoir do not directly feed a CSD WTP, they were not monitored for radiation. .

**Tables 5.47 – 5.53** contain the mean water quality values from the 2010 and 2015 WSS for comparison purposes. These tables do not contain constituents whose levels were below the MDL. See **Appendix 5, (see pages A5.1 thru A5.18)** for a summary of all water quality data. The Drinking Water Standards used in **Appendix 5 (see pages A5.1 thru A5.18)** apply to treated, potable water, and are listed for reference only.

**Source Water Review**

- **General Physical Parameters**
  General/physical source water quality parameters for the Hodges System were within the standards for drinking water except for pH, Color, TDS, Conductivity, and Turbidity (**Appendix 5, see pages A5.1 thru A5.18)**. The maximum pH was 9.59, above the SMCL maximum of 8.5. The maximum Turbidity level was 19.3 NTU, where the SMCL is 5 NTU. The maximum TDS level was 4,160 mg/L exceeding the SMCL of 1000 mg/L. The maximum Conductivity level was 4,160 µS/cm exceeding the SMCL of 1,600 mg/L. The maximum Color level was 170 cu, exceeding the SMCL of 15 cu.

- The water quality is typical of raw water streams and reservoirs in Southern California. Since the streams and reservoirs contain raw water, and the standards are

for treated water, the comparison is for reference only. **Table 5.47** highlights the changes that have occurred since the 2010 WSS.

**Table 5.47 - General/Physical Water Quality Constituents Review for the Source Waters of the Hodges System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Conductivity | µS/cm | 2000 | 1940 | -60 |
| pH | pH | 7.77 | 7.46 | -0.31 |
| Total Dissolved Solids | mg/L | 1340 | 1310 | -30 |
| Total Suspended Solids | mg/L | 15.8 | 8.22 | -7.58 |

| Reservoir Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **General Physical** | | **Mean** | **Mean** | |
| Calcium Hardness (CaCO3) | mg/L | 179 | 129 | -50 |
| Color | Color | 35.3 | 50 | 14.7 |
| Conductivity | µmho/cm | 1570 | 1170 | -400 |
| Total Alkalinity | mg/L | 188 | 146 | -42 |
| Total Dissolved Solids | mg/L | 923 | 752 | -171 |
| Total Hardness (CaCO3) | mg/L | 397 | 319 | -78 |
| Total Suspended Solids (TSS) | mg/L | 397 | NS | 0 |
| Turbidity | ntu | 7.66 | 5.49 | -2.17 |
| pH | pH | 8.24 | 8.33 | 0.09 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Indicator Organisms and Pathogens**

Streams and Reservoirs of the Hodges System were monitored for *Enterococcus*, *E. coli*, and total coliform to obtain a representation of microbiological conditions (**Appendix 5, see pages A5.1 thru A5.18**). *Enterococcus* levels ranged from <1/100 mL to >2,400/100 mL, *E. coli* levels ranged from <10/100 mL to 39,000 /100 mL, and total coliform levels ranged from 10/100mL to >240,000 /100 mL. Wide ranges in microbiological results are expected in raw

water streams and reservoirs. *Cryptosporidium* and *Giardia* were monitored at Hodges Reservoir and all results were ND. **Table 5.48** highlights the changes that have occurred since the 2010 WSS.

**Table 5.48 - Pathogens and Indicator Organisms Review for the Source Waters of the Hodges System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 480 | 523 | 43 |
| E Coli | /100 mL | 1400 | 853 | -547 |
| Total Coliform | /100 mL | 20300 | 24420 | 4120 |
| **Reservoir Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Pathogens and Indicator Organisms** | | **Mean** | **Mean** | |
| Enterococcus | /100 mL | 16.8 | 31.1 | 14.3 |
| E Coli | /100 mL | 29.3 | <10 | 0 |
| Total Coliform | /100 mL | 7640 | 6160 | -1480 |
| Crypto TC | / L | 0 | 0 | 0 |
| Giardia TC | / L | 0 | 0 | 0 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

- **Nutrient Parameters**
  Sources waters of the Hodges System were monitored for TN and *ortho*-Phosphate (**Appendix 5, see pages A5.1 thru A5.18**). The TN levels for streams ranged from ND to 13.5 mg/L, and *ortho*-Phosphate levels ranged from ND to 1.73 mg/L. The TN levels at Hodges Reservoir ranged from ND to 1.54 mg/L, and *ortho*-Phosphate levels ranged from ND to 0.791 mg/L. Mean TN levels for the streams and for Hodges Reservoir exceeded EPA's reference concentrations. **Table 5.49** highlights the changes that have occurred since the 2010 WSS.

- **Metal Parameters**
  The water samples from the streams in the Hodges System were monitored for seventeen metal parameters (**Appendix 5, see pages A5.1 thru A5.18**). The maximum levels of aluminum: 1,410 µg/L for streams and 1,370 µg/L for Hodges

reservoir, exceeded the MCL of 1000 µg/L. Maximum Iron values of 4,960 µg/L for streams and 769 µg/L for Hodges Reservoir exceeded the SMCL of 300 µg/L. Maximum Manganese values of 2,980 µg/L for stream and 446 µg/L for Hodges Reservoir exceeded the SMCL of 50 mg/L. **Table 5.50** highlights the changes that have occurred since the 2010 WSS.

**Table 5.49 - Nutrient Constituents Review for the Source Waters of the Hodges System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Total Nitrogen | mg/L | 1.88 | 1.54 | -0.34 |
| Ortho Phosphate | mg/L | 0.218 | 0 | -0.218 |
| | | | | |
| **Reservoir Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ortho phosphates | mg/L | 0 | 0 | 0 |
| Total Nitrogen | mg/L | 1.21 | 0.409 | -0.801 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Table 5.50 - Metal Constituents Review for the Source Waters of the Hodges System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 107 | 530 | 423 |
| Antimony | µg/L | 0.059 | 0 | -0.059 |
| Arsenic | µg/L | 0.684 | 0 | -0.684 |
| Barium | µg/L | 55.5 | 0 | -55.5 |
| Boron | µg/L | 129 | 121 | -8 |
| Chromium | µg/L | 0.219 | 0 | -0.219 |
| Copper | µg/L | 4.8 | 0 | -4.8 |
| Iron | µg/L | 0 | 512 | 512 |
| Magnesium | µg/L | 0 | 60.3 | 60.3 |

## Table 5.50 – Metal Constituents Review for the Source Waters of the Hodges System – (contd)

| Parameters | Units | Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Manganese | µg/L | 504 | 481 | -23 |
| Nickle | µg/L | 4.54 | 0 | -4.54 |
| | | | | |
| Selenium | µg/L | 0.875 | 0 | -0.875 |
| Vanadium | µg/L | 5.96 | 4.46 | -1.5 |
| Zinc | µg/L | 4.57 | 0 | -4.57 |
| | | | | |

| Parameters | Units | Reservoir Data[a] 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Metals** | | **Mean** | **Mean** | |
| Aluminum | µg/L | 18.4 | 51.5 | 33.1 |
| Arsenic | µg/L | 1.06 | 0 | -1.06 |
| Barium | µg/L | 41.8 | 0 | -41.8 |
| Boron | µg/L | 132 | 140 | 8 |
| Copper | µg/L | 2.69 | 0 | -2.69 |
| Iron | µg/L | 24 | 0 | -24 |
| Magnesium | mg/L | 52.8 | 45.2 | -7.6 |
| Manganese | µg/L | 145 | 73.3 | -71.7 |
| Nickel | µg/L | 1.57 | 0 | -1.57 |
| Selenium | µg/L | 0.142 | 0 | -0.142 |
| Sodium | mg/L | 152 | 132 | -20 |
| Vanadium | µg/L | 4.49 | 6.62 | 2.13 |
| Zinc | µg/L | 0.442 | 0 | -0.442 |
| | | | | |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary
Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

- **Inorganic Parameters**
  The CSD measured relevant Inorganic Parameters at Hodges Reservoir and the streams that enter the reservoir. Maximum stream values for Nitrate (53.3 mg/L) exceeded the MCL of 45 mg/L; and Sulfate (685 mg/L) exceeded the SMCL of 500

mg/L. None of the reservoir levels exceeded the MCLs or SMCLs (**Appendix 5, see pages A5.1 thru A5.18**). **Table 5.51** highlights the changes that have occurred since the 2010 WSS.

## Table 5.51 - Inorganic Constituents Review for the Source Waters of the Hodges System

**Stream Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia_N | mg/L | 0.041 | 0 | -0.041 |
| Bromide | µg/L | ns | 0.269 | 0 |
| Chloride | mg/L | ns | 262 | 0 |
| Nitrate | mg/L | 5.9 | 5.77 | -0.13 |
| Nitrite | mg/L | 0.066 | 0 | -0.066 |
| Phoshorus | mg/L | 0.14 | 0 | -0.14 |
| Sulfate | mg/L | ns | 340 | 0 |

**Reservoir Data[a]**

| Parameters | Units | 2010 WSS[b] | 2015 WSS[b] | Change |
|---|---|---|---|---|
| **Inorganic Constituents** | | **Mean** | **Mean** | |
| Ammonia-N | mg/L | 0.384 | 0.103 | -0.281 |
| Bicarbonate | mg/L | 223 | 167 | -56 |
| Bromide | mg/L | 0.42 | 0.182 | -0.238 |
| Calcium | mg/L | 71.6 | 51 | -20.6 |
| Carbonate | mg/L | 3.69 | 5.1 | 1.41 |
| Chloride | mg/L | 213 | 172 | -41 |
| Fluoride | mg/L | 0.232 | 0.273 | 0.041 |
| Nitrite (NO2) | mg/L | 0.037 | 0 | -0.037 |
| Phosphorus | mg/L | 0.133 | 0.103 | -0.03 |
| Potassium | mg/L | 7.99 | 7.28 | -0.71 |
| Silica | mg/L | 11.7 | 7.34 | -4.36 |
| Sulfate | mg/L | 238 | 212 | -26 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

- **Regulated and Unregulated Organic Parameters**

The source waters of the Hodges System were monitored for both regulated and non-regulated organic constituents including herbicides, pesticides, and synthetic contaminants. Parameter levels in all organic samples were below the MCL and most were ND.

- Stream TOC levels ranged from ND to 73.1 mg/L, while reservoir TOC levels ranged from 4.12 mg/L to 13.9 mg/L. **Tables 5.52 & 5.53** highlight the changes that have occurred since the 2010 WSS.

**Table 5.52 - Regulated Organic Constituents Review for the Source Waters of the Hodges System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Total Organic Carbon (TOC) | mg/L | 6.23 | 6.1 | -0.13 |
| **Reservoir Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Regulated** | | **Mean** | **Mean** | |
| Total Organic Carbon (TOC) | mg/L | 11 | 8.84 | -2.16 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.

**Table 5.53 - Unregulated Organic Constituents Review for the Source Waters of the Hodges System**

| Stream Data[a] | | | | |
|---|---|---|---|---|
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| All Parameters Non-Detect | µg/L | 0 | 0 | 0 |
| **Reservoir Data[a]** | | | | |
| **Parameters** | **Units** | **2010 WSS[b]** | **2015 WSS[b]** | **Change** |
| **Organic Constituents Unregulated** | | **Mean** | **Mean** | |
| 2-Methylisoborneol | ng/L | 6.8 | 0 | -6.8 |
| Geosmin | ng/L | 3.45 | 0 | -3.45 |

Notes:
(a): All non-detects reported as "0" for comparison purposes.
(b): WSS= Watershed Sanitary Survey
ns: not sampled; Constituents reported as ns in either WSS were also reported as 0 change.