Lake Elsinore and Canyon Lake Watersheds Nutrient TMDL Monitoring 2024-2025 Annual Report - DRAFT

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Lake Elsinore & San Jacinto Watersheds Authority

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
µS/cm	microSiemens per centimeter
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
CCC	criterion continuous concentration
cf	cubic feet
cfs	cubic feet per second
CMC	criterion maximum concentration
DI	depth-integrated
DO	dissolved oxygen
EMC	event mean concentration
Epi	epilimnion
EVMWD	Elsinore Valley Municipal Water District
Forest Service	San Bernardino Nation Forest Service
FY	fiscal year
Hypo	hypolimnion
J	concentration between MDL and RL
kg	kilogram
LA	load allocation
LESJWA	Lake Elsinore and San Jacinto Watersheds Authority
MDL	method detection limit
Mgal	million gallons of water
mg/L	milligrams per liter
NA	not applicable
ND	non-detect
NM:LE	not measured lab error
NPDES	National Pollutant Discharge Elimination System
NS	not sampled
NWS	National Weather Service
QAPP	Quality Assurance Project Plan
RCFC&WCD	Riverside County Flood Control and Water Conservation District
RL	reporting limit
RWQCB	Regional Water Quality Control Board, Santa Ana Region
SAWPA	Santa Ana Watershed Project Authority
SM	Standard Method
Surf	surface sample (0-2 meter composite)
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TMDL Task Force	Lake Elsinore and Canyon Lake TMDL Task Force
US EPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
WLA	waste load allocation

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1.0 Introduction

The following document summarizes results of compliance monitoring required in support of the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Load (TMDL) for the 2024-2025 monitoring year. The monitoring was performed according to the Lake Elsinore & Canyon Lake Nutrient TMDL Monitoring Quality Assurance Project Plan (QAPP) (Amec Foster Wheeler, September 2016), and the associated Compliance Monitoring Work Plan (Haley & Aldrich, Inc., July 2016).

1.1 Background

Lake Elsinore is the largest natural freshwater lake in Southern California, supporting a diverse range of terrestrial and aquatic habitats. Although it is a natural lake, it has historically experienced periods of drying during extended droughts, followed by replenishment through significant storm events occurring over one or more years. To help stabilize water levels and avoid the risk of drying out, the Elsinore Valley Municipal Water District (EVMWD) supplements the lake with approximately 6.0 million gallons per day (MGD) of treated, recycled water. The beneficial uses of the lake include water contact recreation (REC1), non-water contact recreation (REC2), commercial and sportfishing (COMM), warm freshwater habitat (WARM), wildlife habitat (WILD), and rare, threatened or endangered species (RARE)[1]. Although Lake Elsinore is a natural lake, it no longer exists in its original condition. Over time, it has been modified to enhance recreational opportunities and improve aquatic habitat. Notable alterations include the construction of a levee at the lake's southern end to increase water depth and reduce evaporation, as well as the ongoing supplementation of recycled water from the EVMWD.

Canyon Lake, located approximately two miles upstream of Lake Elsinore, was originally constructed in 1928 as the Railroad Canyon Reservoir. During wet years, overflow from Canyon Lake serves as a primary source of inflow to Lake Elsinore. Canyon Lake supports a wide range of beneficial uses, including municipal and domestic water supply (MUN), agricultural supply (AGR), groundwater recharge (GWR), body-contact recreation (REC1), non-body-contact recreation (REC2), commercial and sport fishing (COMM), warm freshwater aquatic habitat (WARM), and wildlife habitat (WILD).

The beneficial uses of COMM and RARE in Lake Elsinore, along with COMM in Canyon Lake, were formally recognized by the California Regional Water Quality Control Board, Santa Ana Region (RWQCB). These designations were adopted as amendments to the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) under Resolution R8-2017-0019 on June 16, 2017, and became effective on October 15, 2018, following approval by the U.S. Environmental Protection Agency (EPA).

Lake Elsinore and Canyon Lake were first listed by the RWQCB on its Clean Water Act Section 303(d) list of impaired waterbodies in 1994 and 1998, respectively. Both lakes remain on the latest approved 303(d) list, Res. No. 2022-0006. Current impairments identified for these waters included excessive levels of nutrients in both lakes, as well as organic enrichment/low dissolved oxygen (DO), sedimentation/siltation, unknown causes of toxicity, and PCBs/DDTs in Lake

[1] Based on federally listed Riverside fairy shrimp (*Streptocephalus woottoni*) in adjacent wetlands.

Elsinore. The Clean Water Act Section 303(d) requires the development and implementation of a TMDL for waters that do not or are not expected to meet water quality standards (beneficial uses, water quality objectives). In 2000, the RWQCB initiated the development of TMDLs for nutrients for Lake Elsinore and Canyon Lake.

In December 2004, the RWQCB adopted amendments to the Basin Plan to incorporate TMDLs for nutrients in Canyon Lake and Lake Elsinore. The amendments were subsequently approved by US EPA on September 30, 2005. The Basin Plan Amendment specifies, among other things, monitoring recommendations to measure progress towards attainment of TMDL thresholds and associated waste load allocations (WLAs) and monitoring to measure compliance towards in-lake numeric water quality targets. Numeric in-lake targets and watershed load allocations have been established and incorporated in the TMDL for nutrients (total nitrogen, phosphorus, and ammonia), DO, and chlorophyll-a (Tables 1-1 and 1-2); however, the ultimate compliance goal for beneficial uses in both lakes is to reduce eutrophication, which can negatively affect biological communities, result in fish kills, and impact recreational use. The recommendations outlined in RWQCB Resolution No. R8-2004-0037 required stakeholders to develop management plans and conduct long-term monitoring and implementation programs aimed at reducing nutrient loads to Lake Elsinore and Canyon Lake. Task 4 of the adopted Lake Elsinore and Canyon Lake TMDL Amendment required stakeholders to prepare and implement a Nutrient Monitoring Program. The program was to include the following:

1. A watershed-wide monitoring program to determine compliance with interim and/or final nitrogen and phosphorus loading; compliance with the nitrogen and phosphorus TMDL, and load allocations (LAs), including WLAs.

2. A Lake Elsinore in-lake nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll-a, and DO numeric targets.

3. A Canyon Lake in-lake nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll-a, and DO numeric targets.

4. A draft annual report summarizing the data collected for the year and evaluating compliance with the TMDL, due August 15 of each year.

Table 1-1. Final In-Lake Numeric Compliance Targets for the 2004 TMDLs (adapted from Table 5-9n in the Basin Plan, Santa Ana Water Board 2016)

Indicator	Lake Elsinore	Canyon Lake
Total Phosphorus Concentration (Final)	Annual average no greater than 0.1 milligrams/liter (mg/L) to be attained no later than 2020	Annual average no greater than 0.1 mg/L to be attained no later than 2020
Total Nitrogen Concentration (Final)	Annual average no greater than 0.75 mg/L to be attained no later than 2020	Annual average no greater than 0.75 mg/L to be attained no later than 2020
Ammonia Nitrogen Concentration (Final)	Calculated concentrations to be attained no later than 2020 *Acute*: 1-hour average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the Criterion Maximum Concentration (CMC) (acute criteria), where $CMC = 0.411/(1+10^{7.204-pH}) + 58.4/(1+10^{pH-7.204})$ *Chronic*: 30-day average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the Criterion Continuous Concentration (CCC) (chronic criteria), where $CCC = (0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{pH-7.688})) * \min(2.85, 1.45*10^{0.028(25-T)})$	Calculated concentrations to be attained no later than 2020 *Acute*: 1-hour average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the CMC (acute criteria), where $CMC = 0.411/(1+10^{7.204-pH}) + 58.4/(1+10^{pH-7.204})$ *Chronic*: 30-day average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the CCC (chronic criteria), where $CCC = (0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{pH-7.688})) * \min(2.85, 1.45*10^{0.028(25-T)})$
Chlorophyll-*a* Concentration (Final)	Summer average no greater than 25 micrograms/liter (µg/L); to be attained no later than 2020	Annual average no greater than 25 µg/L; to be attained no later than 2020
Dissolved Oxygen Concentration (Final)	No less than 5 mg/L 1 meter (m) above lake bottom; to be attained no later than 2020	Daily average in hypolimnion no less than 5 mg/L; to be attained no later than 2020

Table 1-2. Final Watershed Loading Numeric Load Allocations from the 2004 TMDL (adapted from Table 5-9p in the Basin Plan, Santa Ana Water Board 2016)

TMDL	Final Total Phosphorus TMDL (kg/yr)[a, b]	Final Total Nitrogen TMDL (kg/yr)[a, b]
Canyon Lake	8,691	37,735
Lake Elsinore	28,584	230,025

a - Final compliance to be achieved as soon as possible, but no later than December 31, 2020.
b - TMDL specified as 10-year running average. Sum all wasteload and allocation sources.

Since August 2001, the Lake Elsinore and San Jacinto Watersheds Authority (LESJWA) has been working with local stakeholders and the RWQCB to identify the source of nutrients impairing each lake and evaluate the impacts to water quality and beneficial uses incurred from nutrient sources.

At that time, LESJWA contracted with the State to serve as a neutral facilitator for the RWQCB to assist in formation of a TMDL workgroup and assist the workgroup in participating with the RWQCB in the development and definition of the TMDLs.

After adoption of the Lake Elsinore and Canyon Lake nutrient TMDLs on December 20, 2004, stakeholders named in the TMDLs began the process to create a formal cost sharing body, or Task Force, to implement several tasks included in the TMDLs.

In November 2006, stakeholders finalized an agreement to form the Lake Elsinore and Canyon Lake TMDL Task Force (hereafter “TMDL Task Force”). The TMDL Task Force consists of representatives from local cities, Riverside County, agriculture and dairy, and the regulatory community. At the request of the stakeholders and RWQCB, LESJWA (staffed by the Santa Ana Watershed Project Authority or “SAWPA”) serves as administrator of the TMDL Task Force and oversees the TMDL implementation for Lake Elsinore and Canyon Lake.

LESJWA, in support of the TMDL Task Force, provided funding to meet the requirement of the TMDL by developing a single comprehensive watershed-wide nutrient Monitoring Plan. The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan was approved by the RWQCB in March 2006 and subsequently implemented by the TMDL Task Force starting in April 2006 through October 2012. During this time frame, in-lake monitoring for both lakes was conducted through the EVMWD National Pollutant Discharge Elimination System (NPDES) compliance program (Order No. R8-2005-0003, NPDES No. CA8000027, Regional Water Reclamation Plant, Lake Elsinore, Riverside County). On October 26, 2012, the RWQCB adopted a resolution (Resolution No. R8-2012-0052) granting the TMDL Task Force a temporary suspension of in-lake TMDL monitoring programs to achieve cost savings that were then applied to implementing lake improvement projects aimed at reducing nutrient impacts in Canyon Lake and Lake Elsinore. As a result, the Lake Elsinore and Canyon Lake Nutrient TMDL field compliance monitoring was not conducted during the 2013-2014 and 2014-2015 fiscal year (FY) cycles.

The in-lake and watershed-wide water quality monitoring for both lakes was resumed in July 2015 as Phase II of the Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Program moving forward. A revised Monitoring Work Plan (Haley & Aldrich 2016) and companion Quality Assurance Project Plan (Amec Foster Wheeler 2016) were prepared and approved by the RWQCB in October 2016.

1.2 Nutrient TMDL Compliance Monitoring Objectives

The primary objectives of the Nutrient TMDL Compliance Monitoring Program are to:

1. Determine in-lake concentrations of causal (total nitrogen and total phosphorus) and response (total ammonia, dissolved oxygen, and chlorophyll-a) targets outlined in the adopted 2004 Lake Elsinore and Canyon Lake Nutrient TMDL through regular monitoring of both lakes.

2. Evaluate trends in causal and response parameter concentrations toward achieving 2004 TMDL numeric targets.

3. Quantify the external pollutant loading originating from the watershed above the lakes through stormwater monitoring of the major upstream inputs to Canyon Lake.

4. Determine the total nutrient loads into Lake Elsinore and Canyon Lake from their tributaries (i.e., San Jacinto River and Salt Creek).

5. Provide water quality data from both in-lake and watershed monitoring to update loading model.

Additionally, the data generated by this monitoring program will help support the needs of other programs by tracking the trends in watershed loading and in-lake concentrations relative to BMPs or any other actions taken in the upstream watershed to reduce nutrient loads.

2.0 San Jacinto River Watershed-Wide Monitoring

Watershed monitoring and reporting was performed by NV5 of San Diego, California.

2.1 Summary of 2024-2025 Wet Weather Watershed Monitoring and Nutrient Loads

A summary of the measured concentrations and estimated annual nutrient loads derived from each of the three monitored locations for the period of July 1, 2024 through June 30, 2025, is presented in **Table 2-1**. A more detailed account, including storm hydrographs and event loads are presented in the following sections for each monitoring location.

Table 2-1. Summary of 2024-2025 Monitoring

Number and Location Description	Total Annual Flow [a] (Mgal)	Annual Event Mean Storm Concentration (mg/L)		Estimated Annual Load (kg)	
		Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus
Site 3 - Salt Creek at Murrieta Road (USGS 11070465)	349	2.70	0.45	3,540	592
Site 4 - San Jacinto River at Goetz Road (USGS 11070365)	507	2.53	0.45	4,145	801
Site 6 - San Jacinto River at Ramona Expressway [b]	0	Not Measured[b]	Not Measured[b]	Not Measured[b]	Not Measured[b]
Site 30 - Canyon Lake Spillway (USGS 11070500)[c]	1,070	0.96	0.10	3,840	403
Site 1 - San Jacinto River at Cranston Guard Station[d]	273	Not Measured[d]	Not Measured[d]	Not Measured[d]	Not Measured[d]

a - Flow data after 02/04/2024 are provisional and may be subject to change.

b - Mystic Lake did not overflow during the wet weather monitoring period from October 1, 2024, to May 31, 2025. Therefore, no samples were collected from the sampling station at San Jacinto River at Ramona Expressway (Station ID 741) during the 2024-2025 monitoring year.

c -The USGS stream gauge at Site 30 (USGS 11070500) is located downstream of Canyon Lake on the San Jacinto River close to the river entrance to Lake Elsinore. This downstream location is influenced by local urban runoff and groundwater seepage in addition to the flows from Canyon Lake. In addition, runoff from other local tributaries into Lake Elsinore are not included in this table.

d - The Cranston Guard Station (USGS 11069500) was monitored between 2007 and 2011 by the San Bernardino National Forest Service in accordance with their agreement for in-lieu obligations to the Task Force. In 2012, the Forest Service pulled out of the Task Force and no longer provides monitoring support.

Mgal = million gallons; 1 million gallons = 133,680 cubic feet = 3,785,412 L; mg/L = milligrams per liter; kg = kilograms; USGS = United States Geological Survey.

2.2 Historical Wet Weather Watershed Monitoring and Incoming Nutrient Loads

A summary of the historical total nitrogen and total phosphorus water quality monitoring data for the period of July 1, 2015 through June 30, 2025, is presented in **Tables 2-2** to **2-3**. **Table 2-4** presents the 10-year running average of incoming total nitrogen and total phosphorus loads for both lakes in comparison to their TMDL load allocations. In general, the monitoring locations only flow during storm events and the storm flows account for the estimated annual load of nutrients. Lake Elsinore meets the current 10-year running average TMDL load allocations for both total

nitrogen and total phosphorus, Canyon Lake meets TMDL load allocation for total nitrogen and exceeds the TMDL allocation for total phosphorus (**Table 2-4**). The 10-year running average loading for Lake Elsinore was calculated from samples collected at the Canyon Lake Spillway station. These samples represent the catchment area upstream of the Canyon Lake Spillway and correspond to 93.6% of the total area contributing runoff to Lake Elsinore. The remaining 6.4% of the Lake Elsinore catchment is in the immediate area surrounding Lake Elsinore.

Table 2-2. Summary of Historical Annual Mean Storm Concentrations Based on Monitoring Year

Monitoring Year	Site 3 - Salt Creek at Murrieta Road		Site 4 - San Jacinto River at Goetz Road		Site 30 - Canyon Lake Spillway	
	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)
2015-2016	2.5	0.5	2.4	1.4	NS	NS
2016-2017	2.1	0.6	2	1.2	1.9	0.4
2017-2018	2.7	0.4	2	0.4	NS	NS
2018-2019	2.4	0.4	1.7	0.6	1.4	0.2
2019-2020	2.4	0.6	1.8	0.7	1.1	0.16
2020-2021	1.9	0.4	1.9	0.5	1.7	0.05
2021-2022	2.7	0.5	2.4	0.6	1.5	ND(<0.003)
2022-2023	1.8	0.3	1.7	0.4	1.6	0.10
2023-2024	2.1	0.4	1.4	0.4	1.2	0.15
2024-2025	2.7	0.5	2.5	0.5	1.0	0.10

ND = not detected (analyte not detected at the indicated method detection limit (MDL)).

NS – Not sampled when Canyon Lake does not overtop the Canyon Lake Spillway. The USGS stream gauge at Site 30 (USGS 11070500) is located downstream of Canyon Lake on the San Jacinto River close to the river entrance to Lake Elsinore. This downstream location is influenced by local urban runoff and groundwater seepage in addition to the flows from Canyon Lake. In addition, runoff from other local tributaries into Lake Elsinore are not included in this table.

a - When a concentration was non-detect, the annual average value for compliance purposes was calculated by converting non-detect (ND) values to zero. If the result of the calculated mean was non-zero but below the corresponding MDL, the average value was reported as ND.

Table 2-3. Summary of Historical Estimated Annual Loads Based on Monitoring Year

Monitoring Year	Site 3 - Salt Creek at Murrieta Road			Site 4 - San Jacinto River at Goetz Road			Site 30 - Canyon Lake Spillway		
	Flow (Mgal)	TN (kg)	TP (kg)	Flow (Mgal)	TN (kg)	TP (kg)	Flow (Mgal)	TN (kg)	TP (kg)
2015-2016[a]	566	6007	1503	915	8184	4678	609	NS	NS
2016-2017	1,596	12,366	4,026	2,802	21,651	14,403	4,850	33,759	6,637
2017-2018	271	2,586	482	393	3,055	810	117	NS	NS
2018-2019	1,394	12,213	2,266	3,208	20,457	7,409	5,893	32,832	5,416
2019-2020	1,645	14,792	3,705	3,290	23,337	8,660	4,497	18,762	2,635
2020-2021	255	1,902	396	519	3,794	992	878	5,626	175
2021-2022	351	3,698	625	537	4,976	1,282	640	3,632	0[b]
2022-2023	1,240	8,576	1,533	2,821	17,132	4,388	4,037	19,391	1,231
2023-2024	1,663	13,312	2,668	5,137	26,684	7,371	6,274	27,399	3,459
2024-2025	349	3,540	592	507	4,145	801	1,070	3,840	403

NS – Not sampled when Canyon Lake does not overtop the Canyon Lake Spillway. The USGS stream gauge at Site 30 (USGS 11070500) is located downstream of Canyon Lake on the San Jacinto River close to the river entrance to Lake Elsinore. This downstream location is influenced by local urban runoff and groundwater seepage in addition to the flows from Canyon Lake. In addition, runoff from other local tributaries into Lake Elsinore are not included in this table.

a - Sum of January 1, 2015 to June 30, 2016. All other monitoring year dates are July 1 to June 30.

b - When a concentration was non-detect, the annual load value for compliance purposes was calculated by converting non-detect (ND) values to zero.

Table 2-4. Historical Estimated Annual Loads as a 10-Year Running Average Relative to the 2004 TMDL Wasteload and Load Allocations

Lake	Analyte	10-yr Running Average (kg/yr) [a]	TMDL Load Allocation (kg/yr)	% of TMDL Load Allocation
Lake Elsinore[b]	Total Nitrogen	14,140	29,953	47.2%
	Total Phosphorus	1,955	6,922	28.2%
Canyon Lake[c]	Total Nitrogen	20,516	21,902	93.7%
	Total Phosphorus	6,727	3,797	177.2%
		-2,061 credit for alum application = 4,666		122.9%

a - Sum of average 10-year annual loads for the monitoring period January 2015 – December 2024.

b – Load allocations taken from Resolution R8-2004-0037 (2004 TMDL) Table 5-9r categorized as Canyon Lake Overflows. Watershed loading estimates for Lake Elsinore were taken from data collected at the Canyon Lake Spillway when it overflows. Internal sediment and atmospheric deposition allocations (Table 5-9r) were subtracted from the total of all allocation sources for both TN and TP to provide a more valid comparison to incoming watershed loads.

c – Load allocations taken from Resolution R8-2004-0037 (2004 TMDL) Table 5-9q. Internal sediment, atmospheric deposition, and supplemental water allocations (Table 5-9q) were subtracted from the total of all allocation sources for both TN and TP to provide a more valid comparison to incoming watershed loads.

2.3 Monitoring Strategy

Phase II of the San Jacinto River Watershed Monitoring Program follows the guidelines detailed in the Lake Elsinore and Canyon Lake Nutrient TMDL Compliance Monitoring Plan. The Phase II San Jacinto River Watershed Monitoring Program sampling activities during the 2024-2025 monitoring period included collection of samples during up to three storm events at the designated monitoring stations throughout the San Jacinto River Watershed. Average nutrient concentrations during the monitored events were used to calculate mass loading during remaining wet weather events that were not monitored to derive total estimated annual mass loads throughout the monitoring year.

2.4 Monitoring Stations and Stream Gauge Locations

To monitor TMDL compliance, five sampling stations were carefully selected to reflect various types of land uses within the San Jacinto River Watershed. Sampling of these locations began in 2006. Sampling station locations were deliberately set up to be within the vicinity of United States Geological Survey (USGS) stream gauge stations. The sampling stations are listed in **Table 2-5** below and shown on **Figure 2-1**.

Three of the five sites (Station IDs 745, 759, and 741) were selected because they are indicative of inputs to Canyon Lake originating from the main stem of the San Jacinto River, Salt Creek, and the watershed above Mystic Lake. The sampling location along the San Jacinto River at Ramona Expressway (Station 741) is located downgradient of Mystic Lake and is only sampled if Mystic Lake is overflowing. Flow has not been observed at this location since a strong El Niño event in the mid-1990s. Because Mystic Lake is an area of active land subsidence, this monitoring station is not expected to flow except under extremely high rainfall conditions.

Table 2-5. San Jacinto River Watershed Monitoring Stations

Station ID	USGS Station ID	Agency	Site Number and Location Description
745	11070465	USGS	Site 3 - Salt Creek at Murrieta Road
759	11070365	USGS	Site 4 - San Jacinto River at Goetz Road
741	11070210	USGS	Site 6 - San Jacinto River at Ramona Expressway
841	11070500	USGS	Site 30 - Canyon Lake Spillway
792[a]	11069500	USGS	Site 1 - San Jacinto River at Cranston Guard Station

a - The Cranston Guard Station (Station 792) was monitored between 2007 and 2011 by the San Bernardino National Forest Service in accordance with their agreement for in-lieu obligations to the Task Force. In 2012, the Forest Service pulled out of the Task Force and no longer provides monitoring support.

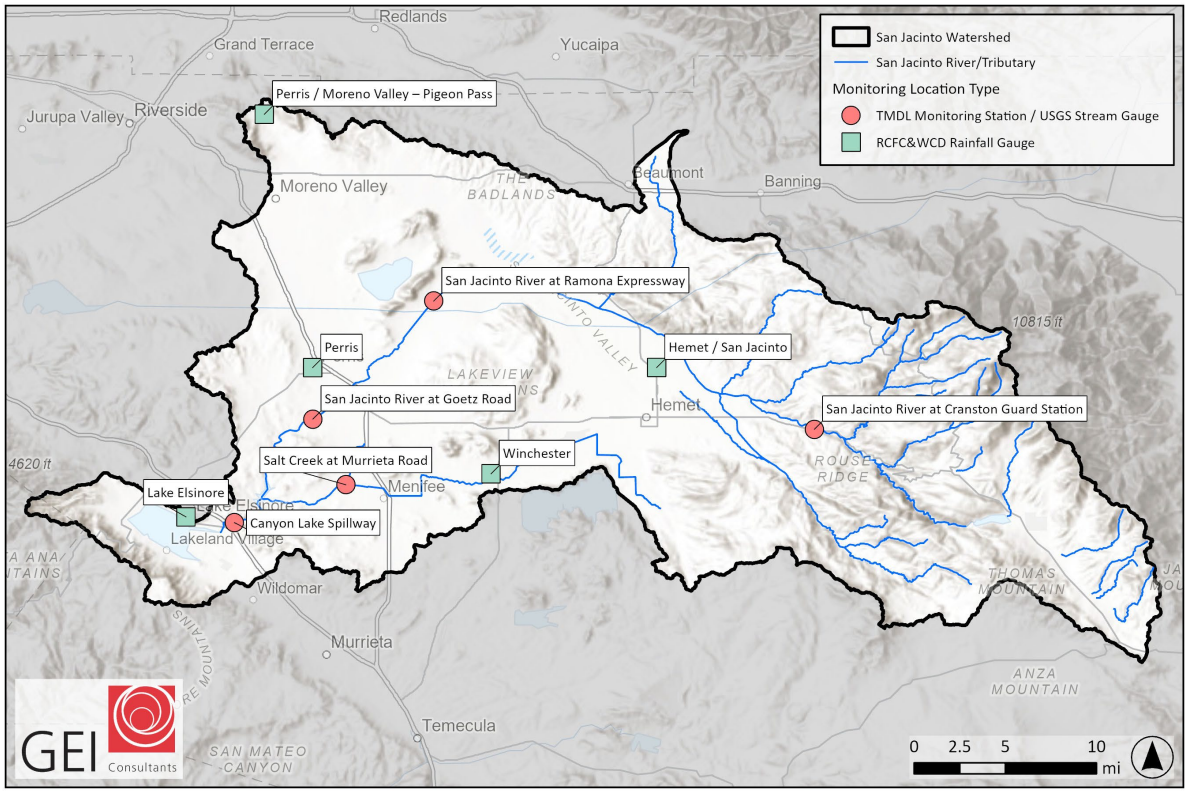


Figure 2-1. San Jacinto River Watershed Monitoring Stations

The fourth site, located below the Canyon Lake Dam (Station ID 841), is indicative of loads entering Lake Elsinore from Canyon Lake and the upstream watershed when the water level overtops the Railroad Canyon Dam Spillway. This site only represents a portion of the total load into Lake Elsinore from upstream of Canyon Lake Dam and does not include runoff from the local watershed. The Railroad Canyon Dam Spillway elevation at Canyon Lake is 1,381.76 feet. Samples are collected from this location during storm events that create lake levels that overtop the dam spillway elevation. The Canyon Lake level is publicly available at the following website:

https://www.evmwd.com/who-we-are/lake-levels

The fifth site at the Cranston Guard Station site on the San Jacinto River (Station 792) was only monitored between 2007 and 2011 by the San Bernardino National Forest Service who no longer provides monitoring support.

2.5 Stream Gauge Records

The USGS monitor stream flow from several gauging stations in the San Jacinto River Watershed. Stream gauging stations maintained and operated for Phase II of the San Jacinto River Watershed Monitoring Program are shown in **Figure 2-1** and identified in **Table 2-5**.

The data record captured per USGS stream gauge is publicly available at the USGS website, where data for the specific gauge numbers provided in **Table 2-6** can be found:

http://waterdata.usgs.gov/ca/nwis/current/?type=flow

A summary of the stream gauge data recorded at each of the stations with measured flow for the monitoring period of July 1, 2024 through June 30, 2025 is presented in **Table 2-6** and visually presented in **Figure 2-2** through **Figure 2-6**. The total monthly flows at each of the USGS stations are reported in **Table 2-6**. In general, the flows are only observed during wet weather storm events and dry weather flows are not observed from each of the USGS stations. The flow data are downloaded from the USGS website and are considered provisional for approximately six months; therefore, flow data presented after February 4, 2025, in this report are provisional. The provisional data provided by the USGS are subject to change and are not citable until reviewed and approved by the USGS.

Table 2-6. Summary of Stream Gauge Data (July 2024 through June 2025)

July 2023-June 2024 Total Monthly Flow (cf)	Site 3 - Salt Creek at Murrieta Road (USGS 11070465) (cf)	Site 4 - San Jacinto River at Goetz Road (USGS 11070365) (cf)	Site 6 - San Jacinto River at Ramona Expressway [a] (USGS 11070210) (cf)	Site 30 - Canyon Lake Spillway (USGS 11070500) (cf)	Site 1 - San Jacinto River at Cranston Guard Station (11069500) (cf)
July	-	-	-	-	147,042
August	-	-	-	-	13,329
September	4,599,954	1,209,051	-	2,547	1,053
October	-	-	-	196,614	3,618
November	-	-	-	1,518,165	9,486
December	-	-	-	2,052,783	59,724
January	669,600	1,589,880	-	2,533,527	72,486
February	15,445,692	38,319,660	-	24,010,083	14,808,123
March	23,795,145	26,372,376	-	105,196,374	18,826,758
April	1,865,961	174,402	-	6,125,742	1,778,220
May	-	170,316	-	1,230,975	489,951
June	227,142	-	-	208,287	307,440
Annual Flow Volume (cf)	**46,603,494**	**67,835,685**	**-**	**143,075,097**	**36,517,230**

Notes:
a - No flows originating from the upper watershed were observed at the TMDL monitoring location just downstream of Mystic Lake.
cf = cubic feet

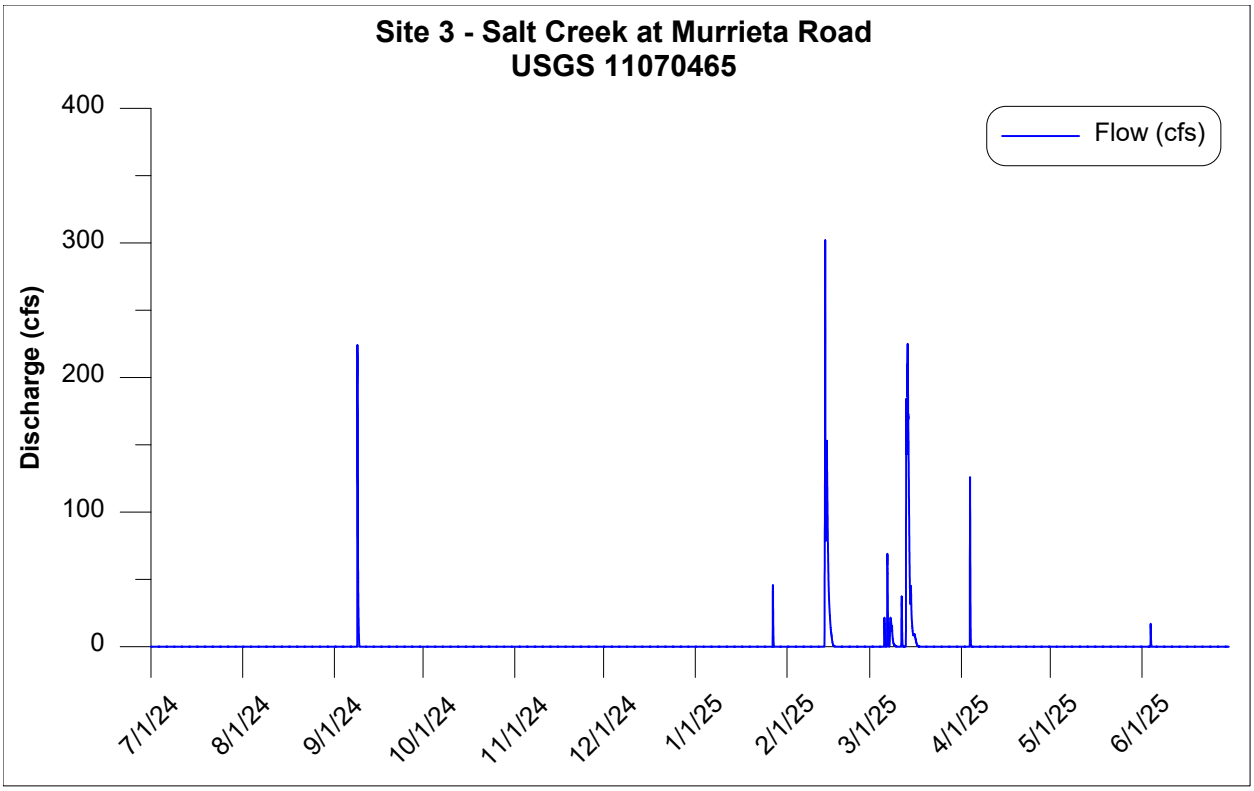


Figure 2-2. Site 3 – Salt Creek at Murrieta Road – Daily Stream Gauge Records

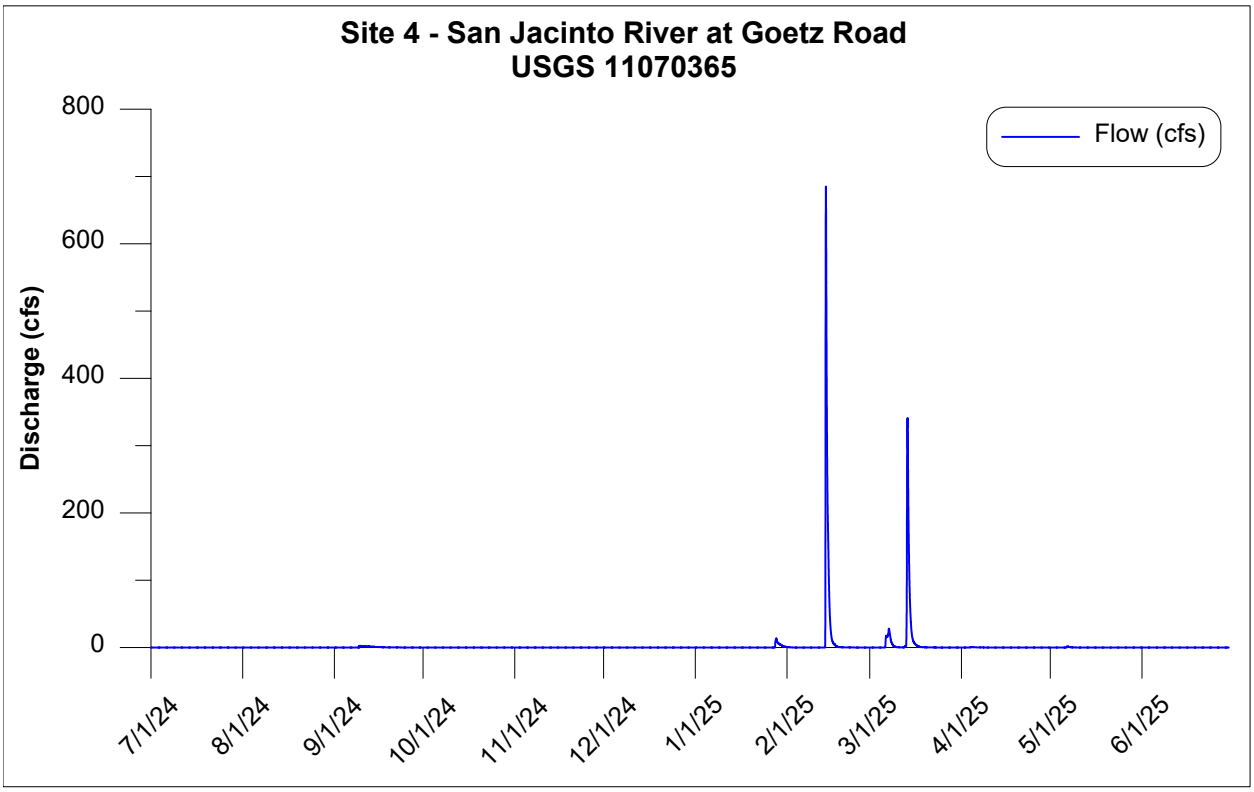


Figure 2-3. Site 4 – San Jacinto River at Goetz Road – Daily Stream Gauge Records

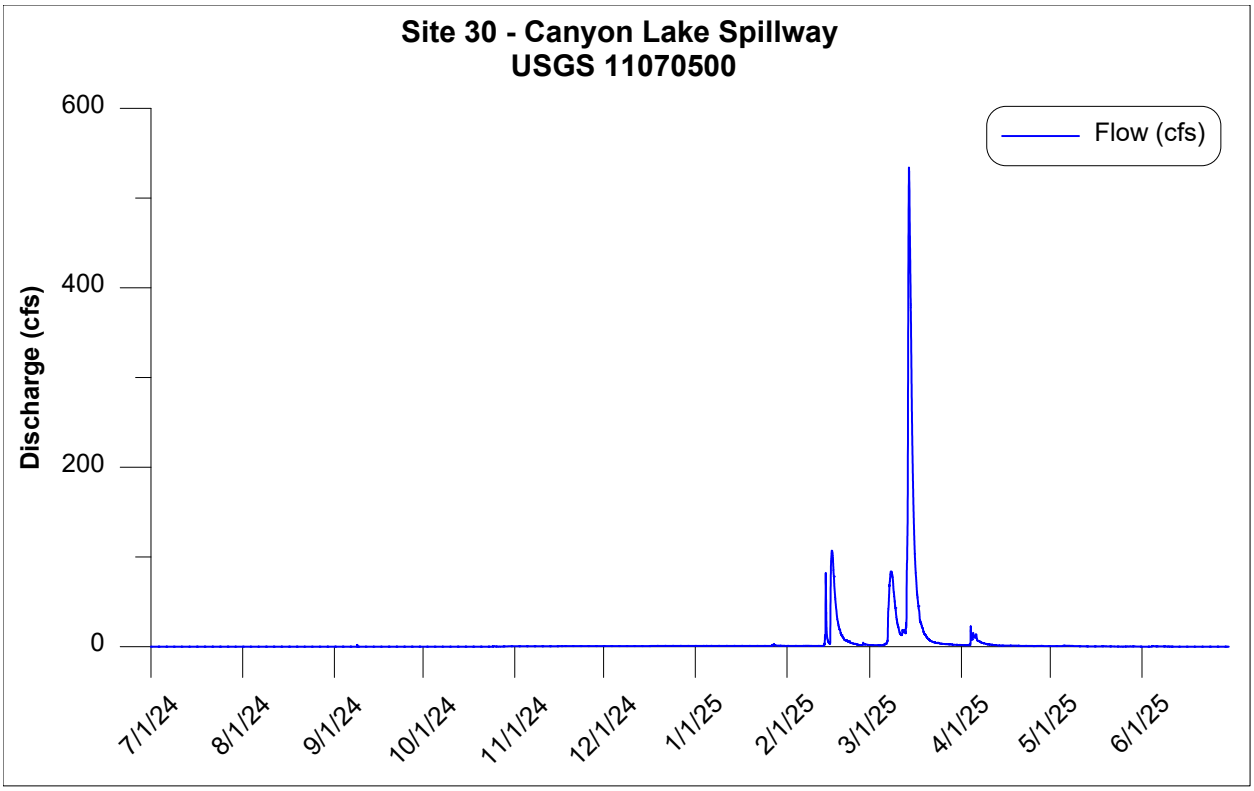


Figure 2-4. Site 30 – Canyon Lake Spillway – Daily Stream Gauge Records

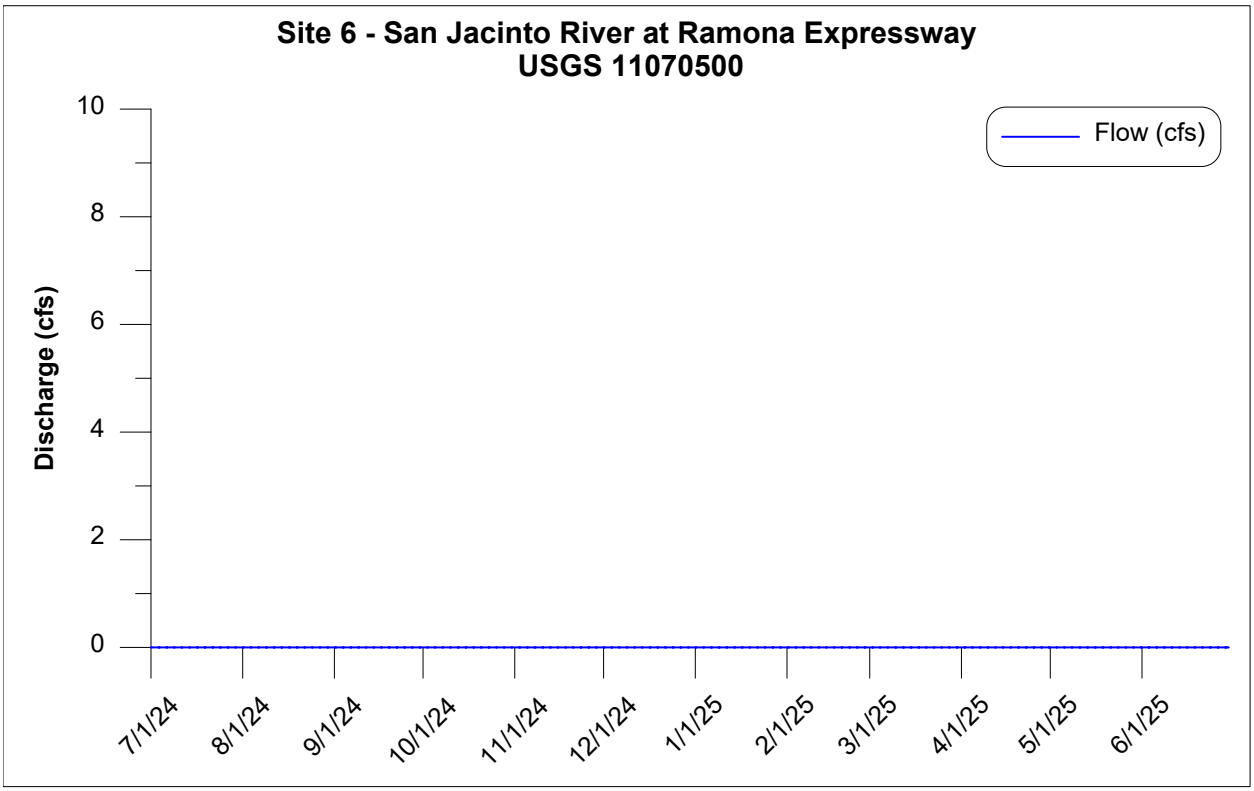


Figure 2-5. Site 6 – San Jacinto River at Ramona Expressway – Daily Stream Gauge Records

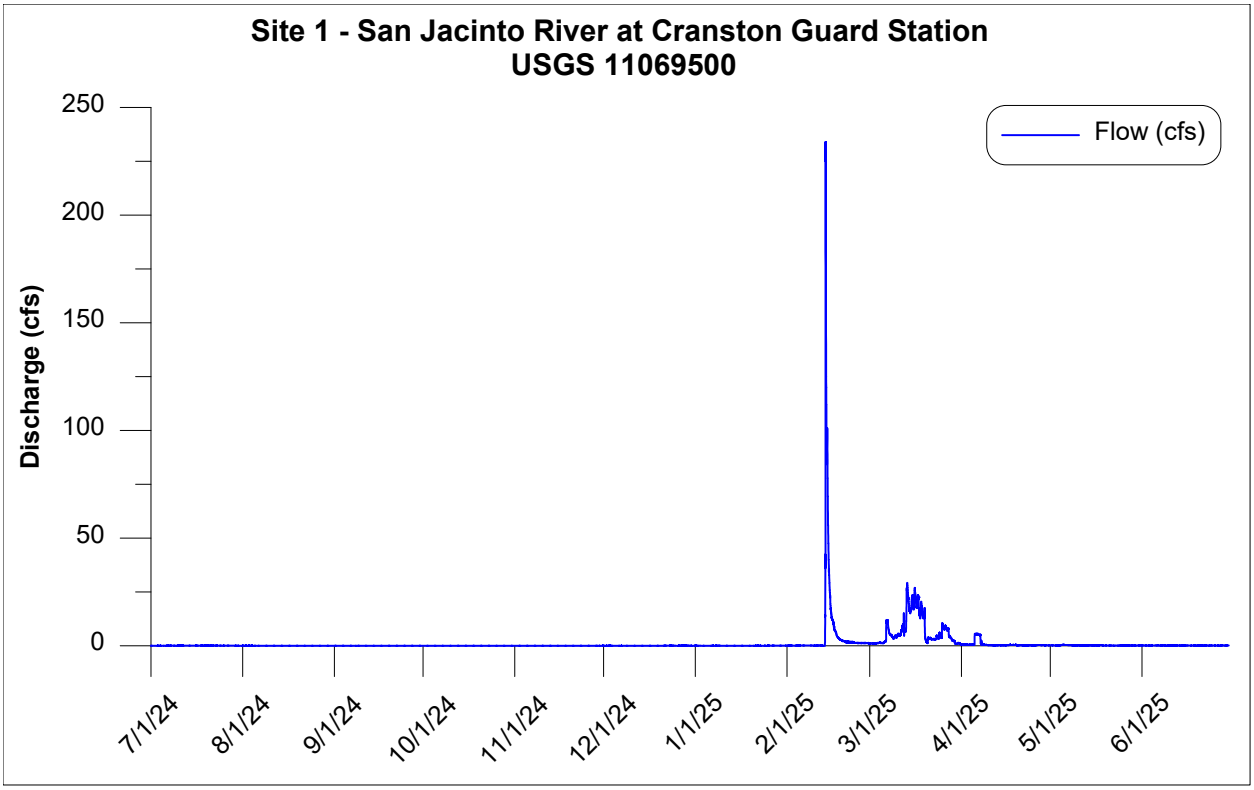


Figure 2-6. Site 1 – San Jacinto River at Cranston Guard Station – Daily Stream Gauge Records

2.6 Sampling Strategy

Phase II of the San Jacinto River Watershed Monitoring Program includes collecting water quality samples during up to three storm events at the designated monitoring stations throughout the San Jacinto River Watershed. Throughout the wet weather monitoring period from October 1, 2024, to May 31, 2025, the National Weather Service (NWS) forecasts were monitored to determine when storm events met the mobilization criteria. The mobilization criteria for sampling requires an NWS quantitative precipitation forecast greater than a 1.0-inch forecast within 24 hours from October 1 through December 31, and greater than an 0.5-inch forecast within 24 hours from January 1 through May 31.

Flow-weighted composite samples were collected during the storm events at the designated monitoring stations. Discrete time-weighted sample aliquots were collected over the rising limb (increasing flow) and the falling limb (decreasing flow) of the hydrograph using automatic sampling equipment (e.g., ISCO autosamplers). The first sample aliquot was taken at or shortly after the time that storm water runoff began, and each subsequent aliquot of equal volume was collected at intervals of approximately 2 hours across the hydrograph, depending on the forecasted size of the storm event. Flow rates and volumes were based on data from USGS stream gauges located near the sampling stations. Upon completion of sampling, field teams downloaded the USGS flow data and subsampled each time-weighted discrete sample to create a single flow-weighted composite sample for laboratory analysis.

The following protocols were applied:

- Sampling commenced once flow was established in the channel.
- Field measurements (temperature, pH, conductivity, dissolved oxygen, and turbidity) were recorded in the field during the rising limb of the hydrograph using portable calibrated YSI multi-parameter meters, or equivalent.
- Biochemical Oxygen Demand and Chemical Oxygen Demand were analyzed for the first discrete grab sample only.

Sampling and analysis followed the guidelines detailed in the Lake Elsinore and Canyon Lake Nutrient TMDL Compliance Monitoring Plan (Haley & Aldrich, Inc., July 2016). More detail regarding the sampling approach (e.g., compositing, sample naming conventions) are described in the Lake Elsinore and Canyon Lake Nutrient TMDL Compliance QAPP (Amec Foster Wheeler, September 2016). These documents are available at the following website under the monitoring tab:

https://sawpa.gov/task-force/lake-elsinore-and-canyon-lake-tmdl-task-force/

Samples for all analytical chemistry measurements were submitted Weck Laboratories Inc. located in Industry, California.

2.7 San Jacinto River Watershed Monitoring Events

Water quality samples were collected during the three storm events that met the mobilization criteria during the wet weather monitoring period from October 1, 2024, to May 31, 2025.

The first monitoring event occurred on January 27-29, 2025. Water quality samples were collected at Salt Creek at Murrieta Road (Station ID 745) and San Jacinto River at Goetz Road (Station ID 759). A peak flow of 45.6 cfs was recorded at Salt Creek at Murrieta Road (Station ID 745) and a peak flow of 13.5 cfs was recorded at San Jacinto River at Goetz Road (Station ID 759). No flows exited Canyon Lake during the monitoring event (i.e., the water level in Canyon Lake did not crest the spillway), and no flows were recorded at the San Jacinto River at Ramona Expressway (Station ID 741). A total of 0.45 to 0.71 inches of rainfall was recorded in the region during this storm (RCFCWCD 2025).

The second monitoring event occurred on March 5-10, 2025. Water quality samples were collected at Salt Creek at Murrieta Road (Station ID 745), San Jacinto River at Goetz Road (Station ID 759), and Canyon Lake Spillway (Station ID 841). A peak flow of 69 cfs was recorded at Salt Creek at Murrieta Road (Station ID 745), a peak flow of 28.2 cfs was recorded at San Jacinto River at Goetz Road (Station ID 759), and a peak flow of 83.8 cfs was recorded at Canyon Lake Spillway (Station ID 841). No flows were recorded at the San Jacinto River at Ramona Expressway (Station ID 741). A total of 0.70 to 1.13 inches of rainfall was recorded in the region during this storm (RCFCWCD 2025).

The third monitoring event occurred on March 11-17, 2025. Water quality samples were collected at Salt Creek at Murrieta Road (Station ID 745), San Jacinto River at Goetz Road (Station ID 759), and Canyon Lake Spillway (Station ID 841). A peak flow of 37.5 cfs was recorded at Salt Creek at Murrieta Road (Station ID 745), a peak flow of 341 cfs was recorded at San Jacinto River at Goetz Road (Station ID 759), and a peak flow of 534 cfs was recorded at Canyon Lake Spillway (Station ID 841). No flows were recorded at the San Jacinto River at Ramona Expressway (Station ID 741). A total of 1.29 to 1.73 inches of rainfall was recorded in the region during this storm (RCFCWCD 2025).

Mass loads for each chemical constituent at each location were calculated as the product of the event mean concentrations and the storm volumes for each storm event. The annual loads were calculated as the sum of the monitored event loads and the storm events where no sampling occurred, which are the product of the storm volumes for the storm events not monitored and the annual mean concentrations.

2.8 San Jacinto River Watershed Annual Water Quality Summary

A summary of watershed water quality monitoring data for each of the four monitoring locations for the monitoring period of July 1, 2024, through June 30, 2025, is presented below. The complete set of analytical laboratory report results is included in **Appendix A**. Included with each summary of the monitoring data are the concentrations for each analyte. Also included are the estimated storm event loads and annual loads for each analyte.

2.8.1 Summary of Monitoring Data – Salt Creek at Murrieta Road

Water quality samples were collected during three storm events at Salt Creek at Murrieta Road (Station ID 745) during the wet weather monitoring period from October 1, 2024, to May 31, 2025.

During the storm event on January 27, 2025, a total of 6 discrete time-weighted samples were collected across the hydrograph at two-hour intervals and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070465), flow for the storm event was estimated at 18 acre-feet or 5 million gallons (Mgal), which represents approximately 1.4% of the total annual flow.

During the storm event on March 5-7, 2025, a total of 21 discrete time-weighted samples were collected across the hydrograph at two-hour intervals and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070465), flow for the storm event was estimated at 18 acre-feet or 15 Mgal, which represents approximately 4.2% of the total annual flow.

During the storm event on March 11-12, 2025, a total of 10 discrete time-weighted samples were collected across the hydrograph at two-hour intervals and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070465), flow for the storm event was estimated at 20 acre-feet or 6 Mgal, which represents approximately 1.6% of the total annual flow.

Photos taken during the storm events are provided in **Figure 2-7** through **Figure 2-9.**

Figure 2-7. Storm Event at Salt Creek at Murrieta Road (January 27, 2025)

Figure 2-8. Storm Event at Salt Creek at Murrieta Road (March 6, 2025)[2]

[2] Photo from February 2024 was not available, image is a representative photo from 2022.

Figure 2-9. Storm Event at Salt Creek at Murrieta Road (March 11, 2025)

Event and annual mean concentrations for each analyte are presented in **Table 2-7**. Event and annual loads for each analyte are presented in **Table 2-8**. Concentrations for nutrients for the three storm events ranged from 1.8 to 4.2 milligrams per liter (mg/L) for total nitrogen, and 0.3 to 0.76 mg/L for total phosphorus (**Table 2-7**). Based on flow data provided by the nearby USGS stream gauge (Station ID 11070465), the total annual flow was estimated at 46,603,494 cubic feet (cf) or 349 Mgal for the period of July 1, 2024, through June 30, 2025. The estimated annual nutrient load was calculated to be 3,540 kg for total nitrogen and 592 kg for total phosphorus (**Table 2-8**) for the period of July 1, 2024 through June 30, 2025.

Table 2-7. Water Quality Concentrations at Salt Creek at Murrieta Road

Analyte	Units	Event 1	Event 2	Event 3	Annual Mean	Annual Geomean
Ammonia-Nitrogen	mg/L	0.51	0.19	0.08 (J)	0.26	0.198
Chemical Oxygen Demand	mg/L	29	36	29	31.33	31.17
Kjeldahl Nitrogen	mg/L	2.6	1.1	1.2	1.63	1.51
Nitrate as N	mg/L	1.4	0.96	0.55	0.97	0.90
Nitrite as N	mg/L	0.1	0.058 (J)	ND (<0.042)[a]	0.08[b]	0.076[b]
Organic Nitrogen	mg/L	2.1	0.89	1.1	1.36	1.27
Total Nitrogen	mg/L	4.2	2.1	1.8	2.70	2.51
Total Phosphorus	mg/L	0.76	0.3	0.3	0.45	0.41
Ortho Phosphate Phosphorus	mg/L	0.44	0.21	0.17	0.27	0.25
Total Dissolved Solids	mg/L	99	93	190	127	121
Total Hardness	mg/L	56.9	47.5	82.9	62.4	60.7
Total Suspended Solids	mg/L	93	33	33	53	46.6

ND = not detected (analyte not detected at the indicated method detection limit (MDL)).
J- Reported value was detected above the MDL, but below the RL.
a – When the result was ND the detection limit is shown in parenthesis.
b –The annual average value for compliance purposes was calculated by converting non-detect (ND) values to zero. If the result of the calculated mean was non-zero but below the corresponding MDL, the average value was reported as ND.

Table 2-8. Water Quality Event and Annual Loads at Salt Creek at Murrieta Road

Analyte	Units	Load Event 1	Load Event 2	Load Event 3	Annual Load
Ammonia-Nitrogen	kg	10	10	2	340
Chemical Oxygen Demand	kg	550	1,980	610	41,513
Kjeldahl Nitrogen	kg	49	61	25	2,135
Nitrate as N	kg	27	53	12	1,279
Nitrite as N	kg	2	3	-[a]	102
Organic Nitrogen	kg	40	49	23	1,782
Total Nitrogen	kg	80	116	38	3,540
Total Phosphorus	kg	14	17	6	592
Ortho Phosphate Phosphorus	kg	8	12	4	358
Total Dissolved Solids	kg	1,877	5,116	3,997	166,930
Total Hardness	kg	1,079	2,613	1,744	81,895
Total Suspended Solids	kg	1,763	1,815	694	69,180

a - When a concentration was non-detect, the load value for compliance purposes was calculated by converting non-detect (ND) values to zero.

Hydrographs with the discrete time-weighted sample aliquot times are provided in **Figure 2-10** through **Figure 2-12.** The figures were developed based on flow data provided by the nearby USGS stream gauge (Station ID 11070465).

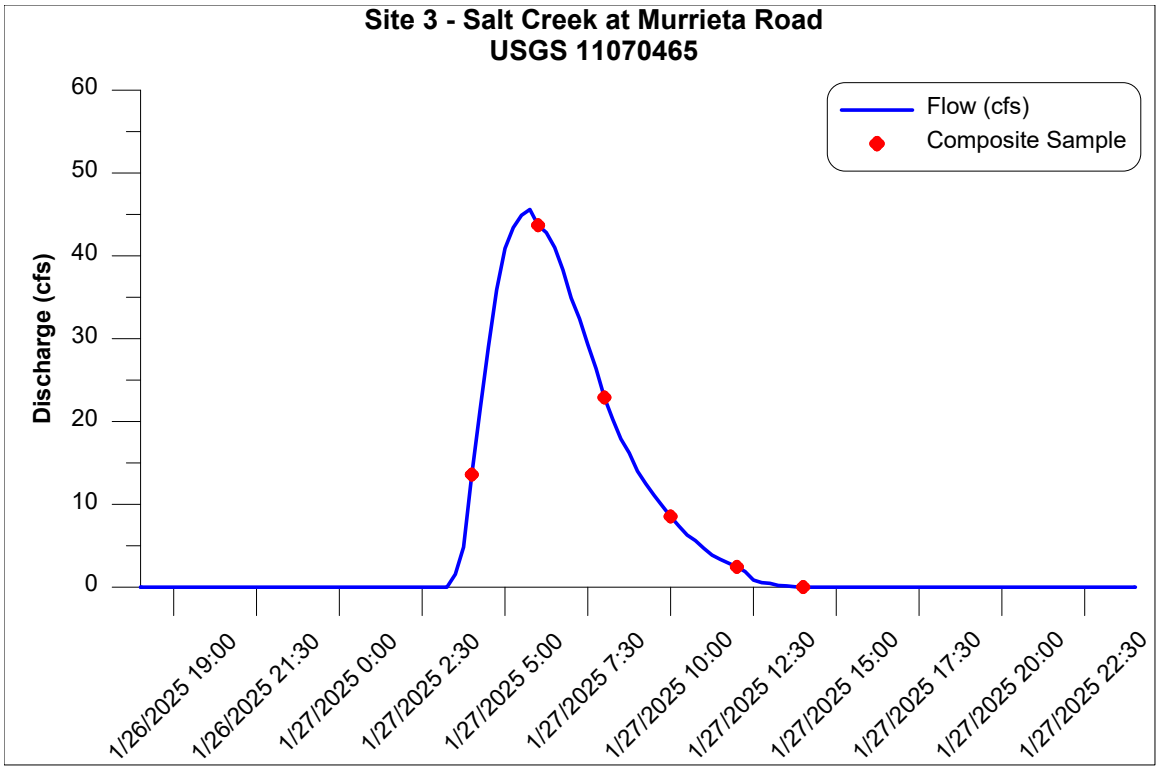


Figure 2-10. Hydrograph of First Storm Event at Salt Creek at Murrieta Road (1/27/2025)

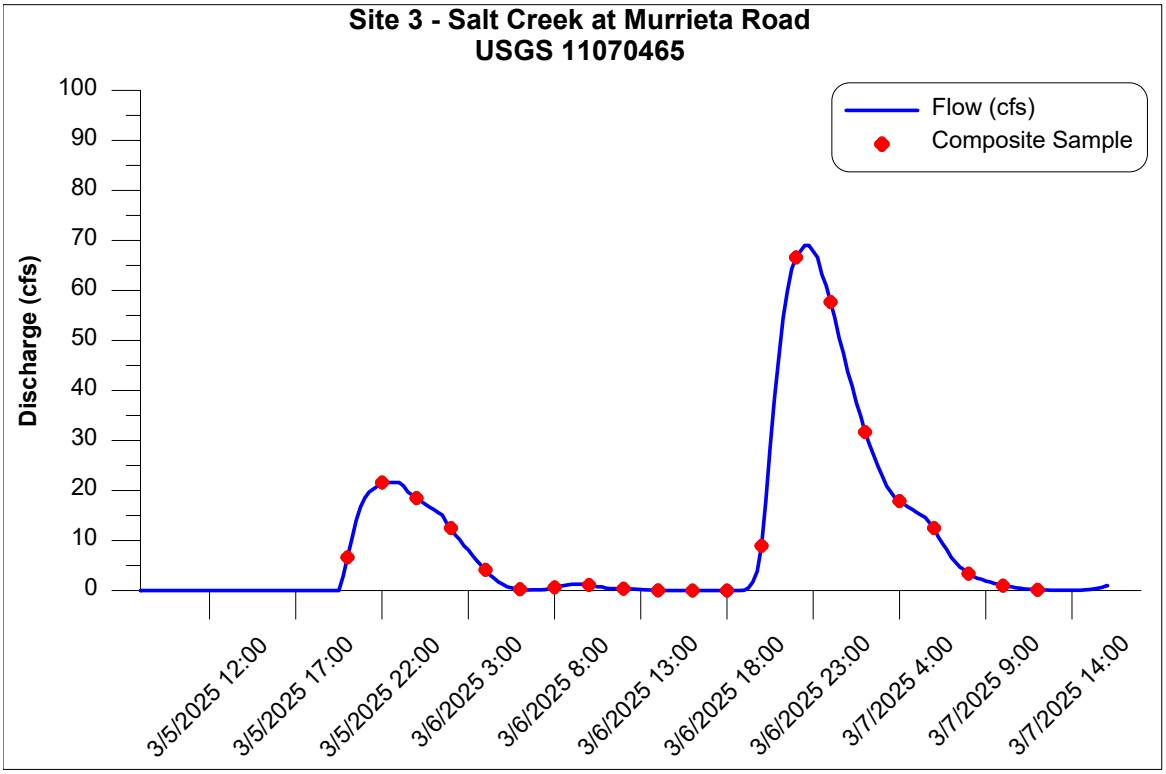


Figure 2-11. Hydrograph of Second Storm Event at Salt Creek at Murrieta Road (March 5-7,2025)

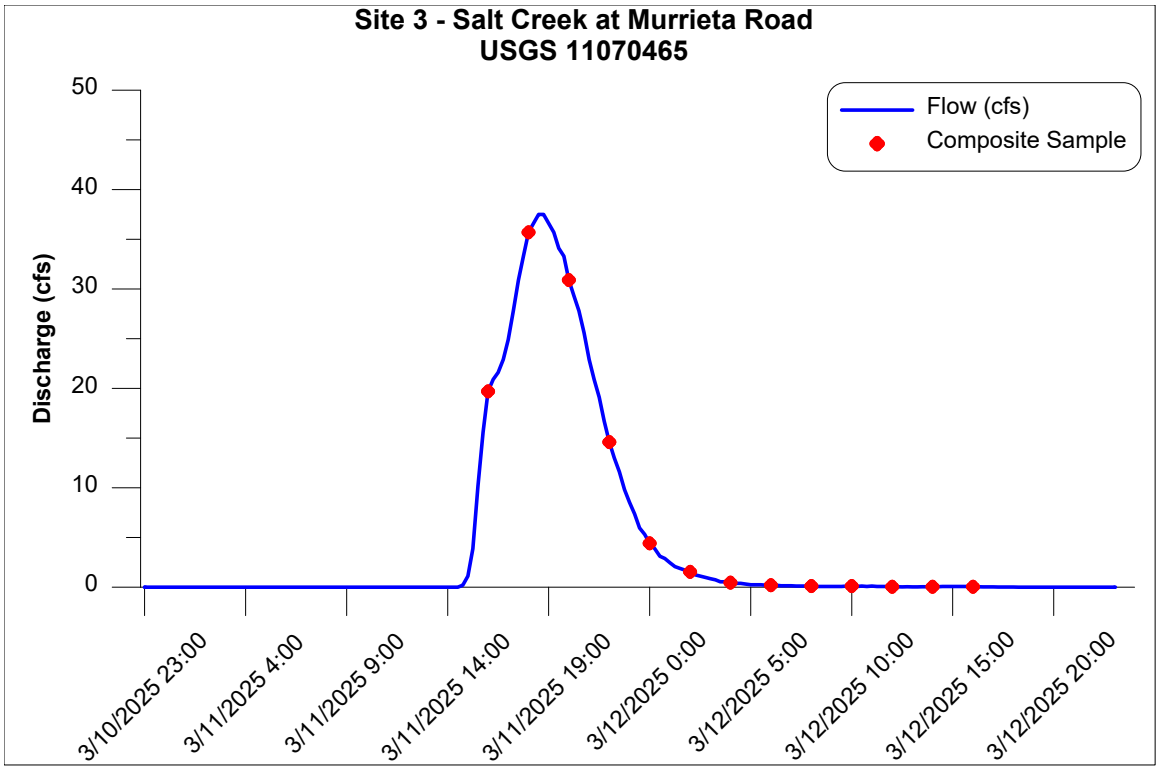


Figure 2-12. Hydrograph of Third Storm Event at Salt Creek at Murrieta Road (March 11-12, 2025)

2.8.2 Summary of Monitoring Data – San Jacinto River at Goetz Road

Water quality samples were collected during three storm events at San Jacinto River at Goetz Road (Station ID 759) during the wet weather monitoring period from October 1, 2024, to May 31, 2025.

During the storm event on January 28-29, 2025 a total of 18 discrete time-weighted samples were collected across the hydrograph at two-hour intervals and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070365), flow for the storm event was estimated at 40 acre-feet or 11 Mgal, which represents approximately 2.2% of the total annual flow.

During the storm event on March 7-9, 2025, a total of 43 discrete time-weighted samples were collected across the hydrograph at two-hour intervals and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070365), flow for the storm event was estimated at 95 acre-feet or 27 Mgal, which represents approximately 5.2% of the total annual flow.

During the storm event on March 11-17 2025, a total of 48 discrete time-weighted samples were collected across the hydrograph at three-hour intervals and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070365), flow for the storm event was estimated at 604 acre-feet or 169 Mgal, which represents approximately 33.3% of the total annual flow.

Photos taken during the storm events are provided in **Figure 2-13** through **Figure 2-15**.

Figure 2-13. Storm Event at San Jacinto River at Goetz Road (January 28, 2025)

Figure 2-14. Storm Event at San Jacinto River at Goetz Road (March 7, 2025)

Figure 2-15. Storm Event at San Jacinto River at Goetz Road (March 13, 2025)

Event and annual mean concentrations for each analyte are presented in **Table 2-9**. Event and annual loads for each analyte are presented in **Table 2-10**. Concentrations for nutrients for the three storm events ranged from 1.4 to 4.4 mg/L for total nitrogen, and 0.32 to 0.69 mg/L for total phosphorus (**Table 2-9)**. Based on flow data provided by the nearby USGS stream gauge (Station ID 11070365), the total annual flow was estimated at 67,835,685 cf or 507 Mgal for the period of July 1, 2024, through June 30, 2025. The estimated annual nutrient load was calculated to be 4,145 kg for total nitrogen and 801 kg for total phosphorus (**Table 2-10**) for the period of July 1, 2024 through June 30, 2025.

Table 2-9. Water Quality Concentrations at San Jacinto River at Goetz Road

Analyte	Units	Event 1	Event 2	Event 3	Annual Mean	Annual Geomean
Ammonia-Nitrogen	mg/L	0.056 (J)	0.049 (J)	0.063 (J)	0.06	0.056
Chemical Oxygen Demand	mg/L	75	48	30	51	47.6
Kjeldahl Nitrogen	mg/L	2.6	0.92	0.84	1.45	1.26
Nitrate as N	mg/L	1.6	0.77	0.59	0.99	0.90
Nitrite as N	mg/L	0.16	0.075 (J)	ND (<0.042) [a]	0.12 [b]	0.11 [b]
Organic Nitrogen	mg/L	2.6	0.87	0.78	1.42	1.21
Total Nitrogen	mg/L	4.4	1.8	1.4	2.53	2.23
Total Phosphorus	mg/L	0.69	0.32	0.35	0.45	0.43
Ortho Phosphate Phosphorus	mg/L	0.52	0.22	0.19	0.31	0.28
Total Dissolved Solids	mg/L	560	170	150	293	243
Total Hardness	mg/L	216	80.2	66	121	105
Total Suspended Solids	mg/L	17	32	60	36.3	32.0

ND = not detected (analyte not detected at the indicated method detection limit (MDL)).
J- Reported value was detected above the MDL, but below the RL.
a – When the result was ND the detection limit is shown in parenthesis.
b –The annual average value for compliance purposes was calculated by converting non-detect (ND) values to zero. If the result of the calculated mean was non-zero but below the corresponding MDL, the average value was reported as ND.

Table 2-10. Water Quality Event and Annual Loads at San Jacinto River at Goetz Road

Analyte	Units	Load Event 1	Load Event 2	Load Event 3	Annual Load
Ammonia-Nitrogen	kg	2	5	40	111
Chemical Oxygen Demand	kg	3,145	4,833	19,215	85,219
Kjeldahl Nitrogen	kg	109	93	538	2,393
Nitrate as N	kg	67	78	378	1,645
Nitrite as N	kg	7	8	- [a]	148
Organic Nitrogen	kg	109	88	500	2,308
Total Nitrogen	kg	184	181	897	4,145
Total Phosphorus	kg	29	32	224	801
Ortho Phosphate Phosphorus	kg	22	22	122	518
Total Dissolved Solids	kg	23,481	17,119	96,077	470,417
Total Hardness	kg	9,057	8,076	42,274	196,771
Total Suspended Solids	kg	713	3,222	38,431	83,704

a - When a concentration was non-detect, the load value for compliance purposes was calculated by converting non-detect (ND) values to zero.

Hydrographs with the discrete time-weighted sample aliquot times are provided in **Figure 2-16** through **Figure 2-18**. The figure was developed based on flow data provided by the nearby USGS stream gauge (Station ID 11070365).

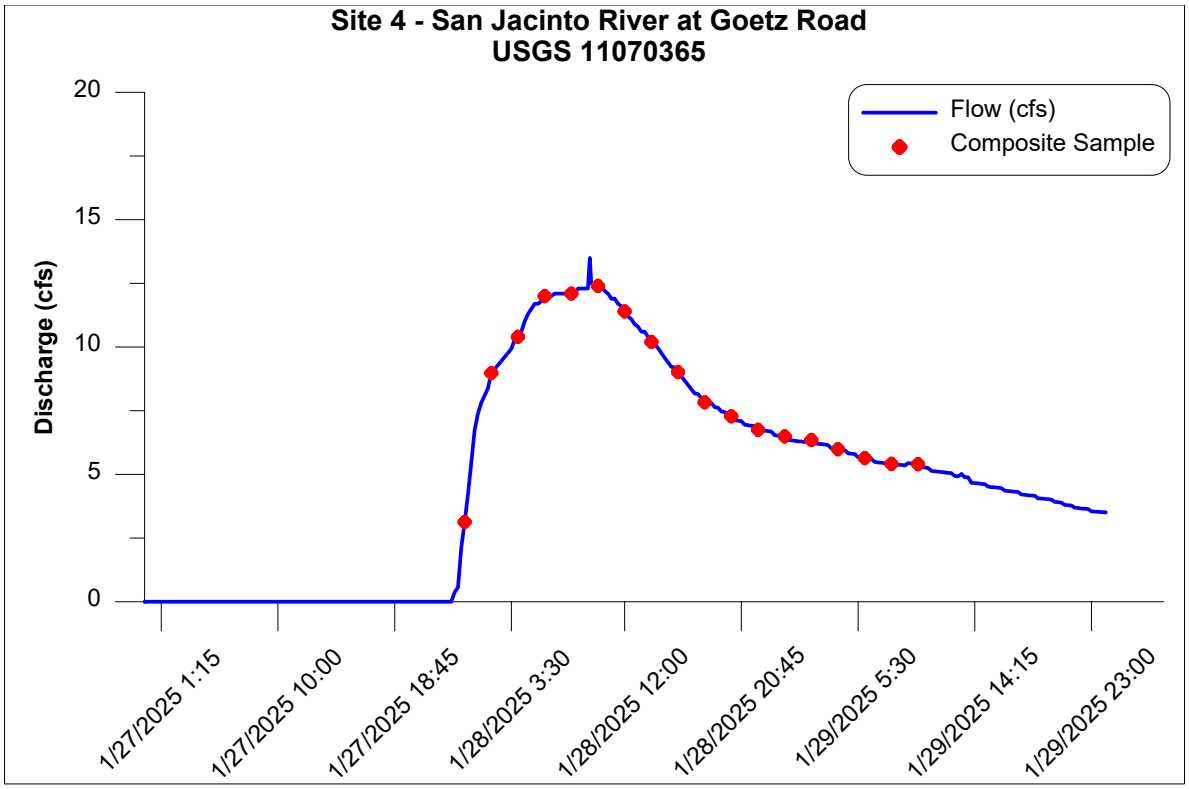


Figure 2-16. Hydrograph of First Storm Event at San Jacinto River at Goetz Road (January 28-29, 2025)

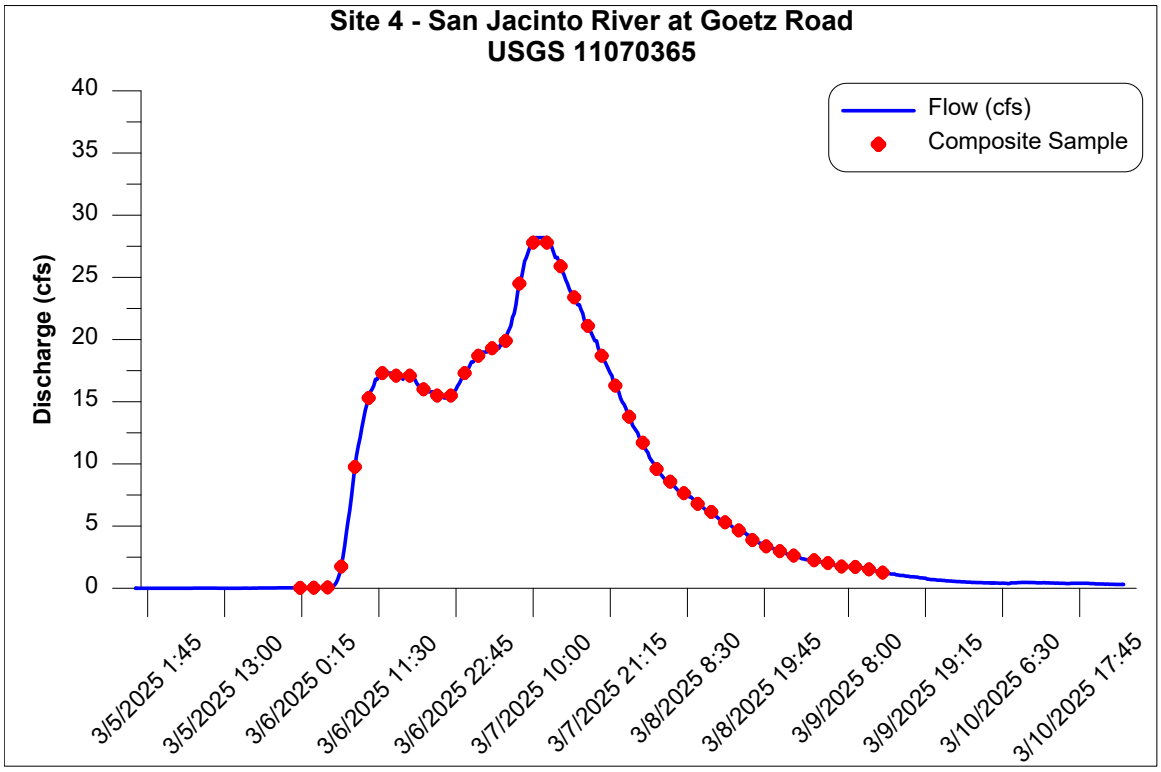


Figure 2-17. Hydrograph of Second Storm Event at San Jacinto River at Goetz Road (March 7-9, 2025)

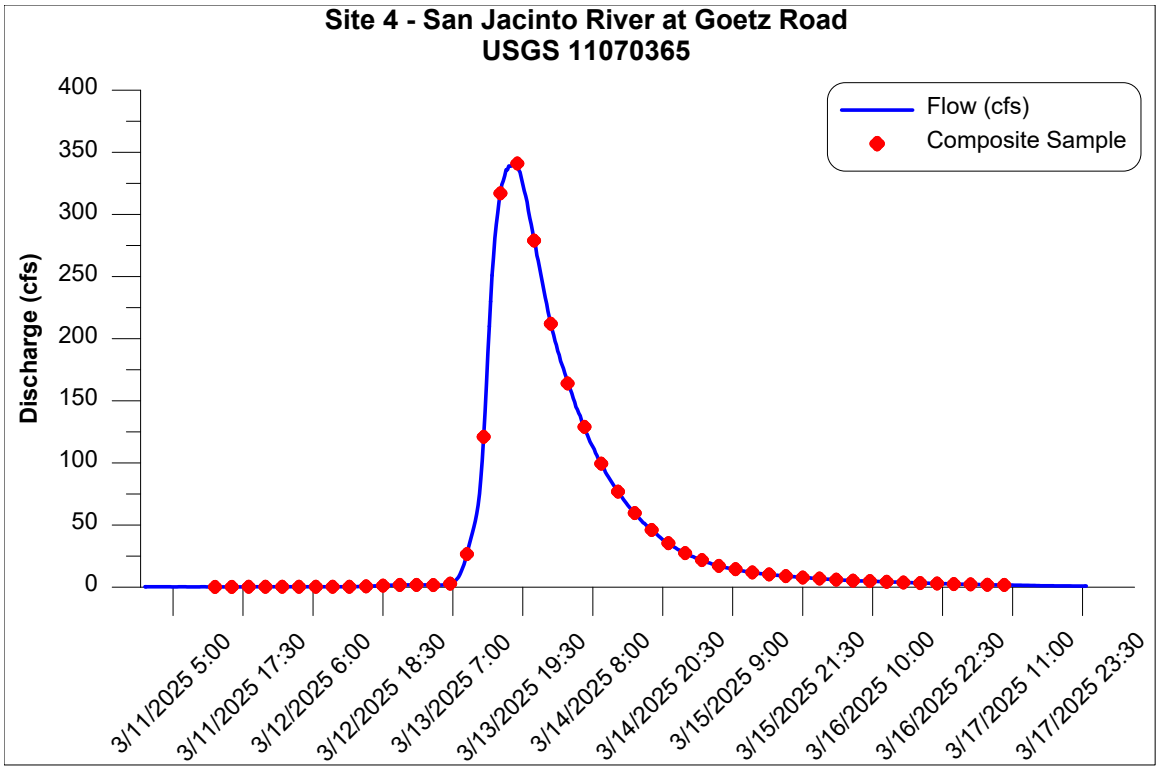


Figure 2-18. Hydrograph of Third Storm Event at San Jacinto River at Goetz Road (March 11-17, 2025)

2.8.3 Summary of Monitoring Data – San Jacinto River at Ramona Expressway

Mystic Lake did not overflow during the wet weather monitoring period from October 1, 2024, to May 31, 2025. Therefore, no samples were collected from the sampling station at San Jacinto River at Ramona Expressway (Station ID 741) during the 2024-2025 monitoring year.

2.8.4 Summary of Monitoring Data – Canyon Lake Spillway

Water quality samples were collected during two storm events at Canyon Lake Spillway (Station ID 841) during the wet weather monitoring period from October 1, 2024, to May 31, 2025.

During the storm event on March 7-10, 2025, a total of 43 discrete time-weighted samples were collected across the hydrograph at two-hour intervals for the period that flows exited Canyon Lake during the monitoring event (i.e., the water level in Canyon Lake was actively cresting the spillway) and a single flow-weighted composite sample was submitted for analysis. Based on data provided by the nearby USGS stream gauge (Station ID 11070500), flow for the storm event was estimated at 471 acre-feet or 132 Mgal, which represents approximately 12.3% of the total annual inflow to Lake Elsinore from Canyon Lake.

During the storm event on March 13-17, 2025, a total of 33 discrete time-weighted samples were collected across the hydrograph at three-hour intervals for the period that flows exited Canyon Lake during the monitoring event (i.e., the water level in Canyon Lake was actively cresting the spillway) and a single flow-weighted composite sample was submitted for analysis. Based on data

provided by the nearby USGS stream gauge (Station ID 11070500), flow for the storm event was estimated at 2,032 acre-feet or 569 Mgal, which represents approximately 53.2% of the total annual inflow to Lake Elsinore from Canyon Lake.

Note that this USGS stream gauge is located below the Canyon Lake Dam at a location that does occasionally capture other flows from the surrounding local watershed. The flows from Canyon Lake do not include runoff from the local surrounding watershed into Lake Elsinore. Photos taken during the storm events are provided in **Figure 2-19** through **Figure 2-20**.

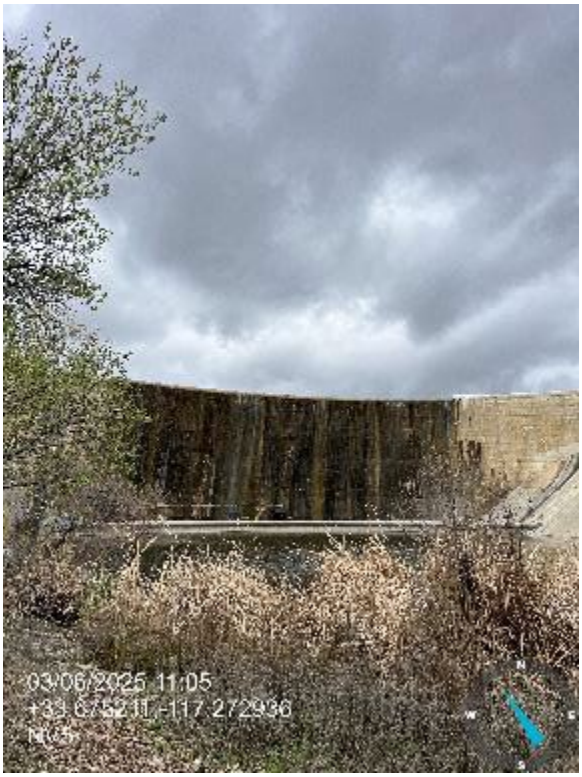


Figure 2-19. Storm Event Sampling Below the Canyon Lake Spillway (March 6, 2025)

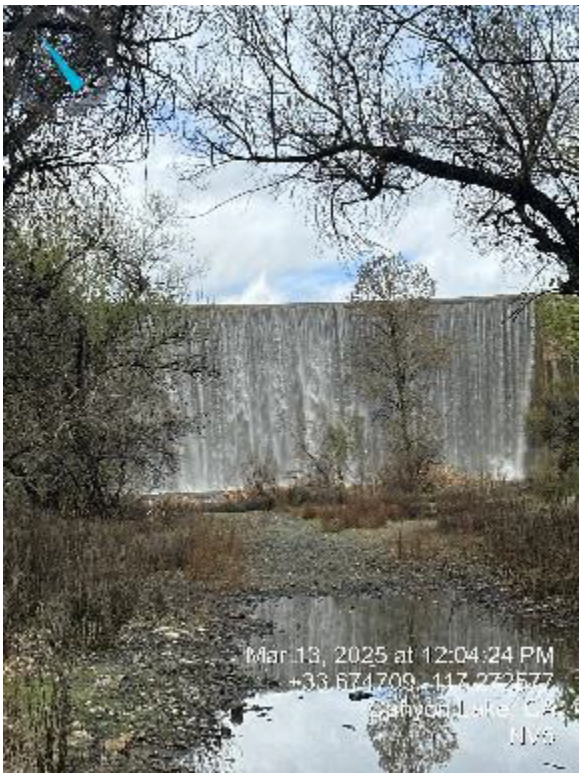


Figure 2-20. Storm Event Sampling Below the Canyon Lake Spillway (March 13, 2025)

Event and annual mean concentrations of each analyte are presented in **Table 2-11**. Event and annual loads for each analyte are presented in **Table 2-12**. Concentrations of nutrients for the three storm events ranged from 0.93 to 0.99 mg/L for total nitrogen and 0.098 to 0.10 mg/L for total phosphorus (**Table 2-11**). Based on flow data provided by the nearby USGS stream gauge (Station ID 11070500), the total annual flow was estimated at 143,075,097 cf or 1,070 Mgal for the period of July 1, 2024, through June 30, 2025. The USGS stream gauge (Station ID 11070500) located downstream of the Canyon Lake Spillway (Station ID 841) sampling location has minimal dry weather flow and storm flows account for the vast majority of the estimated annual load of nutrients exiting Canyon Lake. The estimated annual nutrient load was calculated to be 3,840 kg for total nitrogen and 403 kg for total phosphorus **(Table 2-12**) for the period of July 1, 2024, through June 30, 2025.

Hydrographs with the discrete time-weighted sample aliquot times are provided in **Figure 2-22** through **Figure 2-23**. The figure was developed based on flow data provided by the nearby USGS stream gauge (Station ID 11070365). A hydrograph of the Canyon Lake Level at Railroad Canyon Dam Spillway compared to the spillway elevation is provided in **Figure 2-24**.

Table 2-11. Water Quality Concentrations at Canyon Lake Spillway

Analyte	Units	Event 1	Event 2	Annual Mean	Annual Geomean
Ammonia-Nitrogen	mg/L	0.023 (J)	ND (<0.017) [a]	0.02 [b]	0.023 [b]
Chemical Oxygen Demand	mg/L	22.0	25.0	23.5	23.5
Kjeldahl Nitrogen	mg/L	0.93	0.93	0.93	0.93
Nitrate as N	mg/L	0.06 (J)	ND (<0.040) [a]	0.06 [b]	0.06 [b]
Nitrite as N	mg/L	ND (<0.042)[a]	ND (<0.042) [a]	[b]	[b]
Organic Nitrogen	mg/L	0.90	0.93	0.92	0.915
Total Nitrogen	mg/L	0.99	0.93	0.96	0.960
Total Phosphorus	mg/L	0.098	0.10	0.10	0.099
Ortho Phosphate Phosphorus	mg/L	0.014	0.008 (J)	0.01	0.011
Total Dissolved Solids	mg/L	530	500	515	514.78
Total Hardness	mg/L	263	232	247.5	247.01
Total Suspended Solids	mg/L	9	13	11	10.8

ND = not detected (analyte not detected at the indicated method detection limit (MDL)).
J- Reported value was detected above the MDL, but below the RL.
a – When the result was ND the detection limit is shown in parenthesis.
b –The annual average value for compliance purposes was calculated by converting non-detect (ND) values to zero. If the result of the calculated mean was non-zero but below the corresponding MDL, the average value was reported as ND.

Table 2-12. Water Quality Event and Annual Loads at Canyon Lake Spillway

Analyte	Units	Load Event 1	Load Event 2	Annual Load
Ammonia-Nitrogen	kg	11	- [a]	44
Chemical Oxygen Demand	kg	10,982	53,849	97,691
Kjeldahl Nitrogen	kg	464	2,003	3,768
Nitrate as N	kg	30	- [a]	114
Nitrite as N	kg	- [a]	- [a]	- [a]
Organic Nitrogen	kg	449	2,003	3,732
Total Nitrogen	kg	494	2,003	3,840
Total Phosphorus	kg	49	215	403
Ortho Phosphate Phosphorus	kg	7	17	40
Total Dissolved Solids	kg	264,576	1,076,979	2,061,668
Total Hardness	kg	131,289	499,718	977,082
Total Suspended Solids	kg	4,493	28,001	47,875

a - When a concentration was non-detect, the load value for compliance purposes was calculated by converting non-detect (ND) values to zero.

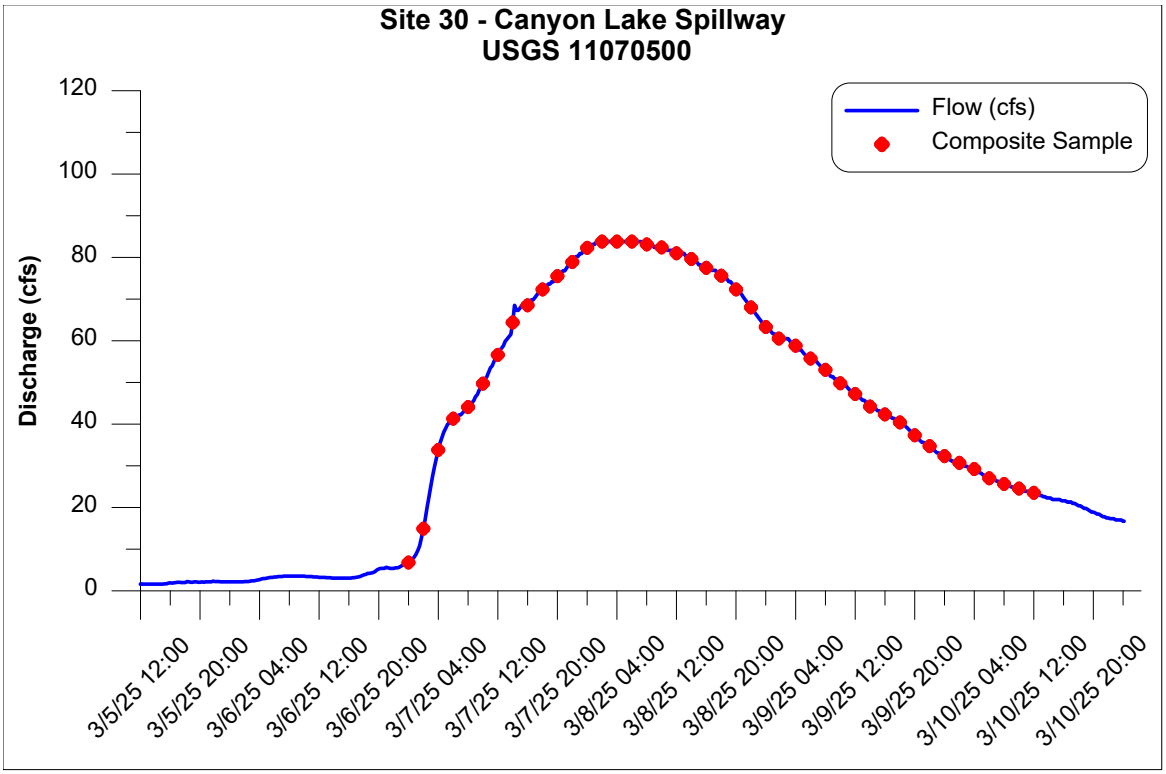


Figure 2-22. Hydrograph of First Storm Event at Canyon Lake Spillway (March 7-10, 2025)

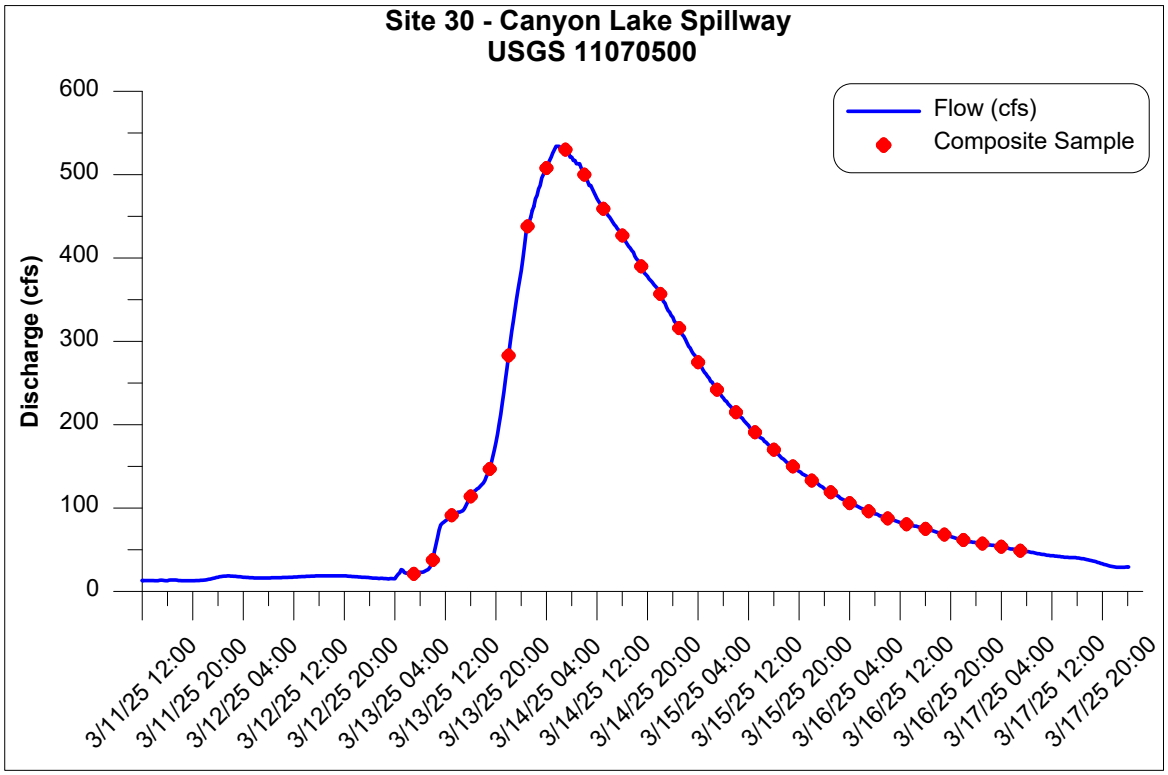


Figure 2-23. Hydrograph of Second Storm Event at Canyon Lake Spillway (March 13-17, 2025)

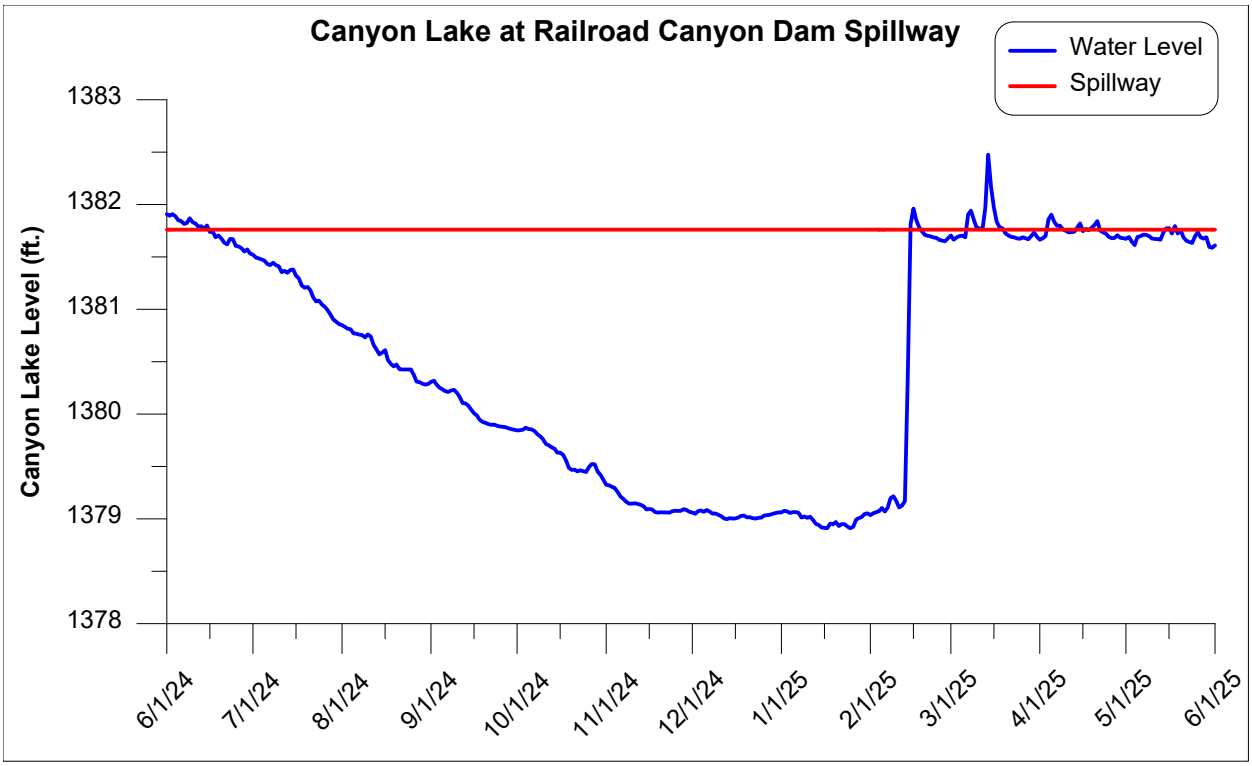


Figure 2-24. Canyon Lake Level at Railroad Canyon Dam Spillway

2.9 San Jacinto River Watershed Rainfall Records

The RCFC&WCD maintains rainfall records for rain gauges located within or near the San Jacinto River Watershed as shown in **Table 2-13**.

Table 2-13. San Jacinto River Watershed Rainfall Gauges

Station ID	Station Description	Latitude	Longitude	Elevation (ft.)
67	Lake Elsinore	33.668712	-117.332380	1281
152	Perris	33.786980	-117.231831	1494
155	Perris / Moreno Valley – Pigeon Pass	33.987703	-117.270221	1902
186	Hemet / San Jacinto	33.787067	-116.959024	1554
248	Winchester	33.702903	-117.090382	1466

Rainfall data recorded at these five stations for the period July 1, 2024, through June 30, 2025, are summarized in **Table 2-14**.

Table 2-14. Summary Rainfall Data (July 2024 to June 2025)

Monthly Rainfall (inches)	Lake Elsinore	Perris CDF	Pigeon Pass	Hemet / San Jacinto	Winchester
Jul	0.00	0.00	0.00	0.00	0.00
Aug	0.01	0.00	0.00	0.00	0.00
Sep	0.40	0.53	0.71	0.20	0.45
Oct	0.03	0.00	0.21	0.00	0.00
Nov	0.00	0.00	0.22	0.00	0.00
Dec	0.00	0.00	0.00	0.00	0.00
Jan	0.56	0.60	0.62	0.69	0.71
Feb	1.84	1.91	2.38	1.87	1.55
Mar	2.11	2.08	2.49	2.42	2.68
Apr	0.18	0.08	0.15	0.11	0.15
May	0.12	0.19	1.29	0.49	0.13
Jun	0.21	0.11	0.02	0.03	0.30
Annual Rainfall (inches)	**5.46**	**5.50**	**8.09**	**5.81**	**5.97**

3.0 In-Lake Monitoring

3.1 Background

Routine in-lake monitoring began in 2006 through a collaborative effort between local stakeholders and the California Regional Water Quality Control Board, Santa Ana Region (RWQCB). Initially, sampling was conducted at three open-water sites on Lake Elsinore and four sites on Canyon Lake. The monitoring schedule included monthly sampling from October through May and biweekly sampling from June through September. Grab samples were collected at the surface, within the water column, or as depth-integrated samples, depending on the lake and the specific analytes being measured.

In 2011–2012, modifications to the monitoring program were adopted under RWQCB Resolution No. R8-2011-0023. These changes reduced the number of sampling stations to one in Lake Elsinore and four in Canyon Lake for analytical chemistry. This decision was based on a review of existing data, which showed consistent nutrient concentrations and physical water quality parameters across the original sites in Lake Elsinore and the East Basin of Canyon Lake. The resulting cost savings enabled a reallocation of resources toward implementing strategies to reduce nutrient impacts in both lakes, as outlined in the same resolution.

Monitoring activities were temporarily suspended during the 2013–2014 and 2014–2015 monitoring years to further prioritize the implementation of in-lake best management practices. Sampling resumed in the 2015–2016 monitoring year and continues to be a critical component for evaluating progress toward achieving nutrient Total Maximum Daily Load (TMDL) targets, including the calculation of annual and 10-year running averages.

The following sections detail the monitoring methods and results for Lake Elsinore and Canyon Lake during the 2024–2025 monitoring year.

3.2 Historical In-Lake Monitoring Concentrations

A summary of TMDL water quality monitoring data parameters of interest during the period of January 1, 2011, through June 30, 2025 is presented in **Tables 3-1 and 3-2**. These tables present historical calendar-year annual means since 2011 for each of the numeric targets outlined in the 2004 TMDL. The tables also present the 10-year running average for each parameter and the number of annual means (total nitrogen, total phosphorus, dissolved oxygen, and chlorophyll-a) and individual samples (total ammonia) within each 10-year period that did not achieve the TMDL target.

Table 3-1. Summary of Historical TMDL Data for Lake Elsinore Based on Calendar Year [1]

Parameter	2020 TMDL Target	Calendar Year	Number of Samples Collected	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025 [a]
Total Phosphorus[b]	<0.1 mg/L (Annual Average)	2011	14	**0.294**	mg/L	0.246 (100%)	0.238 (100%)	0.236 (100%)	0.234 (100%)	0.228 (100%)	0.204 (100%)
		2012	9	**0.162**							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	**0.383**							
		2016	8	**0.416**							
		2017	8	**0.181**							
		2018	8	**0.162**							
		2019	8	**0.154**							
		2020	8	**0.219**							
		2021	8	**0.227**							
		2022	8	**0.146**							
		2023	8	**0.221**							
		2024	8	**0.167**							
		2025	3	**0.145**							
Total Nitrogen[b]	<0.75 mg/L (Annual Average)	2011	14	**3.88**	mg/L	4.91 (100%)	4.97 (100%)	5.18 (100%)	5.05 (100%)	4.82 (100%)	4.46 (100%)
		2012	9	**3.32**							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	**6.10**							
		2016	8	**7.28**							
		2017	8	**4.68**							
		2018	8	**5.56**							
		2019	8	**4.50**							
		2020	8	**3.99**							

Parameter	2020 TMDL Target	Calendar Year	Number of Samples Collected	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025 [a]
		2021	8	**4.30**							
		2022	8	**5.00**							
		2023	8	**4.05**							
		2024	8	**2.76**							
		2025	3	**2.50**							
Total Ammonia[c]	Exceedance Thresholds Calculated from Site Specific Water Quality Conditions During each Event	2011	15	0.049	mg/L	0.180 (2004-CMC: 0%; CCC: 10%)	0.199 (2004-CMC: 0%; CCC: 13%)	0.218 (2004-CMC: 0%; CCC: 15%)	0.232 (2004-CMC: 0%; CCC: 16%)	0.259 (2004-CMC: 0%; CCC: 20%)	0.252 (2004-CMC: 0%; CCC: 19%)
		2012	9	0.096							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	0.357							
		2016	8	0.176							
		2017	8	0.124							
		2018	8	0.097							
		2019	8	0.229							
		2020	8	0.312							
		2021	8	0.199							
		2022	8	0.253							
		2023	8	0.339							
		2024	8	0.506							
		2025	3	0.290							

Table 3-1 (cont.). Summary of Historical TMDL Data for Lake Elsinore Based on Calendar Year [1]

Parameter	2020 TMDL Target	Calendar Year	Number of Samples Collected	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025 [a]
Depth-Integrated Chlorophyll -a (Summer)[d]	≤ 25 mg/L (Summer Average)	2011	8	**169**	µg/L	186 (100%)	183 (100%)	174 (100%)	169 (100%)	159 (100%)	130 (100%)
		2012	2	**200**							
		2013	NA	NA							
		2014	NA	NA							
		2015	1	**326**							
		2016	4	**258**							
		2017	4	**148**							
		2018	4	**87**							
		2019	4	**89**							
		2020	2	**212**							
		2021	3	**147**							
		2022	4	**122**							
		2023	4	**129**							
		2024	4	**71**							
		2025	1	**34**							
Dissolved Oxygen (1-m from lake bottom)[b]	>5 mg/L 1-m from lake bottom	2011	15	**3.4**	mg/L	3.7 (100%)	3.6 (100%)	3.4 (100%)	3.6 (100%)	3.5 (100%)	3.4 (100%)
		2012	8	**4.8**							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	**2.9**							
		2016	8	**4.2**							
		2017	8	**4.9**							
		2018	8	**3.2**							
		2019	8	**3.3**							
		2020	8	**2.8**							

Parameter	2020 TMDL Target	Calendar Year	Number of Samples Collected	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025 [a]
		2021	8	**2.7**							
		2022	8	**3.6**							
		2023	8	**4.7**							
		2024	8	**3.0**							
		2025	3	**1.4**							

Notes:
mg-milligram; ug- microgram; L-liter; m-meter,
CCC- Criterion Continuous Concentration; CMC- Criterion Maximum Concentration
Values in Bold indicate an exceedance of one or more TMDL criteria
The CCC and CMC were calculated using the 2004 TMDL formulas.
1- Reported values and compliance summary based on sampling at the central sampling location in Lake Elsinore (LE02).
a- includes data January 2016 - June 2025.
b- exceedance frequency based on annual mean
c- exceedance frequency based on individual samples exceeding corresponding sample-specific CMC or CCC
d- exceedance frequency based on summer mean
NA - not applicable, data not collected in 2013-2014

Table 3-2. Summary of Historical TMDL Data for Canyon Lake Based on Calendar Year [1]

Parameter	2020 TMDL Target	Calendar Year	Number of Sampling Events	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025[a]
Total Phosphorus[b]	<0.1 mg/L (Annual Average)	2011	15	**0.850**	mg/L	0.244 (70%)	0.167 (60%)	0.138 (50%)	0.125 (50%)	0.121 (50%)	0.122 (50%)
		2012	8	**0.327**							
		2013	2	**0.266**							
		2014	15	**0.246**							
		2015	7	0.084							
		2016	7	0.099							
		2017	6	**0.249**							
		2018	6	0.038							
		2019	6	**0.146**							
		2020	6	**0.133**							
		2021	6	0.084							
		2022	6	0.036							
		2023	6	**0.138**							
		2024	6	**0.206**							
		2025	3	0.094							
Total Nitrogen[b]	<0.75 mg/L (Annual Average)	2011	15	**1.57**	mg/L	1.59 (100%)	1.65 (100%)	1.53 (100%)	1.51 (100%)	1.52 (100%)	1.53 (100%)
		2012	8	**2.41**							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	**1.50**							
		2016	7	**1.47**							
		2017	6	**1.30**							
		2018	6	**1.37**							
		2019	6	**1.50**							
		2020	6	**1.62**							

Parameter	2020 TMDL Target	Calendar Year	Number of Sampling Events	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025[a]
		2021	6	**2.06**							
		2022	6	**1.43**							
		2023	6	**1.31**							
		2024	6	**1.63**							
		2025	3	**1.58**							
Total Ammonia[c]	Exceedance Thresholds Calculated from Site Specific Water Quality Conditions During each Event	2011	14	0.765	mg/L	0.444 (CMC: 0%; CCC: 6%)	0.437 (CMC: 0%; CCC: 4%)	0.444 (CMC: 0%; CCC: 5%)	0.446 (CMC: 0%; CCC: 5%)	0.465 (CMC: 0%; CCC: 5%)	0.469 (CMC: 0%; CCC: 5%)
		2012	8	0.251							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	0.577							
		2016	7	0.270							
		2017	6	0.301							
		2018	6	0.326							
		2019	6	0.471							
		2020	6	0.593							
		2021	6	0.707							
		2022	6	0.305							
		2023	6	0.467							
		2024	6	0.633							
		2025	3	0.614							

Table 3-2 (cont.). Summary of Historical TMDL Data for Canyon Lake Based on Calendar Year [1]

Parameter	2020 TMDL Target	Calendar Year	Number of Sampling Events	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025[a]
Depth-Integrated Chlorophyll-a [b]	< 25 µg/L (Annual Average)	2011	15	**52.7**	µg/L	43.0 (80%)	39.9 (70%)	35.5 (70%)	31.6 (60%)	28.3 (50%)	24.8 (50%)
		2012	8	**69.3**							
		2013	2	**59.5**							
		2014	15	**56.8**							
		2015	3	**60.2**							
		2016	7	**29.7**							
		2017	6	**29.4**							
		2018	6	**27.9**							
		2019	6	21.6							
		2020	6	22.7							
		2021	6	21.8							
		2022	6	**25.4**							
		2023	8	20.5							
		2024	6	24.3							
		2025	3	**25.2**							
Dissolved Oxygen (Hypolimnion) [b]	>5 mg/L Hypo (Daily Average)	2011	11	**0.3**	mg/L	0.9 (100%)	0.9 (100%)	0.8 (100%)	0.7 (100%)	0.7 (100%)	0.3 (100%)
		2012	6	**0.8**							
		2013	NA	NA							
		2014	NA	NA							
		2015	3	**4.0**							
		2016	7	**1.3**							
		2017	5	**0.3**							
		2018	5	**0.4**							
		2019	4	**0.2**							
		2020	3	**0.03**							

Parameter	2020 TMDL Target	Calendar Year	Number of Sampling Events	Annual Average	Units	Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target					
						2011-2020	2012-2021	2013-2022	2014-2023	2015-2024	2016-2025[a]
		2021	4	**0.2**							
		2022	4	**0.3**							
		2023	3	**0.0**							
		2024	6	**0.5**							
		2025	3	**0.1**							

Notes:
mg-milligram; ug- microgram; L-liter; m-meter,
CCC- Criterion Continuous Concentration; CMC- Criterion Maximum Concentration
Values in Bold indicate an exceedance of one or more TMDL criteria
The CCC and CMC were calculated using 2004 TMDL formulas.
1- Reported values and compliance summary based on a lake-wide average for each sampling date (Sites CL07, CL08, CL09, and CL10)
a- includes data January 2016 - June 2025.
b- exceedance frequency based on annual means
c- exceedance frequency based on individual samples exceeding corresponding sample-specific CMC or CCC
NA - not applicable, data not collected in 2013-2014

3.3 Lake Elsinore Monitoring

3.3.1 Sampling Station Locations and Frequency

To maintain consistency and facilitate the assessment of trends toward meeting compliance goals, the in-lake monitoring design was resumed in July 2015 using the three former stations outlined in the approved Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan (LESJWA, 2006; **Figure 3-1**, **Table 3-3**). Analytical chemistry samples and in-situ water column profile readings were collected at Site LE02, while only in-situ water column profile readings were performed at the remaining two stations (LE01 and LE03). Profile readings for all three stations were taken in both the morning and afternoon. Water chemistry samples collected at Site LE02 were analyzed for those constituents outlined in **Table 3-4**. Sampling in Lake Elsinore was conducted monthly during summer months (June-September) and bi-monthly (i.e., every other month) for the remainder of the monitoring year, for a total of eight sampling events per year. In-lake TMDL sampling events were coordinated to correspond with satellite overpass dates to facilitate the comparison of in-lake and satellite derived chlorophyll-a data (see Section 3.4).

Table 3-3. Lake Elsinore TMDL Monitoring Locations

Site	Latitude	Longitude
LE01	33.668978°	-117.364185°
LE02	33.663344°	-117.354213°
LE03	33.654939°	-117.341653°

Table 3-4. In-lake Analytical Constituents and Methods for Lake Elsinore

Parameter	Analysis Method	Sampling Method
Analytical Chemistry		
Nitrite Nitrogen (NO_2-N)	EPA 353.2	Depth Integrated
Nitrate Nitrogen (NO_3-N)	EPA 353.2	Depth Integrated
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	Depth Integrated
Total Nitrogen (TN)[1]	Calculated	Depth Integrated
Ammonia Nitrogen (NH4-N)	EPA 350.1	Depth Integrated
Sulfide	SM 4500S2 D	Depth Integrated
Total Phosphorus (TP)	EPA 365.3	Depth Integrated
Soluble Reactive Phosphorus (SRP / Ortho-P)	EPA 365.3, EPA 353.2	Depth Integrated
Chlorophyll-a	SM 10200H	Surface (0-2m) & Depth Integrated
Total Dissolved Solids (TDS)	SM 2540 C	Depth Integrated

US EPA - United States Environmental Protection Agency; m- meter; SM- standard method
[1] Total Nitrogen calculated as TKN+NO_2+NO_3

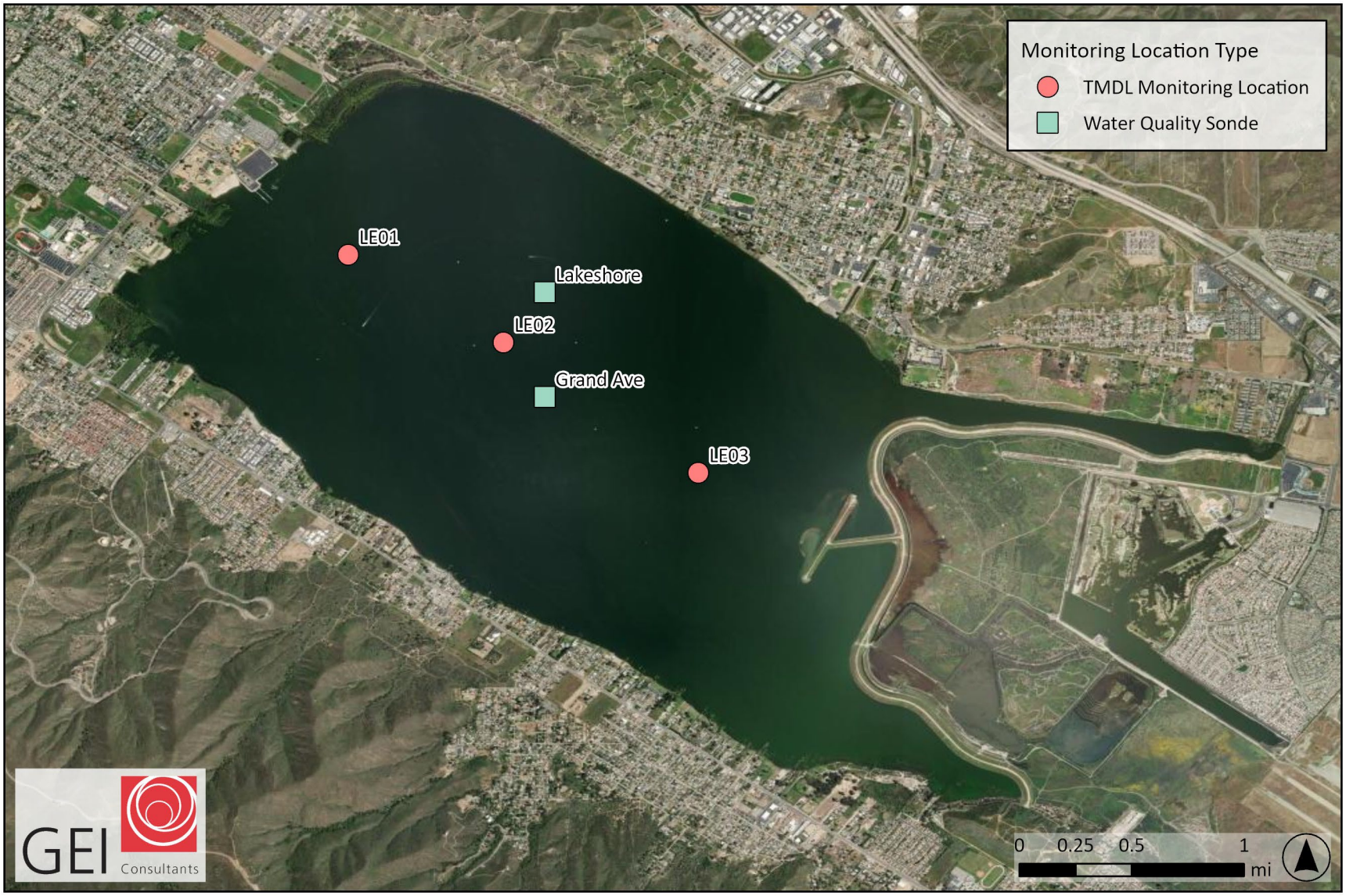


Figure 3-1. Lake Elsinore TMDL Sampling Locations

3.3.2 Sampling Methods

Depth-integrated composite samples for analytical chemistry were collected at Site LE02 by utilizing a peristaltic pump and lowering/raising an inlet tube through the water column at a uniform speed, creating a composite sample of the entire water column. Two samples were collected for chlorophyll-a: 1) a full depth-integrated composite sample as described above; and 2) a 0-2-meter (m) depth-integrated composite surface sample. All samples for chemical analysis were placed on wet ice immediately following collection and transferred to a local courier or shipping company on the same day as the collection. Samples for analysis of nutrients, ammonia, sulfide, and total dissolved solids (TDS) were submitted to Weck Laboratories Inc., located in City of Industry, California. Samples for analysis of chlorophyll-a were submitted to Physis Environmental Laboratories Inc., located in Anaheim, California.

Secchi disk readings for water clarity, as well as in-situ water column profile data, were typically recorded between 8:00 and 11:00 in the morning at all three Lake Elsinore stations using pre-calibrated hand-held YSI field meters or equivalent for pH, temperature, DO, and specific conductivity at 1-m intervals throughout the water column. This data was used to assess lateral and vertical spatial variability within the lake. End-of-the-day water column profiles (i.e., after ~2:00pm) were also recorded for the same in-situ parameters at all three stations to assess any potential temporal variability in these parameters over the course of a day. For water quality reporting purposes, the mean of morning and afternoon in situ measurements were used for each site on each date.

Satellite imagery was used as a tool to remotely measure chlorophyll-a concentrations at the water surface. These images provide a more complete picture of spatial variability that can exist for these two parameters at any given point in time. In-lake sampling dates were selected to correspond with satellite overpasses to enable comparison of analytical laboratory and satellite derived chlorophyll-a concentrations. Processed satellite imagery and associated reports were provided by EOMAP GmbH & co. KG (EOMAP) based in Germany (Castle Seefeld Schlosshof).

3.3.3 Water Quality Summary

A summary of the in-lake monitoring events for Lake Elsinore for the period of July 1, 2024 to June 30, 2025, is presented below. A total of eight Lake Elsinore events were sampled during this period under the TMDL monitoring program, with five occurring in 2024 (July 23, August 15, September 19, October 24 and December 3) and three in 2025 (February 6, April 17 and June 11). Complete monthly water column profile measurements are provided in Appendix B. Detailed analytical chemistry lab reports for each event are contained in Appendix C. Satellite imagery reports for each event are provided in Appendix D. Current data in the context of historical water quality monitoring results from 2002-present are presented in Appendix E.

A summary of mean water column profile values for each site and monitoring event are presented in **Tables 3-5 and 3-6**. Water column mean profile statistics for each site across the entire monitoring period are presented in **Table 3-7**. Mean values for water column measurements for each site, as well as the lake-wide mean are also summarized graphically in **Figures 3-2** through

Table 3-5. In-Situ Water Quality Parameter Measurements in Lake Elsinore – 2024 Monthly Means for Each Site (July – Dec 2024)

Site	Measure	Jul-24		Aug-24		Sep-24		Oct-24		Dec-24	
		Water Column Mean	1m from bottom	Water Column Mean	1m from bottom	Water Column Mean	1m from bottom	Water Column Mean	1m from bottom	Water Column Mean	1m from bottom
LE01	Temp (°C)	29.0	28.6	28.0	27.7	24.3	24.2	21.3	21.0	14.9	14.6
	Cond (µS/cm)	2,685	2,685	2,716	2,719	2,766	2,766	2,872	2,875	2,838	2,839
	pH	*9.05*	*8.92*	*8.99*	*8.86*	*8.57*	*8.53*	*8.69*	*8.55*	*9.04*	*8.97*
	DO (mg/L)	5.28	**1.41**	6.12	**3.36**	2.32	**1.61**	7.21	**4.82**	11.3	10.03
LE02	Temp (°C)	28.8	28.0	27.9	27.4	24.0	23.8	21.3	21.0	15.0	14.8
	Cond (µS/cm)	2,686	2,683	2,730	2,782	2,765	2,765	2,874	2,878	2,840	2,842
	pH	*9.00*	*8.78*	*8.98*	*8.87*	*8.56*	*8.54*	*8.63*	8.43	*9.02*	*8.89*
	DO (mg/L)	4.63	**0.22**	5.67	**2.42**	2.35	**1.72**	6.54	**3.06**	9.78	7.75
LE03	Temp (°C)	28.9	27.5	27.9	27.5	24.1	24.1	21.4	21.2	14.9	14.8
	Cond (µS/cm)	2,687	2,685	2,726	2,720	2,760	2,764	2,876	2,876	2,833	2,833
	pH	*8.98*	8.46	*8.97*	*8.79*	*8.64*	*8.57*	*8.69*	8.43	*9.19*	*9.07*
	DO (mg/L)	4.53	**0.22**	5.25	**0.86**	2.99	**1.65**	6.51	**2.59**	11.00	9.62
Lake-wide Average	Temp (°C)	28.9	28.0	27.9	27.5	24.1	24.0	21.4	21.0	14.9	14.7
	Cond (µS/cm)	2,686	2,684	2,724	2,740	2,763	2,765	2,874	2,876	2,837	2,838
	pH	*9.01*	*8.72*	*8.98*	*8.84*	*8.59*	*8.55*	*8.67*	8.47	*9.08*	*8.97*
	DO (mg/L)	4.81	**0.61**	5.68	**2.21**	2.55	**1.66**	6.75	**3.49**	10.7	9.13

Notes:
°C = degrees Celsius; µS/cm = microSiemens per centimeter; m= meter; mg/L = milligrams per liter
2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L 1m from the bottom
Bold Underline - Indicates not meeting the 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan water quality objective

Table 3-6. In-Situ Water Quality Parameter Measurements in Lake Elsinore – 2025 Monthly Means for Each Site (February – June 2025)

Site	Measure	Feb-25		Apr-25		Jun-25		2024-2025 Mean	
		Water Column Mean	1m from bottom	Water Column Mean	1m from bottom	Water Column Mean	1m from bottom	Water Column Mean	1m from bottom
LE01	Temp (°C)	12.6	11.8	18.0	17.1	25.0	23.2	21.6	21.0
	Cond (µS/cm)	2,797	2,799	2,771	2,776	2,880	2,876	2,791	2,792
	pH	*8.73*	*8.56*	*8.57*	8.15	*8.63*	8.21	*8.78*	*8.59*
	DO (mg/L)	9.74	6.11	6.78	**1.15**	5.28	**0.25**	6.75	**3.59**
LE02	Temp (°C)	12.2	11.2	17.8	16.7	24.6	23.4	21.4	20.8
	Cond (µS/cm)	2,796	2,794	2,773	2,778	2,878	2,876	2,793	2,800
	pH	*8.61*	8.38	8.44	8.05	*8.62*	8.34	*8.73*	*8.53*
	DO (mg/L)	7.75	**3.54**	5.71	**0.28**	4.47	**0.24**	5.86	**2.40**
LE03	Temp (°C)	12.4	11.2	18.5	18.4	24.4	23.4	21.6	21.0
	Cond (µS/cm)	2,802	2,797	2,767	2,770	2,889	2,884	2,793	2,791
	pH	*8.61*	8.32	*8.68*	*8.63*	*8.83*	*8.59*	*8.82*	*8.61*
	DO (mg/L)	7.71	**2.21**	9.43	8.53	5.01	**0.63**	6.55	**3.29**
Lake-wide Average	Temp (°C)	12.4	11.4	18.1	17.4	24.4	23.4	21.5	20.9
	Cond (µS/cm)	2,798	2,797	2,770	2,775	2,890	2,885	2,793	2,795
	pH	*8.65*	8.42	*8.56*	8.28	*8.75*	*8.53*	*8.79*	*8.59*
	DO (mg/L)	8.40	**3.95**	7.31	**3.32**	4.93	**0.54**	6.39	**3.11**

Notes:
°C = degrees Celsius; µS/cm = microSiemens per centimeter; m= meter; mg/L = milligrams per liter
2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L 1m from the bottom
Bold Underline - Indicates not meeting the 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan water quality objective

3-7. The mean of morning and afternoon water quality measurements for any given monitoring event are presented in the tables and figures.

In prior years, the greatest DO concentrations throughout the water column (both water column mean and 1-meter from bottom) have been observed in the winter and early spring across all three monitoring locations. This monitoring year was no different with the highest DO concentrations occurring in the water column and bottom in December and February, with one notable exception of Site LE03. The DO concentration at the bottom dropped from 9.6 mg/L in December 2024 to 2.2 mg/L in February 2025, followed by a sharp increase to 8.5 mg/L in April 2025. These wide fluctuations were not observed at the other two sites which exhibited a more gradual decline in DO concentration across the Spring. This pattern is not unprecedented in Lake Elsinore, as the sharp decline and recovery of DO concentrations at the bottom was also observed at all three sites in the 2023-2024 monitoring period, and at individual sites in previous years.

At Sites LE01 and LE02, the period between February and April marked the onset of DO divergence between the water column mean and the lake bottom, indicating the beginning of stratification as surface waters warmed, supported by concurrent increases in recorded water temperatures. Historically, stratification in the lake typically begins between late March and mid-April. During this same period in 2025, some locations within the watershed received up to 5.5 inches of rainfall. Given Site LE03's proximity to inflows from Canyon Lake, these precipitation events may have disrupted stratification in the southern portion of the lake, while the mid and northern regions had already begun to stratify. At Site LE02, the 12-month rolling mean DO concentration measured 1 meter above the lake bottom ranged from 2.4 to 3.4 mg/L, consistently remaining below the 2020 TMDL target of 5.0 mg/L (**Figure 3-2**).

Conductivity across the lake showed a gradual increase from July to October 2024, rising from a lake-wide average of 2,684 to 2,876 microSiemens per centimeter (µS/cm). Following this peak, conductivity steadily declined each month through April 2025, reaching 2,775 µS/cm. In June 2025, a renewed increase in conductivity was observed, likely driven by elevated water temperatures that enhanced evaporation rates.

The lake wide average water column mean pH for all monitoring events ranged from 8.56 to 9.08, with all sites showing a similar pattern of highest pH in December, and an overall decreasing trend in pH across the monitoring year.

Water clarity, as measured by Secchi disk depth, showed some variability throughout the monitoring year. Clarity peaked at 2.6 feet in July 2024, declined to a low of 1.1 feet in August, and then returned to 2.6 feet by December 2024 (**Figure 3-7**). This trend closely mirrored changes in surface chlorophyll-a concentrations (**Figure 3-10**), as chlorophyll-a levels reached their highest point in August 2024, coinciding with the lowest water clarity. Overall, fluctuations in Secchi depth were inversely related to chlorophyll-a concentrations, with increases in one generally corresponding to decreases in the other.

For further inter-year comparisons of in-situ water quality parameters, **Table 3-7** includes lake-wide averages observed for the current 2024-25 monitoring year, as well as the prior 2020-21, 2021-22, 2022-23, and 2023-24 monitoring years.

Table 3-7. In-Situ Water Quality Parameter Measurements in Lake Elsinore for the Current and Prior Four Monitoring Years

Range	Parameter	Measure	LE01	LE02	LE03	Lake-Wide Averages				
						July 2024-June 2025	July 2023-June 2024	July 2022-June 2023	July 2021-June 2022	July 2020-June 2021
Water Column Mean	Min	Temp (°C)	12.6	12.2	12.4	12.4	13.7	10.7	11.7	13.0
		Cond (µS/cm)	2,685	2,686	2,687	2,686	2,480	2,935	3,610	3,144
		pH	*8.57*	8.44	8.61	8.56	8.16	*8.75*	*8.67*	*8.56*
		DO (mg/L)	2.3	2.3	3.0	2.6	0.3	2.7	1.8	1.9
	Max	Temp (°C)	29.0	28.8	28.9	28.9	27.8	27.9	27.6	27.3
		Cond (µS/cm)	2,880	2,878	2,889	2,890	3,333	4,509	4,127	3,474
		pH	9.05	9.02	9.19	9.08	*8.87*	*9.31*	*9.03*	*9.16*
		DO (mg/L)	11.3	9.8	11.0	10.7	10.2	10.5	10.7	8.5
	Average	Temp (°C)	21.6	21.4	21.6	21.5	21.3	20.6	21.4	21.5
		Cond (µS/cm)	2,791	2,793	2,793	2,793	3,021	3,793	3,819	3,322
		pH	8.78	8.73	8.82	8.79	*8.59*	*8.98*	*8.79*	*8.81*
		DO (mg/L)	6.8	5.9	6.6	6.4	5.7	6.3	5.4	5.1
1m from Bottom	Min	Temp (°C)	11.8	11.2	11.2	11.4	12.8	10.6	11.4	12.9
		Cond (µS/cm)	2,685	2,683	2,685	2,684	2,482	2,942	3,608	3,144
		pH	8.15	8.05	8.32	8.28	7.84	*8.67*	*8.60*	8.50
		DO (mg/L)	0.3	0.2	0.2	**0.5**	**0.1**	**0.5**	**0.3**	**0.2**
	Max	Temp (°C)	28.6	28.0	27.5	28.0	27.8	27.3	27.2	26.8
		Cond (µS/cm)	2,876	2,878	2,884	2,885	3,335	4,509	4,124	3,478
		pH	8.97	8.89	9.07	8.97	*8.74*	*9.27*	*8.98*	*9.07*
		DO (mg/L)	10.0	7.7	9.6	9.1	7.7	9.5	10.5	8.1
	Average	Temp (°C)	21.0	20.8	21.0	20.9	20.7	20.2	21.0	21.0
		Cond (µS/cm)	2,792	2,800	2,791	2,795	3,033	3,794	3,817	3,322
		pH	8.59	8.53	8.61	8.59	8.39	*8.92*	*8.74*	*8.73*
		DO (mg/L)	3.6	2.4	3.3	**3.1**	**2.9**	**4.8**	**3.8**	**3.0**

Notes:
- Individual site values are annual mean, maximum, and minimum statistics for each site in the current monitoring year. Lake wide average values are the mean, maximum, and minimum of the monthly lake wide means.

°C = degrees Celsius; µS/cm = microSiemens per centimeter; m= meter; mg/L = milligrams per liter
2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L in bottom 1m of sampling site
Bold Underline - Indicates not meeting the 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan water quality objective

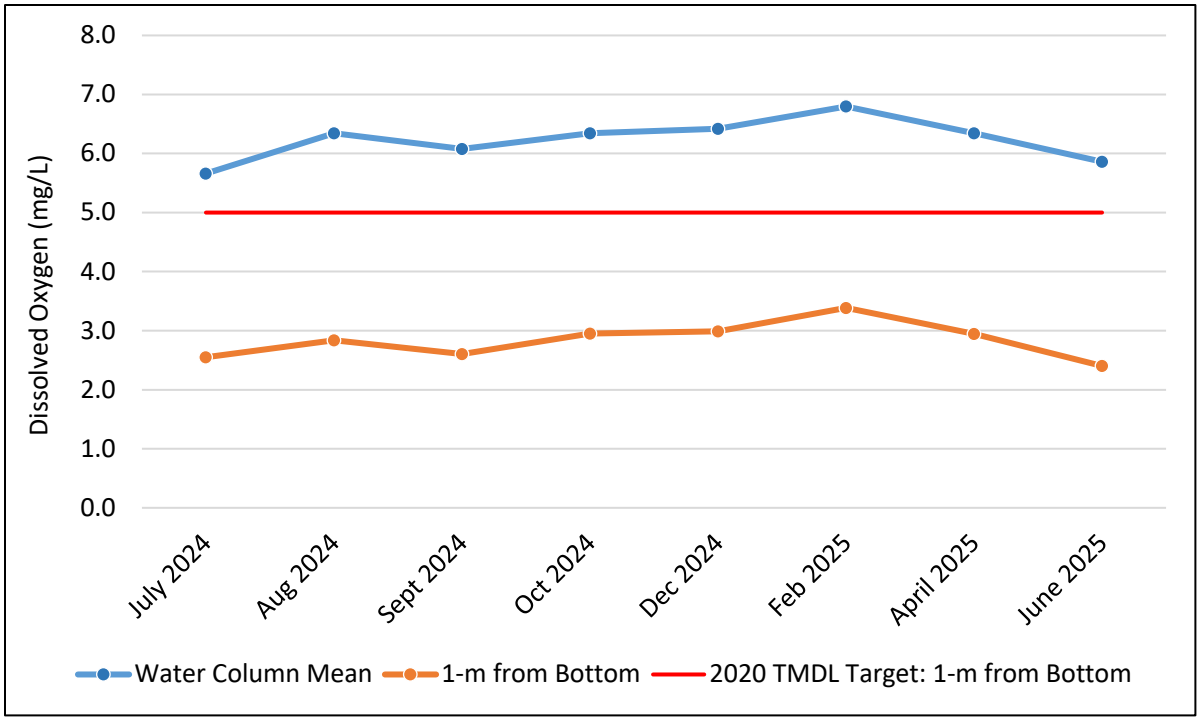


Figure 3-2. Water Column Mean Dissolved Oxygen 12-month Rolling Average – Lake Elsinore for Site LE02

Each data point is calculated by averaging the measurement from each event with the previous seven events (i.e., one year of data) to obtain a rolling average. Therefore, the full graph represents data collected from August 2024 to June 2025.

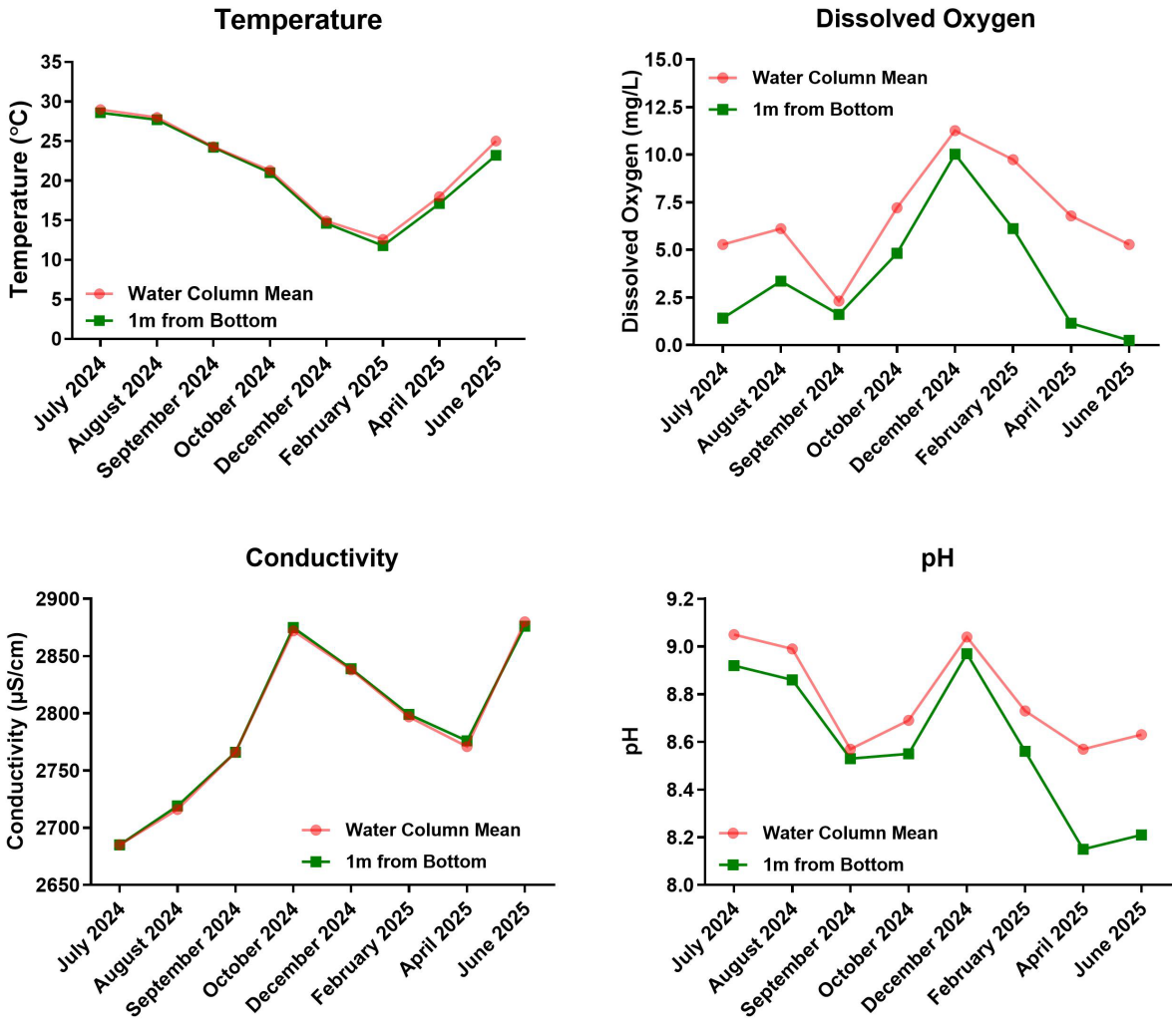


Figure 3-3. In-Situ Physical Water Quality Parameters - Lake Elsinore - Site LE01

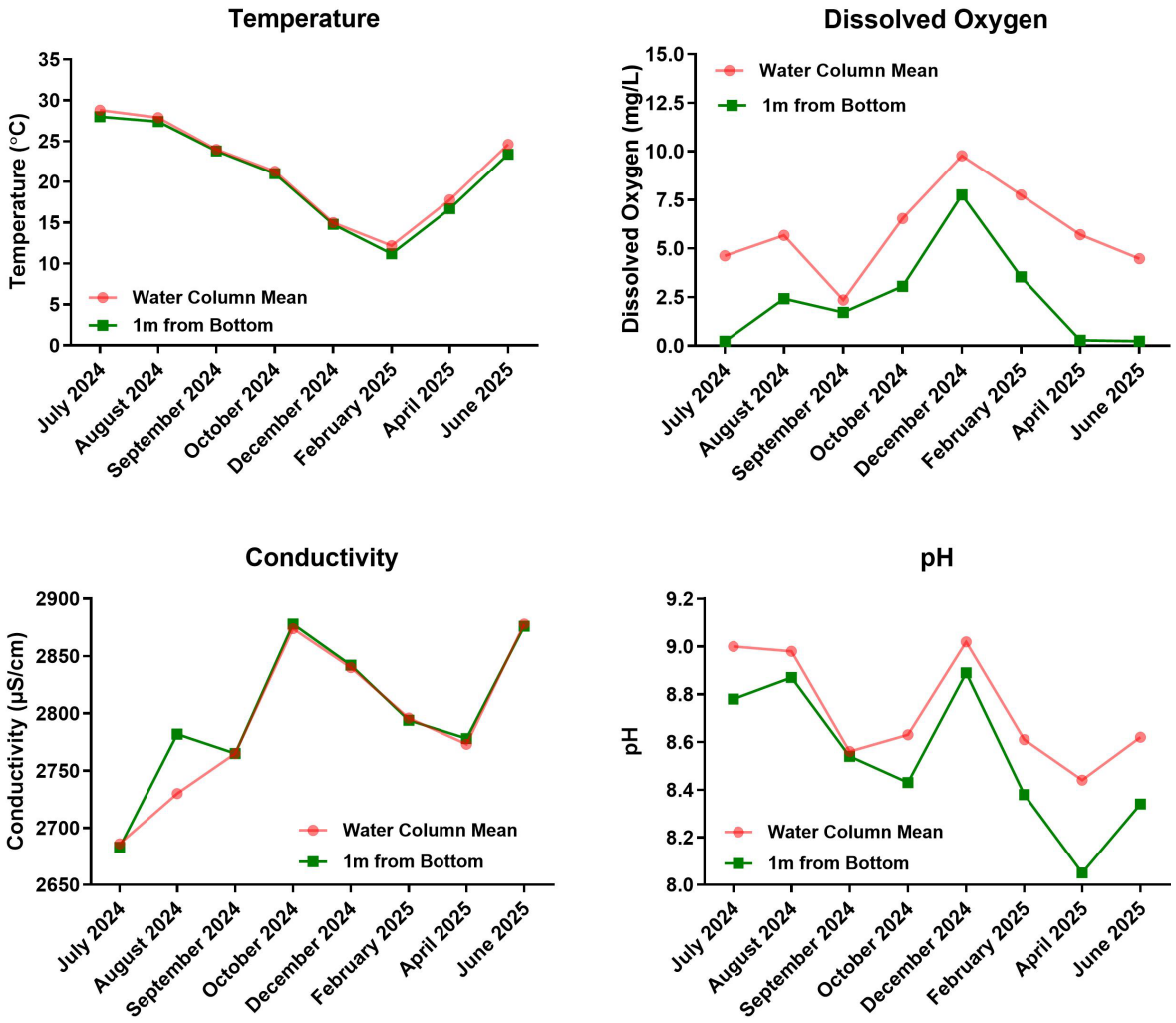


Figure 3-4. In- Situ Physical Water Quality Parameters - Lake Elsinore Site LE02

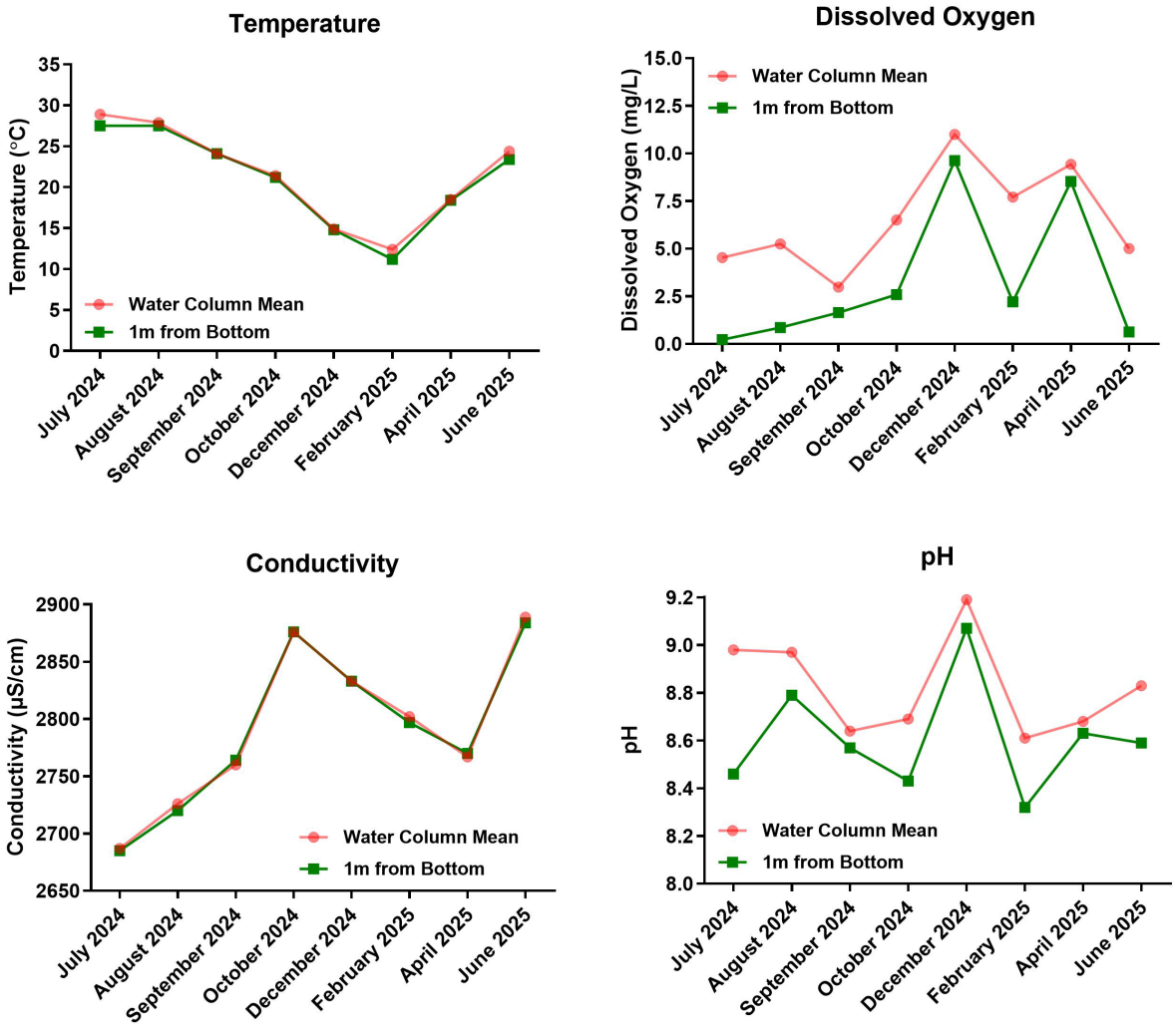


Figure 3-5. In- Situ Physical Water Quality Parameters - Lake Elsinore Site LE03

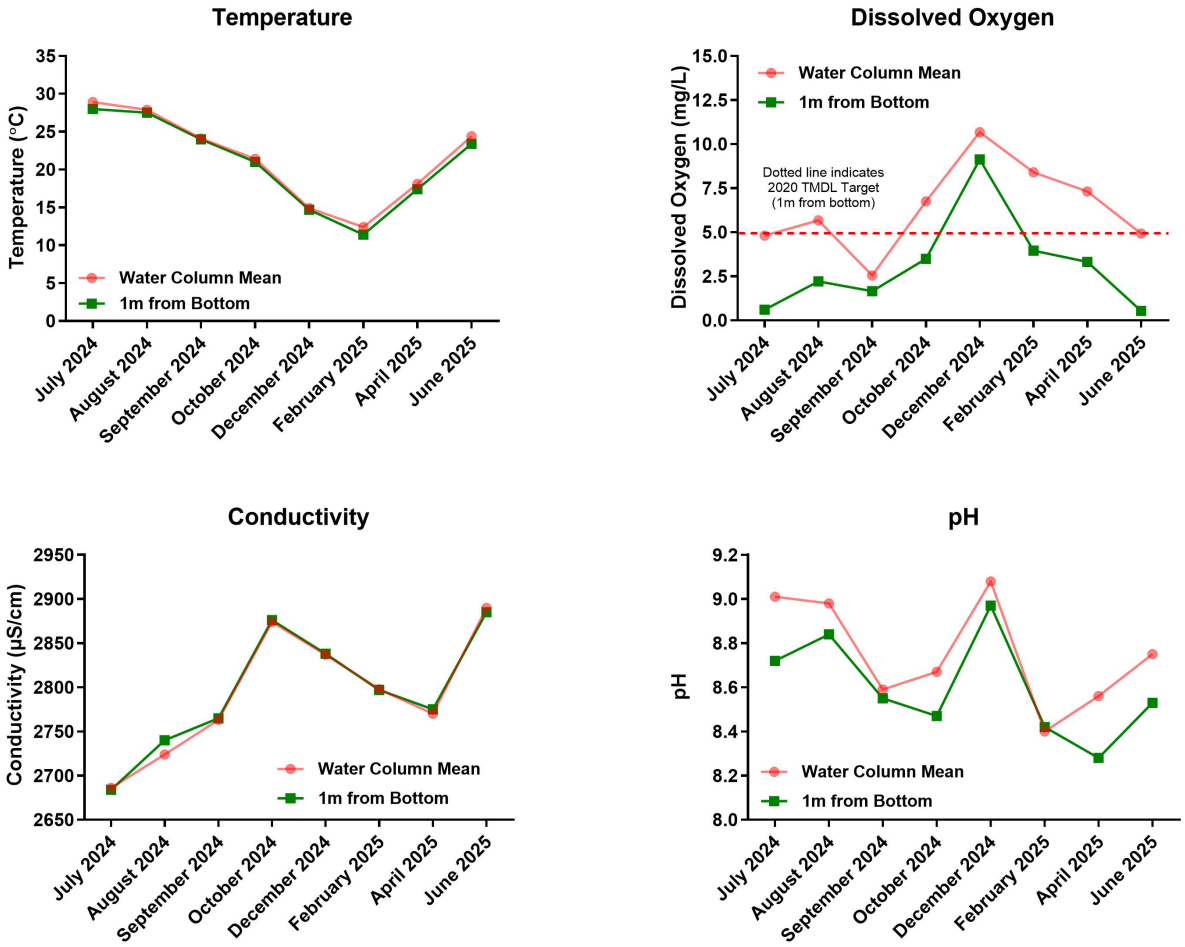


Figure 3-6. Monthly Lake-wide Mean of In-Situ Physical Water Quality Parameters – Mean of All Three Stations

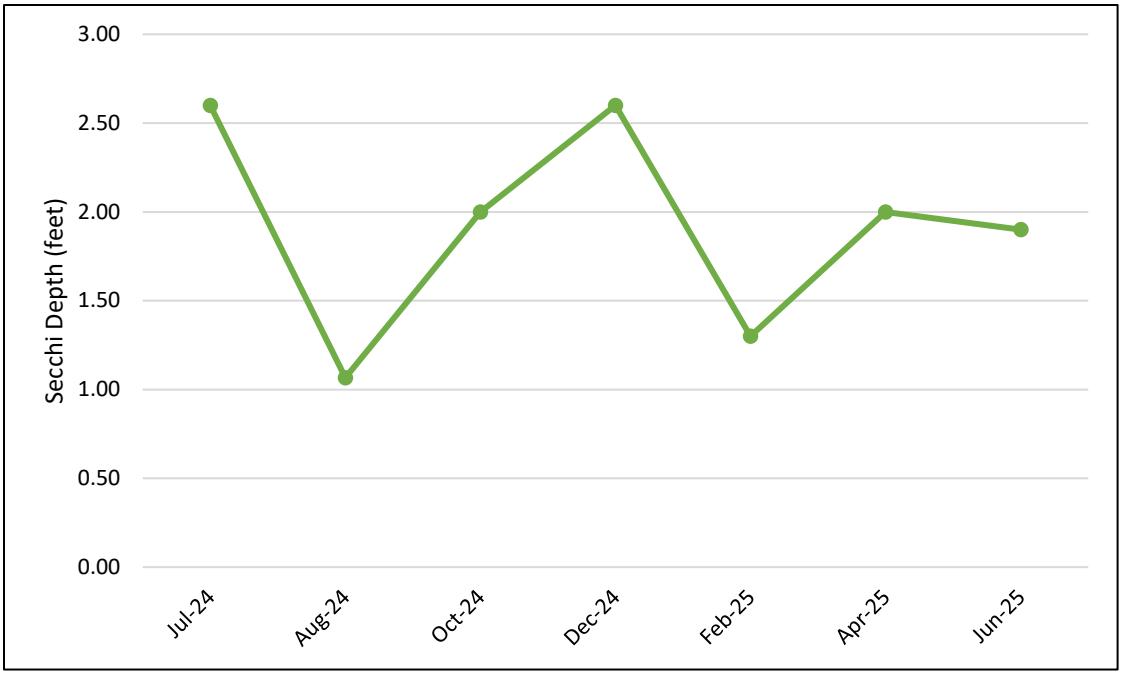


Figure 3-7. In- Situ Water Clarity Using a Secchi Disk - Lake Elsinore Site LE02

Analytical Chemistry

Monthly and annual summary analytical concentrations at Site LE02 are presented in **Tables 3-8 and 3-9**, respectively. Concentrations of analytes at Site LE02 are graphically presented in **Figures 3-8 through 3-10**.

Total nitrogen concentrations rose from 2.2 mg/L in July to 3.0 mg/L in August 2024 but then held relatively steady from August 2024 through February 2025 ranging from 2.9 to 3.2. The remaining monitoring months of April and June exhibited a decreasing trend to a low of 2.0 mg/L (**Figure 3-8**). The annual mean concentration of total nitrogen was 2.7 mg/L (3.5 mg/L in the previous monitoring year). The 1-year rolling average total nitrogen concentration, calculated by averaging the measurement from each event with the previous seven events (i.e., one year of data), exhibited a slight decreasing trend over the monitoring year (**Figure 3-9**), yet remained above the current 2020 TMDL annual target of 0.75 mg/L.

Total phosphorus concentrations varied between 0.09 and 0.2 mg/L across all monitoring events, with an annual mean of 0.14 mg/L (0.23 mg/L the previous year). A gradual decline was observed from July through December 2024, followed by an increase in February 2025, likely driven by stormwater inflows. Concentrations then decreased again in April and June, reaching a monitoring year low of 0.09 mg/L (**Figure 3-8**). The 1-year rolling average also showed a consistent downward trend, dropping from 0.23 to 0.14 mg/L over the monitoring period (**Figure 3-9**). Despite this improvement, the rolling average remained above the 2020 TMDL annual target of 0.10 mg/L.

Total ammonia-N concentrations were variable across the monitoring year, ranging from 0.12 to 0.83 mg/L, with an annual mean of 0.39 mg/L (0.53 mg/L the previous year). Ammonia concentrations showed an increasing trend across late summer and fall to a monitoring year high

of 0.83 mg/L in October 2024, followed by a gradual decline through June 2025 (**Figure 3-8**). Four exceedances of the 2004 TMDL total ammonia Criterion Continuous Concentration (CCC) objective were observed in July (0.23 mg/L), September (0.64 mg/L), October (0.83 mg/L) and December 2024 (0.49 mg/L). No samples exceeded the acute total ammonia Criterion Maximum Concentration (CMC) objective.[3]

Very little change in total dissolved solids (TDS) concentration was observed across the monitoring year, increasing slightly from 1,500 to 1,700 mg/L (**Figure 3-8**).

Surface and depth-integrated chlorophyll-a concentrations largely tracked with each other. Depth-integrated concentrations of chlorophyll-a ranged from 27.2 to 153 µg/L across all eight sampling events, while the surface (0-2m) concentrations ranged from 44.9 to 166 µg/L. Concentrations increased sharply between July and August 2024, followed by an equally sharp decline from August to September (**Figure 3-10**). Chlorophyll-a concentrations then remained in a relatively narrow range for the remainder of the monitoring year for both surface and depth-integrated samples. The mean chlorophyll-a concentration observed in samples collected during the summer months (June 2024 through September 2024) was 71 µg/L for depth-integrated samples and 81 µg/L for surface samples, both exceeding the current 2020 TMDL summer average target of 25 µg/L**.** The mean annual chlorophyll-a concentration across the entire monitoring year was 65 µg/L for depth-integrated samples and 77 µg/L for surface samples**.**

[3]Note that the water quality objectives for total ammonia vary for each sampling event based on site-specific pH, temperature, and salinity values measured at the time of collection.

Table 3-8. Monthly Analytical Chemistry Results for Lake Elsinore in 2024-2025

Compound	Units	MDL	RL	Depth Integrated or Surface Sample	July 2024	Aug 2024	Sept 2024	Oct 2024	Dec 2024	Feb 2025	April 2025	June 2025	Annual Average
General Chemistry													
Total Dissolved Solids	mg/L	4.0	10.00	DI	1,500	1,600	1,600	1,700	1,700	1,700	1,600	1,700	1,638
Sulfide	mg/L	0.1	0.10	DI	0.10	ND	ND	ND	ND	ND	ND	0.10	ND
Nitrate as N	mg/L	0.0	0.20	DI	ND	ND	ND	ND	0.073 J	0.250	0.097 J	ND	ND
Nitrite as N	mg/L	0.0	0.10	DI	ND	ND	ND	ND	0.085 J	0.150	ND	ND	ND
Total Kjeldahl Nitrogen	mg/L	0.13-0.26	0.2-0.4	DI	2.2	3.0	3.2	2.9	2.8	2.8	2.2	2.0	2.6
Total Nitrogen [a]	mg/L	NA	NA	DI	2.2	3.0	3.2	2.9	3.0	3.2	2.3	2.0	**2.7**
Ammonia-Nitrogen	mg/L	0.0	0.10	DI	**0.23 ***	0.12	**0.64 ***	**0.83 ***	**0.49 ***	0.40	0.18	0.19	0.39
Unionized Ammonia [b]	mg/L	NA	NA	DI	0.09	0.04	0.10	0.11	*0.10*	0.03	0.01	0.03	ND
Ortho Phosphate Phosphorus	mg/L	0.0	0.01	Surface	0.12	0.009 J	0.008 J	0.01	0.009 J	0.009 J	ND	ND	0.02
Total Phosphorus	mg/L	0.0	0.01	DI	0.20	0.18	0.13	0.11	0.10	0.16	0.13	0.09	**0.14**
Chlorophyll-a													
Chlorophyll-a	µg/L	1.0	2.0	Surface	49.7	166	72.1	66.1	63.2	87.3	68.1	44.9	77.2
Chlorophyll-a	µg/L	1.0	2.0	DI	27.2	153	77.4	50.1	66.4	61.9	47.3	34.2	64.7

Notes:
- When a concentration was non-detect (ND), the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was non-zero, but below the corresponding MDL, the mean value was reported as ND.

a - Total Nitrogen = TKN+NO2+NO3
b - The concentration of unionized ammonia was calculated using equation by Thursby (1986), based on site specific pH and temperature recorded at each location.
ND – Not detected; NA – Not Applicable
DI = Depth integrated; Surf = Surface 0-2m
µg/L – micrograms per liter; mg/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J - Reported value is an estimate as detection was above the MDL, but below the RL
Bold Underline - Indicates exceedance of 2020 TMDL Objective for annual average
Italicize - Indicates exceedance of Basin Plan Water Quality Objective
Bold asterisk * Exceeds 2004 TMDL Permit NH3 CCC; **Bold double asterisk**** Exceeds 2004 TMDL Permit NH3 CMC

Table 3-9. Analytical Chemistry Summary for Lake Elsinore – Annual Mean Statistics for 2024-2025

Compound	Units	MDL	RL	Basin Plan WQO or TMDL Target	Depth Integrated or Surface Sample	Min	Max	Annual Average	Summer Average [a]
General Chemistry									
Total Dissolved Solids	mg/L	4.0	10.00	2000 [b]	DI	1,500	1,700	1,638	1,550
Sulfide	mg/L	0.1	0.10	NA	DI	ND	0.10	ND	ND
Nitrate as N	mg/L	0.0	0.20	NA	DI	ND	0.25	0.05	ND
Nitrite as N	mg/L	0.0	0.10	NA	DI	ND	0.15	ND	ND
Total Kjeldahl Nitrogen	mg/L	0.13-0.26	0.2-0.4	NA	DI	2.0	ND	ND	2.7
Total Nitrogen [c]	mg/L	NA	--	0.75 [d, e]	DI	2.0	3.2	**2.7**	2.7
Ammonia-Nitrogen	mg/L	0.017	0.10	2004 - CMC: 1.31-3.63 [ef] ; CCC: 0.2-0.98 [ef]	DI	0.12	0.83	0.39	0.31
Unionized Ammonia [f]	mg/L	NA	--	NA	DI	ND	ND	ND	ND
Ortho Phosphate Phosphorus	mg/L	0.0	0.01	NA	DI	ND	0.12	0.02	0.06
Total Phosphorus	mg/L	0.0	0.01	0.1 [d, e]	DI	0.09	0.20	**0.14**	0.18
Chlorophyll-a									
Chlorophyll-a	µg/L	1.0	2.0	25 [a, e]	Surface	44.9	166	77.2	**81.0**
Chlorophyll-a	µg/L	1.0	2.0	25 [a, e]	DI	27.2	153	64.7	**71.3**

Notes:
- When a concentration was non-detect (ND), the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was non-zero, but below the corresponding MDL, the mean value was reported as ND.

a- Summer average (June 2024 – September 2024)
b- Santa Ana Region Basin Plan Objective
c- Total Nitrogen = TKN+NO2+NO3
d- Annual average
e- 2020 TMDL Target, based on Table 5-9n of 2004 TMDL.
f- Values calculated using site/date specific water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986). The range of TMDL target thresholds apply to individual samples and is not applicable to annual means.
NA – Not applicable/ available; ND – not detected; DI = Depth Integrated; mg/L – micrograms per liter; ug/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J –Reported value was detected above the MDL, but below the RL.
Bold Underline - Indicates exceedance of 2020 TMDL target. TN, TP, and CHL-a TMDL criteria are all based on annual average. Ammonia TMDL criteria are based on sample specific calculated criteria based pH and temperature at the time of collection.
* Exceeds 2004 TMDL Permit NH3 CCC; ** Exceeds 2004 TMDL Permit NH3 CMC

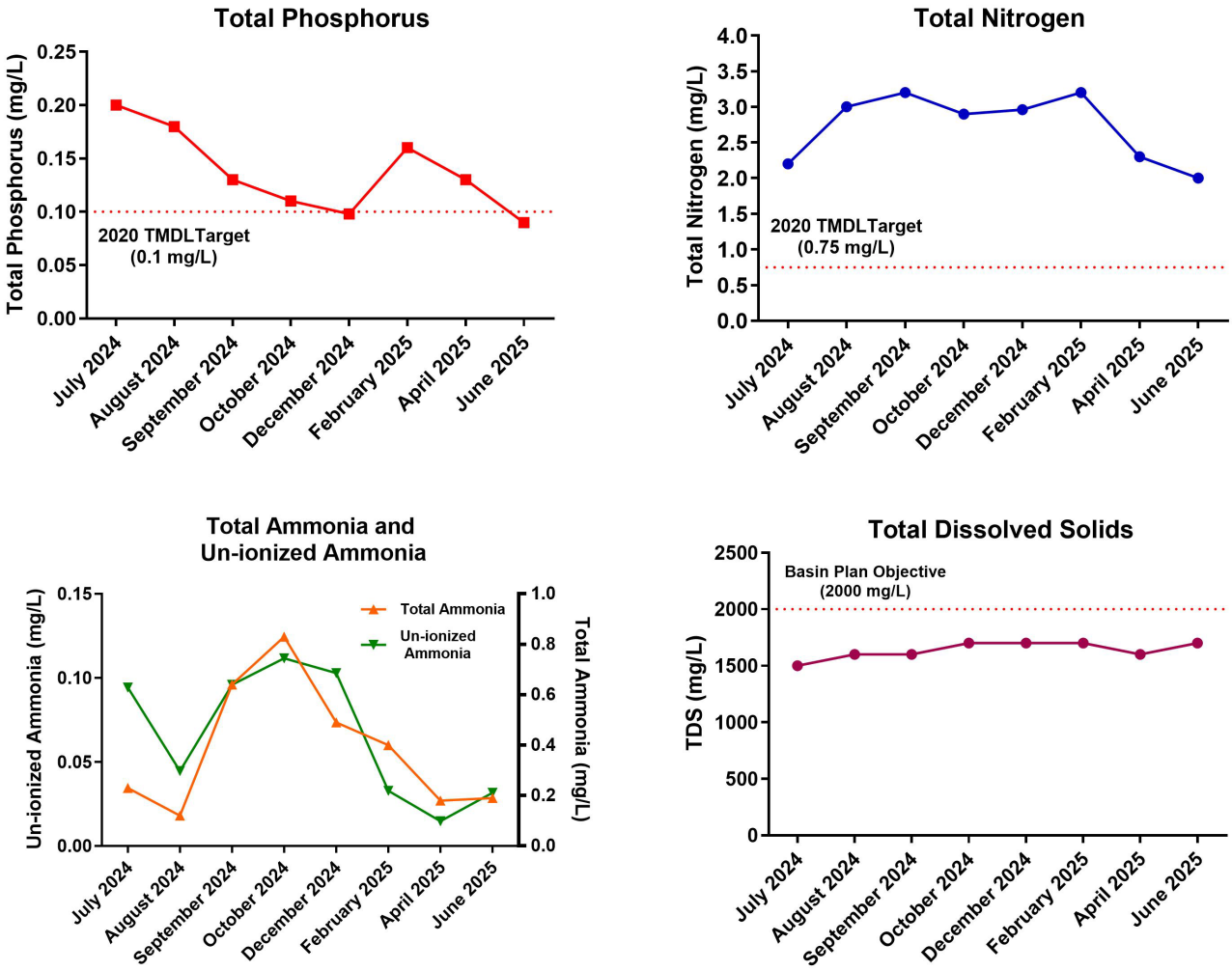
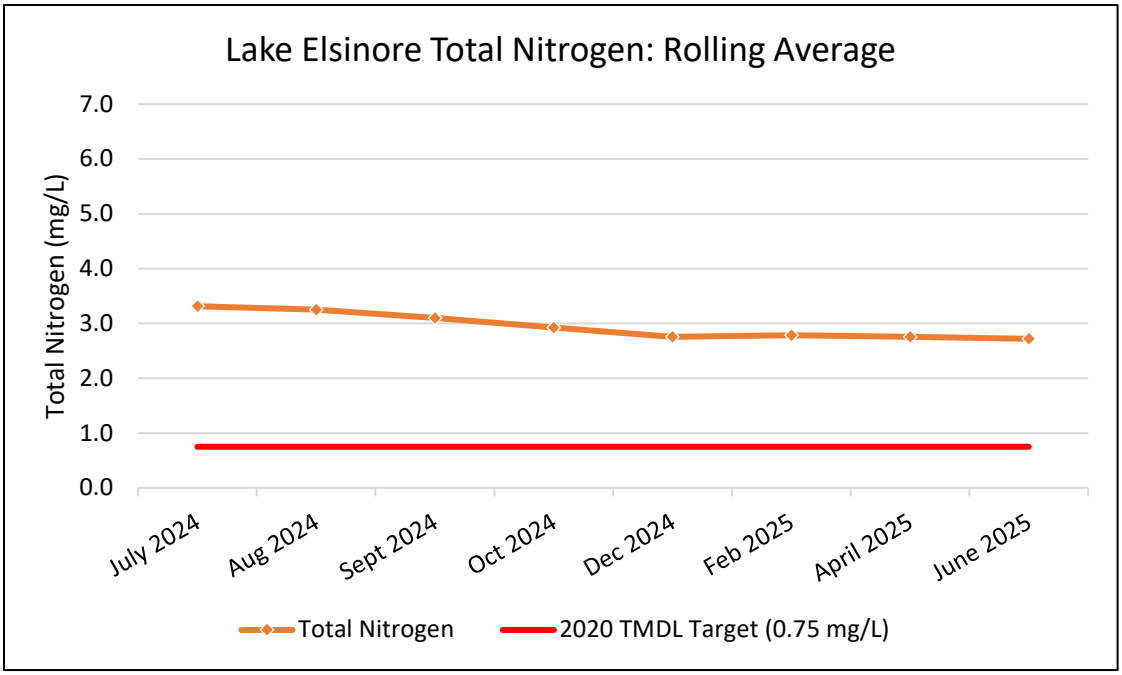


Figure 3-8. Lake Elsinore Analytical Chemistry – Depth-Integrated Samples Site LE02 (July 204-June 2025)

Long term trends can be found in Appendix E



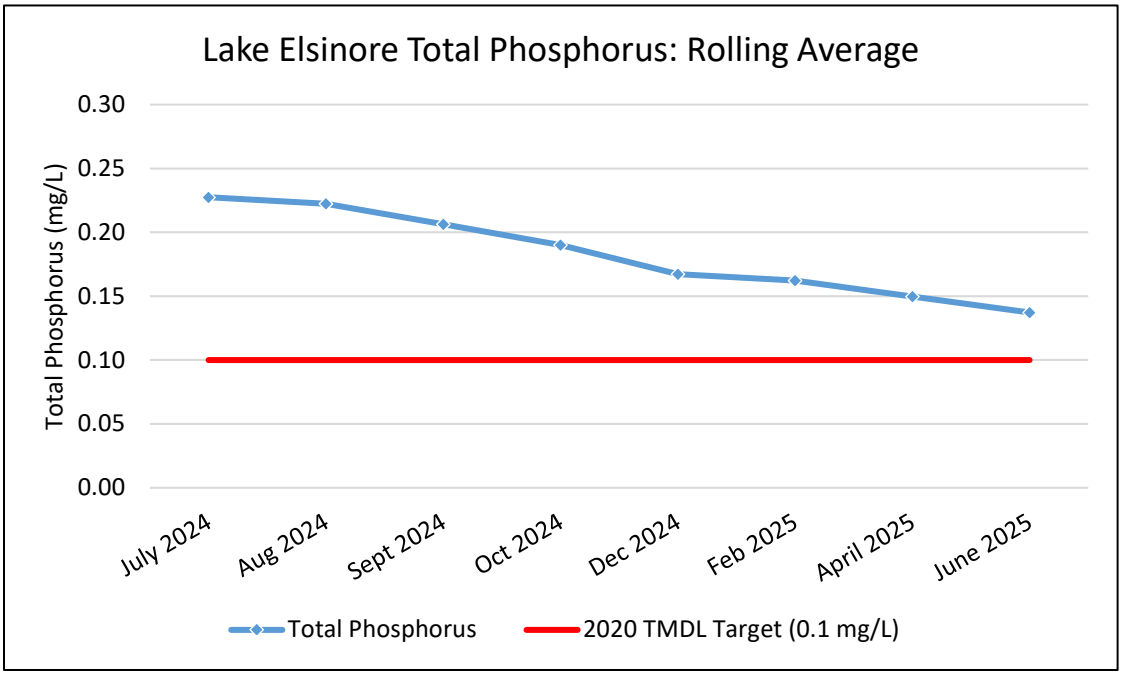


Figure 3-9. Lake Elsinore Analytical Chemistry – Total Nitrogen and Total Phosphorus Rolling Averages (July 2024 – June 2025)

Each data point is calculated by averaging the value of each event with the previous seven events (i.e., one year of data) to obtain a rolling average. Therefore, the graph represents data collected from August 2023 to June 2025.

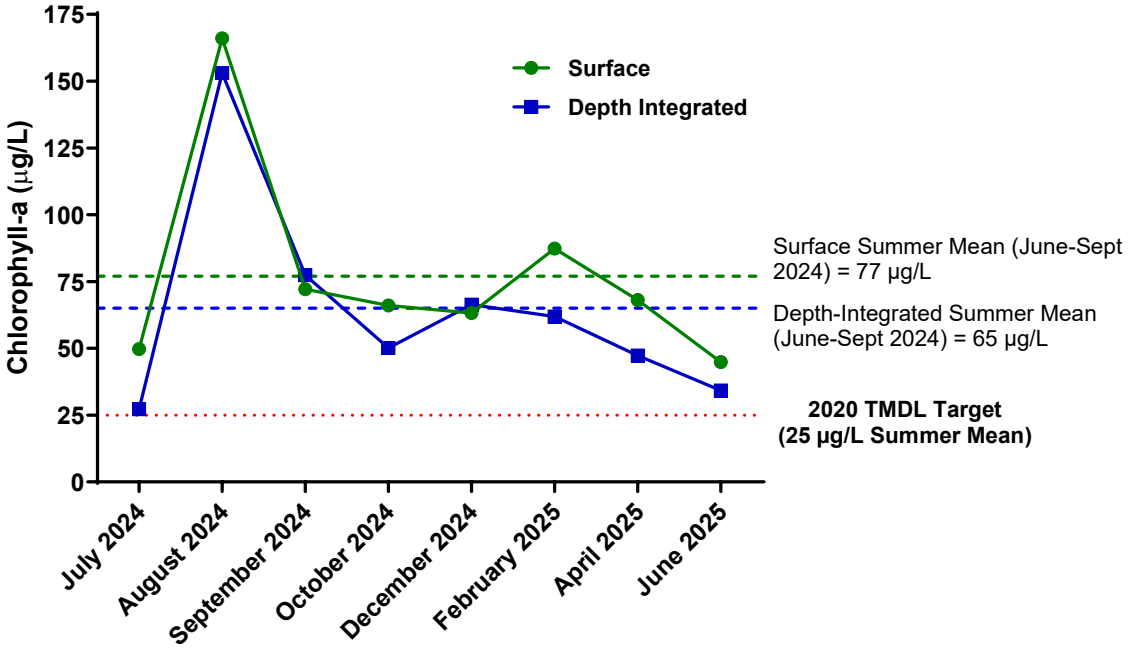


Figure 3-10. Lake Elsinore Analytical Chemistry – Depth-Integrated and Surface Chlorophyll-a at Site LE02

Long term trends can be found in Appendix E

3.4 Canyon Lake Monitoring

3.4.1 Sampling Station Locations and Frequency

As with Lake Elsinore, sampling parameters and locations in Canyon Lake were based on the TMDL monitoring conducted between 2006 and 2012 to provide consistency in assessing trends toward meeting compliance goals. The in-lake monitoring design halted in 2012 was resumed in July 2015 using the four stations outlined in the approved Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan (LESJWA, 2006; **Figure 3-11**, **Table 3-10)**. Two sites are located in the Main Basin of the lake (CL07 near the dam and CL08 in the northern arm), and two in the East Basin (CL09 and CL10). Samples for analytical chemistry and chlorophyll-a were collected at all four sites, in addition to morning and afternoon in-situ water column profile readings.

Sampling in Canyon Lake was conducted bi-monthly (i.e., every other month) concurrent with the TMDL sampling in Lake Elsinore and was also coordinated with satellite overpass dates (see Section 3.4).

Table 3-10. Canyon Lake TMDL Monitoring Locations

Site	Latitude	Longitude
CL07	33.678027°	-117.275135°
CL08	33.688211°	-117.268944°
CL09	33.681100°	-117.258892°
CL10	33.679495°	-117.250669°

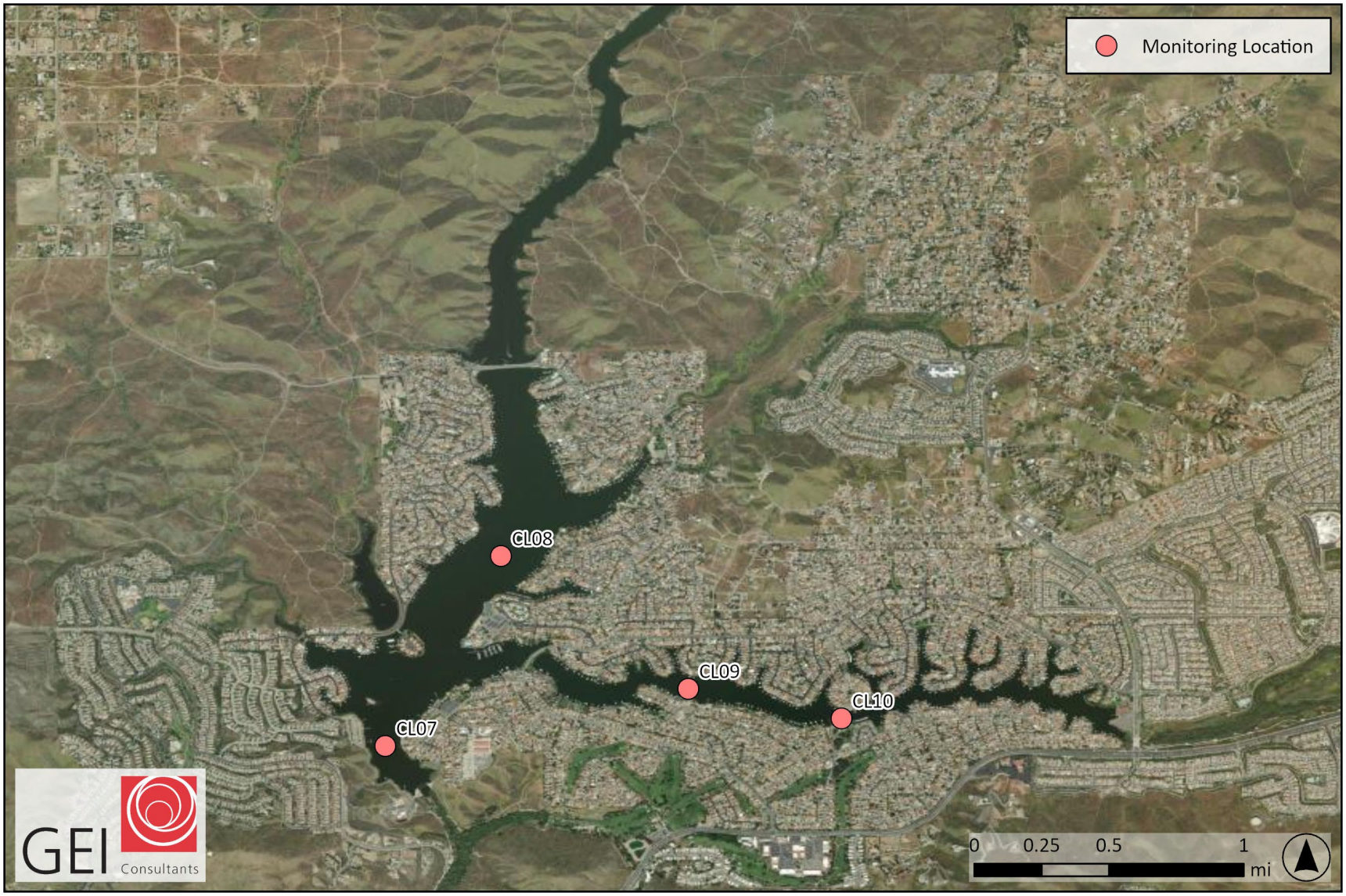


Figure 3-11. Canyon Lake TMDL Sampling Locations

3.4.2 Sampling Methods

Samples for analytical chemistry were collected in the same manner as in Lake Elsinore using a peristaltic pump to collect depth-integrated composite samples. Two samples were collected for chlorophyll-a: 1) a full depth-integrated composite sample; and 2) a 0-2-m depth-integrated composite surface sample. All analytical samples were held on wet ice immediately following collection and transferred to a local courier or shipping company on the same day as the collection. Samples for analysis of nutrients, ammonia, sulfide, aluminum, TDS, and total suspended solids (TSS) were submitted to Weck Laboratories Inc., located in City of Industry, California. Samples for analysis of chlorophyll-a were submitted to Physis Environmental Laboratories Inc., located in Anaheim, California. A full list of constituents analyzed for Canyon Lake can be found in **Table 3-11**.

Beginning with the February 2017 sampling event, the TMDL Task Force directed that the pre- and post-alum application monitoring be integrated into the routine TMDL monitoring, given that the monitored analytes were largely identical to the TMDL monitoring, with the exception of aluminum and TSS. Given this directive, total/dissolved aluminum and TSS were added to the nutrient TMDL monitoring analyte list for all subsequent routine TMDL monitoring events on Canyon Lake. During the 2024-2025 monitoring period, Canyon Lake alum applications were performed during the weeks of October 14, 2024 and March 24, 2025. Pre-alum application monitoring events were performed on October 9, 2024 and on March 19, 2025, with the October 2024 and April 2025 TMDL monitoring dates serving as the post-alum application monitoring.

In-situ water column profile data was recorded in the morning at all four Canyon Lake stations using pre-calibrated hand-held YSI field meters or equivalent for pH, temperature, DO, and specific conductivity at 1-m intervals throughout the water column. These data were used to assess lateral and vertical spatial variability within the lake. End-of-the-day water column profiles (i.e., after ~2:00pm) were also recorded for the same suite of in-situ parameters at all stations to assess any potential temporal variability in these parameters over the course of a day. Water clarity was also assessed with a Secchi disk at all stations. For water quality reporting purposes, the morning and afternoon in situ measurements were averaged at each site on each date.

Satellite imagery was used to remotely measure chlorophyll-a concentrations at the water surface in Canyon Lake.

Table 3-11. In-lake Analytical Constituents and Methods for Canyon Lake (2024-2025)

Parameter	Analysis SOP #	Sampling Method
Analytical Chemistry		
Nitrite Nitrogen (NO_2-N)	EPA 353.2	Depth Integrated
Nitrate Nitrogen (NO_3-N)	EPA 353.2	Depth Integrated
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	Depth Integrated
Total Nitrogen (TN)	Calculated	Depth Integrated
Ammonia Nitrogen (NH4-N)	EPA 350.1	Depth Integrated
Sulfide	SM 4500S2 D	Depth Integrated
Total Phosphorus (TP)	EPA 365.3	Depth Integrated
Soluble Reactive Phosphorus (SRP / Ortho-P)	EPA 365.3	Depth Integrated
Chlorophyll-a	SM 10200H	Surface (0-2m) & Depth Integrated
Total Dissolved Solids (TDS)	SM 2540 C	Depth Integrated
Total Suspended Solids (TSS)	SM 2540D	Depth Integrated
Total Aluminum	EPA 200.7	Depth Integrated
Dissolved Aluminum	EPA 200.7	Depth Integrated

Notes:
US EPA - United States Environmental Protection Agency; m- meter; SM- standard method

3.4.3 Water Quality Summary

A summary of the in-lake monitoring events for Canyon Lake for the period of July 1, 2024 to June 30, 2025 is presented below. A total of six events were sampled under the TMDL monitoring program, with three occurring in 2024 (August 15, October 24, and December 3) and three in 2024 (February 6, April 17, and June 11). Complete monthly water column profiles can be found in Appendix B. Detailed analytical chemistry lab reports for each event are contained in Appendix C. Satellite imagery reports for each event are provided in Appendix D. Current data in the context of historical water quality monitoring results from 2002-present are presented in Appendix E.

Water Column Profiles

A summary of water column profile mean values for each site and monitoring event are presented in **Tables 3-12 and 3-13**. A summary of water column profile mean values for each basin (i.e., Main Lake and East Bay) are presented in **Tables 3-14 and 3-15**. Water column profile mean statistics for each site across the entire monitoring period are presented in **Table 3-16**. Mean water column values across the annual cycle are also summarized graphically in **Figures 3-12 to 3-16**. Mean profile values are gathered by averaging morning and afternoon readings across sites.

In this report, the epilimnion is defined as the layer of water above the thermocline, and the hypolimnion as the layer below it, with both zones characterized by relatively stable temperatures. The thermocline refers to the transitional layer between the epilimnion and hypolimnion, where temperature decreases sharply, specifically by more than 1.0°C per meter of depth. Measurements taken within the thermocline were excluded from epilimnion and hypolimnion

means. When stratification was present, full water column averages included data from all three zones.

For both the Main Basin and East Basin, temperatures exhibited a typical pattern with the lowest temperatures occurring during the winter months (December and February) and the highest temperatures in August and October 2024 (Main Basin) and August 2024 and June 2025 (East Basin). The Main Basin exhibited stratification in August and October 2024, becoming de-stratified December through March, before becoming stratified again in April 2025 (**Figure 3-12**). The East Basin exhibited a slightly different stratification cycle, destratifying prior to the October 2024 TMDL monitoring event, and restratifying again in April 2025 (**Figure 3-13)**. When the thermocline develops, typically beginning in late spring and lasting through fall, DO concentrations within the epilimnion and hypolimnion diverge with hypolimnion concentrations falling substantially during that timeframe. Lake-wide water column mean DO for the current monitoring year was 6.0 mg/L, slightly higher than the mean of 5.6 mg/L in the previous monitoring year. The rolling 12-month DO concentration was never above the 2020 TMDL target of 5.0 mg/L in the hypolimnion (**Figure 3-14**). The rolling average of the full water column mean was greater than 5.0 mg/L for all monitoring dates (**Figure 3-15**).

Specific conductivity in the Main Basin generally increased throughout the monitoring year, with a slight decrease in April following the storm season. In contrast, the East Basin exhibited higher conductivity levels and a different seasonal pattern, rising from August to October, remaining relatively stable through winter and early spring, and increasing again in June. Mean full water column conductivity ranged from 709 to 934 µS/cm in the Main Basin and 956 to 1,073 µS/cm in the East Basin (see **Tables 3-14** and **3-15**; **Figures 3-12** and **3-13**). Monthly mean pH values were generally higher in the East Basin, ranging from 7.9 to 8.8, compared to 7.3 to 8.1 in the Main Basin.

Secchi depth patterns varied slightly between the two basins. In the Main Basin, water clarity steadily declined from August through April, followed by an increase in June. The East Basin showed an initial decrease in Secchi depth from August to October, then remained relatively stable through the winter and early spring, before also increasing in June, mirroring the trend observed in the Main Basin (**Figure 3-16**).

For further comparisons regarding in-situ water quality parameters, **Table 3-16** includes lake-wide averages observed for the current 2024-25 monitoring year, as well as the prior 5 monitoring years.

Table 3-12. In-Situ Water Quality Parameter Measurements for Canyon Lake - Monthly Means for Each Site (August – December 2024)

Basin	Site	Measure	Water Column Means								
			August 2024			October 2024			December 2024		
			All	Epi	Hypo	All	Epi	Hypo	All	Epi	Hypo
Main Basin	CL07	Temp (°C)	21.3	28.4	14.1	18.3	20.9	14.4	14.5	-	-
		Cond (µS/cm)	700	753	648	765	827	684	837	-	-
		pH	8.0	*9.0*	7.2	7.2	7.4	6.9	7.3	-	-
		DO (mg/L)	3.61	8.07	**0.00**	1.97	3.68	**0.00**	2.26	-	-
	CL08	Temp (°C)	23.8	28.3	14.9	20.8	-	-	14.5	-	-
		Cond (µS/cm)	719	752	664	817	-	-	832	-	-
		pH	8.2	*8.8*	7.2	7.4	-	-	7.5	-	-
		DO (mg/L)	4.19	6.96	**0.00**	3.59	-	-	4.81	-	-
East Basin	CL09	Temp (°C)	24.2	28.7	15.8	20.5	-	-	14.0	-	-
		Cond (µS/cm)	957	920	1,006	1,002	-	-	978	-	-
		pH	8.1	*8.8*	7.0	7.6	-	-	7.8	-	-
		DO (mg/L)	4.49	7.90	**0.02**	5.28	-	-	7.65	-	-
	CL10	Temp (°C)	28.9	-	-	21.0	-	-	14.3	-	-
		Cond (µS/cm)	955	-	-	1,036	-	-	1,010	-	-
		pH	*8.8*	-	-	8.2	-	-	8.5	-	-
		DO (mg/L)	8.54	-	-	9.72	-	-	11.69	-	-
Lake-wide Average		Temp (°C)	24.6	28.5	14.9	20.1	20.9	14.4	14.3	-	-
		Cond (µS/cm)	833	808	772	905	827	684	914	-	-
		pH	8.3	*8.9*	7.2	7.6	7.4	6.9	7.8	-	-
		DO (mg/L)	5.21	7.64	**0.01**	5.14	3.68	**0.00**	6.60	-	-

Notes:
Epi = epilimnion; Hypo = hypolimnion; -- not applicable due to lack of thermocline
2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L in the hypolimnion
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

Table 3-13. In-Situ Water Quality Parameter Measurements for Canyon Lake - Monthly Means for Each Site (February – June 2025)

Basin	Site	Measure	Water Column Means								
			February 2025			April 2025			June 2025		
			All	Epi	Hypo	All	Epi	Hypo	All	Epi	Hypo
Main Basin	CL07	Temp (°C)	11.3	-	-	14.5	18.4	12.6	17.6	26.4	13.1
		Cond (µS/cm)	872	-	-	866	816	888	937	918	943
		pH	7.8	-	-	8.0	*9.1*	7.6	7.8	*8.9*	7.3
		DO (mg/L)	5.60	-	-	3.19	11.45	**0.03**	2.20	8.48	**0.00**
	CL08	Temp (°C)	12.0	-	-	16.3	18.6	13.8	20.3	27.3	14.0
		Cond (µS/cm)	859	-	-	816	734	875	931	913	944
		pH	8.1	-	-	8.2	*8.9*	7.5	8.2	*9.1*	7.5
		DO (mg/L)	8.10	-	-	5.22	11.46	**0.17**	3.72	10.25	**0.16**
East Basin	CL09	Temp (°C)	12.0	-	-	15.5	18.6	12.7	19.9	26.3	13.4
		Cond (µS/cm)	967	-	-	988	900	1,056	1,085	1,000	1,140
		pH	8.0	-	-	7.9	*8.9*	7.2	8.0	*8.9*	7.2
		DO (mg/L)	6.61	-	-	4.99	12.01	**0.22**	4.00	9.75	**0.16**
	CL10	Temp (°C)	13.2	-	-	18.7	-	-	26.1	-	-
		Cond (µS/cm)	994	-	-	960	-	-	1,061	-	-
		pH	*8.6*	-	-	8.3	-	-	*9.6*	-	-
		DO (mg/L)	12.84	-	-	9.87	-	-	8.96	-	-
Lake-wide Average		Temp (°C)	12.1	-	-	16.2	18.5	13.0	21.0	26.5	13.5
		Cond (µS/cm)	923	-	-	908	817	939	1,003	973	1,009
		pH	8.1	-	-	8.1	*8.9*	7.4	8.4	*9.1*	7.3
		DO (mg/L)	8.29	-	-	5.82	11.64	**0.14**	4.72	9.36	**0.11**

Notes:
Epi = epilimnion; Hypo = hypolimnion; -- not applicable due to lack of thermocline
2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L in the hypolimnion
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

Table 3-14. In-Situ Water Quality Parameter Measurements in Canyon Lake – 2024 Monthly Means for Each Basin (August – December 2024)

Basin	Measure	Water Column Means								
		August 2024			October 2024			December 2024		
		All	Epi	Hypo	All	Epi	Hypo	All	Epi	Hypo
Main Basin	Temp (°C)	22.6	28.4	14.5	19.5	20.9	14.4	14.5	-	-
	Cond (µS/cm)	709	752	656	791	827	684	835	-	-
	pH	8.1	*8.9*	7.2	7.3	7.4	6.9	7.4	-	-
	DO (mg/L) [a]	3.9	7.5	**0.00**	2.8	3.7	**0.00**	3.5	-	-
East Basin	Temp (°C)	26.6	28.7	15.8	20.8	-	-	14.1	-	-
	Cond (µS/cm)	956	920	1,006	1,019	-	-	994	-	-
	pH	8.4	*8.8*	7.0	7.9	-	-	8.2	-	-
	DO (mg/L) [a]	6.5	7.9	**0.0**	7.5	-	-	9.7	-	-
Lake-wide Average	Temp (°C)	24.6	28.5	15.1	20.1	20.9	14.4	14.3	-	-
	Cond (µS/cm)	833	836	831	905	827	684	914	-	-
	pH	8.3	*8.9*	7.1	7.6	7.4	6.9	7.8	-	-
	DO (mg/L) [a]	5.2	7.7	**0.0**	5.1	3.7	**0.0**	6.6	-	-

Notes:
Epi = epilimnion; Hypo = hypolimnion; - – not applicable due to lack of thermocline
a. 2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L in the hypolimnion
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

Table 3-15. In-Situ Water Quality Parameter Measurements in Canyon Lake – 2025 Monthly Means for Each Basin (February – June 2025)

Basin	Measure	Water Column Means								
		February 2025			April 2025			June 2025		
		All	Epi	Hypo	All	Epi	Hypo	All	Epi	Hypo
Main Basin	Temp (°C)	11.6	-	-	15.4	18.5	13.2	18.9	26.8	13.6
	Cond (µS/cm)	865	-	-	841	775	881	934	916	943
	pH	8.0	-	-	8.1	9.0	7.6	8.0	9.0	7.4
	DO (mg/L) [a]	6.9	-	-	4.2	11.5	0.1	3.0	9.4	0.1
East Basin	Temp (°C)	12.6	-	-	17.1	18.6	12.7	23.0	26.2	13.4
	Cond (µS/cm)	980	-	-	974	900	1,056	1,073	1,031	1,140
	pH	8.3	-	-	8.1	*8.9*	7.2	*8.8*	*9.2*	7.2
	DO (mg/L) [a]	9.7	-	-	7.4	12.0	**0.2**	6.5	9.4	**0.2**
Lake-wide Average	Temp (°C)	12.1	-	-	16.2	18.6	12.9	21.0	26.5	13.5
	Cond (µS/cm)	923	-	-	908	838	969	1,003	973	1,042
	pH	8.1	-	-	8.1	*8.9*	7.4	8.4	*9.1*	7.3
	DO (mg/L) [a]	8.3	-	-	5.82	11.73	**0.16**	4.72	9.36	**0.12**

Notes:
Epi = epilimnion; Hypo = hypolimnion; - – not applicable due to lack of thermocline
a. 2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L in the hypolimnion
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

Table 3-16. In-Situ Water Quality Parameter Measurements for Canyon Lake - Annual Mean Statistics for Each Site (August 2024 – June 2025) and Comparison to Previous Monitoring Events

Depth	Site	Measure	CL07	CL08	Main Basin[a]	CL09	CL10	East Basin[b]	Lake-Wide Averages (July-June)				
									2024-2025	2023-2024	2022-2023	2021-2022	2020-2021
Water Column Mean	Min	Temp (°C)	11.3	12.0	11.6	12.0	13.2	12.6	12.1	15.6	11.3	12.4	12.8
		Cond (µS/cm)	700	719	709	957	955	956	833	626	702	939	740
		pH	7.19	7.43	7.31	7.58	8.24	7.91	7.61	7.41	7.51	7.72	7.45
		DO (mg/L)	1.97	3.59	2.78	4.00	8.54	6.48	4.72	4.30	4.60	5.40	3.80
	Max	Temp (°C)	21.3	23.8	22.6	24.2	28.9	26.6	24.6	24.9	26.2	25.6	24.3
		Cond (µS/cm)	937	931	934	1,085	1,061	1,073	1,003	892	1,157	1,102	960
		pH	8.05	8.22	8.13	8.05	*9.56*	*8.77*	8.37	8.24	8.32	8.29	8.26
		DO (mg/L)	5.60	8.10	6.85	7.65	12.84	9.73	8.29	6.30	10.40	9.10	7.60
	Avg	Temp (°C)	16.2	18.0	17.1	17.7	20.4	19.0	18.1	18.5	18.2	19.4	18.9
		Cond (µS/cm)	829	829	829	996	1,003	999	914	781	969	1,016	839
		pH	7.70	7.94	7.82	7.89	*8.68*	8.28	8.05	7.88	7.98	8.04	7.92
		DO (mg/L)	3.14	4.94	4.04	5.50	10.27	7.89	5.96	5.30	6.70	7.20	5.40
Epi [c]	Min	Temp (°C)	18.4	18.6	18.5	18.6	26.1	18.6	18.6	22.8	24.4	20.1	20.4
		Cond (µS/cm)	753	734	752	900	1,061	900	827	719	771	930	685
		pH	7.40	*8.83*	7.40	*8.79*	*9.56*	*8.79*	7.40	7.40	8.34	8.20	8.21
		DO (mg/L)	3.68	6.96	3.68	7.90	8.96	7.90	3.68	5.90	7.20	7.90	7.70
	Max	Temp (°C)	28.4	28.3	28.4	28.7	26.1	28.7	28.5	29.4	28.8	28.5	28.3
		Cond (µS/cm)	918	913	916	1,000	1,061	1,031	973	818	1,138	1,077	923
		pH	*9.06*	*9.05*	*8.96*	*8.91*	*9.56*	*9.24*	*9.10*	*9.10*	*8.58*	*8.60*	*9.13*
		DO (mg/L)	11.45	11.46	11.45	12.01	8.96	12.01	11.73	10.00	8.20	10.60	11.20
	Avg	Temp (°C)	23.5	24.7	23.7	24.5	26.1	24.5	23.6	25.7	26.6	24.9	24.9
		Cond (µS/cm)	829	800	818	940	1,061	950	868	778	975	1,012	803
		pH	*8.59*	*8.91*	*8.56*	*8.86*	*9.56*	*8.97*	*8.57*	8.37	8.45	8.42	*8.61*
		DO (mg/L)	7.92	9.55	8.00	9.89	8.96	9.76	8.12	8.10	7.70	9.50	9.20
Hypo [c]	Min	Temp (°C)	12.6	13.8	13.2	12.7	-	12.7	12.9	13.8	13.1	13.2	13.7
		Cond (µS/cm)	648	664	656	1,006	-	1,006	684	745	832	923	800
		pH	6.94	7.22	6.94	7.05	-	7.05	6.94	6.83	7.03	7.13	6.93
		DO (mg/L) [d]	**0.00**	**0.00**	**0.00**	**0.02**	-	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
	Max	Temp (°C)	14.4	14.9	14.5	15.8	-	15.8	15.1	16.5	17.2	19.5	16.9
		Cond (µS/cm)	943	944	943	1,140	-	1,140	1,042	852	1,062	1,056	942
		pH	7.63	7.53	7.58	7.19	-	7.19	7.37	7.52	7.21	7.49	7.29
		DO (mg/L) [d]	**0.03**	**0.17**	**0.10**	**0.22**	-	**0.22**	**0.16**	**1.50**	**0.10**	**1.00**	**0.80**
	Avg	Temp (°C)	13.5	14.2	13.9	13.9	-	13.9	14.0	15.0	15.3	16.5	15.2
		Cond (µS/cm)	790	827	791	1,067	-	1,067	881	814	956	995	870
		pH	7.27	7.41	7.28	7.13	-	7.13	7.18	7.17	7.11	7.29	7.10
		DO (mg/L) [d]	**0.01**	**0.11**	**0.05**	**0.13**	-	**0.13**	**0.07**	**0.50**	**0.10**	**0.40**	**0.20**

Notes:
- Individual site values are annual mean, maximum, and minimum statistics for each site in the current monitoring year. Lake wide average values are the mean, maximum, and minimum of the monthly lake wide means.

a. Main Basin = mean of sites CL07 and CL08
b. East Basin = mean of sites CL09 and CL10
c. Values reported for epilimnion and hypolimnion are the arithmetic mean of measurements collected across all months sampled in which stratification was present.
d. 2020 TMDL target for Dissolved Oxygen (DO) is no less than 5 mg/L in the hypolimnion

Bold Underline - Indicates exceedance of 2020 TMDL target
- – not applicable due to lack of thermocline; Epi – epilimnion; Hypo – hypolimnion; mg/L – milligrams per liter; uS/cm – microsiemens per centimeter

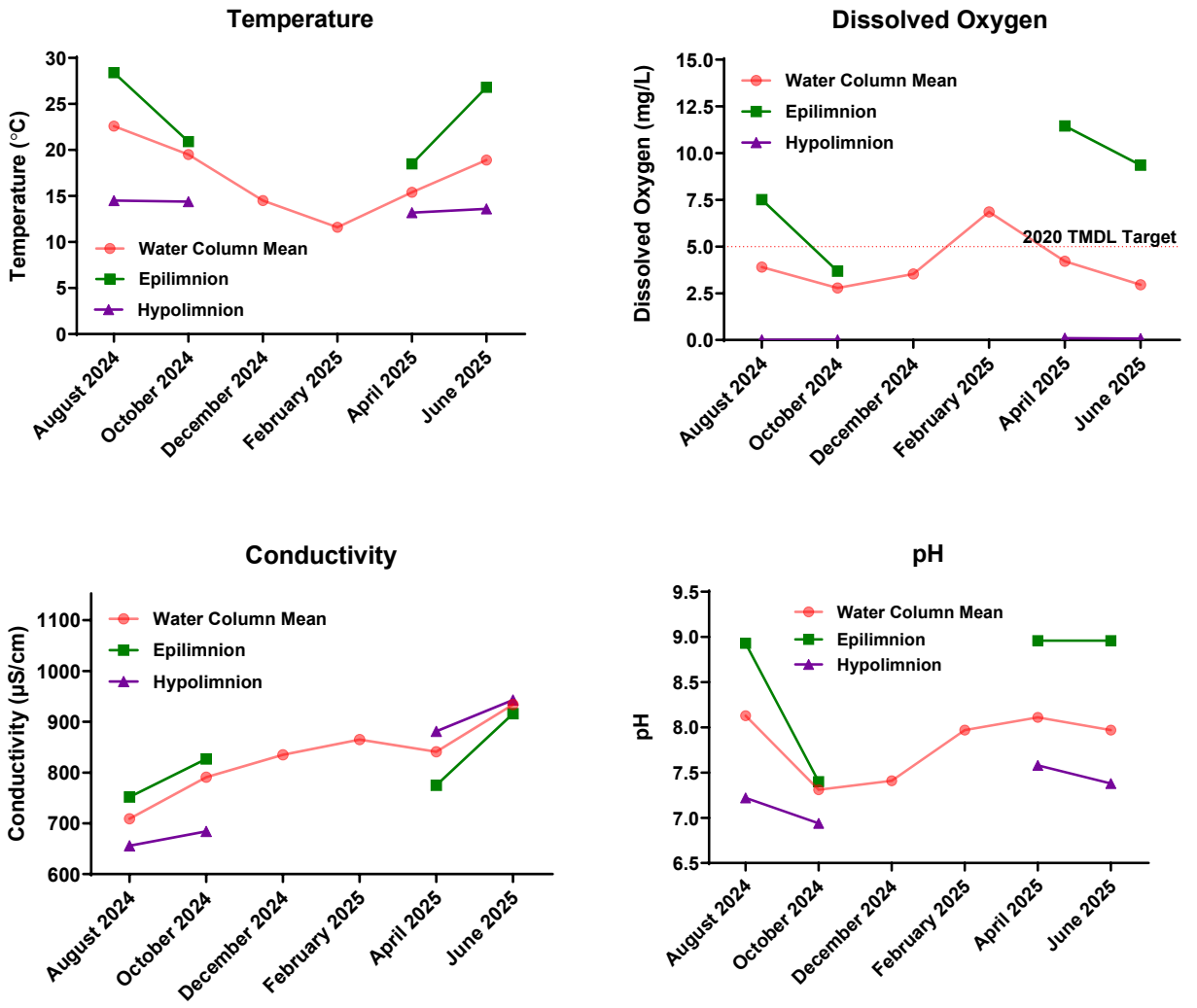


Figure 3-12. Mean In-Situ Physical Water Quality Parameters – Canyon Lake Main Basin

(Values represent the mean of Sites CL07 & CL08. Missing epilimnion and hypolimnion values represent time periods when no stratification was present)

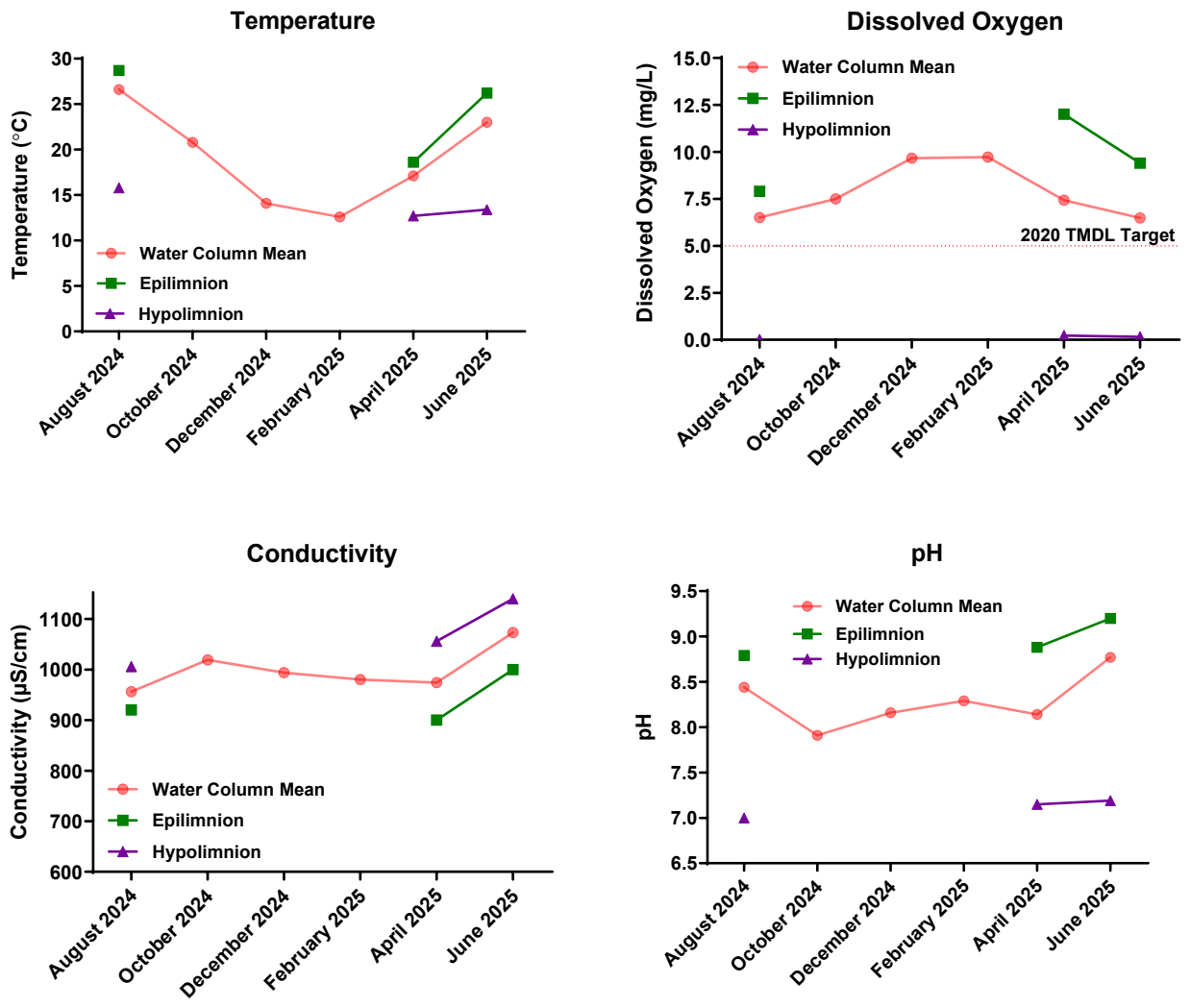


Figure 3-13. Mean In-Situ Physical Water Quality Parameters - Canyon Lake East Basin

(Values represent the mean of Sites CL09 & CL10. Missing epilimnion and hypolimnion values represent time periods when no stratification was present.)

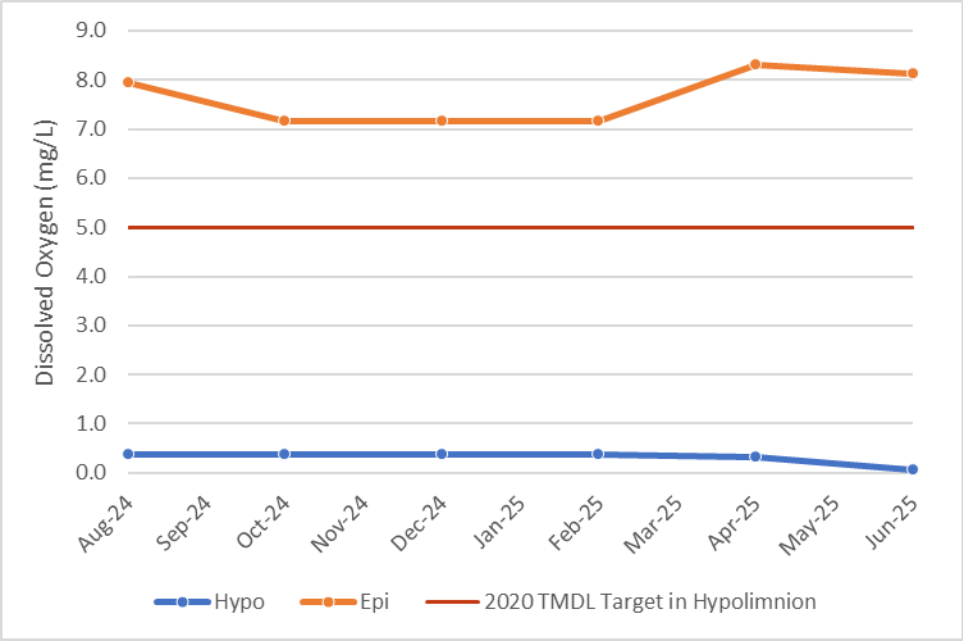


Figure 3-14. Rolling Average Concentrations of Dissolved Oxygen in the Epilimnion and Hypolimnion of Canyon Lake

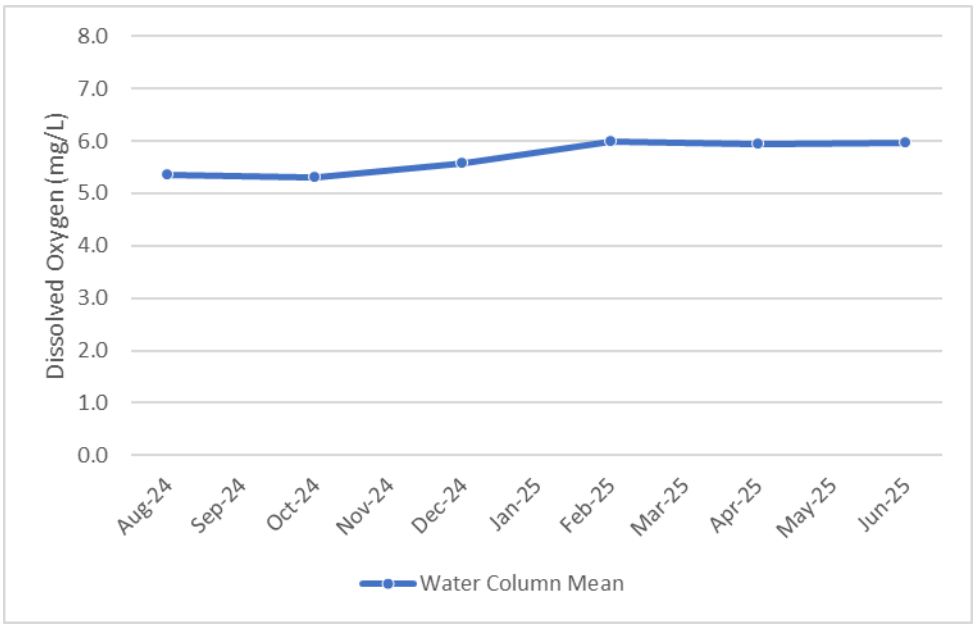


Figure 3-15. Rolling Average Concentration of Dissolved Oxygen - Full Vertical Water Column in Canyon Lake

Each data point is calculated by averaging the values from all 4 sites of each event with the previous five event values (i.e., one year of data) to obtain a rolling average. Therefore, the graph represents data collected from October 2023 to June 2025.

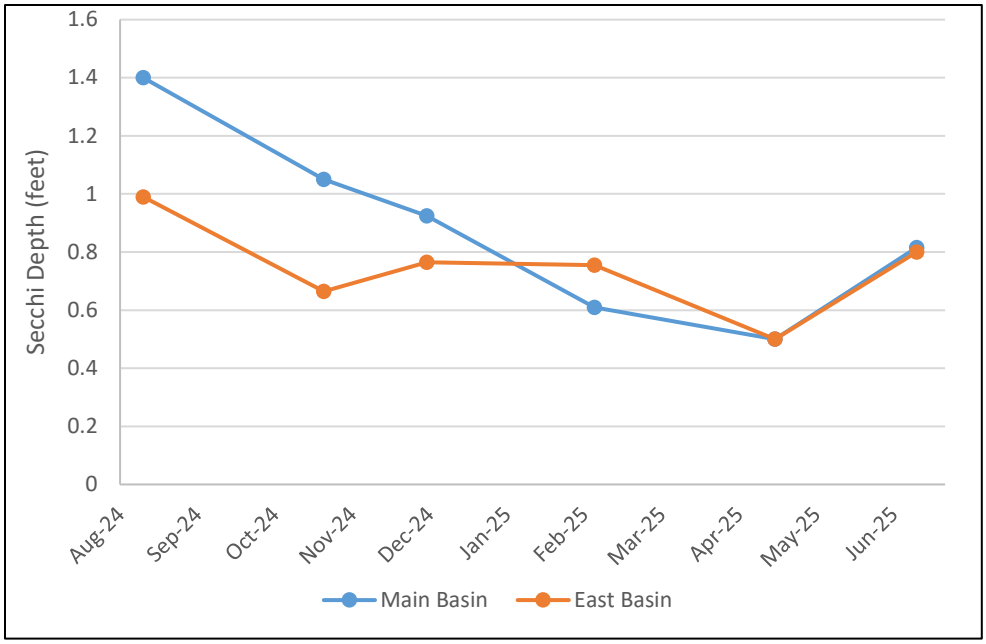


Figure 3-16. In-Situ Water Clarity Using a Secchi Disk– Main and East Basins

Analytical Chemistry

Analytical chemical concentration summaries for each monitoring event in Canyon Lake are presented in **Tables 3-17 and 3-18**. A summary of analytical chemistry mean statistics for each site and basin across the entire monitoring period is presented in **Tables 3-19 through 3-21**. Concentrations of analytes are presented graphically in **Figures 3-17 and 3-18.**

Depth-integrated concentrations of individual total nitrogen samples in the Main Basin (Sites CL07 and CL08) ranged from 0.65 to 3.76 mg/L across the six sampling events, with a Main Basin annual mean of 1.67 mg/L (slight increase from the 2023-24 annual mean of 1.5 mg/L). Individual total nitrogen sample concentrations within the East Basin ranged from 0.87 to 3.0 mg/L across the six sampling events, with an annual mean of 1.5 mg/L (remaining the same as the 2023-24 annual mean). Lake-wide 1-year rolling average for total nitrogen remained steady across the monitoring year ranging from 1.52 to 1.71 mg/L; all exceeding the current 2020 TMDL target of 0.75 mg/L (**Figure 3-19**).

In August, depth-integrated total phosphorus concentrations in both basins were comparable to those recorded during the final sampling event of the previous monitoring period (June 2024). In the Main Basin, concentrations declined from 0.23 mg/L in August to 0.05 mg/L in December 2024, with a pronounced drop following the October alum application. Levels remained stable in February 2025 and then increased slightly to 0.09 mg/L in both April and June 2025. The East Basin showed a similar initial decline, followed by relatively stable concentrations from October through February. Phosphorus levels in the East Basin then rose in April and June, likely influenced by regional rainfall, which was most significant between February and April 2025. In the Main Basin, individual sample concentrations ranged from 0.04 to 0.34 mg/L, with an annual

mean of 0.12 mg/L, down from 0.19 mg/L in 2023–2024. East Basin concentrations ranged from 0.05 to 0.21 mg/L, with an annual mean of 0.09 mg/L, also lower than the previous year's mean of 0.19 mg/L. Lake-wide, the 1-year rolling average for total phosphorus ranged from 0.10 to 0.20 mg/L, showing a consistent decline beginning in December 2024 and approaching the 2020 TMDL target of 0.1 mg/L (**Figure 3-19**).

During the 2024-2025 monitoring year, two alum applications occurred in Canyon Lake: weeks of October 14, 2024 and March 24, 2025. Total phosphorus had a notable decrease in the Main Basin following the first alum treatment, however no impact on total phosphorus was noted in the East Basin. Total phosphorus in both basins exhibited an increase following the second alum treatment. This increase in phosphorus after the spring application is likely due to the influx of stormwater which was largely confined to the February through April timeframe. The regular application of alum since September 2013 has served to reduce the annual mean water column total phosphorus concentration in Canyon Lake in comparison to those measured prior to the alum applications (see historical figures in Appendix E).

Depth-integrated total ammonia concentrations in the Main Basin (Sites CL07 and CL08) ranged from 0.08 to 3.0 mg/L across six sampling events, with an annual mean of 0.85 mg/L, slightly higher than the 2023–2024 mean of 0.60 mg/L. In the East Basin, concentrations ranged from non-detectable (<0.017 mg/L) to 2.2 mg/L, with an annual mean of 0.53 mg/L, similar to the previous year's mean of 0.58 mg/L. In the Main Basin, ammonia levels followed a typical seasonal pattern seen in previous years: peaking in August and October, declining through the winter, and rising again in spring. This trend aligns with the lake's stratification cycle, which typically begins in early spring (April) and persists through early fall (October). During stratification, low dissolved oxygen in the hypolimnion promotes the release of phosphorus and ammonia from sediments. The greater depth of the Main Basin supports stronger and longer-lasting stratification, contributing to elevated ammonia concentrations, especially at the deepest site, CL07. In contrast, the East Basin exhibited a different pattern this year. The typical increase in ammonia concentration observed in October during previous monitoring years was absent. Instead, levels remained low and stable through fall and winter, rising only in spring 2025. This deviation may be due to earlier destratification in the East Basin; unlike prior years, the basin was already destratified by October 2024. No total ammonia concentrations exceeded the applicable CCC or CMC criteria during the 2024–25 monitoring year.

Total dissolved solids concentration in both basins exhibited a gradual increase across the 2024-25 monitoring year (**Figure 3-17**). The TDS concentration of individual samples in the Main Basin ranged from 410 to 580 mg/L, with an average of 498 mg/L. The average concentration of individual sample TDS in the East Basin were slightly higher, ranging from 550 to 720 mg/L, with an average of 606 mg/L. Only one individual sample exceeded the Santa Ana Basin Plan water quality objective for TDS of 700 mg/L (720 mg/L in June 2025 at Site CL10).

Mean depth-integrated chlorophyll-a concentrations in both basins exhibited a decrease between August and October. While the Main Basin continued its decline through December, East Basin chlorophyll-a concentrations increased in December and again in February. The Main Basin chlorophyll-a also increased in February, remained steady on April, before decreasing in June 2025. Chlorophyll-a concentrations in the East Basin showed a sharp decrease between February and April. While this decrease in chlorophyll-a suggests a decrease in cyanobacteria and green

algae, algal biomass was still high in the East Basin as evidenced by the brown color of the water in the East Basin (**Figure 3-20**) and low Secchi depth measurements in April 2025 (**Figure 3-16**). A bloom of golden algae (*Prymnesium parvum*) occurred in Canyon Lake beginning in mid-April and lasting through late July 2025, resulting in a significant fish kill. Although golden algae contain chlorophyll-a, their cellular concentrations are lower than those found in green algae and cyanobacteria. As a result, even though chlorophyll-a concentrations had declined in April 2025, an active algal bloom was still underway. For more information, refer to Appendix F, which details the Spring 2025 golden algae bloom and resulting fish kill in Canyon Lake. In the Main Basin, depth-integrated chlorophyll-a concentrations across six sampling events ranged from 9 to 41 µg/L, with an annual mean of 23 µg/L, higher than the 2023–2024 mean of 16 µg/L (Figure 3-18). In the East Basin, concentrations ranged from 15 to 45 µg/L, with an annual mean of 29 µg/L, slightly above the previous year's mean of 27 µg/L. Lake-wide 1-year rolling averages for depth-integrated chlorophyll-a remained below the 2020 TMDL target of 25 µg/L through December 2024, but exceeded the target in all sampling events conducted in 2025 (**Figure 3-19**).

Concentrations of total and dissolved aluminum are measured in Canyon Lake to assess any potential long-term influence that the alum additions may have on water column aluminum concentrations relative to existing water quality objectives. Concentrations of total aluminum individual samples ranged from 42 to 170 µg/L in the Main Basin and 100 to 470 µg/L in the East Basin.

All total aluminum concentrations measured as part of the TMDL monitoring events were below calculated chronic Criteria Continuous Concentration (CCC) and acute Criteria Maximum Concentration (CMC) values based on the US EPA's Final Aquatic Life Ambient Water Quality Criteria for Aluminum[4] (US EPA, 2018) when using the water column mean pH for each station/date combination, and a default total organic carbon and hardness value. Dissolved aluminum concentrations ranged from ND (<0.041 µg/L) to 120 µg/L in the Main Basin and ND (<0.041 µg/L) to 450 µg/L in the East Basin.

[4] Aquatic Life Criteria - Aluminum | US EPA

Table 3-17. Analytical Chemistry Results for Canyon Lake - Monthly Depth-Integrated Results (Aug – Dec 2024)

Compound	Units	MDL	RL	DI or Surface Sample	August 2024				October 2024				December 2024			
					Main Basin		East Basin		Main Basin		East Basin		Main Basin		East Basin	
					CL07	CL08	CL09	CL10	CL07	CL08	CL09	CL10	CL07	CL08	CL09	CL10
General Chemistry																
Total Dissolved Solids	mg/L	4	10	DI	410	410	550	560	410	480	600	620	520	500	590	610
Total Suspended Solids	mg/L	5.0	5.00	DI	8.00	6.00	9.00	6.00	7.00	ND	5.00	6.00	7.00	5.00	9.00	8.00
Sulfide	mg/L	0.05-0.5	0.1-1.0	DI	4.00	3.00	6.00	ND	5.00	ND	1.60	ND	ND	ND	ND	ND
Nitrate as N	mg/L	0.040	0.20	DI	ND	ND	ND	ND	0.055 J	ND	0.048 J	ND	ND	ND	0.180	0.085 J
Nitrite as N	mg/L	0.042	0.10	DI	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Kjeldahl Nitrogen	mg/L	0.065	0.10	DI	2.20	1.80	1.90	0.93	3.70	0.65	1.40	0.87	1.40	1.30	1.20	1.10
Total Nitrogen [a]	mg/L	NA	--	DI	2.20	1.80	1.90	0.93	3.76	0.65	1.45	0.87	1.40	1.30	1.20	1.19
Ammonia-Nitrogen	mg/L	0.017	0.10	DI	1.40	0.910	1.00	0.019 J	3.00	0.084 J	0.560	0.023 J	0.740	0.650	0.470	0.270
Unionized Ammonia [b]	mg/L	NA	--	DI	0.058	0.067	0.067	0.005	0.014	0.001	0.007	0.001	0.004	0.005	0.007	0.015
Ortho Phosphate Phosphorus	mg/L	0.007	0.01	DI	0.230	0.140	0.029	0.042	0.310	ND	0.008 J	0.018	0.008 J	0.008 J	ND	ND
Total Phosphorus	mg/L	0.007	0.01	DI	0.270	0.190	0.090	0.110	0.340	0.036	0.047	0.070	0.056	0.047	0.060	0.062
Total Aluminum	mg/L	0.022	0.05	DI	0.069	0.080	0.097	0.150	0.051	0.093	0.140	0.190	0.042 J	0.046 J	0.160	0.140
Dissolved Aluminum	mg/L	0.041	0.05	DI	0.055	0.077	0.080	0.094	ND	0.048 J	0.071	0.120	ND	ND	0.047 J	0.057
Chlorophyll-a																
Chlorophyll-a	µg/L	1.0	2.0	Surface	11.2	21.4	20.0	25.8	16.6	19.2	34.0	25.2	14.8	14.4	32.0	39.5
Chlorophyll-a	µg/L	1.0	2.0	DI	30.3	40.6	44.1	23.1	26.7	15.0	24.7	25.1	8.7	18.0	27.1	34.2

Notes:

- When a concentration was non-detect, the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was below the corresponding MDL, the average value was reported as ND.

a. Total Nitrogen = TKN+NO2+NO3

b. Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986).

NA – Not applicable/ available; ND – not detected; DI = Depth Integrated; mg/L – micrograms per liter; ug/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J –Reported value was detected above the MDL, but below the RL.

Table 3-18. Monthly Analytical Chemistry Results for Canyon Lake (Feb – June 2025)

Compound	Units	MDL	RL	DI or Surface Sample	February 2025				April 2025				June 2025			
					Main Basin		East Basin		Main Basin		East Basin		Main Basin		East Basin	
					CL07	CL08	CL09	CL10	CL07	CL08	CL09	CL10	CL07	CL08	CL09	CL10
General Chemistry																
Total Dissolved Solids	mg/L	4	10	DI	520	520	590	610	530	520	620	560	570	580	640	*720*
Total Suspended Solids	mg/L	5.0	5.00	DI	6.00	8.00	10.00	13.00	7.00	10.00	13.00	18.00	6.00	6.00	7.00	5.00
Sulfide	mg/L	0.05-0.5	0.1-1.0	DI	ND	ND	ND	ND	0.70	0.30	2.00	ND	3.00	4.00	7.00	ND
Nitrate as N	mg/L	0.0400	0.20	DI	0.17 J	0.13 J	0.13 J	0.082 J	ND	ND	ND	ND	ND	ND	ND	0.056 J
Nitrite as N	mg/L	0.0420	0.10	DI	0.280	0.210	0.062 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Kjeldahl Nitrogen	mg/L	0.0650	0.10	DI	0.87	0.93	1.30	1.10	1.30	1.10	2.20	1.20	2.00	1.90	3.00	0.99
Total Nitrogen [a]	mg/L	NA	--	DI	1.32	1.27	1.49	1.18	1.30	1.10	2.20	1.20	2.00	1.90	3.00	1.05
Ammonia-Nitrogen	mg/L	0.0170	0.10	DI	0.140	0.150	0.410	0.045 J	0.510	0.190	1.300	ND	1.300	1.100	**2.2 ***	0.018 J
Unionized Ammonia [b]	mg/L	NA	--	DI	0.002	0.004	0.008	0.004	0.017	0.006	0.019	0.000	0.024	0.064	0.082	0.005
Ortho Phosphate Phosphorus	mg/L	0.0071	0.01	DI	ND	ND	ND	ND	0.018	ND	0.120	ND	0.036	0.024	0.110	ND
Total Phosphorus	mg/L	0.0067	0.01	DI	0.044	0.051	0.090	0.076	0.088	0.091	0.210	0.088	0.088	0.082	0.180	0.045
Total Aluminum	mg/L	0.0220	0.05	DI	0.058	0.160	0.140	0.180	0.087	0.170	0.240	0.470	0.064	0.078	0.150	0.200
Dissolved Aluminum	mg/L	0.0410	0.05	DI	ND	ND	ND	ND	0.052	0.120	0.140	0.450	0.051	0.066	0.100	0.200
Chlorophyll-a																
Chlorophyll-a	µg/L	1.0	2.0	Surface	39.9	50.1	30.0	38.3	22.3	18.7	17.4	16.0	9.5	12.5	13.4	13.7
Chlorophyll-a	µg/L	1.0	2.0	DI	24.9	30.0	27.8	44.9	22.3	28.5	24.0	14.7	14.9	18.3	36.1	16.0

Notes:
- When a concentration was non-detect, the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was below the corresponding MDL, the average value was reported as ND.

a. Total Nitrogen = TKN+NO2+NO3
b. Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986).

NA – Not applicable/ available; ND – not detected; DI = Depth Integrated; mg/L – micrograms per liter; ug/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J –Reported value was detected above the MDL, but below the RL.
Bold Underline - Indicates exceedance of 2020 TMDL target. **Bold asterisk *** Exceeds 2004 TMDL Permit NH3 CCC; **Bold double asterisk**** Exceeds 2004 TMDL Permit NH3 CMC

Table 3-19. Analytical Chemistry Results for Canyon Lake - Annual Mean Statistics for Each Site in the Main Basin

Compound	Units	MDL	RL	Basin Plan WQO or TMDL Target	DI or Surface Sample	CL07			CL08			Main Basin		
						Min	Max	Avg [a]	Min	Max	Avg [a]	Min	Max	Avg [a]
General Chemistry														
Total Dissolved Solids	mg/L	4.0	10.0	700 [b]	DI	410	570	493	410	580	502	410	575	498
Total Suspended Solids	mg/L	5.0	5.0	NA	DI	6.00	8.00	6.83	ND	10.00	5.83	ND	8.50	6.33
Sulfide	mg/L	0.05-0.5	0.1-1.0	NA	DI	ND	5.0	2.1	ND	4.0	1.2	ND	3.5	1.7
Nitrate as N	mg/L	0.04	0.2	NA	DI	ND	0.17 J	ND	ND	0.13 J	ND	ND	0.150	ND
Nitrite as N	mg/L	0.042	0.1	NA	DI	ND	0.280	0.047	ND	0.210	ND	ND	0.245	ND
Total Kjeldahl Nitrogen	mg/L	0.065	0.1	NA	DI	0.87	3.7	1.9	0.65	1.9	1.3	0.90	2.2	1.6
Total Nitrogen [c]	mg/L	NA	--	0.75 [a, d]	DI	1.30	3.76	**2.00**	0.65	1.90	**1.34**	1.20	2.20	**1.67**
Ammonia-Nitrogen	mg/L	0.017	0.1	CMC: 1.8-30.92 [d, e]; CCC: 0.31-4.88 [d, e]	DI	0.14	3.0	1.2	0.08 J	1.10	0.51	0.15	1.5	0.85
Unionized Ammonia [f]	mg/L	NA	--	NA	DI	ND	0.058	0.020	ND	0.067	0.024	ND	0.063	0.022
Ortho Phosphate Phosphorus	mg/L	0.0071	0.01	NA	DI	ND	0.310	0.100	ND	0.140	0.029	ND	0.185	0.065
Total Phosphorus	mg/L	0.0067	0.01	0.1 [a, d]	DI	0.044	0.340	**0.148**	0.036	0.190	0.083	0.048	0.230	**0.115**
Total Aluminum	mg/L	0.022	0.05	NA	DI	0.042 J	0.087	0.062	0.046 J	0.170	0.105	0.044	0.129	0.083
Dissolved Aluminum	mg/L	0.041	0.05	NA	DI	ND	0.055	ND	ND	0.120	0.052	ND	0.086	ND
Chlorophyll-a														
Chlorophyll-a	µg/L	1.0	2.0	25 [a, d]	Surface	9.5	39.9	19.1	12.5	50.1	22.7	11.0	45.0	20.9
Chlorophyll-a	µg/L	1.0	2.0	25 [a, d]	DI	8.7	30.3	21.3	15.0	40.6	**25.1**	13.3	35.5	23.2

Notes:
- When a concentration was non-detect, the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was below the corresponding MDL, the average value was reported as ND.
- Individual site values are annual mean, maximum, and minimum statistics for each site in the current monitoring year. Main Basin mean, maximum, and minimum values are for the combined Main Basin average values.

a. Annual average
b. Santa Ana Region Basin Plan Objective
c. Total Nitrogen = TKN+NO2+NO3
d. 2020 TMDL Target, based on Table 5-9n of 2004 TMDL.
e. The range of TMDL target thresholds apply to individual samples, not applicable to annual means.
f. Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986).

NA – Not applicable/ available; ND – not detected; DI = Depth Integrated; mg/L – micrograms per liter; ug/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J –Reported value was detected above the MDL, but below the RL.

Bold Underline - Indicates exceedance of 2020 TMDL target.

Table 3-20. Analytical Chemistry Results for Canyon Lake - Annual Mean Statistics for Each Site in the East Basin

Compound	Units	MDL	RL	Basin Plan WQO or TMDL Target	DI or Surface Sample	CL09			CL010			East Basin		
						Min	Max	Avg [a]	Min	Max	Avg [a]	Min	Max	Avg [a]
General Chemistry														
Total Dissolved Solids	mg/L	4.0	10.0	700 [b]	DI	550	640	598	560	*720*	613	555	680	606
Total Suspended Solids	mg/L	5.0	5.0	NA	DI	5.00	13.0	8.83	5.00	18.0	9.33	5.50	15.5	9.08
Sulfide	mg/L	0.05-0.5	0.1-1.0	NA	DI	ND	7.00	2.77	ND	ND	ND	ND	3.50	1.38
Nitrate as N	mg/L	0.04	0.2	NA	DI	ND	0.13 J	ND	ND	0.085 J	ND	ND	0.106	0.041
Nitrite as N	mg/L	0.042	0.1	NA	DI	ND	0.062 J	ND	ND	ND	ND	ND	ND	ND
Total Kjeldahl Nitrogen	mg/L	0.065	0.1	NA	DI	1.20	3.00	1.83	0.87	1.20	1.03	1.14	2.00	1.43
Total Nitrogen [c]	mg/L	NA	--	0.75 [a, d]	DI	1.20	3.00	**1.87**	0.87	1.20	**1.07**	1.16	2.02	**1.47**
Ammonia-Nitrogen	mg/L	0.017	0.1	CMC: 1.8-30.92 [d, e]; CCC: 0.31-4.88 [d, e]	DI	0.41	2.2	0.99	ND	0.27	0.06	0.23	1.1	0.53
Unionized Ammonia [f]	mg/L	NA	--	NA	DI	ND	0.082	0.032	ND	ND	ND	ND	0.043	0.018
Ortho Phosphate Phosphorus	mg/L	0.0071	0.01	NA	DI	ND	0.120	0.045	ND	0.042	0.010	ND	0.060	0.027
Total Phosphorus	mg/L	0.0067	0.01	0.1 [a, d]	DI	0.047	0.210	**0.113**	0.045	0.110	0.075	0.059	0.149	0.094
Total Aluminum	mg/L	0.022	0.05	NA	DI	0.097	0.240	0.155	0.140	0.470	0.222	0.124	0.355	0.188
Dissolved Aluminum	mg/L	0.041	0.05	NA	DI	ND	0.140	0.073	ND	0.450	0.154	ND	0.295	0.113
Chlorophyll-a														
Chlorophyll-a	µg/L	1.0	2.0	25 [a, d]	Surface	13.4	34.0	24.5	13.7	39.5	**26.4**	13.6	35.8	**25.4**
Chlorophyll-a	µg/L	1.0	2.0	25 [a, d]	DI	24.0	44.1	**30.6**	14.7	44.9	**26.3**	19.4	36.4	**28.5**

Notes:
- When a concentration was non-detect, the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was below the corresponding MDL, the average value was reported as ND.
- Individual site values are annual mean, maximum, and minimum statistics for each site in the current monitoring year. East Basin mean, maximum, and minimum values are for the combined East Basin average values.

a. Annual average
b. Santa Ana Region Basin Plan Objective
c. Total Nitrogen = TKN+NO2+NO3
d. 2020 TMDL Target, based on Table 5-9n of 2004 TMDL.
e. The range of TMDL target thresholds apply to individual samples, not applicable to annual means.
f. Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986).

NA – Not applicable/ available; ND – not detected; DI = Depth Integrated; mg/L – micrograms per liter; ug/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J –Reported value was detected above the MDL, but below the RL.

Bold Underline - Indicates exceedance of 2020 TMDL target.

Table 3-21. Analytical Chemistry Results for Canyon Lake - Annual Mean Statistics for Main and East Basins

Compound	Units	MDL	RL	Basin Plan WQO or TMDL Target	DI or Surface Sample	Main Basin			East Basin			Lake-wide Average		
						Min	Max	Avg [a]	Min	Max	Avg [a]	Min	Max	Avg [a]
General Chemistry														
Total Dissolved Solids	mg/L	4	10	700 [b]	DI	410	575	498	555	680	606	483	628	552
Total Suspended Solids	mg/L	5.00	5.00	NA	DI	ND	8.50	6.33	5.50	15.50	9.08	ND	12.00	7.71
Sulfide	mg/L	0.05-0.5	0.1-1.0	NA	DI	ND	3.50	1.67	ND	3.50	1.38	ND	3.50	1.53
Nitrate as N	mg/L	0.040	0.200	NA	DI	ND	0.150	ND	ND	0.106	0.041	ND	0.128	ND
Nitrite as N	mg/L	0.042	0.100	NA	DI	ND	0.245	ND	ND	ND	ND	ND	0.138	ND
Total Kjeldahl Nitrogen	mg/L	0.07	0.10	NA	DI	0.90	2.18	1.60	1.14	2.00	1.43	1.05	1.97	1.51
Total Nitrogen [c]	mg/L	NA	--	0.75 [a, d]	DI	1.20	2.20	**1.67**	1.16	2.02	**1.47**	1.27	1.99	**1.57**
Ammonia-Nitrogen	mg/L	0.02	0.10	CMC: 1.8-30.92 [d, e]; CCC: 0.31-4.88 [d, e]	DI	0.15	1.54	0.85	0.23	1.11	0.53	0.19	1.15	0.69
Unionized Ammonia [f]	mg/L	NA	--	NA	DI	ND	0.063	0.022	ND	0.043	0.018	ND	0.049	0.020
Ortho Phosphate Phosphorus	mg/L	0.007	0.010	NA	DI	ND	0.185	0.065	ND	0.060	0.027	ND	0.110	0.046
Total Phosphorus	mg/L	0.007	0.010	0.1 [a, d]	DI	0.048	0.230	**0.115**	0.059	0.149	0.094	0.056	0.165	**0.105**
Total Aluminum	mg/L	0.022	0.050	NA	DI	0.044	0.129	0.083	0.124	0.355	0.188	0.097	0.242	0.136
Dissolved Aluminum	mg/L	0.041	0.050	NA	DI	ND	0.086	ND	ND	0.295	0.113	ND	0.191	0.076
Chlorophyll-a														
Chlorophyll-a	µg/L	1.0	2.0	25 [a, d]	Surface	11.0	45.0	20.9	13.6	35.8	**25.4**	12.3	39.6	23.2
Chlorophyll-a	µg/L	1.0	2.0	25 [a, d]	DI	13.3	35.5	23.2	19.4	36.4	**28.5**	21.3	34.5	**25.8**

Notes:
- When a concentration was non-detect, the annual mean value for compliance purposes was calculated by converting ND values to zero. If the result of the calculated mean was below the corresponding MDL, the average value was reported as ND.
- Main and East Basin mean, maximum, and minimum values are for the combined Main and East Basin average values respectively. Lake wide average values are the mean, maximum, and minimum of the monthly Main and East Basin means.

a. Annual average
b. Santa Ana Region Basin Plan Objective
c. Total Nitrogen = TKN+NO2+NO3
d. 2020 TMDL Target, based on Table 5-9n of 2004 TMDL.
e. The range of TMDL target thresholds apply to individual samples, not applicable to annual means.
f. Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986).

NA – Not applicable/ available; ND – not detected; DI = Depth Integrated; mg/L – micrograms per liter; ug/L – milligrams per liter; MDL – method detection limit; RL – reporting limit; J –Reported value was detected above the MDL, but below the RL.

Bold Underline - Indicates exceedance of 2020 TMDL target.

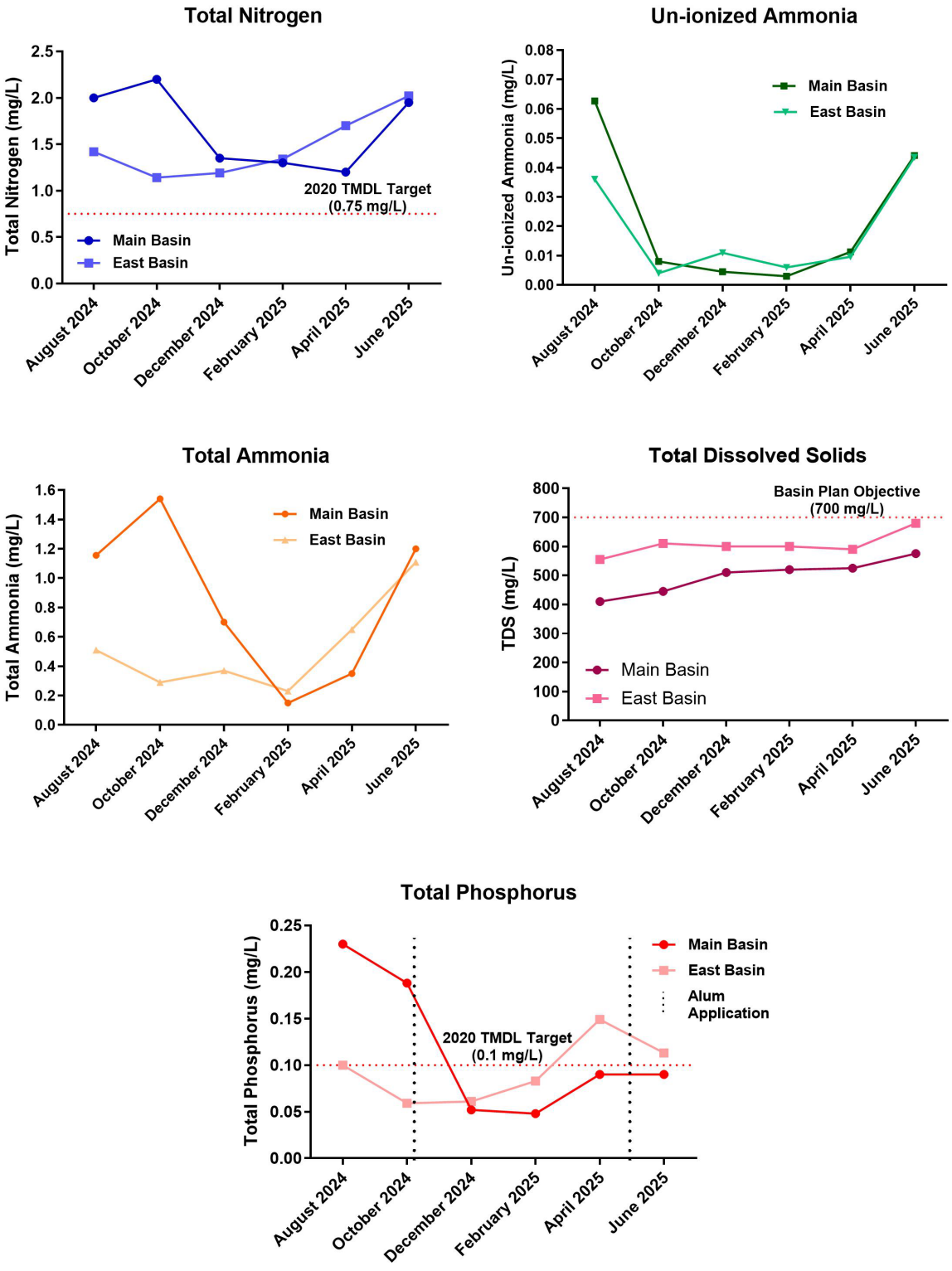


Figure 3-17. Canyon Lake Analytical Chemistry – Depth-Integrated Means

Main Basin values represent the mean of Sites CL07 & CL08, East Basin values represent the mean of Sites CL09 & CL10
Long term trends can be found in Appendix E

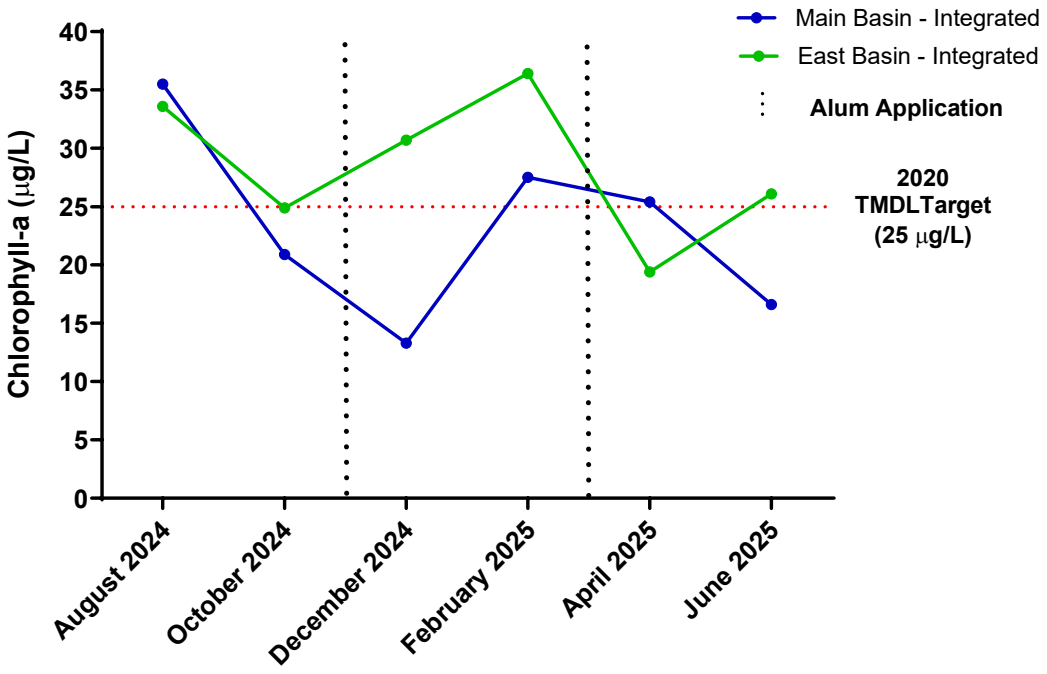


Figure 3-18. Canyon Lake Analytical Chemistry – Depth-Integrated Chlorophyll-a

Main Basin values represent the mean of Sites CL07 & CL08, East Basin values represent the mean of Sites CL09 & CL10
Long term trends can be found in Appendix E

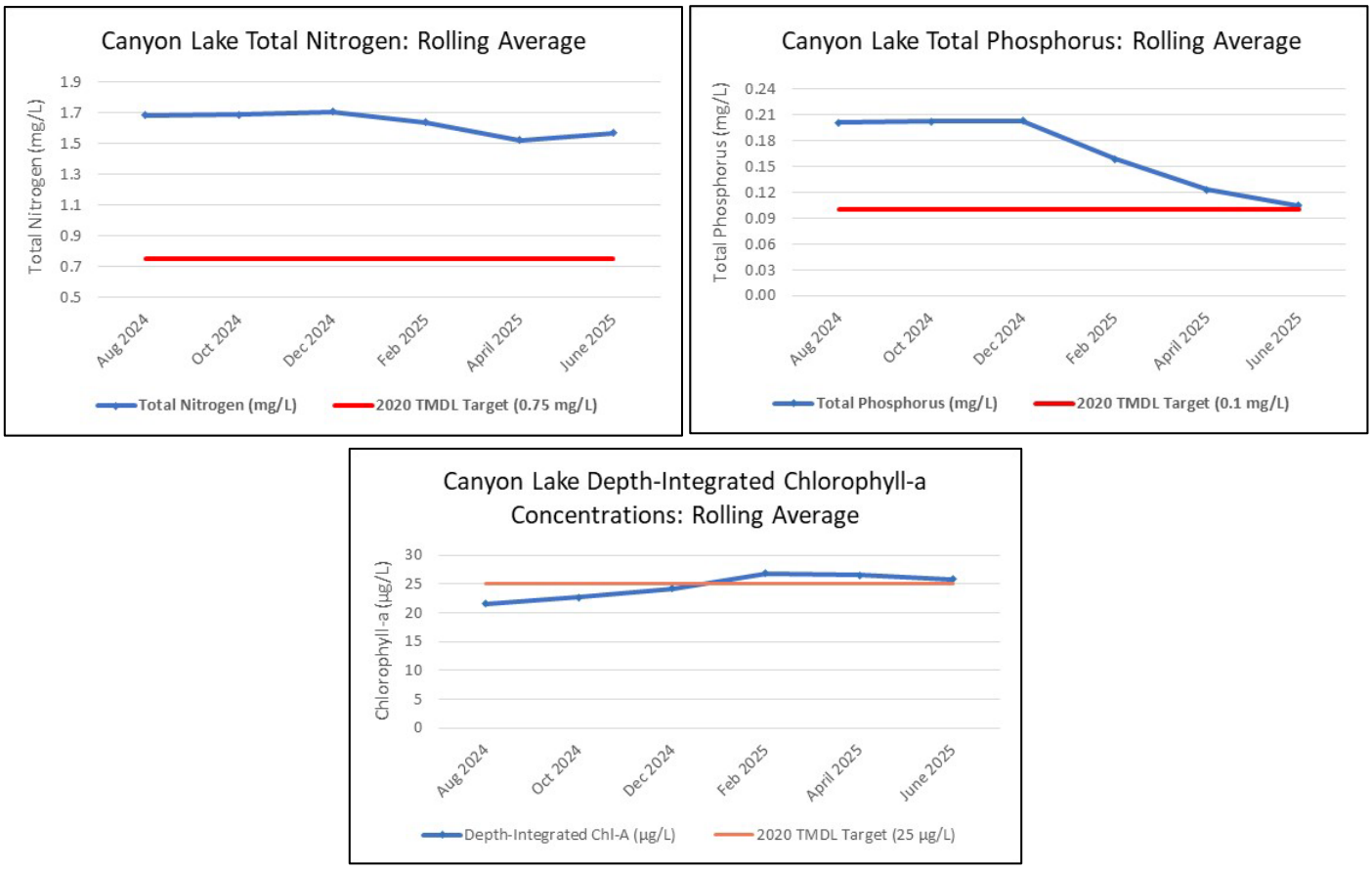


Figure 3-19. Canyon Lake Lake-wide Analytical Chemistry- Rolling Averages

Each data point is calculated by averaging the value from each event across all 4 sites with the previous five events across all 4 sites (i.e., one year of data) to obtain a rolling average. Therefore, each graph represents data collected from October 2023 to June 2025.

Figure 3-20. East Basin Brownish Water Color Indicating an Algal Bloom- April 2025

3.5 Satellite Imagery

In 2015-2016 and following, the TMDL Task Force contracted with satellite vendor EOMAP to conduct remote sensing using LandSat and Sentinel-2 satellite imagery to estimate chlorophyll-a and turbidity concentrations in Lake Elsinore and Canyon Lake. Using 30-m (LandSat) or 10-m (Sentinel-2) pixel resolution, this effort produced maps of the lakes showing graphical, color-coded images of chlorophyll-a and turbidity concentrations at up to approximately 1,000 unique data points across Canyon Lake and approximately 11,000 unique data points across Lake Elsinore. This tool provides a snapshot of conditions throughout the lakes at a given point in time, as opposed to the single data points provided at water quality collection locations and dates. The satellite images are also able to provide a sense of the relative variability in algae concentrations across the lake that can be rather dramatic and missed by measuring individual values from only a few discrete locations. However, the satellite imagery only represents approximately the upper 3-ft of the water column depending on water clarity and therefore cannot completely replace manual sampling where depth-integrated values are required.

As part of the TMDL compliance monitoring, satellite imagery depicting surficial lake-wide chlorophyll-a and turbidity concentrations in Lake Elsinore and Canyon Lake were generated for each in-lake monitoring event. Satellite images for each lake during the eight monitoring events evaluated in the report are presented in **Figures 3-21 and 3-22**. Spatial variability in chlorophyll-a is evident, providing a more complete assessment of algal density conditions across each lake.

To support interpretation of the satellite imagery, cumulative frequency distribution (CDF) plots of lake-wide chlorophyll-a concentrations based on individual pixel data are shown in **Figures 3-23** and **3-24**. These plots illustrate the distribution of chlorophyll-a across the lake surface for each

sampling date. Satellite-derived mean and median concentrations are presented alongside in-lake chlorophyll-a measurements from surface composite samples (0–2 m), allowing for direct comparison between localized field data and lake-wide conditions. Each pixel in the satellite imagery was treated as an individual data point to calculate mean and median values.

Satellite imagery of Lake Elsinore indicated low chlorophyll-a concentrations (≤30 µg/L) dominating the lake in July 2024. A lake-wide increase was observed in August 2024, followed by a decline in September and October, with concentrations remaining relatively low for the rest of the 2024–25 monitoring year. These satellite-based patterns generally aligned with in-lake surface sample analytical results.

Satellite imagery of Canyon Lake indicated generally low chlorophyll-a concentrations in both basins throughout the monitoring year, with the exception of September 2024, when levels increased slightly across much of the Main Basin and parts of the East Basin. Because in-lake TMDL monitoring is not conducted in September, these elevated concentrations could not be verified through analytical sampling. In June 2025, satellite data showed high chlorophyll-a concentrations in the San Jacinto River just upstream of the causeway separating the Main Basin from the North Ski Basin. Surface sample results for chlorophyll-a were variable: concentrations were relatively low in August (11–26 µg/L), peaked in February (30–50 µg/L), and then declined steadily through June to the lowest levels of the year (10–14 µg/L). The elevated February values may have been influenced by suspended sediment from storm activity, a pattern observed in previous years. Notably, the first significant storm of the monitoring year occurred on January 26–27, 2025, just nine days before the February 2025 sampling event. Overall, satellite-derived chlorophyll-a concentrations did not consistently align with surface sample analytical results, highlighting the potential influence of spatial variability and possible localized environmental factors.

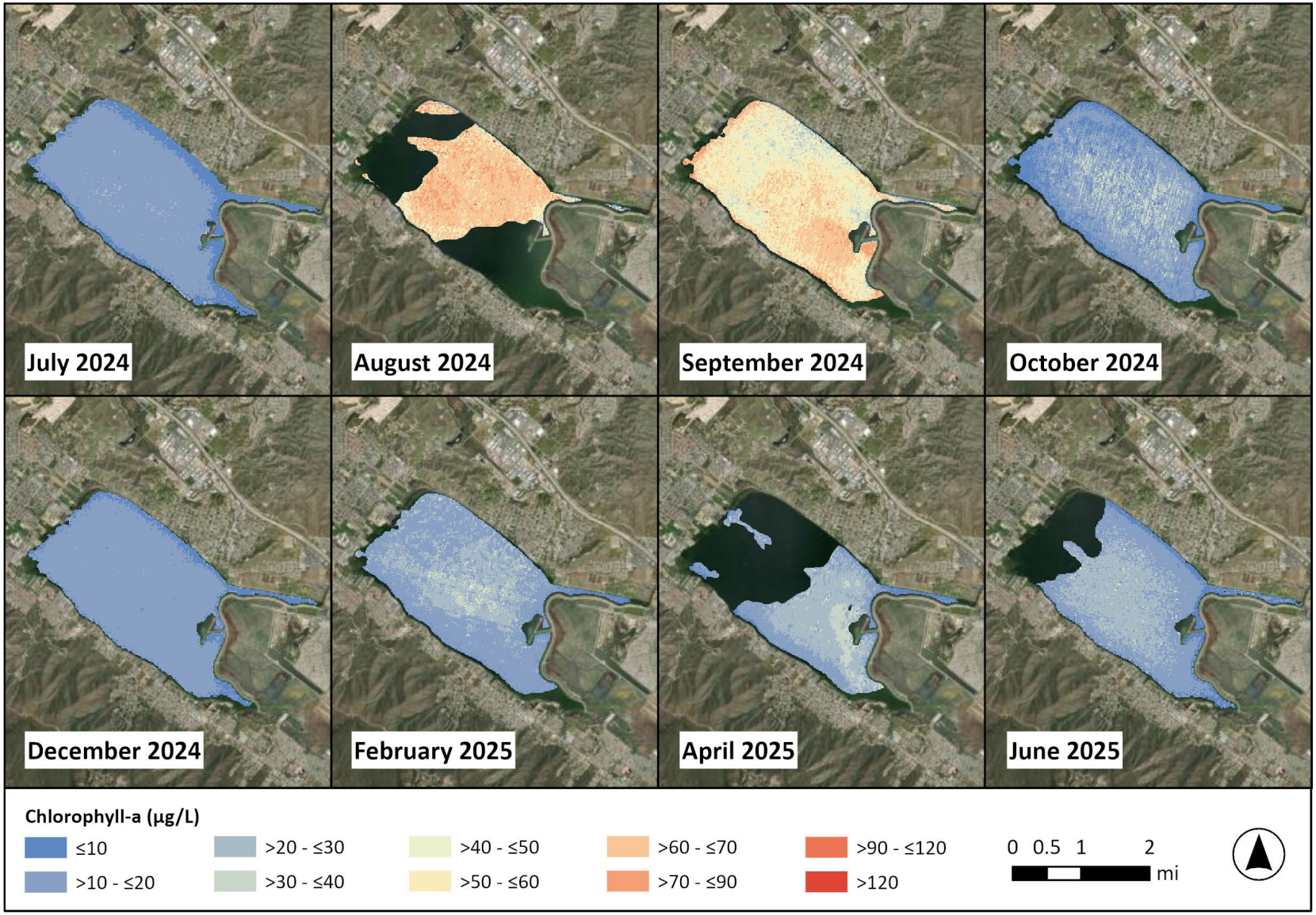


Figure 3-21. Satellite Imagery of Chlorophyll-a Concentrations in Lake Elsinore

(Data gaps are due to sun glare)

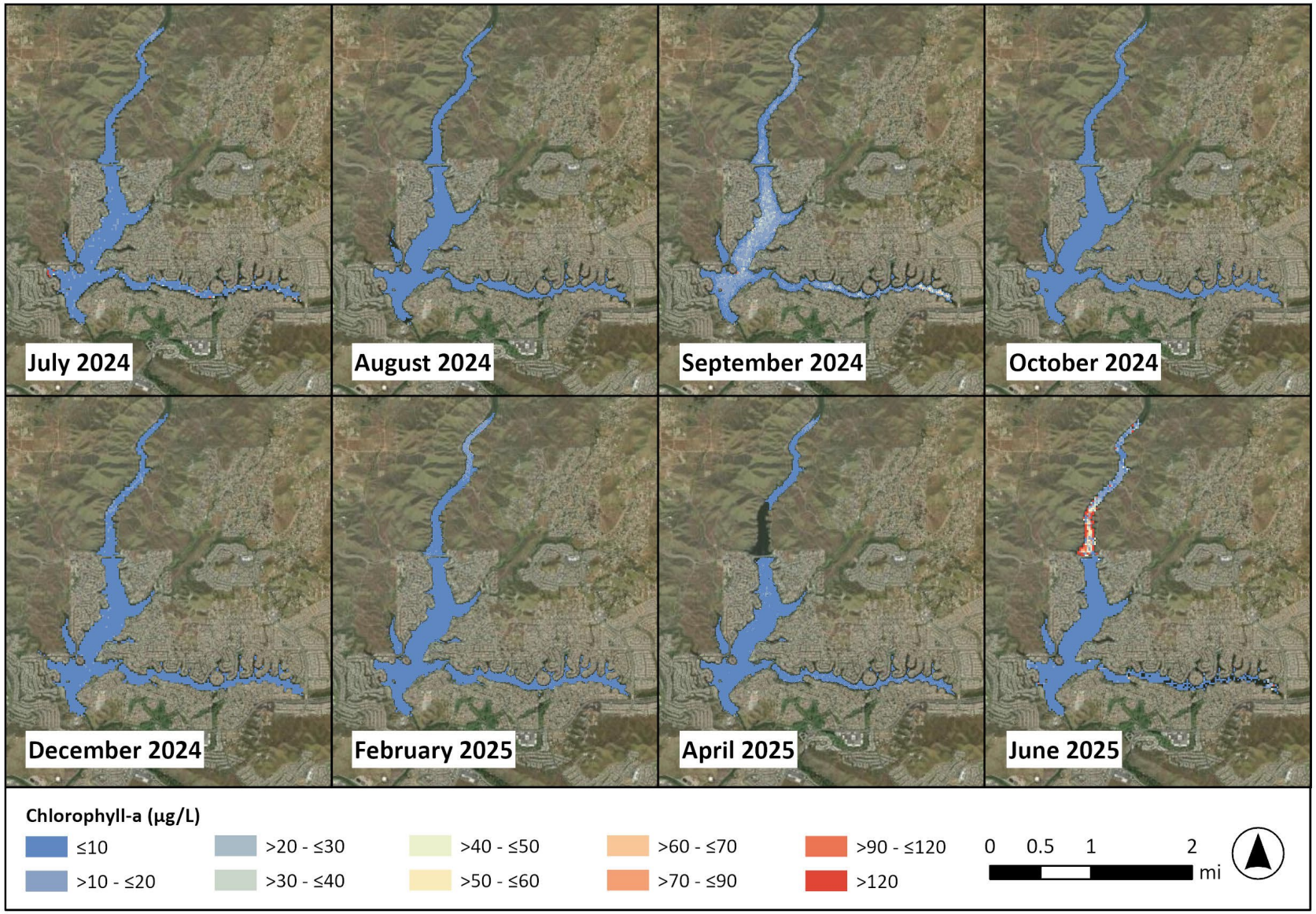


Figure 3-22. Satellite Imagery of Chlorophyll-a Concentrations in Canyon Lake

(Data gaps are due to sun glare)

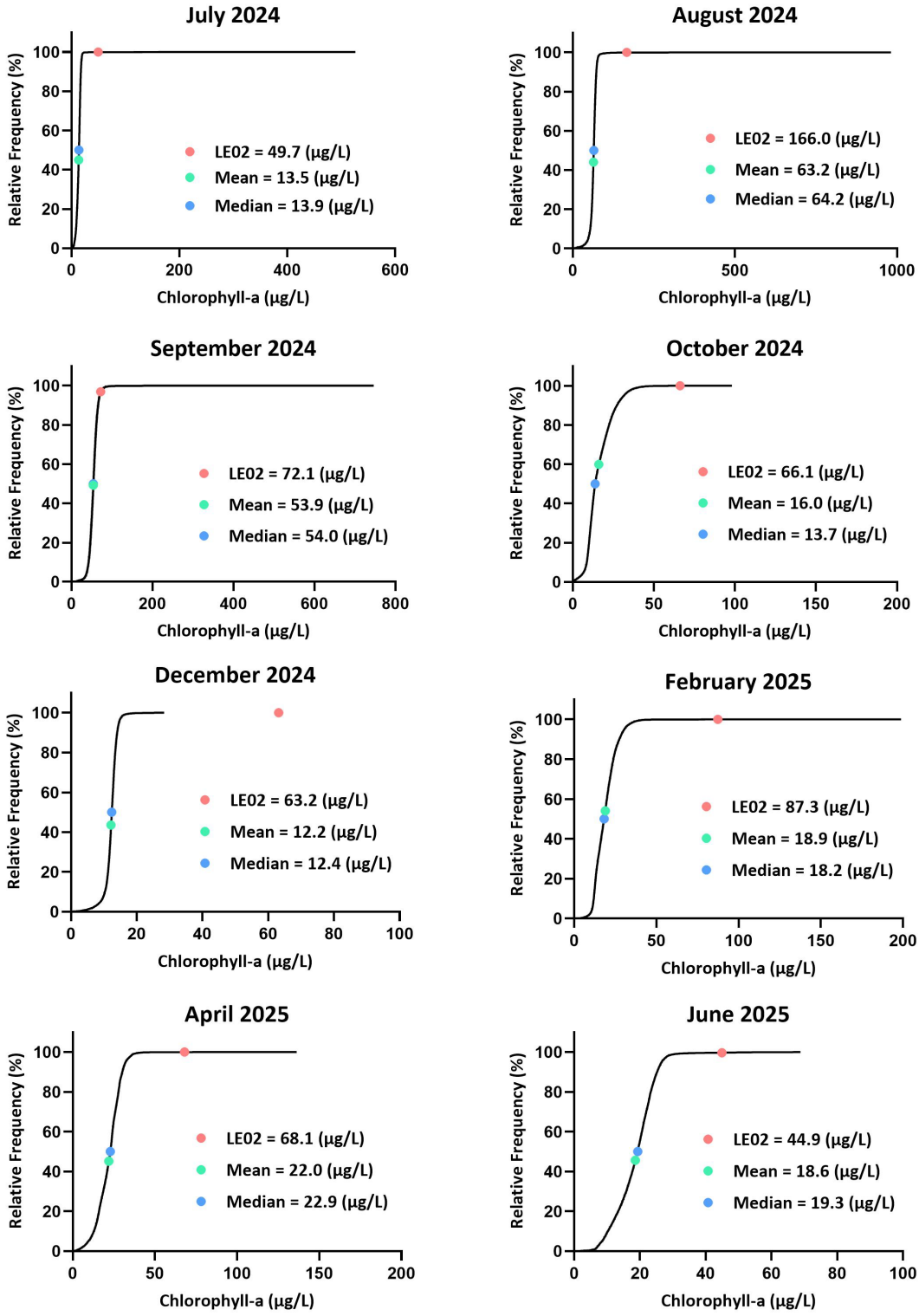


Figure 3-23. Cumulative Distribution of Satellite Derived Chlorophyll-a Concentrations in Lake Elsinore Relative to Measured Chlorophyll-a in Field Collected Samples

Colored dots represent the in-lake surface (0-2m) analytical measured concentration for each event and mean/median derived from all satellite pixel data.

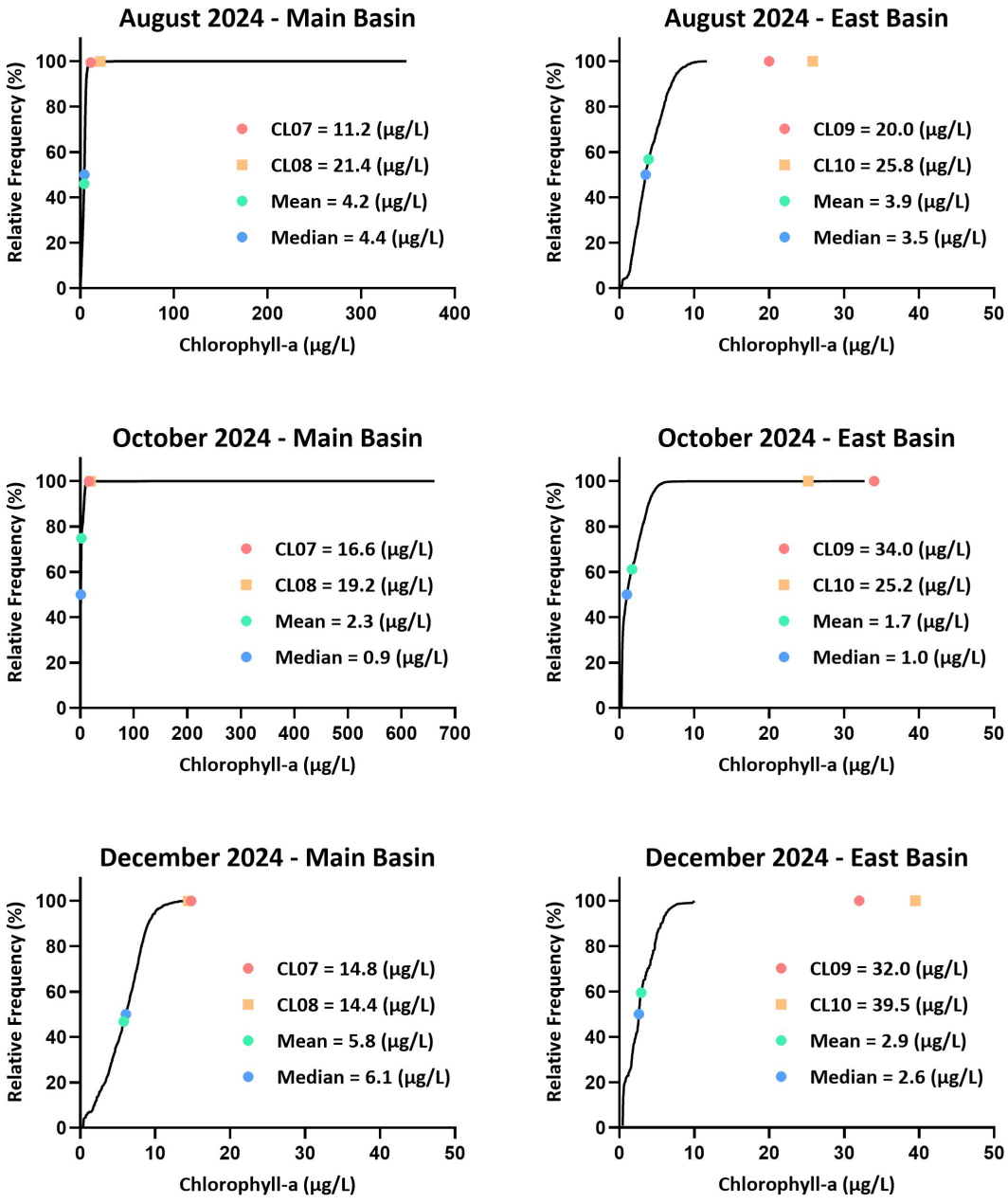


Figure 3-24. Cumulative Distribution of Satellite Derived Chlorophyll-a Concentrations in Canyon Lake Relative to Measured Chlorophyll-a in Field Collected Samples

Colored dots represent the in-lake surface (0-2m) analytical measured concentration for each event and mean/median derived from all satellite pixel data.

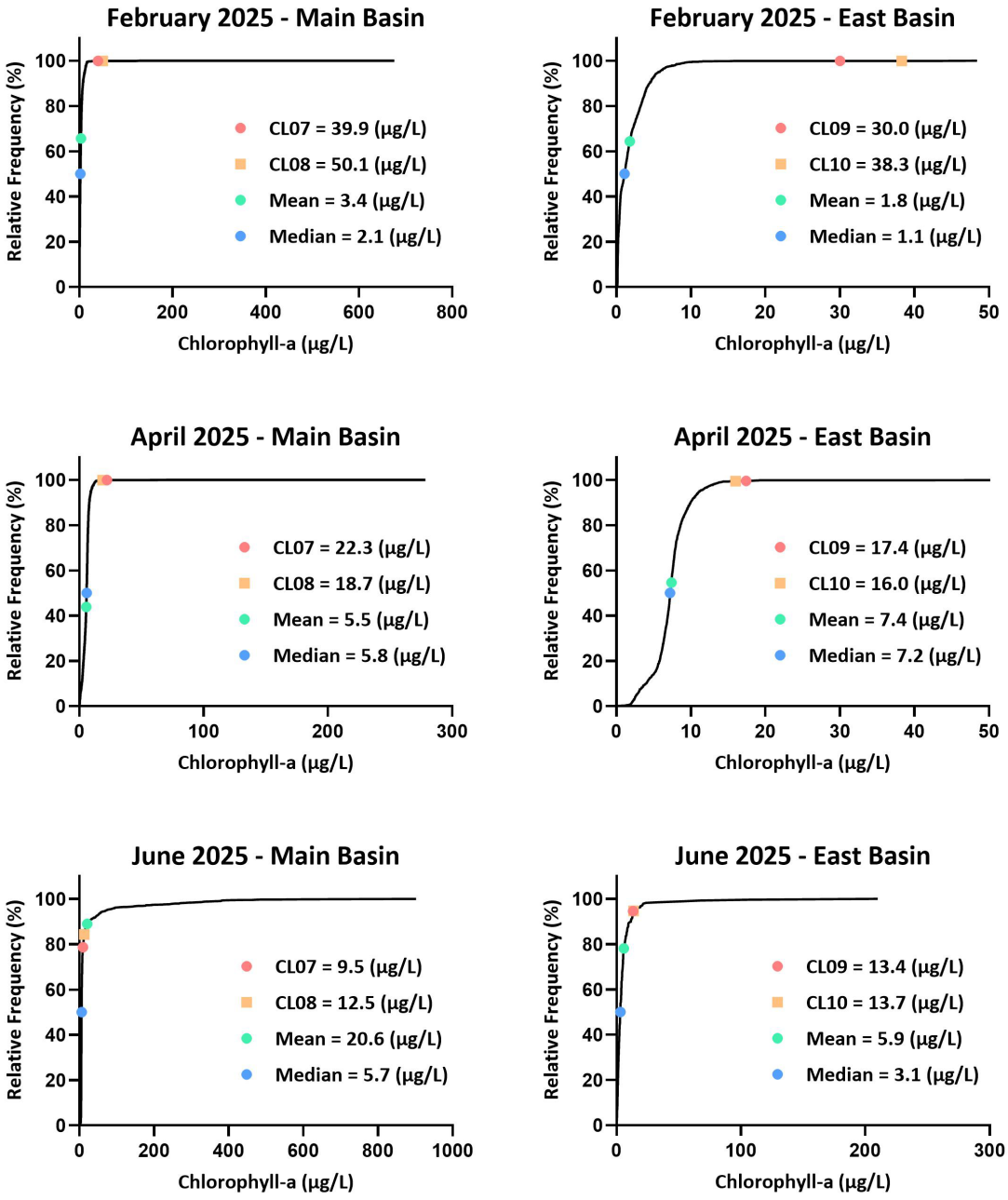


Figure 3-24 (continued). Cumulative Distribution of Satellite Derived Chlorophyll-a Concentrations in Canyon Lake Relative to Measured Chlorophyll-a in Field Collected Samples

Colored dots represent the in-lake surface (0-2m) analytical measured concentration for each event and mean/median derived from all satellite pixel data.

4.0 Conclusions

Sampling was conducted during the July 2024 to June 2025 monitoring year according to the Lake Elsinore and Canyon Lake Nutrient Monitoring Work Plan (Haley & Aldrich 2016) and companion Quality Assurance Project Plan (Amec Foster Wheeler 2016) to fulfill the requirements outlined in RWQCB Resolution No. R8-2004-0037. A total of 8 monitoring events were conducted in Lake Elsinore (monthly June to September, bi-monthly otherwise) and 6 monitoring events in Canyon Lake (bi-monthly). A total of three storm events were sampled in the watershed, occurring on January 27-29, 2025, March 5-10, 2025, and March 11-17, 2025.

The following summarizes the data collected during the 2024-2025 monitoring year, noting any exceedances of TMDL targets, and any relevant observations pertaining to results obtained.

4.1 Watershed Monitoring

A summary of watershed water quality monitoring data for each of the four monitoring locations for the monitoring period of July 1, 2024 through June 30, 2025 is provided below.

1. Concentrations of nutrients for the three storm events monitored at Salt Creek at Murrieta Road (Station ID 745) ranged from 1.8 to 4.2 milligrams per liter (mg/L) for total nitrogen, and 0.3 to 0.76 mg/L for total phosphorus. Based on flow data provided by the nearby USGS stream gauge (Station ID 11070465), the total annual flow was estimated at 46,603,494 cf or 349 Mgal for the period of July 1, 2024, through June 30, 2025. The estimated annual nutrient load was calculated to be 3,540 kg for total nitrogen and 592 kg for total phosphorus for the period of July 1, 2024 through June 30, 2025.

2. Concentrations of nutrients for the three storm events monitored at San Jacinto River at Goetz Road (Station ID 759) ranged from 1.4 to 4.4 mg/L for total nitrogen, and 0.32 to 0.69 mg/L for total phosphorus. Based on flow data provided by the nearby USGS stream gauge (Station ID 11070365), the total annual flow was estimated at 67,835,685 cf or 507 Mgal for the period of July 1, 2024, through June 30, 2025. The estimated annual nutrient load was calculated to be 4,145 kg for total nitrogen and 801 kg for total phosphorus for the period of July 1, 2024 through June 30, 2025.

3. Concentrations of nutrients for the two storm events monitored at Canyon Lake Spillway (Station ID 841) ranged from 0.93 to 0.99 mg/L for total nitrogen and 0.098 to 0.1 mg/L for total phosphorus. Based on flow data provided by the nearby USGS stream gauge (Station ID 11070500), the total annual flow was estimated at 143,075,097 cf or 1,070 Mgal for the period of July 1, 2024, through June 30, 2025. The USGS stream gauge (Station ID 11070500) located downstream of the Canyon Lake Spillway (Station ID 841) sampling location has minimal dry weather flow and storm flows account for the vast majority of the estimated annual load of nutrients exiting Canyon Lake. The estimated annual nutrient load was calculated to be 3,840 kg for total nitrogen and 403 kg for total phosphorus for the period of July 1, 2024, through June 30, 2025.

4. No samples were collected from the sampling station at San Jacinto River at Ramona Expressway (Station ID 741) during the 2024-2025 monitoring year. In-Lake Monitoring

4.2 Lake Elsinore

1. Lake Elsinore annual monitoring year means for total nitrogen and total phosphorus were 2.7 mg/L and 0.14 mg/L respectively, with both exceeding their associated 2020 TMDL limits. Both annual mean concentrations decreased from the previous 2023-2024 monitoring year annual means of 3.5 and 0.23 mg/L, respectively.

2. The annual mean for total ammonia was 0.39 mg/L, a decrease from the previous monitoring year mean of 0.53 mg/L. All total ammonia concentrations were below CMC threshold, however four exceeded the CCC threshold in July 2024 (0.23 mg/L), September 2024 (0.64 mg/L), October 2024 (0.83 mg/L), and December 2024 (0.49 mg/L) The 2023-2024 monitoring year had two total ammonia exceedances of the CCC thresholds in July 2023 and August 2023.

3. The DO concentration 1-m above the lake bottom as a 12-month rolling average at Site LE02 remained below the 2020 TMDL target of 5.0 mg/L for the entire monitoring year, identical to the previous 2023-2024 monitoring year. The average full-water column DO concentration at LE02 during the 2024-2025 monitoring year was 5.9 mg/L, while the 2023-2024 mean full-water column DO concentration was similar at 5.7 mg/L.

4. The mean chlorophyll-a concentration observed in samples collected during the summer TMDL compliance period (June 2024 through September 2024) was 71 µg/L for depth-integrated samples and 81 µg/L for surface samples. These concentrations both exceed the 2020 TMDL target of 25 µg/L chlorophyll-a. The mean summer depth-integrated and surface chlorophyll-a values in 2024 were well below those observed during the previous summer of 2023 (123 µg/L and 148 µg/L, respectively).

4.3 Canyon Lake

1. The annual average lake-wide concentrations of total nitrogen and total phosphorus in Canyon Lake were 1.6 mg/L and 0.11 mg/L, respectively. Both total nitrogen and total phosphorus means exceeded their 2020 TMDL limits of 0.75 mg/L and 0.10 mg/L, respectively. While the annual mean total nitrogen concentration increased slightly from the previous monitoring year (1.5 mg/L in 2023-24), the lake-wide annual total phosphorus mean was well below the 2023-24 annual mean of 0.19 mg/L.

2. The annual lake-wide mean concentration of total ammonia was 0.69 mg/L. This value is higher than the previous three monitoring years which had mean total ammonia concentrations of 0.59, 0.50, and 0.48 mg/L. No samples exceeded the total ammonia CCC or CMC value for the 2024-25 monitoring year.

3. The lake-wide DO concentration in the hypolimnion (when the lake was stratified) ranged from 0.0 to 0.14 mg/L. The rolling 12-month mean DO concentration in the hypolimnion was never above the 2020 TMDL target of 5.0 mg/L. The magnitude of stratification in Canyon Lake, particularly in the Main Basin, as well as its duration limits the ability of the lake to meet the 2020 TMDL target for DO. The lake is stratified during large portions of the year, during which there is almost no mixing between the upper epilimnion and

lower hypolimnion. During this time, the DO in the hypolimnion declines substantially as sediment biological and chemical processes deplete oxygen. However, the lake-wide average DO concentration was 6.0 mg/L when averaging values across all monitored sites and depths during the 2024-25 period.

4. The mean annual lake-wide depth-integrated chlorophyll-a concentration was 26 µg/L (depth-integrated) and 23 µg/L for surface samples. Surface chlorophyll-a concentration was below the 2020 TMDL target of 25 µg/L, while depth-integrated chlorophyll-a concentration was just above the target. These values are similar to the previous monitoring year of 21 µg/L and 22 µg/L, for the depth-integrated and surface samples.

5. The highest total aluminum concentration was measured at 470 µg/L at Site CL10 in the East Basin in April 2025, however none of the samples collected as part of the 2024-25 TMDL monitoring effort exceeded the 2018 EPA water chronic (CCC) or acute (CMC) criteria.

5.0 References

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