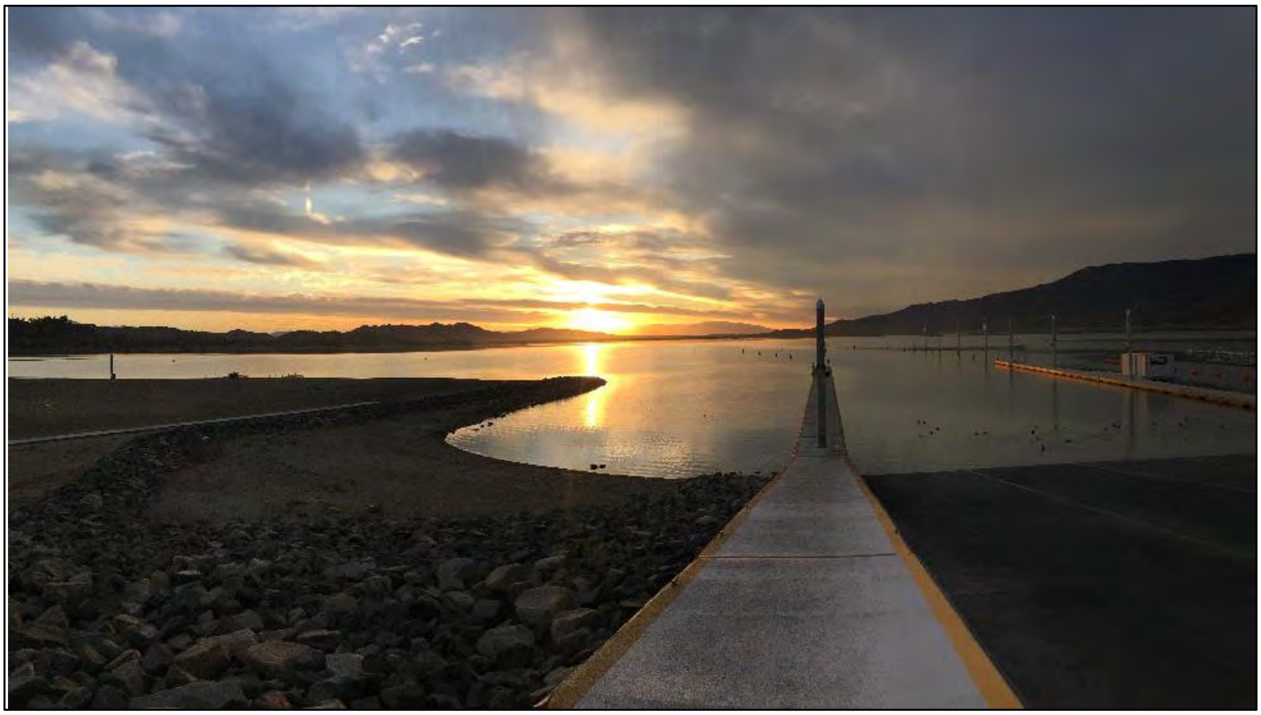
Lake Elsinore and Canyon Lake Watersheds Nutrient TMDL Monitoring 2021-2022 Annual Report FINAL



Prepared for:
Lake Elsinore & San Jacinto Watersheds Project Authority
11615 Sterling Avenue
Riverside, California 92503

Lake Elsinore & San Jacinto
Watersheds Authority

Prepared by:
Wood Environment and Infrastructure Solutions Inc. (now WSP USA)
9177 Sky Park Court
San Diego, CA 92123

November 22th, 2022

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

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

This page intentionally left blank.

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 2021-2022 fiscal year (FY). 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 a natural freshwater lake in southern California that provides a variety of natural habitats for terrestrial and aquatic species. 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]. While being a natural lake, the lake has been modified in various ways to enhance its recreational use and aquatic habitat, including creation of a levee at the lake's south end to increase the water depth / reduce evaporation, and water in the lake is supplemented with approximately 6 million gallons per day of recycled water from Elsinore Valley Municipal Water District (EVMWD). Canyon Lake was constructed in 1928 as the Railroad Canyon Reservoir. It is located approximately two miles upstream of Lake Elsinore and water spilled from Canyon Lake is a main source of water for Lake Elsinore during wet years. The beneficial uses of Canyon Lake include municipal and domestic water supply (MUN), agricultural supply (AGR), groundwater recharge (GWR), body contact recreation (REC1), non-body contact recreation (REC2), commercial and sportfishing (COMM), warm freshwater aquatic habitat (WARM), and wildlife habitat (WILD). The beneficial uses of COMM and RARE in Lake Elsinore and COMM in Canyon Lake were approved by the California Regional Water Quality Control Board, Santa Ana Region (RWQCB) as an amendment 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 after being approved by US EPA.

In 1994, Lake Elsinore and Canyon Lake were first listed by the RWQCB on its Clean Water Act Section 303(d) list of impaired waterbodies. Both lakes remain on the latest approved 303(d) list, Res. No. 2020-0039. 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 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,

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

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 (2015 interim and 2020 final) and watershed load allocations were 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 2015 and final 2020 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 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 a number of 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 Alta Environmental DBA NV5 of San Diego, California.

2.1 Summary of 2021-2022 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, 2021 through June 30, 2022, 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 2021-2022 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)	351	2.73	0.46	3,698	625
Site 4 - San Jacinto River at Goetz Road (USGS 11070365)	537	2.40	0.60	4,976	1,282
Site 6 - San Jacinto River at Ramona Expressway [b] (USGS 11070210)	0	Not Measured [b]	Not Measured [b]	Not Measured [b]	Not Measured [b]
Site 30 - Canyon Lake Spillway [c] (USGS 11070500)	640	1.5	ND(<0.003)[d]	3,632	0

a - Flow data after 10/14/2021 are provisional and may be subject to change.
b - No flows originating from the upper watershed were observed at the TMDL monitoring location just downstream of Mystic Lake and no sampling was conducted.
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.
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.
d - 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.

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, 2012 through June 30, 2022, is presented in Tables 2-2 to and 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 and Canyon Lake meet the current 10-year running average TMDL load allocations for both total nitrogen and total phosphorus (Table 2-4). The Canyon Lake TMDL load allocation for total phosphorous is met when accounting for an annual allowable 1,981 kg offset resulting from alum addition to the lake. 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	
	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
2012-2013	1.9	0.3	2.1	0.5	NS	NS
2013-2014	2.7	0.9	1.8	0.6	NS	NS
2014-2015	2.2	0.5	1.8	0.4	NS	NS
2015-2016	2.5	0.5	2.4	1.4	NS	NS
2016-2017	2.1	0.6	2.0	1.2	1.9	0.4
2017-2018	2.7	0.4	2.0	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)[a]

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		
	Total Annual Flow (Mgal)	Total Nitrogen (kg)	Total Phosphorus (kg)	Total Annual Flow (Mgal)	Total Nitrogen (kg)	Total Phosphorus (kg)	Total Annual Flow (Mgal)	Total Nitrogen (kg)	Total Phosphorus (kg)
2012-2013a	309	2,211	363	606	4,869	1,145	192	NS	NS
2013-2014	411	4,268	1,409	484	3,252	1,178	148	NS	NS
2014-2015	511	4,661	1,257	570	3,932	1,041	196	NS	NS
2015-2016	515	5,647	1,447	872	7,926	4,624	476	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]

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, 2012 to June 30, 2013. 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

<table>
<tr><th>Lake</th><th>Analyte</th><th>10-yr Running Average (kg/yr) [a]</th><th>TMDL Load Allocation (kg/yr) [b]</th><th>% of TMDL Load Allocation</th></tr>
<tr><td rowspan="2">Lake Elsinore [c]</td><td>Total Nitrogen</td><td>9,361</td><td>29,953</td><td>31.3%</td></tr>
<tr><td>Total Phosphorus</td><td>1,486</td><td>6,922</td><td>21.5%</td></tr>
<tr><td rowspan="3">Canyon Lake</td><td>Total Nitrogen</td><td>16,202</td><td>22,268</td><td>72.8%</td></tr>
<tr><td rowspan="2">Total Phosphorus</td><td>5,782</td><td rowspan="2">3,845</td><td>150.4%</td></tr>
<tr><td>-1,981 credit for alum application = 3,801</td><td>98.9%</td></tr>
</table>

a - Sum of average 10-year annual loads from Salt Creek at Murrieta Road and San Jacinto River at Goetz Road for the monitoring period January 2012 - December 2021.

b – Load allocations taken from Resolution R8-2004-0037 (2004 TMDL) Tables 5-9p and 5-9q. Internal sediment and atmospheric deposition 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.

c – watershed loading estimates for Lake Elsinore were taken from data collected at the Canyon Lake Spillway when it overflows

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 2021-2022 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, an area of land subsidence. Flow has not been observed at this location since a strong El Niño event in the mid-1990s. Because of the active 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
792a	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.

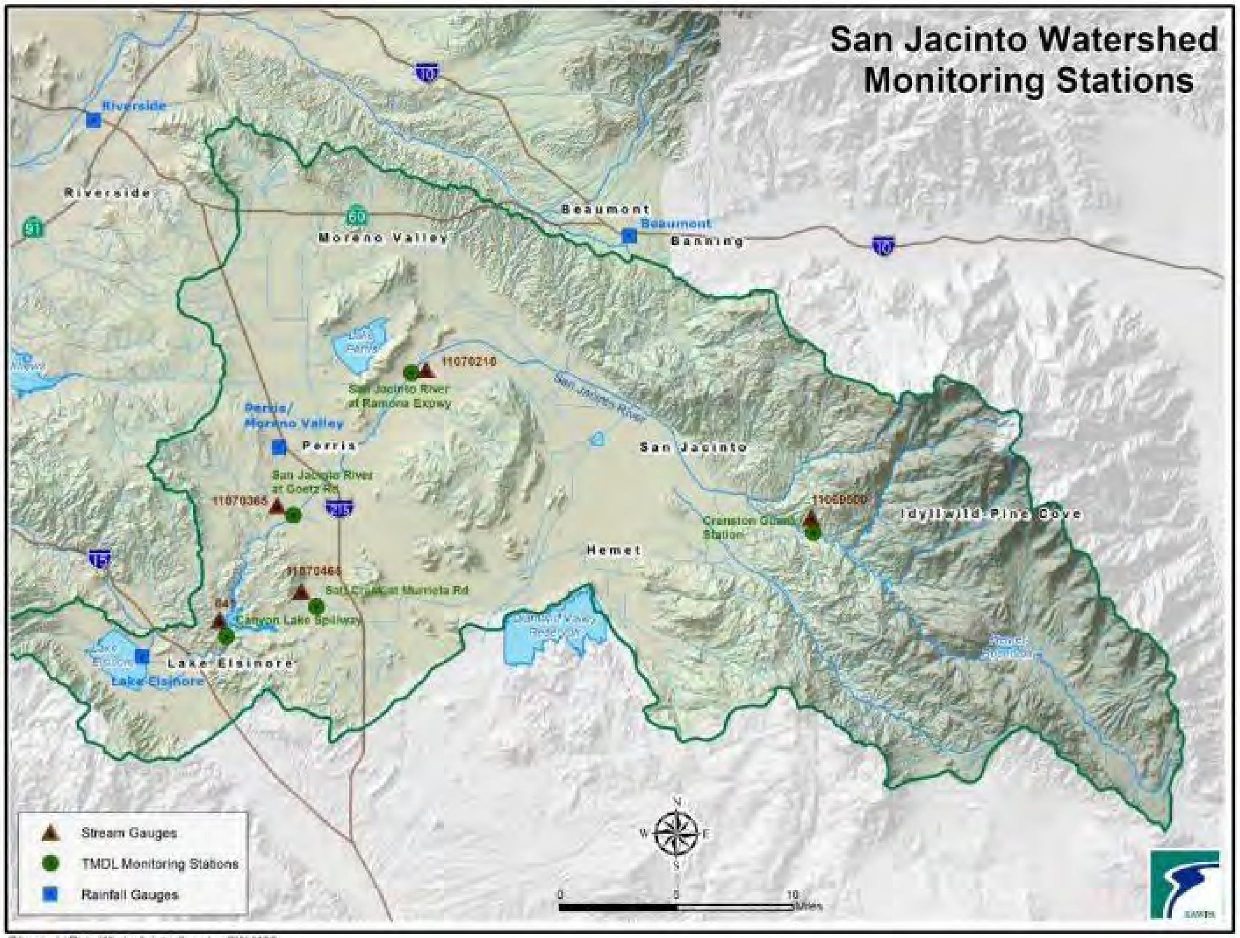


Figure 2-1. San Jacinto River Watershed Monitoring Stations

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, 2021 through June 30, 2022 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 October 14, 2021 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 2021 through June 2022)

July 2021-June 2022 Total Monthly Flow (cf)	Site 3 - Salt Creek at Murrieta Road (11070465[c])	Site 4 - San Jacinto River at Goetz Road (11070365 [c])	Site 6 - San Jacinto River at Ramona Expressway [a] (11070210 [c])	Site 30 - Canyon Lake Spillway (11070500 [b])	Site 1 - San Jacinto River at Cranston Guard Station (11069500 [c])
July	0	0	0	0	115,299
August	0	45	0	0	74,547
September	0	0	0	0	156,609
October	0	0	0	0	72,837
November	0	0	0	738,855	110,187
December	44,020,998	68,478,984	0	61,289,739	247,725
January	7,992	872,955	0	13,506,552	16,798,527
February	201,915	0	0	2,760,705	5,402,547
March	2,734,416	2,356,092	0	2,824,983	980,235
April	0	43,038	0	4,161,618	2,956,365
May	0	0	0	210,114	1,786,806
June	0	0	0	7,551	317,025
Total Annual Flow (cf)	**46,965,321**	**71,751,114**	**0**	**85,500,117**	**29,018,709**

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

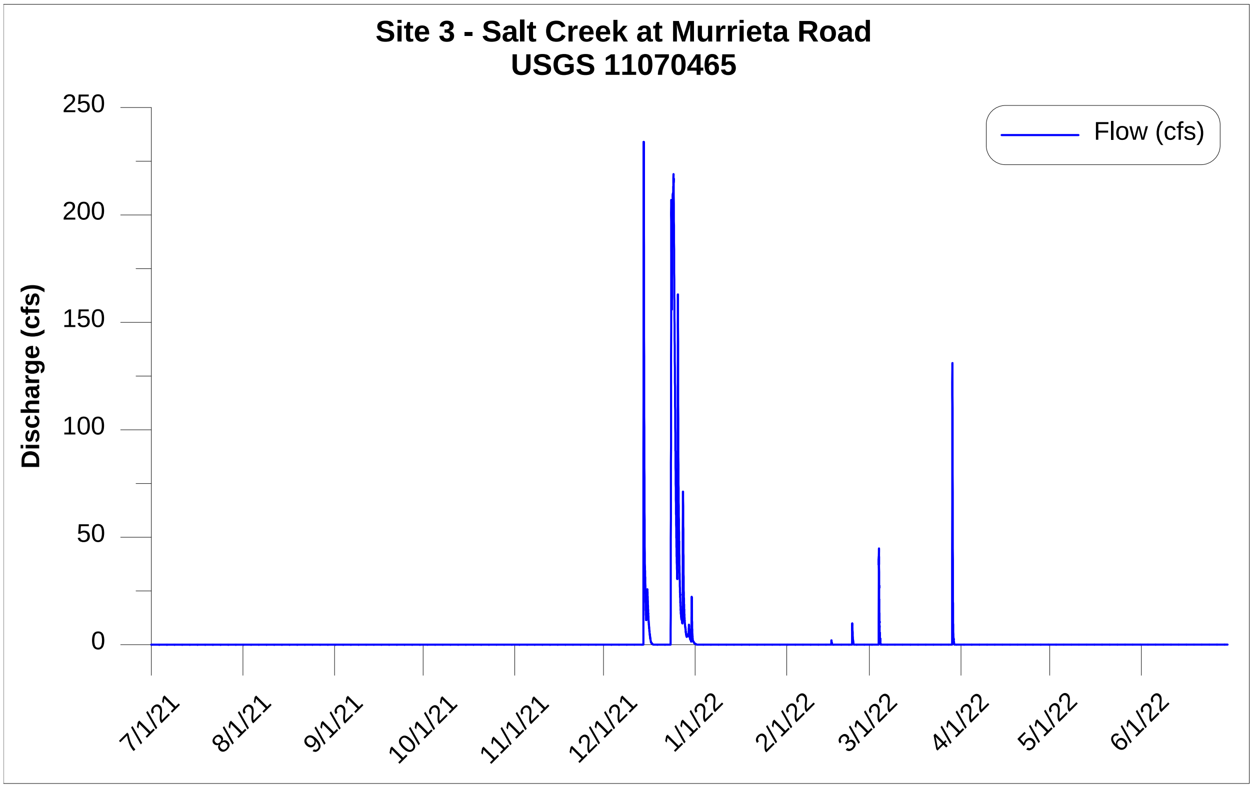


Figure 2-2. Site 3 – Salt Creek at Murrieta Road – Daily Stream Gauge Records

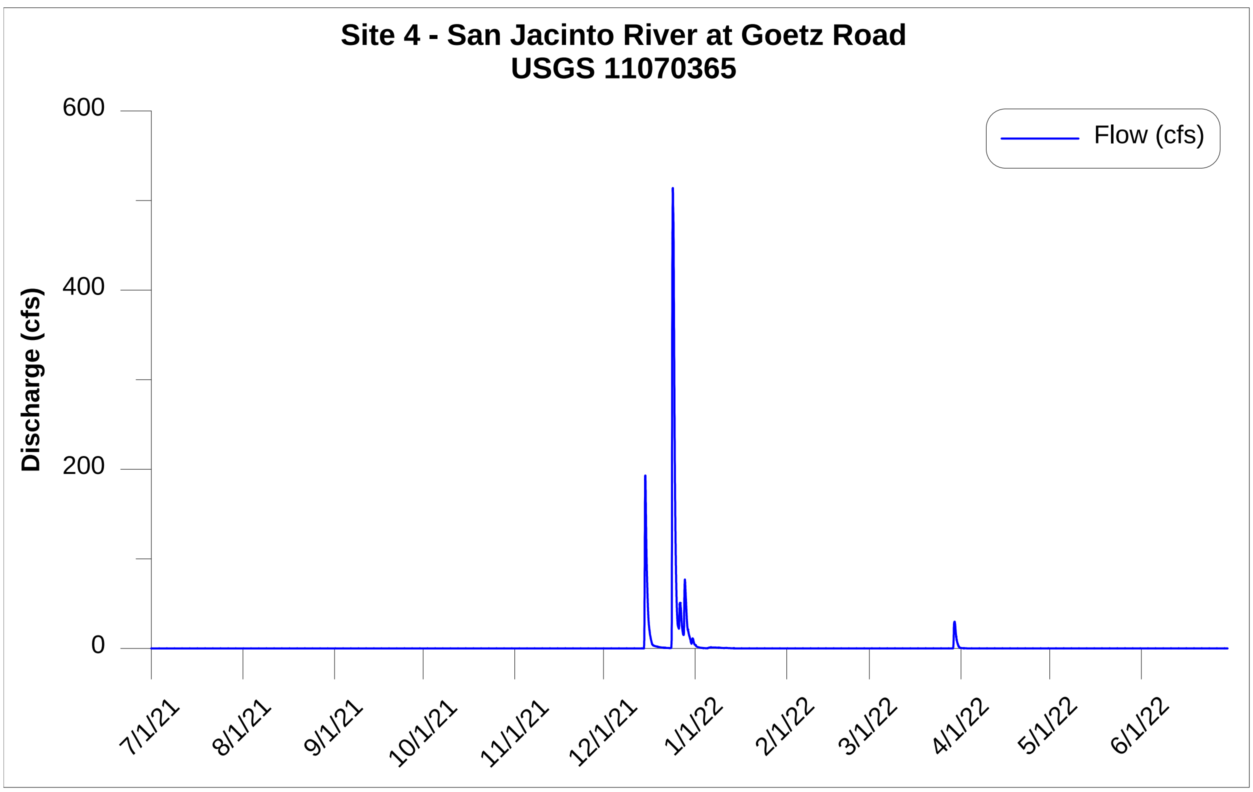


Figure 2-3. Site 4 – San Jacinto River at Goetz Road – Daily Stream Gauge Records

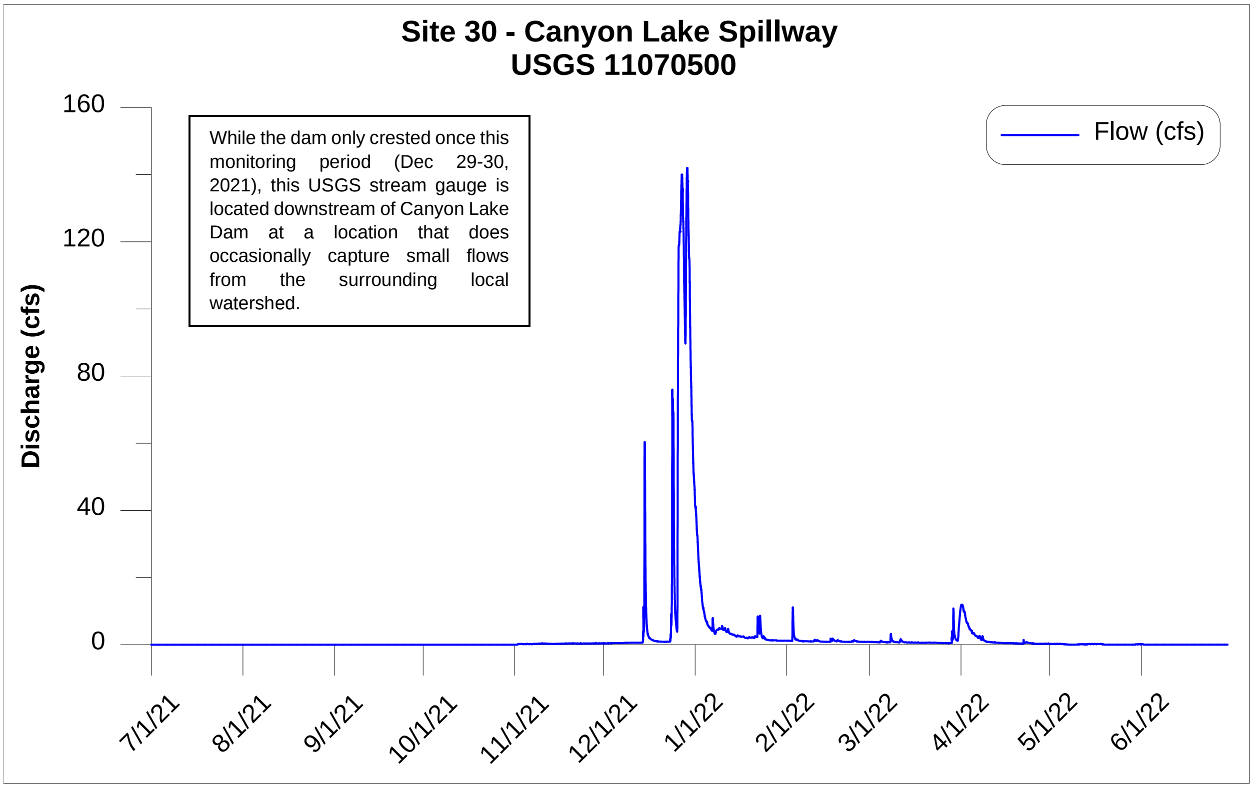


Figure 2-4. Site 30 – Canyon Lake Spillway – Daily Stream Gauge Records

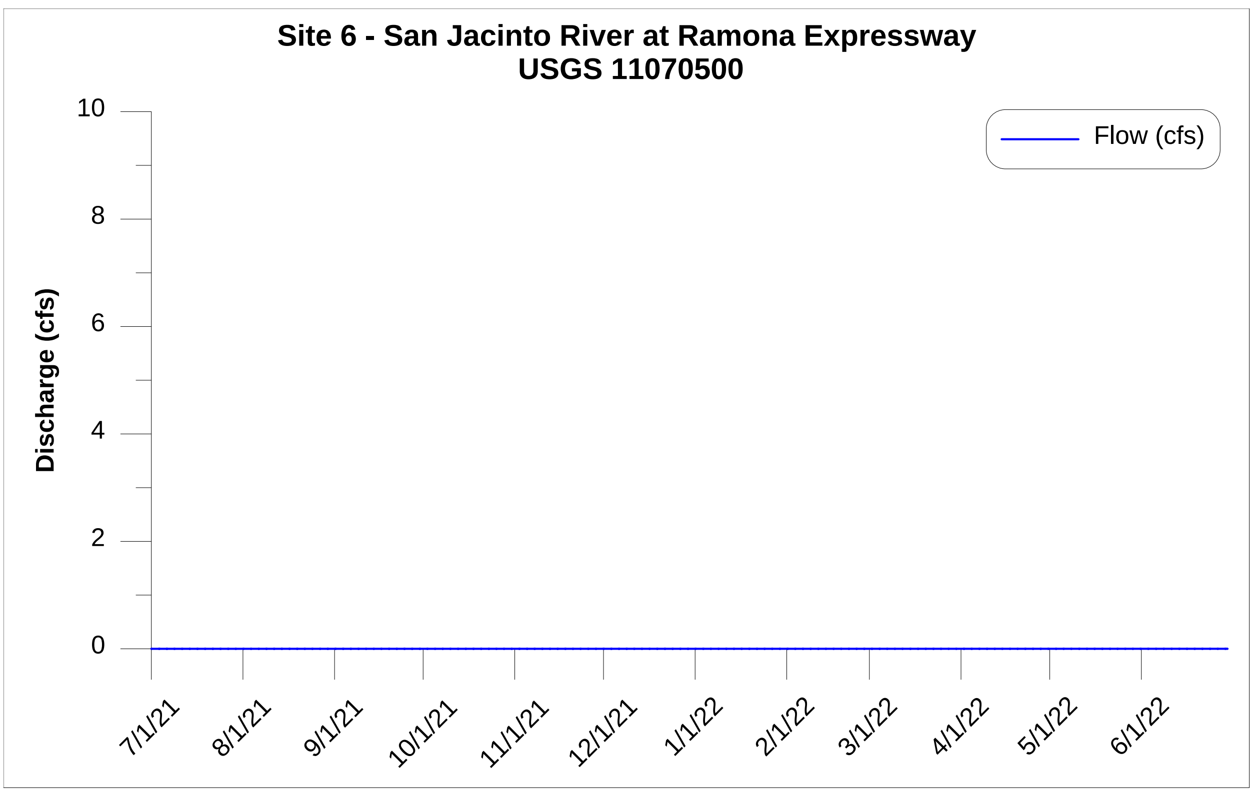


Figure 2-5. Site 6 – San Jacinto River at Ramona Expressway – Daily Stream Gauge Records

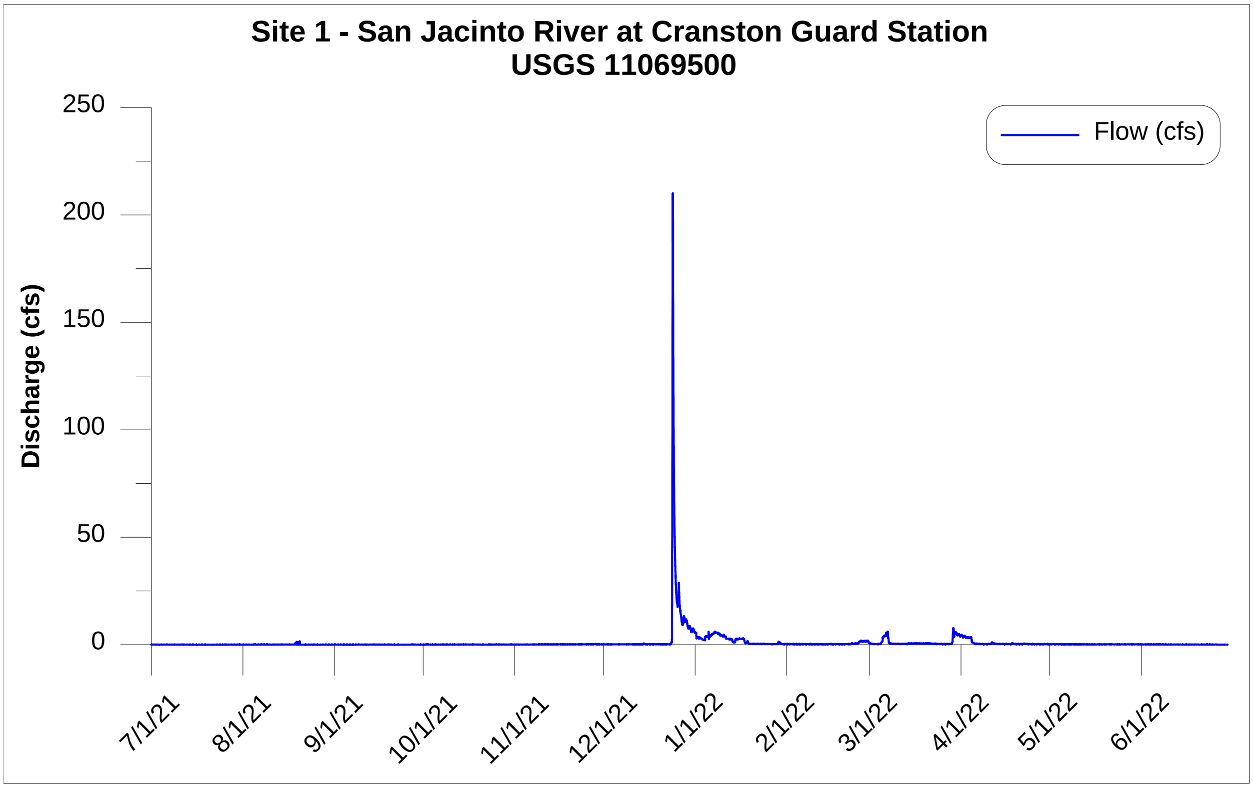


Figure 2-6. Site 1 – San Jacinto River at Cranston Guard Station – Daily Stream Gauge Records

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, 2021 to May 31, 2022, the National Weather Service (NWS) forecasts were monitored to determine when storm events met the mobilization criteria. The mobilization criteria for sampling requires a 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 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 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:

https://sawpa.org/task-forces/lake-elsinore-and-canyon-lake-tmdl-task-force/#monitoring-program

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 four storm events that met the mobilization criteria during the wet weather monitoring period from October 1, 2021 to May 31, 2022.

The first monitoring event occurred on December 14-16, 2021. 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 234 cubic feet per second (cfs) was recorded at Salt Creek at Murrieta Road (Station ID 745) and a peak flow of 193 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 0.76 to 1.74 inches of rainfall was recorded in the region during this storm (RCFCWCD 2021.

The second monitoring event occurred on December 29-30, 2021. Water quality samples were collected at Canyon Lake Spillway (Station ID 841) for the period of time that flows exited Canyon Lake during the monitoring event (i.e., the water level in Canyon Lake was actively cresting the spillway) and a peak flow of 234 cfs was recorded. No sampling occurred at Salt Creek at Murrieta Road (Station ID 745) and San Jacinto River at Goetz Road (Station ID 759) due to the flows occurring over the Christmas Holiday and the associated laboratory closures. No flows were recorded at the San Jacinto River at Ramona Expressway (Station ID 741). A total of 1.57 to 3.35 inches of rainfall was recorded in the region from December 24-30, 2021 (RCFCWCD 2021).

The third monitoring event occurred on March 4, 2022. Water quality samples were collected at Salt Creek at Murrieta Road (Station ID 745) and a peak flow of 44 cfs. No flow 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 0.02 to 0.16 inches of rainfall was recorded in the region during this storm (RCFCWCD 2021).

The fourth monitoring event occurred on March 29-30, 2021. 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 131 cubic feet per second (cfs) was recorded at Salt Creek at Murrieta Road (Station ID 745) and a peak flow of 30 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 0.40 to 0.79 inches of rainfall was recorded in the region during this storm (RCFCWCD 2021).

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, 2021 through June 30, 2022, 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, 2021 to May 31, 2022.

During the storm event on December 14-16, 2021, a total of 24 discrete 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 210 acre-feet or 59 million gallons (Mgal), which represents approximately 17% of the total annual flow.

During the storm event on March 4, 2022, a total of 6 discrete 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 18.5 acre-feet or 5.2 Mgal, which represents approximately 1.5% of the total annual flow.

During the storm event on March 29, 2022, a total of 9 discrete 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 55 acre-feet or 15 Mgal, which represents approximately 4.3% of the total annual flow.

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

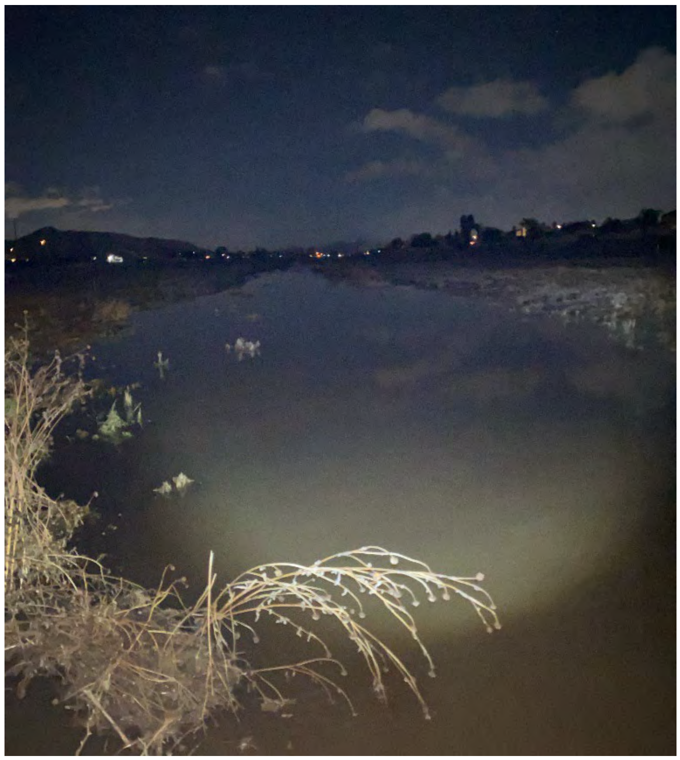


Figure 2-7. Storm Event at Salt Creek at Murrieta Road (December 14-16, 2021)

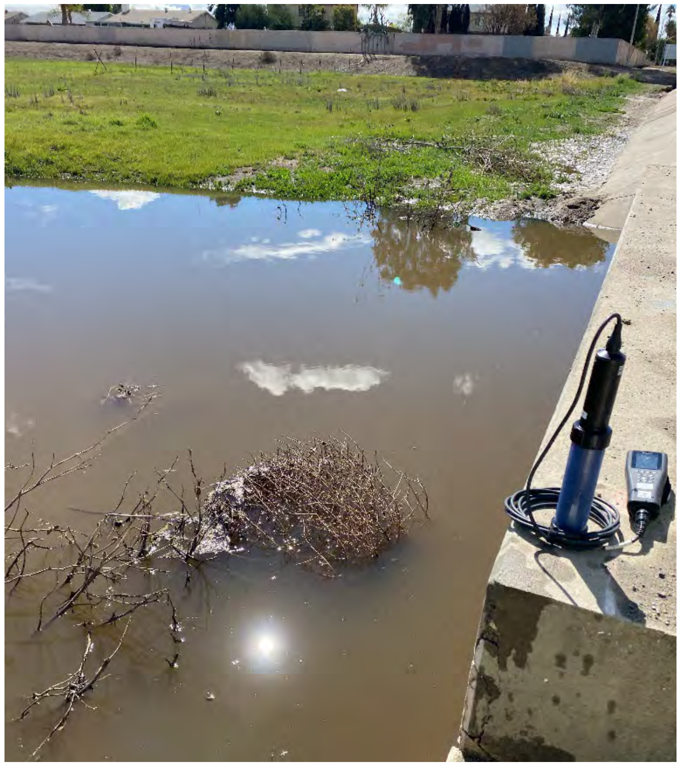


Figure 2-8. Storm Event at Salt Creek at Murrieta Road (March 4, 2022)

Figure 2-9. Storm Event at Salt Creek at Murrieta Road (March 29, 2022)

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 1.9 to 3.2 milligrams per liter (mg/L) for total nitrogen, and 0.38 to 0.56 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 46,956,321 cubic feet (cf) or 351 Mgal for the period of July 1, 2021 through June 30, 2022. No dry weather flows enter Canyon Lake from Salt Creek at Murrieta Road (Station ID 745), so storm flows accounted for the total estimated annual load of nutrients. The estimated annual nutrient load was calculated to be 3,698 kg for total nitrogen and 625 kg for total phosphorus (Table 2-8) for the period of July 1, 2021 through June 30, 2022.

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	0.22	0.53	0.17	0.31	0.27
Chemical Oxygen Demand	mg/L	40	72	37	49.7	47
Kjeldahl Nitrogen	mg/L	2.1	2.1	1.2	1.80	1.7
Nitrate as N	mg/L	1.1	0.92	0.68	0.90	0.88
Nitrite as N	mg/L	ND(<0.1)[a]	(0.047)J	(0.044)J	0.03	NA
Organic Nitrogen	mg/L	1.9	1.6	1.0	1.50	1.4
Total Nitrogen	mg/L	3.2	3.1	1.9	2.73	2.7
Total Phosphorus	mg/L	0.56	0.43	0.38	0.46	0.45
Ortho Phosphate Phosphorus	mg/L	0.23	0.43	0.34	0.33	0.32
Total Dissolved Solids	mg/L	430	110	67	202	147
Total Hardness	mg/L	203	42.2	30.3	91.8	64
Total Suspended Solids	mg/L	73	43	29	48.3	45

ND = not detected (analyte not detected at the indicated method detection limit (MDL)).
NA = Geomean calculation not available.
J- Reported value was detected above the MDL, but below the RL.
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 2-8. 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	49	10	10	385
Chemical Oxygen Demand	kg	8,883	1,411	2,140	63,611
Kjeldahl Nitrogen	kg	466	41	69	2,432
Nitrate as N	kg	244	18	39	1,229
Nitrite as N	kg	0[a]	1	3	35
Organic Nitrogen	kg	422	31	58	2,057
Total Nitrogen	kg	711	61	110	3,698
Total Phosphorus	kg	124	8	22	625
Ortho Phosphate Phosphorus	kg	51	8	20	423
Total Dissolved Solids	kg	95,495	2,156	3,875	310,010
Total Hardness	kg	45,083	827	1,752	142,287
Total Suspended Solids	kg	16,212	843	1,677	68,534

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

Hydrographs with flow-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).

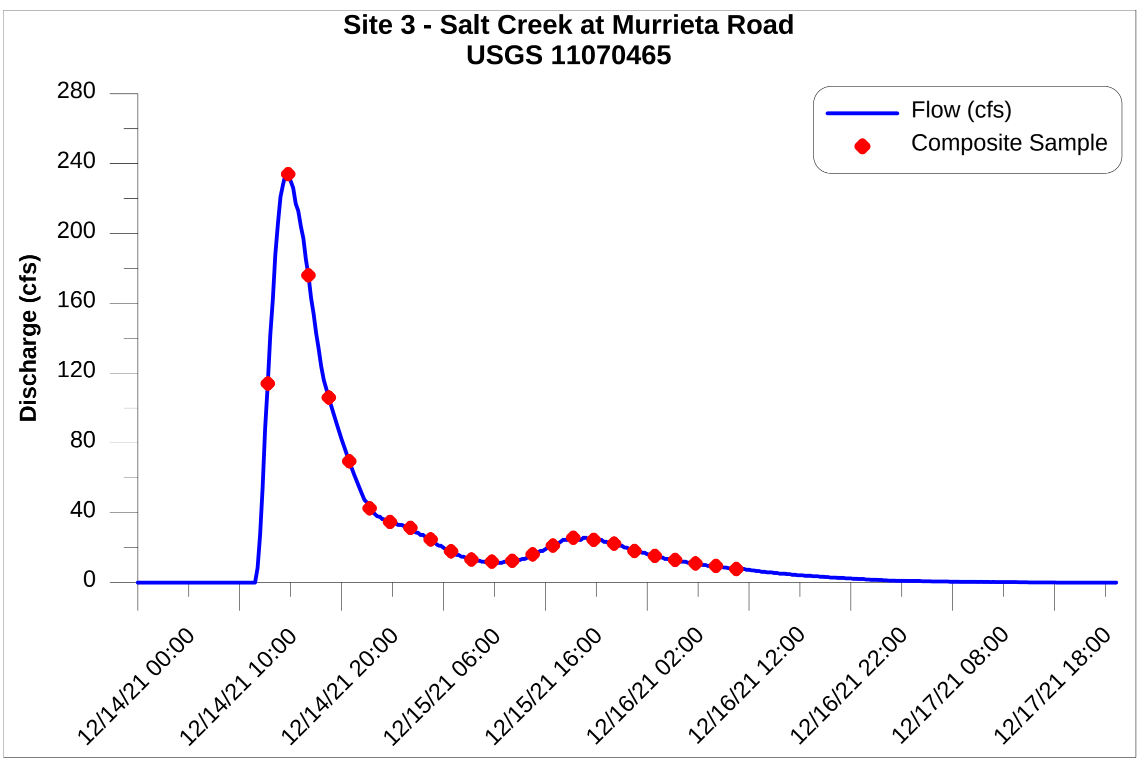


Figure 2-10. Hydrograph of First Storm Event at Salt Creek at Murrieta Road (December 14-16, 2021)

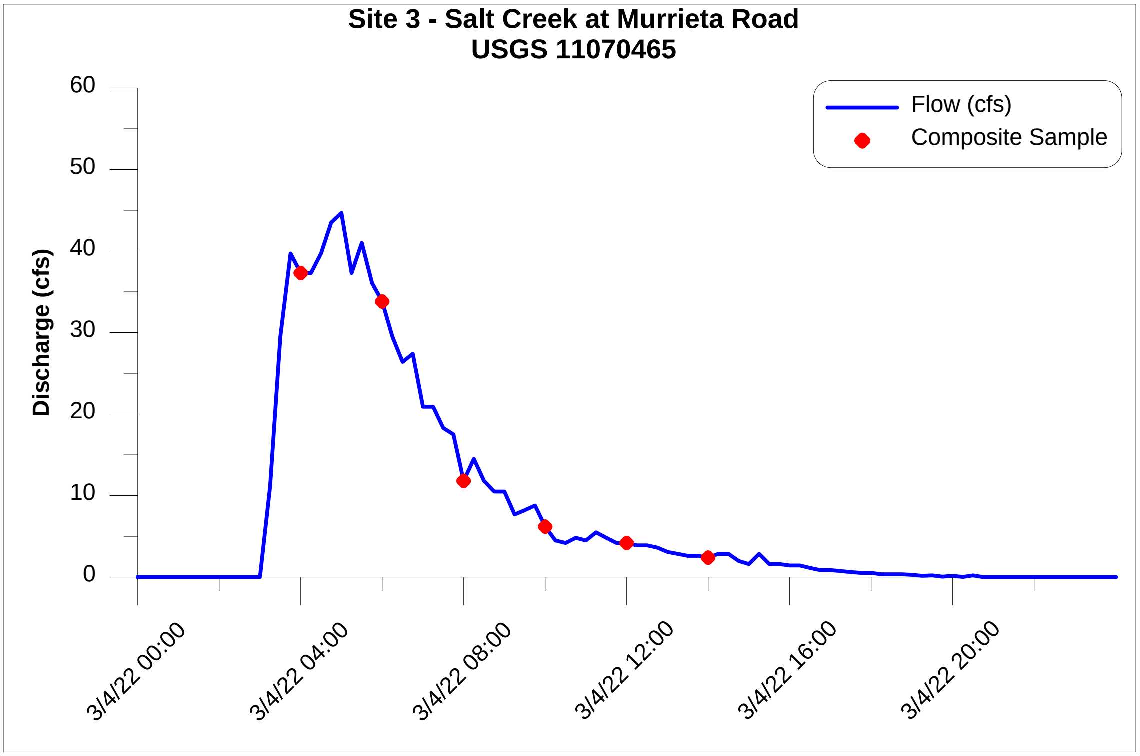


Figure 2-11. Hydrograph of Second Storm Event at Salt Creek at Murrieta Road (March 4, 2022)

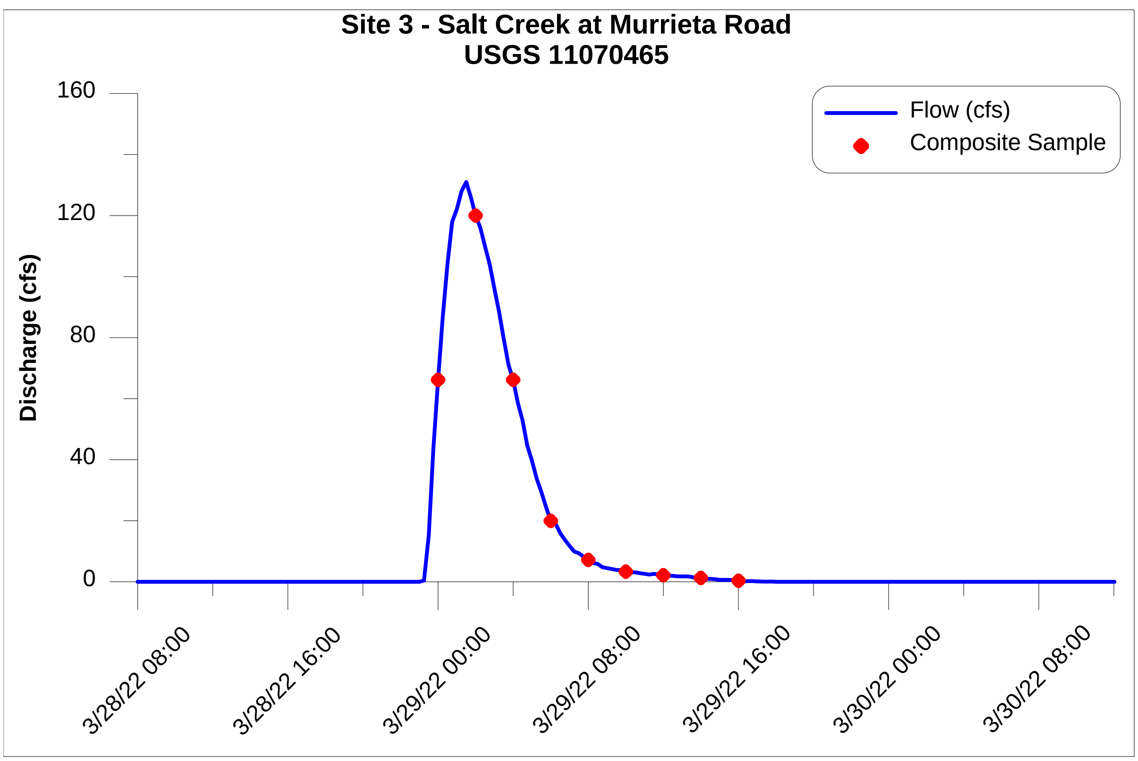


Figure 2-12. Hydrograph of Third Storm Event at Salt Creek at Murrieta Road (March 29, 2022)

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

Water quality samples were collected during two storm events at San Jacinto River at Goetz Road (Station ID 759) during the wet weather monitoring period from October 1, 2021 to May 31, 2022.

During the storm event on December 14-16 2021, a total of 34 discrete 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 377 acre-feet or 106 Mgal, which represents approximately 20% of the total annual flow.

During the storm event on March 29-30, 2022, a total of 16 discrete 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 63 acre-feet or 18 Mgal, which represents approximately 3.3% of the total annual flow.

Photos taken during the storm events are provided in Figure 2-13 and Figure 2-14.

Figure 2-13. Storm Event at San Jacinto River at Goetz Road (December 14-16, 2021)

Figure 2-14. Storm Event at San Jacinto River at Goetz Road (March 29-30, 2022)

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 two storm events ranged from 2.1 to 2.7 mg/L for total nitrogen, and 0.41 to 0.79 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 71,751,114 cf or 537 Mgal for the period of July 1, 2021 through June 30, 2022. No dry weather flows enter Canyon Lake from San Jacinto River at Goetz Road (Station ID 759), so storm flows accounted for the total estimated annual load of nutrients. The estimated annual nutrient load was calculated to be 4,976 kg for total nitrogen and 1,282 kg for total phosphorus (Table 2-10) for the period of July 1, 2021 through June 30, 2022.

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

Analyte	Units	Event 1	Event 2	Annual Mean	Annual Geomean
Ammonia-Nitrogen	mg/L	ND(<0.1)[a]	(0.032)J	0.02	NA
Chemical Oxygen Demand	mg/L	50	29	39.5	38.1
Kjeldahl Nitrogen	mg/L	1.5	1.2	1.35	1.34
Nitrate as N	mg/L	1.2	0.89	1.05	0.32
Nitrite as N	mg/L	ND(<0.1)[a]	(0.072)J	0.04	NA
Organic Nitrogen	mg/L	1.5	1.1	1.30	1.28
Total Nitrogen	mg/L	2.7	2.1	2.40	2.38
Total Phosphorus	mg/L	0.79	0.41	0.60	0.57
Ortho Phosphate Phosphorus	mg/L	0.4	0.36	0.38	0.15
Total Dissolved Solids	mg/L	170	200	185	184
Total Hardness	mg/L	95.6	86.2	90.9	90.8
Total Suspended Solids	mg/L	130	61	95.5	89.1

ND = not detected (analyte not detected at the indicated method detection limit (MDL)).
NA = Geomean calculation not available.
J- Reported value was detected above the MDL, but below the RL.
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 2-10. Water Quality Event and Annual Loads at San Jacinto River at Goetz Road

Analyte	Units	Load Event 1	Load Event 2	Annual Load
Ammonia-Nitrogen	kg	0[a]	2	27
Chemical Oxygen Demand	kg	19,995	1,935	83,753
Kjeldahl Nitrogen	kg	600	80	2,793
Nitrate as N	kg	480	59	2,175
Nitrite as N	kg	0[a]	5	61
Organic Nitrogen	kg	600	73	2,708
Total Nitrogen	kg	1,080	140	4,976
Total Phosphorus	kg	316	27	1,282
Ortho Phosphate Phosphorus	kg	160	24	779
Total Dissolved Solids	kg	67,983	13,343	370,879
Total Hardness	kg	38,230	5,751	186,253
Total Suspended Solids	kg	51,987	4,070	205,528

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

Hydrographs with flow-weighted sample aliquot times is provided in Figure 2-15 and Figure 2-16. The figure was developed based on flow data provided by the nearby USGS stream gauge (Station ID 11070365).

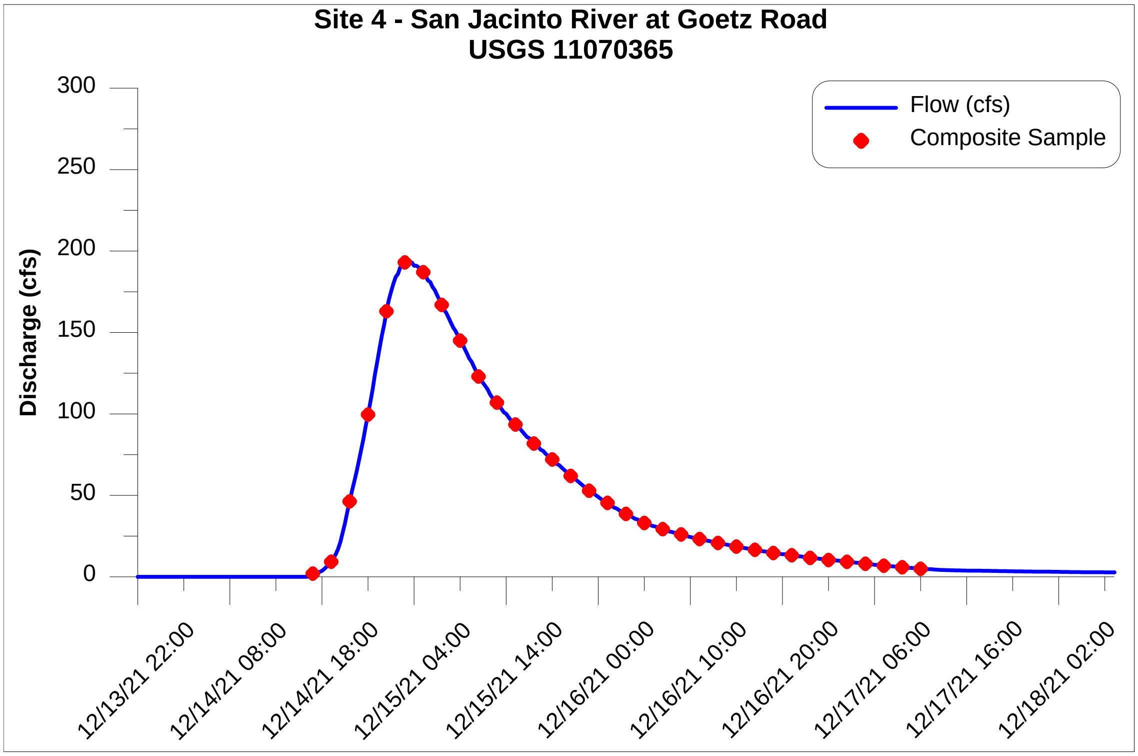


Figure 2-15. Hydrograph of First Storm Event at San Jacinto River at Goetz Road (December 14-16, 2021)

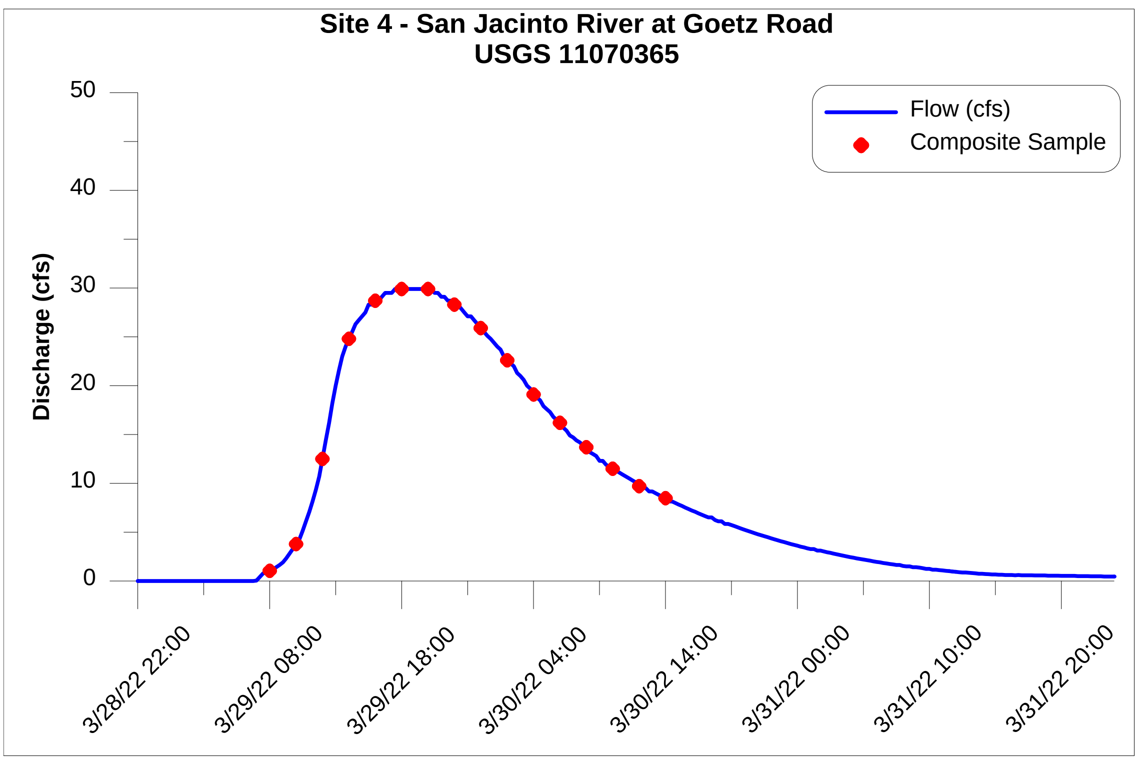


Figure 2-16. Hydrograph of Second Storm Event at San Jacinto River at Goetz Road (March 29-30, 2021)

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, 2021 to May 31, 2022. No flows were observed, and no samples were collected from the sampling station at San Jacinto River at Ramona Expressway (Station ID 741) during the 2021-2022 monitoring year.

2.8.4 Summary of Monitoring Data – Canyon Lake Spillway

Water quality samples were collected during one storm event at Canyon Lake Spillway (Station ID 841) during the wet weather monitoring period from October 1, 2021 to May 31, 2022.

During the storm event on December 29-30, 2021, a total of 9 discrete samples were collected across the hydrograph at two-hour intervals for the period of time 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. The period of time that flows exited Canyon Lake during the storm event on December 29-30, 2021 was the single event throughout the wet weather monitoring period from October 1, 2021 to May 31, 2022 when flows exited Canyon Lake (Figure 2-19). Based on data provided by the nearby USGS stream gauge (Station ID 11070500), flow for the storm event was estimated at 616 acre-feet or 172 Mgal, which represents approximately 27% 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 as shown in Figure 2-4.

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 2-17.

Figure 2-17. Storm Event Sampling Below the Canyon Lake Spillway (December 29-30, 2021)

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 storm event were 1.5 mg/L for total nitrogen and 0.0 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 85,500,117 cf or 640 Mgal for the period of July 1, 2021 through June 30, 2022. 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 3,632 kg for total nitrogen and 0 kg for total phosphorus (Table 2-12) for the period of July 1, 2021 through June 30, 2022.

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

Analyte	Units	Event 1
Ammonia-Nitrogen	mg/L	0.64
Chemical Oxygen Demand	mg/L	15
Kjeldahl Nitrogen	mg/L	1.3
Nitrate as N	mg/L	(0.096)J
Nitrite as N	mg/L	(0.066)J
Organic Nitrogen	mg/L	0.67
Total Nitrogen	mg/L	1.5
Total Phosphorus	mg/L	ND(<0.003)[a]
Ortho Phosphate Phosphorus	mg/L	(0.008)J
Total Dissolved Solids	mg/L	580
Total Hardness	mg/L	287
Total Suspended Solids	mg/L	ND(<5.0)[a]

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

Analyte	Units	Load Event 1	Annual Load
Ammonia-Nitrogen	kg	418	1,549
Chemical Oxygen Demand	kg	9,788	36,316
Kjeldahl Nitrogen	kg	848	3,147
Nitrate as N	kg	63	232
Nitrite as N	kg	43	160
Organic Nitrogen	kg	437	1,622
Total Nitrogen	kg	979	3,632
Total Phosphorus	kg	0[a]	0[a]
Ortho Phosphate Phosphorus	kg	5	19
Total Dissolved Solids	kg	378,479	1,404,234
Total Hardness	kg	187,282	694,854
Total Suspended Solids	kg	0[a]	0[a]

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

A hydrograph with flow-weighted sample aliquot time is provided in Figure 2-18. 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 2-19.

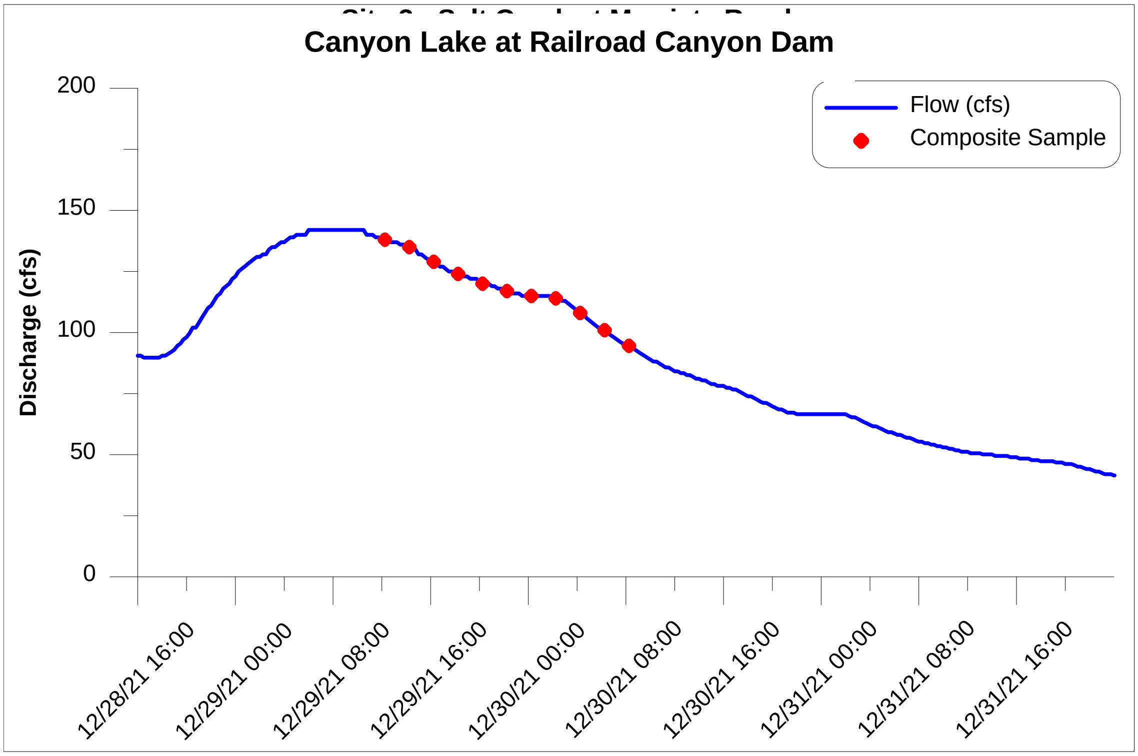


Figure 2-17. Hydrograph of First Storm Event at Canyon Lake Spillway (December 29-30, 2021)

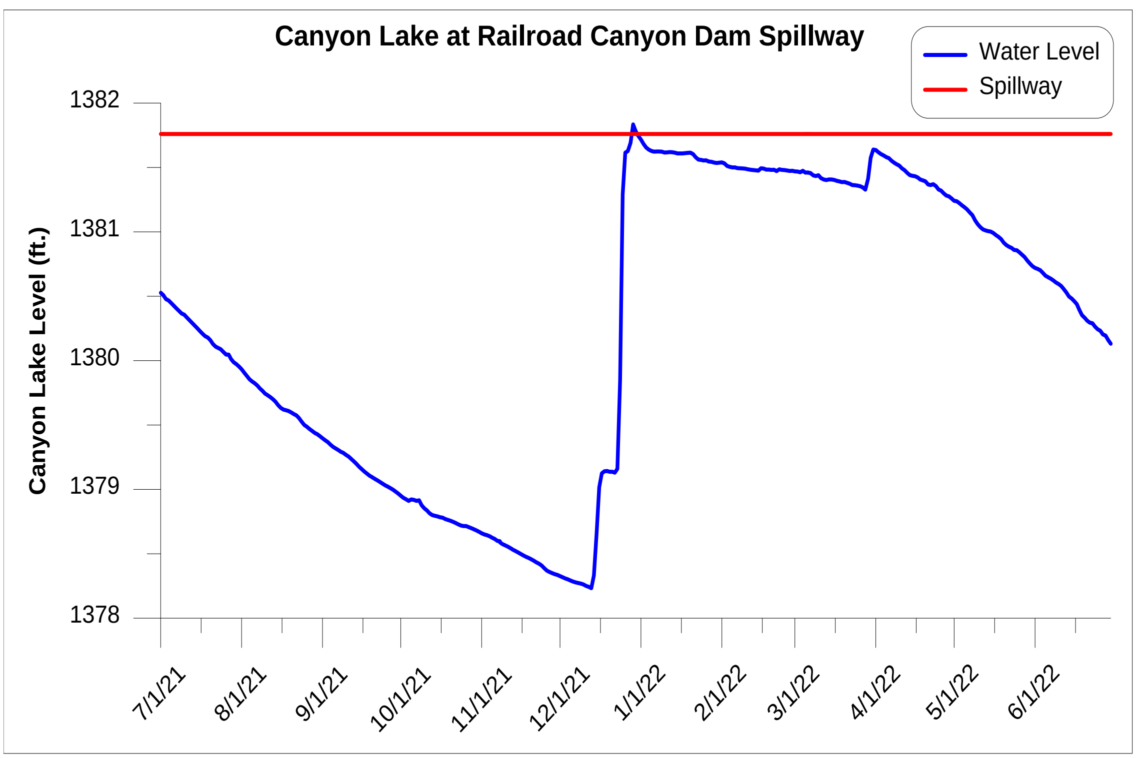


Figure 2-18. Canyon Lake Level at Railroad Canyon Dam Spillway

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 2-4. 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, 2021, through June 30, 2022, are summarized in Table 2-14.

Table 2-5. Summary Rainfall Data (July 2021 to June 2022)

Monthly Rainfall (inches)	Lake Elsinore	Perris CDF	Pigeon Pass	Hemet / San Jacinto	Winchester
Jul	0.14	0.21	0.18	0.28	0.29
Aug	0.00	0.00	0.00	0.00	0.00
Sep	0.00	0.00	0.00	0.00	0.00
Oct	0.46	0.45	0.63	0.77	0.56
Nov	0.01	0.00	0.00	0.00	0.01
Dec	3.61	2.85	5.46	2.97	2.81
Jan	0.22	0.05	0.16	0.00	0.03
Feb	0.25	0.27	0.10	0.41	0.51
Mar	0.56	0.71	0.97	0.66	0.67
Apr	0.16	0.13	0.24	0.31	0.20
May	0.01	0.00	0.08	0.00	0.00
Jun	0.06	0.00	0.00	0.00	0.00
Annual Rainfall (inches)	**5.48**	**4.67**	**7.82**	**5.40**	**5.08**

3.0 In-Lake Monitoring

3.1 Background

Routine in-lake monitoring was initiated in 2006 by local stakeholders in cooperation with the RWQCB at three open water locations in Lake Elsinore and four locations in Canyon Lake. Initially, monitoring consisted of monthly sampling October to May, and biweekly sampling June to September, with grab samples collected at the surface, within the water column, and/or as depth-integrated samples (depending on the lake and the analyte). Based on modifications adopted to the sampling program (RWQCB Resolution No. R8-2011-0023), in 2011-2012 sampling locations in Lake Elsinore and Canyon Lake were reduced to one and four stations, respectively, for analytical chemistry. This decision was based on a review of available data that indicated consistent similar nutrient concentrations and physical water quality parameters among the three sampling sites in Lake Elsinore and two sites in the East Basin of Canyon Lake. This cost savings allowed for shifting resources toward several implementation strategies aimed at reducing nutrient impacts in both lakes as described in RWQCB Resolution No. R8-2011-0023. All in-lake monitoring was then suspended temporarily during the 2013-2014 and 2014-2015 FYs to further redirect resources toward implementing in-lake best management practices. Starting in FY 2015-2016, ongoing in-lake sampling was resumed and is required to estimate progress toward attaining nutrient TMDL targets and calculating annual and 10-year running averages. The following sections describe monitoring methods and results in both lakes for the 2021-2022 FY.

3.2 Historical In-Lake Monitoring Concentrations

A summary of the historical calendar year annual means for TMDL water quality monitoring data parameters of interest during the period of July 1, 2012 through June 30, 2022, is presented in Tables 3-1 and 3-2. The rolling 10-year average is also presented for each TMDL constituent, although the annual TMDL compliance for each lake is determined by its annual calendar-year average relative to the 2020 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	2011-2020 Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target)	2012-2021 Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target)	2013-2022 Ten Year Average[a] (Percent of Annual Means/Samples Not Meeting TMDL Target)
Total Phosphorus[b]	<0.1 mg/L (Annual Average)	2011	14	**0.294**	mg/L	0.246 (100%)	0.238 (100%)	0.239 (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	3	**0.173**				
Total Nitrogen[b]	<0.75 mg/L (Annual Average)	2011	14	**3.88**	mg/L	4.91 (100%)	4.97 (100%)	5.10 (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**				
		2021	8	**4.30**				
		2022	3	**4.40**				
Total Ammonia[c]	Exceedance Thresholds Calculated from Site Specific Water Quality Conditions During each Event	2011	15	0.049	mg/L	0.189 (2004- CMC: 0%; CCC: 10%)	0.207 (2004- CMC: 0%; CCC: 13%)	0.209 (2004- CMC: 0%; CCC: 13%)
		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	0.300				
		2020	8	0.312				
		2021	8	0.199				
		2022	3	0.105				

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	2011-2020 Ten Year Average (Percent of Annual Means Not Meeting TMDL Target)	2012-2021 Ten Year Average (Percent of Annual Means Not Meeting TMDL Target)	2013-2022 Ten Year Average[a] (Percent of Annual Means Not Meeting TMDL Target)
Depth-Integrated Chlorophyll-a (Summer)[b]	≤ 25 mg/L (Summer Average)	2011	8	**169**	µg/L	186 (100%)	183 (100%)	173 (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	1	**120**				
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%)	3.7 (90%)
		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**				
		2021	8	**2.7**				
		2022	3	5.3				

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 targets
The CCC and CMC were calculated using the 2004 TMDL formulas.
a- includes data January 2013 - June 2022.
b- exceedance frequency based 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

[1]Reported values and compliance summary based on sampling at the central sampling location in Lake Elsinore (LE02).

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	2011-2020 Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target)	2012-2021 Ten Year Average (Percent of Annual Means/Samples Not Meeting TMDL Target)	2013-2022 Ten Year Average[a] (Percent of Annual Means/Samples Not Meeting TMDL Target)
Total Phosphorus[b]	<0.1 mg/L (Annual Average)	2011	15	**0.846**	mg/L	0.243 (70%)	0.167 (60%)	0.136 (50%)
		2012	8	**0.346**				
		2013	2	**0.266**				
		2014	15	**0.246**				
		2015	7	0.084				
		2016	7	0.089				
		2017	6	**0.237**				
		2018	6	0.038				
		2019	6	**0.144**				
		2020	6	**0.133**				
		2021	6	0.084				
		2022	3	0.042				
Total Nitrogen[b]	<0.75 mg/L (Annual Average)	2011	15	**1.64**	mg/L	1.60 (100%)	1.66 (100%)	1.51 (100%)
		2012	8	**2.43**				
		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**				
		2021	6	**2.06**				
		2022	3	**1.28**				
Total Ammonia[c]	Exceedance Thresholds Calculated from Site Specific Water Quality Conditions During each Event	2011	14	0.672	mg/L	0.422 (CMC: 0%; CCC: 6.0%)	0.423 (CMC: 0%; CCC: 4.4%)	0.443 (CMC: 0%; CCC: 4.3%)
		2012	8	0.168				
		2013	NA	NA				
		2014	NA	NA				
		2015	3	0.455				
		2016	7	0.236				
		2017	6	0.297				
		2018	6	0.346				
		2019	6	0.471				
		2020	6	0.733				
		2021	6	0.680				
		2022	3	0.331				

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	2011-2020 Ten Year Average (Percent of Annual Means Not Meeting TMDL Target)	2012-2021 Ten Year Average[a] (Percent of Annual Means Not Meeting TMDL Target)	2013-2022 Ten Year Average[a] (Percent of Annual Means Not Meeting TMDL Target)
Depth-Integrated Chlorophyll-a[b]	< 25 µg/L (Annual Average)	2011	15	**59.1**	µg/L	44.3 (80%)	40.6 (70%)	35.5 (70%)
		2012	8	**76.3**				
		2013	2	**59.6**				
		2014	15	**56.4**				
		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	3	**25.7**				
Dissolved Oxygen (Hypolimnion)[b]	>5 mg/L Hypolimnion (Daily Average)	2011	11	**0.3**	mg/L	0.9 (100%)	0.9 (100%)	0.9 (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**				
		2021	4	**0.2**				
		2022	2	**0.4**				

Notes:
mg-milligram; ug- microgram; L-liter; m-meter,
CCC- Criterion Continuous Concentration; CMC- Criterion Maximum Concentration
Values in Bold indicate an exceedance of its TMDL target
The CCC and CMC were calculated using 2004 TMDL formulas.
a- includes data January 2013 - June 2022.
b- exceedance frequency based 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
[1] Reported values and compliance summary based on a lake-wide average for each sampling date (Sites CL07, CL08, CL09, and CL10)

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. 2021-2022 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 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 and held on wet ice immediately following collection and transferred to a local courier or shipping company on the same day of collection. Samples for analysis of nutrients, ammonia, sulfide, TDS, and chlorophyll-a were submitted to Weck Laboratories Inc., located in City of Industry, California.

Secchi disk readings for water clarity, as well as in-situ water column profile data, were typically recorded between 7:00 and 9:00 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.

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, 2021 to June 30, 2022 is presented below. A total of eight Lake Elsinore events were sampled during this period under the TMDL monitoring program, with five occurring in 2021 (July 15, August 16, September 17, October 5, and December 21) and three in 2022 (February 17, April 13 and June 9). 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 3-3 through 3-8. The measurements during the morning and afternoon of any given monitoring event were averaged prior to summarizing in the tables and figures below.

Table 3-5. In-Situ Water Quality Parameter Measurements in Lake Elsinore – 2021 Monthly Means for Each Site (July – Dec 2021)

Site	Measure	Jul-21		Aug-21		Sep-21		Oct-21		Dec-21	
		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)	27.8	27.2	27.2	26.4	25.2	25.0	22.6	22.2	11.4	11.2
	Cond (µS/cm)	3612	3608	3756	3754	3988	3990	4124	4117	3660	3660
	pH	*8.78*	*8.71*	*8.70*	*8.60*	*8.74*	*8.72*	*8.76*	*8.72*	*8.73*	*8.69*
	DO (mg/L)	2.7	**0.6**	5.5	**1.3**	1.9	**1.0**	5.0	**3.8**	7.7	6.9
LE02	Temp (°C)	27.4	27.1	26.7	26.4	25.3	25.1	22.5	22.2	11.8	11.6
	Cond (µS/cm)	3607	3607	3756	3755	3989	3988	4131	4130	3659	3658
	pH	*8.73*	*8.68*	*8.62*	*8.56*	*8.73*	*8.70*	*8.77*	*8.72*	*8.71*	*8.65*
	DO (mg/L)	1.6	**0.1**	2.4	**1.1**	1.6	**0.7**	4.5	**3.0**	7.8	6.4
LE03	Temp (°C)	27.7	27.4	27.4	26.8	25.2	25.1	22.7	22.5	11.9	11.5
	Cond (µS/cm)	3612	3610	3757	3754	3987	3983	4126	4127	3644	3641
	pH	*8.73*	*8.69*	*8.69*	*8.64*	*8.74*	*8.73*	*8.74*	*8.70*	*8.74*	*8.64*
	DO (mg/L)	2.2	**0.6**	5.2	**3.2**	1.9	**1.5**	3.7	**3.0**	8.9	6.1
Lake-wide Average	Temp (°C)	27.6	27.2	27.1	26.5	25.2	25.0	22.6	22.3	11.7	11.4
	Cond (µS/cm)	3610	3608	3756	3754	3988	3987	4127	4124	3654	3653
	pH	*8.75*	*8.69*	*8.67*	*8.60*	*8.74*	*8.72*	*8.75*	*8.71*	*8.72*	*8.66*
	DO (mg/L)	2.2	**0.4**	4.3	**1.8**	1.8	**1.0**	4.4	**3.3**	8.1	6.5

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 in bottom 1m of sampling site
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan WQO

Table 3-6. In-Situ Water Quality Parameter Measurements in Lake Elsinore – 2022 Monthly Means for Each Site (February – June 2022)

Site	Measure	Feb-22		Apr-22		Jun-22	
		Water Column Mean	1m from Bottom	Water Column Mean	1m from Bottom	Water Column Mean	1m from Bottom
LE01	Temp (°C)	13.4	13.4	19.9	19.5	25.0	24.1
	Cond (µS/cm)	3657	3658	3683	3679	4083	4074
	pH	*8.92*	*8.90*	*9.08*	*9.04*	*8.85*	*8.74*
	DO (mg/L)	10.9	10.8	7.4	6.3	6.1	**2.5**
LE02	Temp (°C)	13.1	12.9	19.3	18.7	24.6	23.7
	Cond (µS/cm)	3662	3663	3682	3677	4071	4073
	pH	*8.87*	*8.85*	*8.99*	*8.93*	*8.68*	*8.66*
	DO (mg/L)	10.5	10.2	5.9	**4.6**	4.0	**1.0**
LE03	Temp (°C)	13.1	12.9	18.8	18.5	24.7	23.7
	Cond (µS/cm)	3664	3665	3677	3674	4073	4066
	pH	*8.89*	*8.87*	*9.02*	*8.97*	*8.79*	*8.66*
	DO (mg/L)	10.9	10.5	6.3	5.2	4.4	**0.3**
Lake-wide Average	Temp (°C)	13.2	13.0	19.3	18.9	24.8	23.8
	Cond (µS/cm)	3661	3662	3680	3676	4076	4071
	pH	*8.89*	*8.87*	*9.03*	*8.98*	*8.77*	*8.69*
	DO (mg/L)	10.7	10.5	6.5	5.4	4.8	**1.3**

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 in bottom 1m of sampling site
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan WQO

Regular differences in morning and afternoon water column mean measurements were noted across all monitoring events, with consistent increases in pH (up to 0.25 standard units (SU)), DO (up to 4.3 mg/L), and temperature (up to 1.4 °C increase), while specific conductivity remained stable. These increases were more prominent in summer months, while little deviation was observed during winter and spring monitoring events.

Temperature exhibited a typical pattern with lowest values occurring during the winter events (December and February) and highest values in summer months (July and August). Historical Lake Elsinore data shows that the average lake-wide annual temperature during this monitoring year was comparable to that of the 2020-2021 monitoring year, which was the highest observed over the last 19 years of record when including data from complete monitoring years July to June (i.e., temperature data available for each month of the monitoring year[2]). Lake water temperature was somewhat correlated with ambient air temperature, as the annual mean of daily high air temperature exhibited a good relationship with annual mean lake surface water temperature (Figure 3-2).

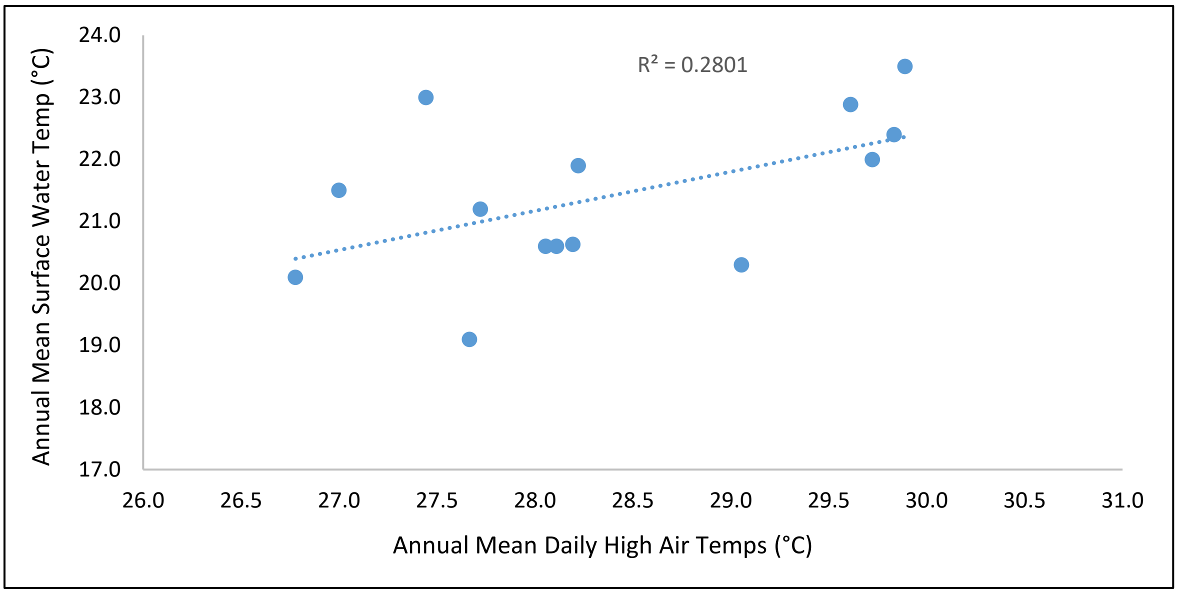


Figure 3-2. Relationship of Annual Mean Surface Water Temperature and Annual Mean Daily High Air Temperatures in Lake Elsinore
(for years with complete monthly water temperatures (2006-2011, 2015-2022))

[2] 2004-05, 2005-06 and 2008-09 monitoring years each had several months of missing water temperature data and were not included in this retrospective analysis. No temperature profile data was collected across the July 2012 to June 2015 monitoring years.

Generally, the greatest DO concentrations throughout the water column (both water column mean and 1-meter from bottom) were observed in February at all three sites. This is a typical pattern observed historically at Lake Elsinore. One exception to this was an increase in water column mean across all three sites observed in August 2021, possibly as a result of an increase in algae biomass during that same month resulting increase in photosynthesis a byproduct of which is oxygen. Concentrations of DO near the bottom, while lower, generally tracked with the overall water column mean for all three sites. All three sites exhibited a divergence in the water column mean and 1-meter from bottom concentration of DO beginning in April 2022. These diverging measurements indicate that the lake was starting to stratify, further supported by the concurrent increased temperatures recorded during the April and June 2022 events and historical trends that demonstrate stratification of the lake beginning during this period. The 12-month rolling mean DO concentration 1-m above the lake bottom at Site LE02 remained below the 2020 TMDL target of 5.0 mg/L for the entire monitoring year, ranging from 2.0 to 3.5 mg/L. (Figure 3-3).

Conductivity exhibited a gradual increase from July through October 2021, from approximately 3610 to 4127 microSiemens per centimeter (µS/cm) before decreasing in December 2021 to a concentration of approximately 3654 µS/cm. These concentrations are slightly higher than seen in the previous monitoring year for the same sampling period, where July through December 2020 saw concentrations from 3144 to 3474 µS/cm. A large storm dropped approximately 1.5 inches of rain in the area 9 days prior to the sampling event December 2021 which contributed to the observed decrease in conductivity. Conductivity then remained steady before an increase in June 2022.

The pH measurements for the first 5 monitoring events remained relatively steady across the monitoring year and within a relatively narrow band. An increase of approximately 0.3 SU was observed between the December and April field events, followed by a decline back to levels consistent with previous events. There is no obvious reason for the increase in pH across these monitoring events but could be partially due to a combination of the rain events during this period and dynamics of the algal composition of the lake as a result of the known close relationship between the processes involved in algal photosynthesis and pH levels particularly in lakes with high algal biomass.

Water clarity measured using a Secchi disk remained steady at Station LE02 from July through December 2021 at 0.98 feet (ft) before increasing to 1.31 ft in February 2022 (Figure 3-8). Clarity then decreased slightly to 1.15 ft for the remaining two sampling events. This increase in clarity between the December and February events is likely due to the influx of rain during that period, followed by an increase in algal biomass thereafter (see Figure 3-11).

The first and only overflow of the Canyon Lake spillway was observed between December 29-30 (see Figure 2-19). This was following the second major storm of the monitoring period, with the majority of the precipitation in this monitoring year falling between ….

For further comparisons regarding in-situ water quality parameters, Table 3-7 includes lake-wide averages observed for the current 2021-22 monitoring year, as well as the prior 2018-19, 2019-20 and 2020-21 monitoring years.

Table 3-7. In-Situ Water Quality Parameter Measurements in Lake Elsinore – 2021-2022 Annual Mean Statistics for Each Site

		Measure	LE01	LE02	LE03	Lake-wide Average (July 2021-June 2022)	Lake-wide Average (July 2020-June 2021)	Lake-wide Average (July 2019-June 2020)	Lake-wide Average (July 2018-June 2019)
Water Column Mean	Min	Temp (°C)	11.4	11.8	11.9	11.7	13.0	12.0	11.4
		Cond (µS/cm)	3612	3607	3612	3610	3144	2880	3329
		pH	*8.70*	*8.62*	*8.69*	*8.67*	*8.56*	*8.97*	*8.76*
		DO (mg/L)	1.9	1.6	1.9	1.8	1.9	2.8	3.9
	Max	Temp (°C)	27.8	27.4	27.7	27.6	27.3	27.4	28.3
		Cond (µS/cm)	4124	4131	4126	4127	3474	3895	5224
		pH	*9.08*	*8.99*	*9.02*	*9.03*	*9.16*	*9.28*	*9.10*
		DO (mg/L)	10.9	10.5	10.9	10.7	8.5	11.6	10.4
	Average	Temp (°C)	21.5	21.3	21.4	21.4	21.5	20.5	20.9
		Cond (µS/cm)	3820	3819	3817	3819	3322	3562	4473
		pH	*8.82*	*8.76*	*8.79*	*8.79*	*8.81*	*9.15*	*8.93*
		DO (mg/L)	5.9	4.8	5.4	5.4	5.1	5.9	6.6
1m from Bottom	Min	Temp (°C)	11.2	11.6	11.5	11.4	12.9	11.6	11.2
		Cond (µS/cm)	3608	3607	3610	3608	3144	3007	3330
		pH	*8.60*	*8.56*	*8.64*	*8.60*	8.50	*8.85*	*8.70*
		DO (mg/L)	0.6	0.1	0.3	0.3	0.2	0.1	1.3
	Max	Temp (°C)	27.2	27.1	27.4	27.2	26.8	27.2	27.7
		Cond (µS/cm)	4117	4130	4127	4124	3478	3896	5232
		pH	*9.04*	*8.93*	*8.97*	*8.98*	*9.07*	*9.23*	*9.03*
		DO (mg/L)	10.8	10.2	10.5	10.5	8.1	8.3	8.8
	Average	Temp (°C)	21.1	20.9	21.0	21.0	21.0	20.1	20.5
		Cond (µS/cm)	3817	3819	3815	3817	3322	3578	4478
		pH	*8.76*	*8.72*	*8.74*	*8.74*	*8.73*	*9.07*	*8.88*
		DO (mg/L)	**<u>4.1</u>**	**<u>3.4</u>**	**<u>3.8</u>**	**<u>3.8</u>**	**<u>3.0</u>**	**<u>3.7</u>**	**<u>4.5</u>**

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 in bottom 1m of sampling site
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan WQO

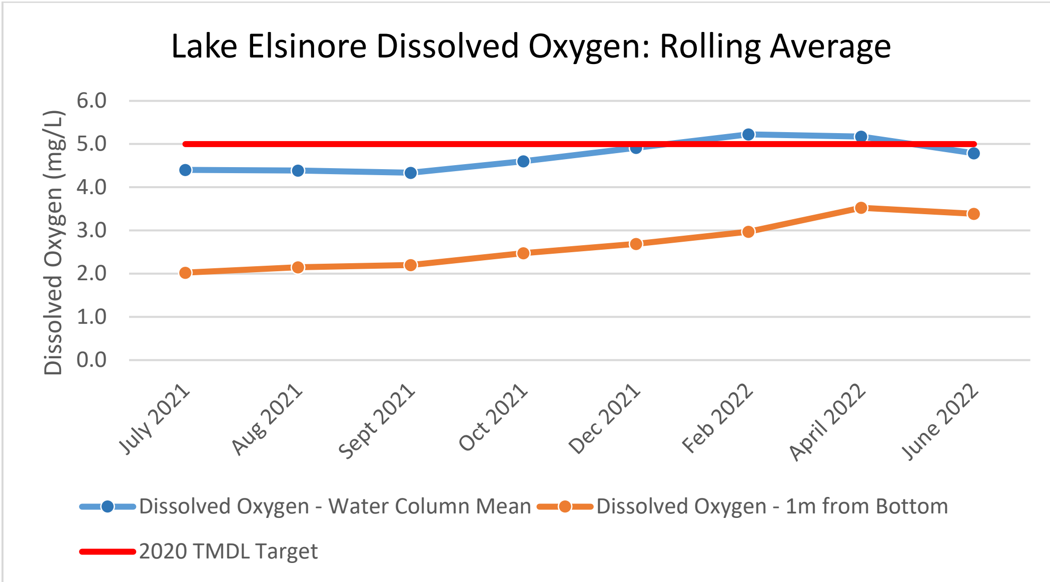


Figure 3-3. Water Column Mean Dissolved Oxygen (DO) Rolling Average – Lake Elsinore for Site LE02

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 graph represents data collected from August 2020 to June 2022.

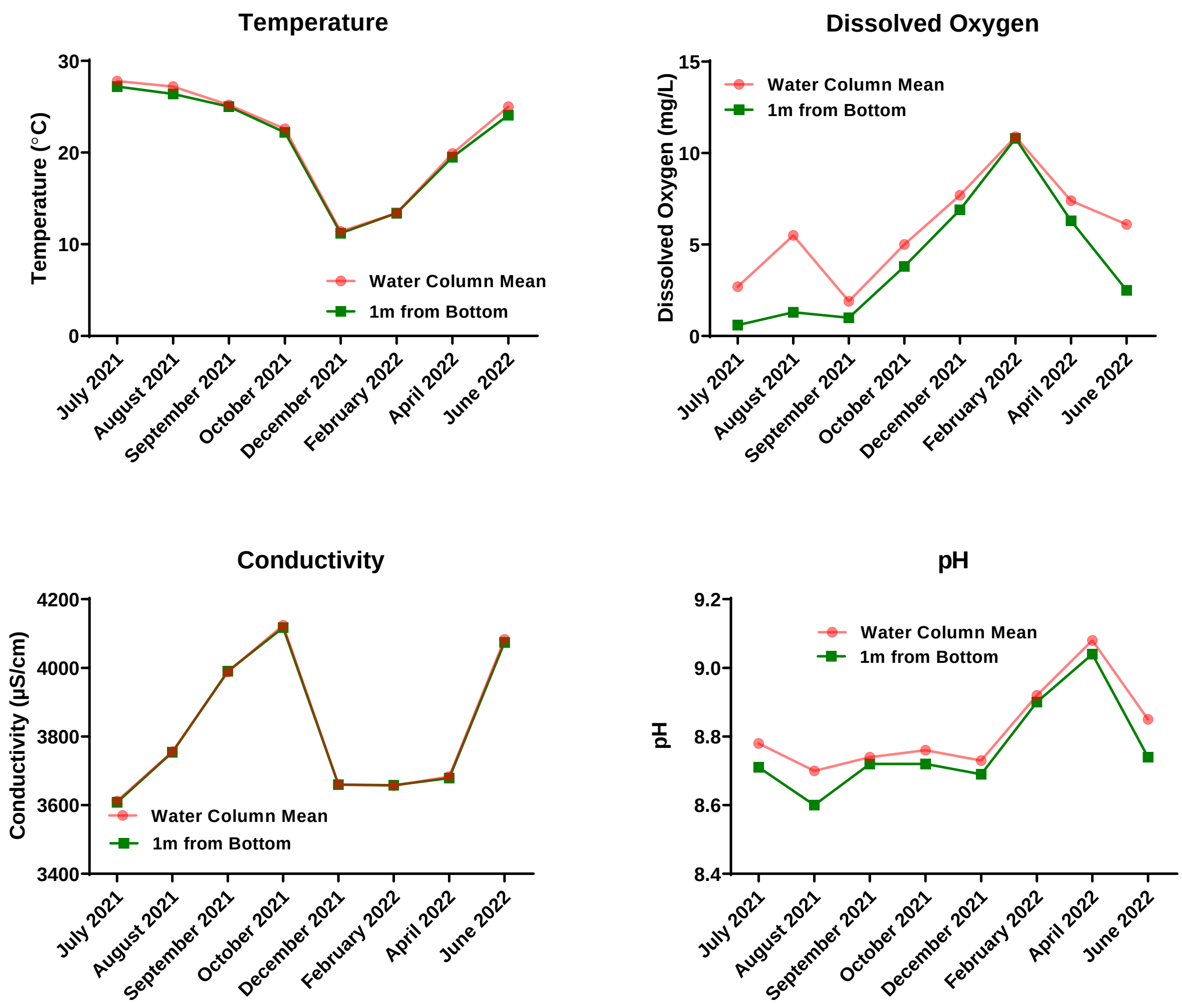


Figure 3-4. In-Situ Physical Water Quality Parameters - Lake Elsinore - Site LE01

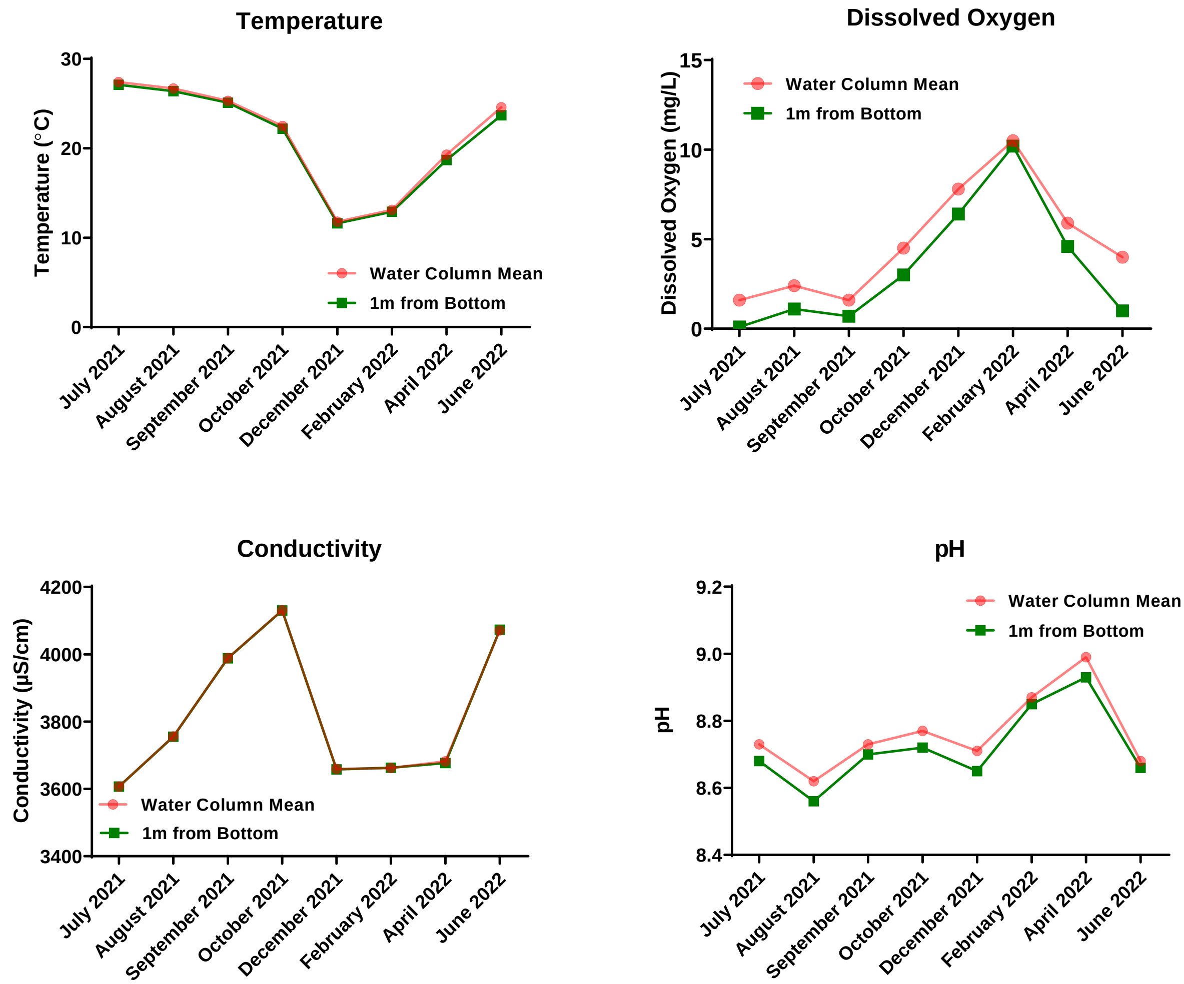


Figure 3-5. In- Situ Physical Water Quality Parameters - Lake Elsinore Site LE02

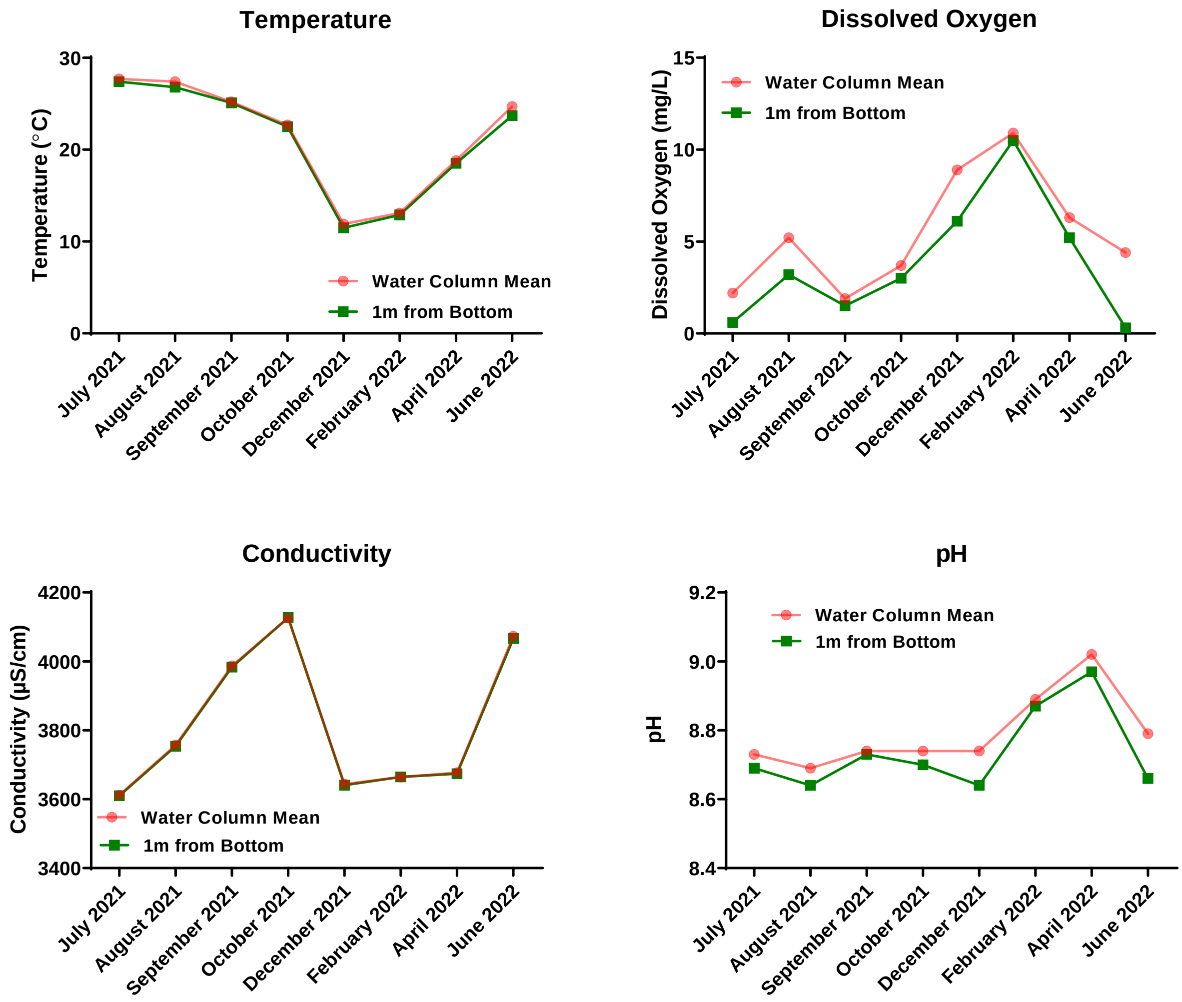


Figure 3-6. In- Situ Physical Water Quality Parameters - Lake Elsinore Site LE03

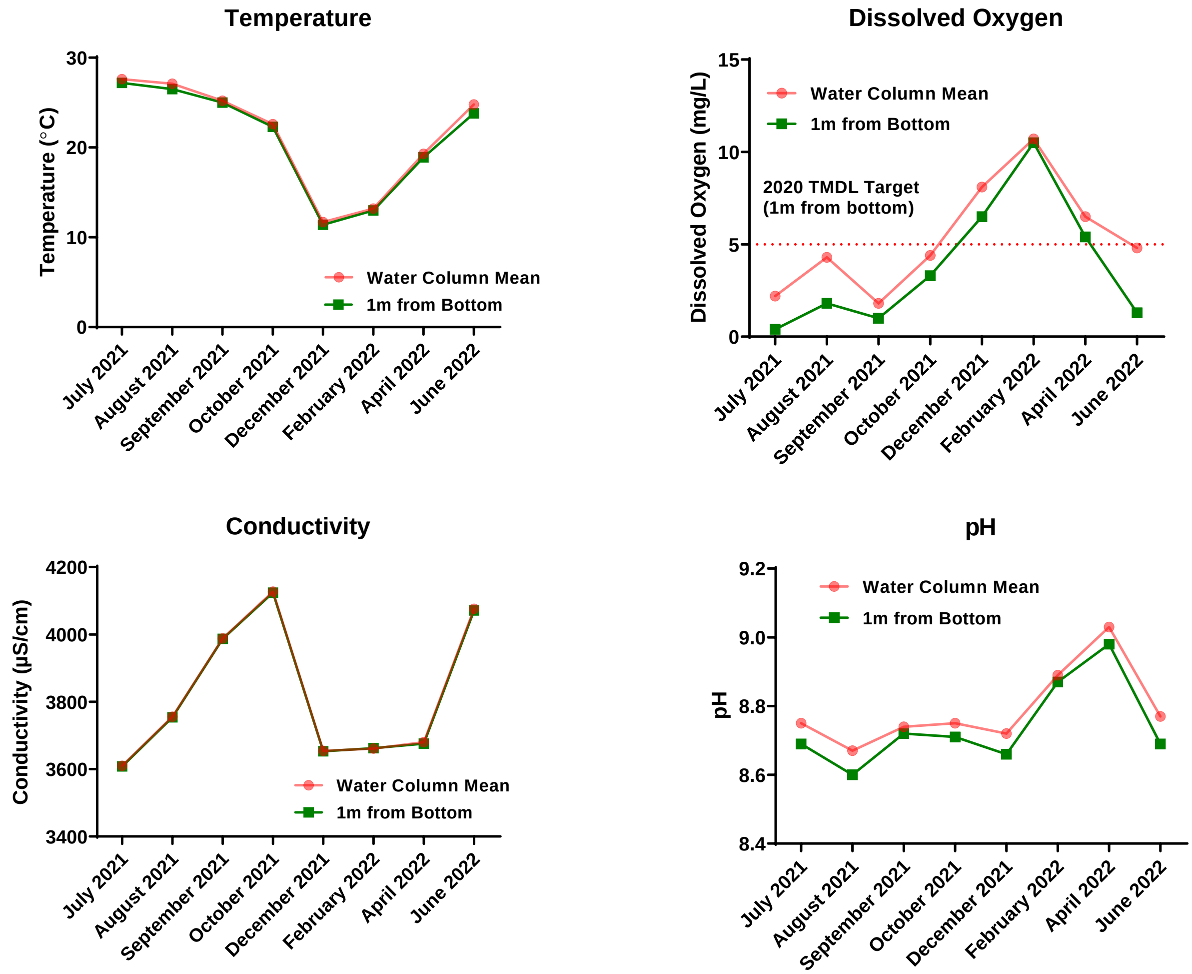


Figure 3-7. Monthly Lake-wide Mean of In-Situ Physical Water Quality Parameters – Mean of All Three Stations

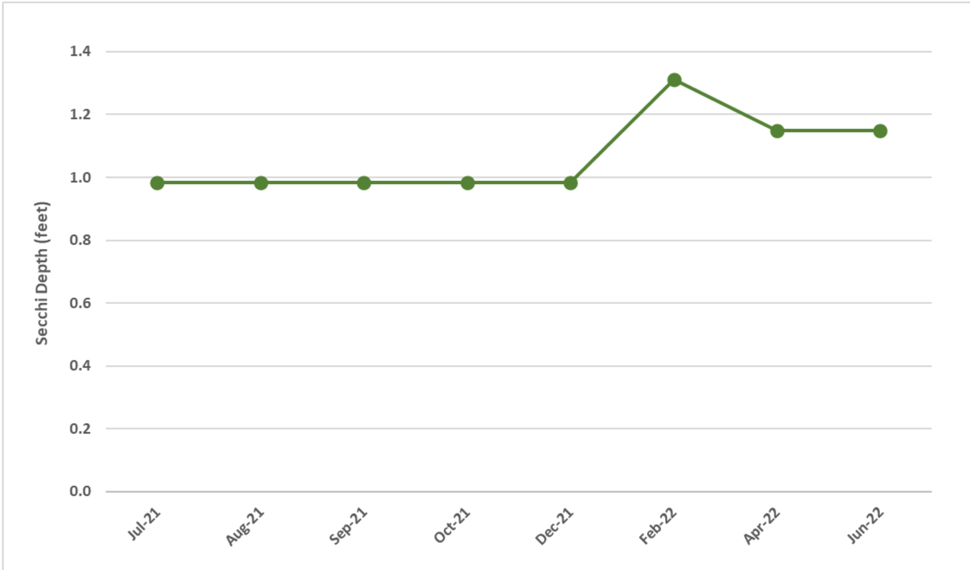


Figure 3-8. In- Situ Water Clarity Using a Secchi Disk - Lake Elsinore Site LE02

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 3-9 through 3-11.

Total nitrogen concentrations were steady across the summer, fall and early winter months, before decreasing slightly in February 2022 (Figure 3-9), this is likely because of winter precipitation events that had occurred throughout the month of December, and the overflow of Canyon Lake spillway in late December 2021. Heavy rainfalls and an increase in lake water levels would decrease the amount of total nitrogen found throughout the lake. Total nitrogen values across the monitoring year ranged from 4.3 to 5.0 mg/L. The lowest value recorded for the 2021-2022 monitoring year was higher than that of the previous monitoring year, which had a value of 2.6 mg/L in April 2021. This may be a result of less annual precipitation observed during this monitoring year and the lack of sizeable spillway overflow. The previous monitoring year experienced larger storms throughout the winter coupled with two spillway overflows (February and March 2021) each of which discharged a larger volume of water than the single event observed this monitoring year. The annual mean concentration of total nitrogen was 4.6 mg/L (4.1 mg/L in the previous monitoring year). The total nitrogen 1-year rolling average concentration, calculated by averaging the measurement from each event with the previous seven events (i.e., one year of data), exceeded the current 2020 TMDL target of 0.75 mg/L for each event (Figure 3-10).

Total phosphorus concentrations ranged from 0.072 to 0.28 mg/L across all monitoring events. The lowest total phosphorus concentration was observed in July 2021. The remainder of the monitoring events exhibited higher concentrations of total phosphorus, all within a narrow range

(0.21 – 0.28 mg/L) with the exception of February 2022 which exhibited a concentration of 0.12 mg/L (Figure 3-9). As with total nitrogen, this may be due to the amount of precipitation during December 2021 storm events. The total phosphorus concentration tripled between the months of July and August 2021, rising from 0.072 to 0.21 mg/L. Water quality profile readings indicated that the lake became stratified for DO between the same months and did not de-stratify until sometime between the October and December 2021 monitoring events. It is likely that as a result of the stratification and resulting anoxic conditions near the bottom, phosphorus became mobilized fluxing into the water column from the sediment. This same total phosphorus and DO pattern was observed in the previous monitoring year. All QA data associated with the July 2021 total phosphorus laboratory data meets acceptability criteria and does not explain the low value for July. The annual mean concentration of total phosphorus was 0.19 mg/L, down from the 0.24 mg/L annual mean from the previous monitoring year. The 1-year total phosphorus rolling average concentration exceeded the current 2020 TMDL target of 0.1 mg/L for each event (Figure 3-10).

Total ammonia-N concentrations were variable across the summer months, with the highest concentrations observed in July and September. Concentrations ranged from ND (<0.017 mg/L) to 0.35 mg/L, with an annual mean of 0.17 mg/L. The total ammonia concentration of 0.35 mg/L measured in July 2021 exceeded the corresponding Criterion Continuous Concentration (CCC) target of 0.32 mg/L (Table 3-10) in the 2004 TMDL. No other samples exceeded the total ammonia CCC or the Criterion Maximum Concentration (CMC) TMDL target.[3]

Total dissolved solids (TDS) concentrations exhibited an increase between July and December (2000 to 2400 mg/L) before decreasing slightly as a result of rain events and then beginning to increase again in June 2022. The TDS data for September 2021 was excluded from the dataset as a result of lab error. The measured TDS concentration for September was 1600 mg/L, a decrease from 2200 mg/L in August and 2300 mg/L in October. There were no rain events nor discharge inputs from the Canyon Lake Spillway (see Section 2.8.4) during this time period, causing reasonable doubt for the TDS concentration to decrease by 600 mg/L and then increase by 700 mg/L across three monitoring events. Additionally, this result does not correlate with conductivity measurements performed during the monitoring event, which are directly related to TDS concentrations. The conductivity in Lake Elsinore increased from August to September (lake-wide averages of 3,756 µS/cm and 3,988 µS/cm, respectively), further indicating that the September TDS result was erroneously reported. Given the samples collected during the months of August and October are similar in TDS concentration and conductivity, it is more likely that the 1600 mg/L TDS measurement is a laboratory reporting error, and the actual September TDS concentration is more in line with the prior and subsequent months. Although conductivity did exhibit a drop in values after December, a corresponding typical decrease of TDS in Lake Elsinore due to winter storm events was less obvious this year, likely due to the reduced precipitation totals of this past winter, and the scarcity of water coming over the Canyon Lake spillway.

Depth-integrated concentrations of chlorophyll-a across all eight sampling events ranged from 70 to 220 µg/L. Surface (0-2m) chlorophyll-a concentrations ranged from 91 to 210 µg/L. Surface and depth-integrated samples generally tracked with each other. Chlorophyll-a concentrations

[3] Note that the water quality objectives for total ammonia vary for each sampling date based on site-specific pH, temperature, and salinity values.

exhibited a general increase across the summer and early fall months (Figure 3-11). This is typical for this lake as it generally exhibits an increase in chlorophyll-a during these months until winter storms bring rain to the area. This was followed by an increase in surface chlorophyll-a concentration from 91 to 120 µg/L between the February and April monitoring events, while the increase in depth-integrated chlorophyll-a concentration occurred between April and June 2022 (70 to 120 µg/L). The mean chlorophyll-a concentration observed in samples collected during the summer months (June 2021 through August 2021) was 147 µg/L for depth-integrated samples and 150 µg/L for surface samples**.** September surface and depth-integrated chlorophyll-a measurements were omitted from analysis due to a lab error resulting in loss of the samples.

Table 3-8. Monthly Analytical Chemistry Results for Lake Elsinore in 2021-2022

Compound	Units	MDL	RL	Depth Integrated or Surface Sample	July 2021	August 2021	September 2021	October 2021	December 2021	February 2022	April 2022	June 2022	Annual Average
General Chemistry													
Total Dissolved Solids	mg/L	4.0	10	DI	2000	*2200*	*NM:LE*	*2300*	*2400*	*2300*	*2300*	*2400*	*2271*
Sulfide	mg/L	0.05	0.1	DI	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)
Nitrate as N	mg/L	0.04	0.2	DI	ND (<0.04)	ND (<0.04)	ND (<0.04)	ND (<0.04)	0.10 J	ND (<0.04)	ND (<0.04)	ND (<0.04)	ND (<0.04)
Nitrite as N	mg/L	0.042	0.1	DI	ND (<0.042)	ND (0.042)	ND (0.042)	0.088 J	0.061 J	ND (0.042)	ND (0.042)	ND (<0.042)	0.019
Total Kjeldahl Nitrogen	mg/L	0.065-0.26	0.1-0.4	DI	4.3	5.0	4.7	4.7	4.8	4.3	4.5	4.4	4.6
Total Nitrogen[a]	mg/L	NA	--	DI	4.3	5.0	4.7	4.8	5.0	4.3	4.5	4.4	**<u>4.6</u>**
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	DI	**<u>0.35*</u>**	0.10	0.30	0.17	0.16	ND (<0.017)	0.025 J	0.29	0.17
Unionized Ammonia[b]	mg/L	NA	--	DI	0.1	0.02	0.0685	0.0344	0.0146	0.000	0.006	0.0455	0.035
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	DI	0.012	0.004 J	0.005 J	0.012	0.005 J	0.011	0.004 J	0.003 J	0.007
Total Phosphorus	mg/L	0.0030-0.0067	0.01	DI	0.072	0.21	0.21	0.26	0.28	0.12	0.23	0.17	**<u>0.19</u>**
Chlorophyll-a													
Chlorophyll-a	µg/L	NA	1.0	Surf	130	140	NM:LE	210	170	91	120	160	146
Chlorophyll-a	µg/L	NA	1.0	DI	110	180	NM:LE	220	150	76	70	120	132

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+NO_2+NO_3
b - The concentration of unionized ammonia was calculated using equation by Thursby (1986), based on site specific pH and temperature recorded at each location.
c – Sample measured out of holding time
ND – Not detected; NA – Not Applicable/ available; NM:LE – Not measured due to laboratory error
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
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL Objective
Italicize – Indicates exceedance of Basin Plan Water Quality Objective
* Exceeds 2004 TMDL targets NH3 CCC

Table 3-9. Analytical Chemistry Summary for Lake Elsinore – Annual Mean Statistics (2021-2022)

Compound	Units	MDL	RL	Basin Plan WQO or TMDL Target	Depth Integrated or Surface Sample	Min	Max	Summer Average[d]	Annual Average
General Chemistry									
Total Dissolved Solids	mg/L	4.0	10	2000 [2]	DI	2000	*2400*	*2100*	*2271*
Sulfide	mg/L	0.05	0.1	NA	DI	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)
Nitrate as N	mg/L	0.04	0.2	NA	DI	ND (<0.04)	0.10	ND (<0.04)	0.013
Nitrite as N	mg/L	0.042	0.1	NA	DI	ND (<0.042)	0.088	ND (<0.042)	0.019
Total Kjeldahl Nitrogen	mg/L	0.065-0.26	0.1-0.4	NA	DI	4.3	5.0	4.5	4.6
Total Nitrogen[a]	mg/L	NA	--	0.75[b1]	DI	4.3	5.0	4.5	<u>**4.6**</u>
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	2004 - CMC: 1.5-2.9[c1]; CCC: 0.32-0.79[c1]	DI	ND (<0.017)	<u>**0.35***</u>	0.25	0.17
Unionized Ammonia[d]	mg/L	NA	--	NA	DI	0.0	0.093	0.052	0.035
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	NA	DI	ND (<0.003)	0.012	0.0083	0.0070
Total Phosphorus	mg/L	0.003-0.0067	0.01	0.1[b1]	DI	0.072	0.28	0.19	<u>**0.19**</u>
Chlorophyll-a									
Chlorophyll-a	µg/L	NA	1.0	25[d1]	Surf	91	210	<u>**150**</u>	146
Chlorophyll-a	µg/L	NA	1.0	25[c1]	DI	70	220	<u>**147**</u>	132

Notes:
When a concentration was non-detect, the annual value for compliance purposes was calculated by converting non-detect (ND) values to zero. If the result of the calculation was below the corresponding MDL, the annual average value was reported as ND.
Annual and summer chlorophyll-a average does not include September 2021 measurement due to lab error.
Annual and summer Total Dissolved Solids average does not include September 2021 measurement due to lab error.

a - Total Nitrogen = TKN+NO_2+NO_3
b - Annual average
c - Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986). The range of TMDL target thresholds apply to individual samples, not applicable to annual means
d - Summer average (June 2021 – September 2021)
1 – 2020 TMDL Target, based on Table 5-9n of 2004 TMDL
2 – Santa Ana Region Basin Plan Water Quality Objective
NA – Not applicable/ available; ND – not detected
DI = Depth integrated; Surf = Surface 0-2m
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
<u>**Bold Underline**</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective
* Exceeds 2004 TMDL targets NH3 CCC

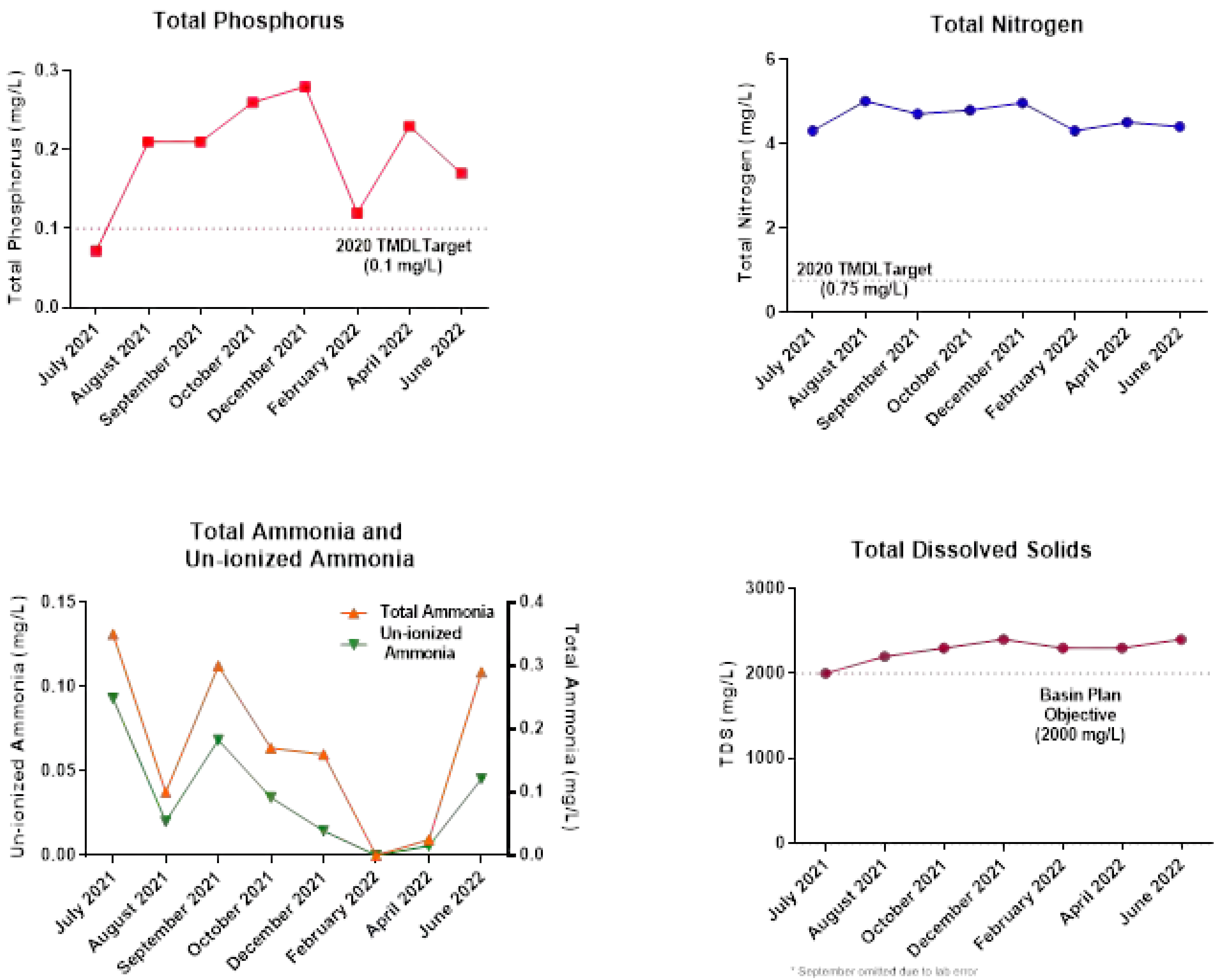
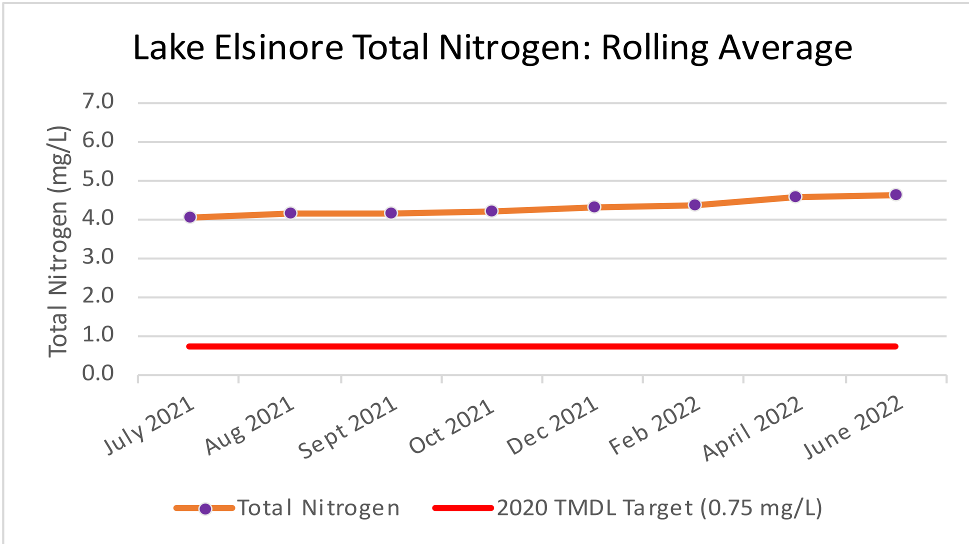


Figure 3-9. Lake Elsinore Analytical Chemistry – Depth-Integrated Means at Site LE02 (July 2021-June 2022)

Long term trends can be found in Appendix E



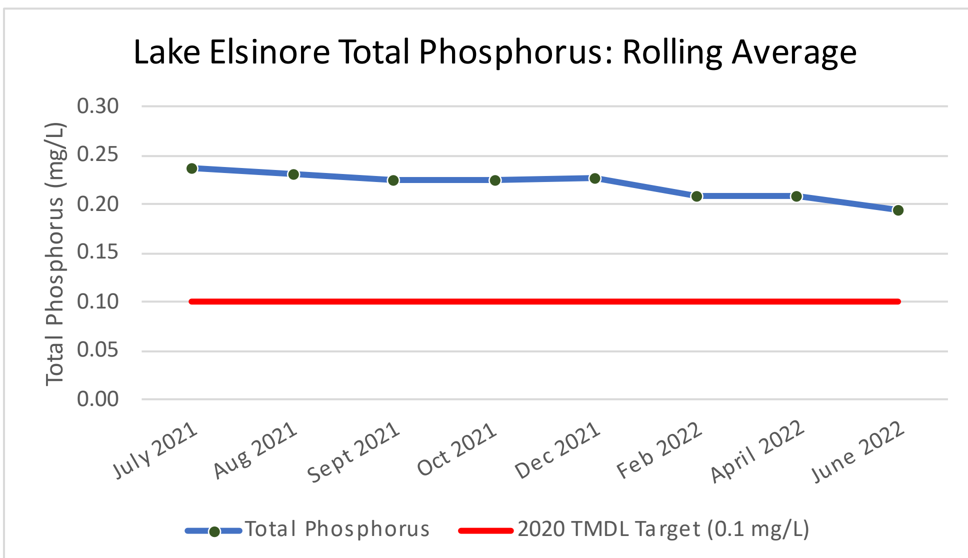


Figure 3-10. Lake Elsinore Analytical Chemistry – Total Nitrogen and Phosphorus Rolling Averages (July 2021 – June 2022)

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 2020 to June 2022.

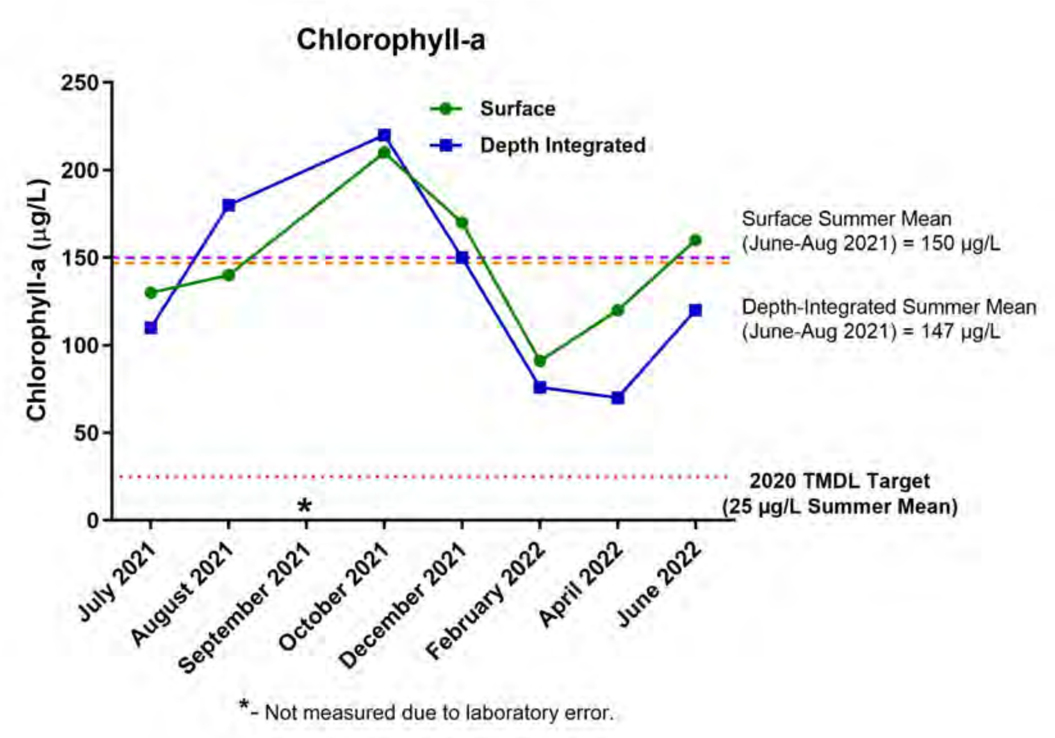


Figure 3-11. Lake Elsinore Analytical Chemistry – Depth-Integrated and Surface Chlorophyll-a at Site LE02

September (Depth-integrated & Surface) samples not analyzed due to lab error (see text). Long term trends can be found in Appendix E

3.4 Canyon Lake Monitoring

3.4.1 Sampling Station Locations and Frequency

Similar to 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 3-12, Table 3-12). Two sites are located in the main body of the lake (CL07 near the dam and CL08 in the northern arm), and two in the East Bay (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°

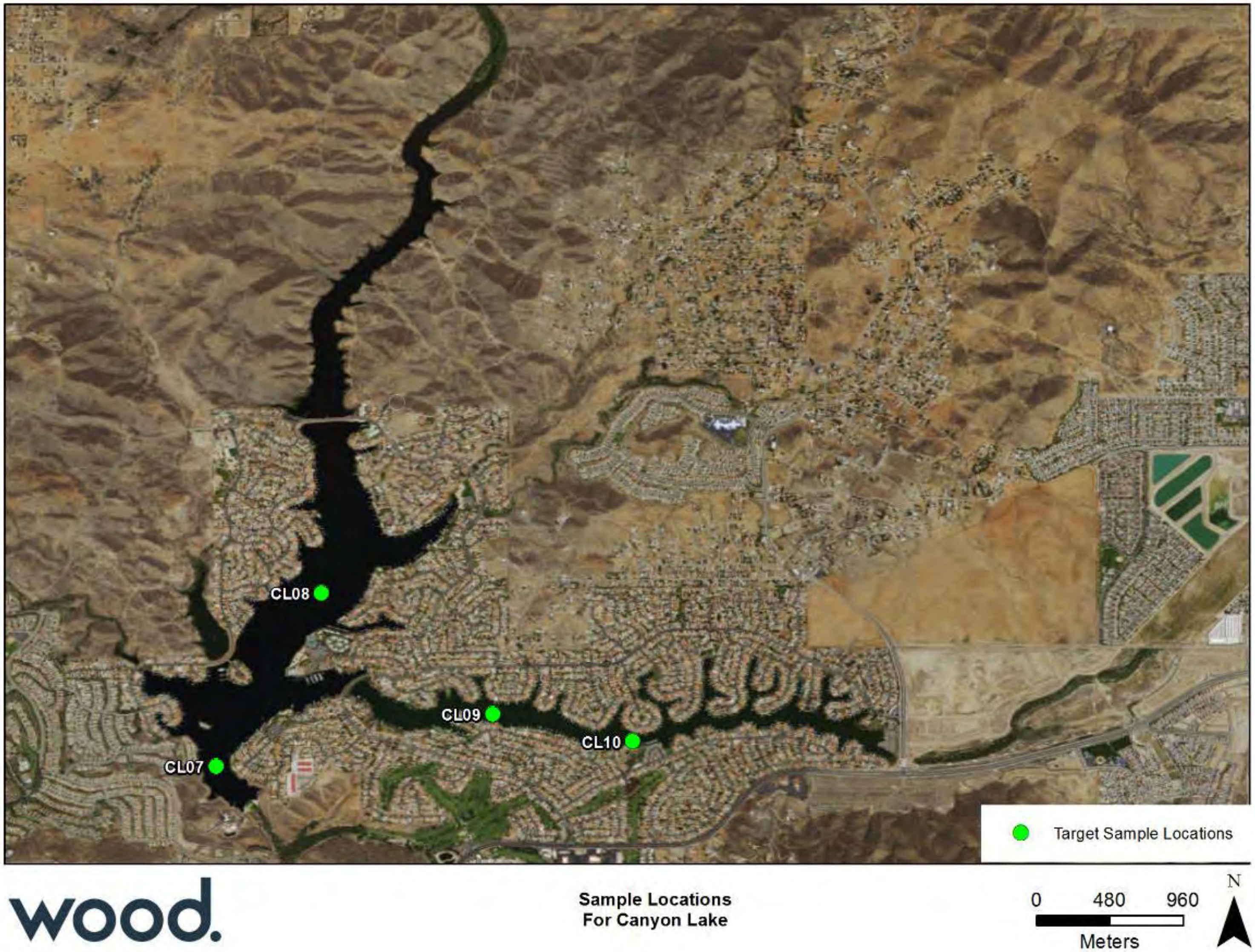


Figure 3-12. Canyon Lake Sampling Locations

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 of collection. Samples for analysis of nutrients, ammonia, sulfide, TDS, total suspended solids and chlorophyll-a were submitted to Weck Laboratories Inc., located in City of Industry, California with methods summarized 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 total suspended solids. Given this directive, total/dissolved aluminum and total suspended solids were added to the nutrient TMDL monitoring analyte list for all subsequent routine TMDL monitoring events on Canyon Lake. During the 2021-2022 monitoring period, Canyon Lake alum applications were performed during the week of October 11, 2021 and April 18, 2022. Pre-alum application monitoring events were performed on October 5, 2021 and April 13, 2022 with the subsequent respective bi-monthly TMDL event on December 21, 2021 and June 9, 2022 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.

Satellite imagery was used to remotely measure chlorophyll-a concentrations at the water surface in Canyon Lake. Satellite imagery was also used to estimate the likelihood of a harmful algae bloom.

Table 3-11. In-lake Analytical Constituents and Methods for Canyon Lake (2020-2021)

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, 2021 to June 30, 2022 is presented below. A total of six events were sampled under the TMDL monitoring program, with three occurring in 2021 (August 16, October 5, and December 21) and three in 2022 (February 17, April 13, and June 9). 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 Eastern) 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 3-13 to 3-17. Mean profile values are gathered by averaging morning and afternoon readings across sites. Due to technical issues with the YSI field meter, morning readings at Site CL07 for the February and April monitoring events are omitted from analysis to prevent inaccurate representation of profile data.

For the purposes of this report, the epilimnion is defined as the region of the water column above the thermocline, while the hypolimnion is the region of the water column below the thermocline, with both regions exhibiting relatively stable temperatures. The thermocline portion of the water column is defined as the region between the epilimnion and hypolimnion where a marked drop in temperature per unit of depth is evident (i.e., >1.0°C over 1-m depth differential). Measurements within the thermocline were excluded from epilimnion and hypolimnion averaging. Full water column means included data recorded from all three zones if stratification was present.

For both the Main Basin and East Basin, temperature exhibited a typical pattern with the lowest values occurring during the winter months (December and February) and highest values in summer months (June and August). Dissolved oxygen concentrations for both basins reflected an inverse pattern with temperature, exhibiting elevated concentrations during the winter months when averaged throughout the water column, reaching a maximum concentration in February 2022. When the thermocline develops in the lake, typically beginning in late spring through early fall period as the surface water heats up, DO concentrations within the epilimnion and hypolimnion diverge, with hypolimnion concentrations falling substantially during that timeframe. This same pattern was observed this monitoring year with the lake exhibiting stratification in August and October 2021, being de-stratified in December and February, and becoming stratified again in April 2022 (Figures 3-13 and 3-14). The lake-wide water column DO average for the current monitoring year was 7.2 mg/L and represents a large increase from the previous three monitoring years, which had values of 5.4, 5.8, and 5.5 mg/L (Table 3-16). The rolling 12-month average DO concentration, which is calculated by averaging measurements from all stations with the previous five event values (i.e., one year of data), was never above 5.0 mg/L in the hypolimnion (Figure 3-15). The rolling average of the full water column mean was above 5.0 mg/L for all monitoring dates (Figure 3-16).

Specific conductivity within the epilimnion and hypolimnion (when present) and the water column in general exhibited a gradual increase through October, a slight decrease during the rainy winter season, and then a gradual increase again. Average specific conductivity throughout the entire water column in the Main Basin (mean of CL07 & CL08) ranged from 872 to 1019 µS/cm (Tables 3-14 and 3-15, Figure 3-13). Locations in the East Basin (mean of CL09 & CL10) exhibited a similar increase across the monitoring year from 1007 to 1186 µS/cm. Mean values for pH were slightly higher in the East Basin than the Main Basin, with values ranging from 7.89 – 8.43 and 7.55 – 8.10, respectively. Values for pH within the epilimnion and hypolimnion tended to diverge as the thermocline developed, with pH values remaining higher in the epilimnion.

Secchi depths were stable between August and October 2021 before decreasing steadily (decreased water clarity) during the next two monitoring periods (December and February), with the decrease likely the result of increased turbidity as winter storm flows enter the lake. A large increase in secchi depth (increased clarity) was then observed between February and April 2022. Both basins exhibited the increase with secchi depths rising from less than 4 feet to 7.7 and 10.8 feet for the East and Main Basins, respectively (Figure 3-17). The increase in water clarity during the April 2022 event could be related to the decreased concentrations of algae at the surface of Canyon Lake as surface chlorophyll-a correspondingly decline in April 2022, particularly at Site CL09. The relationship between Secchi depth and depth-integrated chlorophyll-a for the Main Basin appears to follow an intuitive inverse relationship, in that as algae density goes up (increased chlorophyll-a) secchi depth goes down (decreased clarity). This relationship can be observed by comparing Figures 3-17 and 3-19. However, the East Basin does not exhibit this pattern, and in fact during some months of the year the algae density and secchi depth track with each other, particularly in the spring months as the thermocline begins to develop. This same pattern has been observed over the previous two monitoring years and appears to be driven primarily by Site CL09. Further discussion of this relationship between algae density, stratification, and alum application at Site CL09 can be found in the following analytical chemistry section.

For further comparisons regarding in-situ water quality parameters, Table 3-18 includes lake-wide averages observed for the current 2021-22 monitoring year, as well as the prior years dating back to the 2018-19 monitoring years.

Table 3-12. In-Situ Water Quality Parameter Measurements for Canyon Lake - Monthly Means for Each Site (August – December 2021)

Basin	Site	Measure	Aug-21			Oct-21			Dec-21		
			Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo
Main Basin	CL07	Temp (°C)	21.7	28.6	14.8	20.6	23.5	15.0	13.2	--	--
		Cond (µS/cm)	863	899	835	949	980	908	941	--	--
		pH	7.84	*8.62*	7.25	7.58	7.91	7.07	7.47	--	--
		DO (mg/L)	4.1	10.0	**<u>0.1</u>**	3.5	5.7	**<u>0.1</u>**	5.5	--	--
	CL08	Temp (°C)	26.2	28.7	17.5	23.7	--	--	13.2	--	--
		Cond (µS/cm)	881	897	843	977	--	--	936	--	--
		pH	8.15	*8.55*	7.25	8.09	--	--	7.63	--	--
		DO (mg/L)	6.0	9.0	**<u>0.1</u>**	6.8	--	**<u>--</u>**	6.9	--	--
East Basin	CL09	Temp (°C)	25.6	28.4	18.1	23.2	--	--	12.1	--	--
		Cond (µS/cm)	1022	995	1092	1115	--	--	1049	--	--
		pH	8.04	*8.59*	7.08	7.87	--	--	7.79	--	--
		DO (mg/L)	6.5	10.2	**<u>0.2</u>**	4.9	--	--	8.2	--	--
	CL10	Temp (°C)	28.5	--	--	23.3	--	--	12.3	--	--
		Cond (µS/cm)	1018	--	--	1144	--	--	1057	--	--
		pH	*8.71*	--	--	8.27	--	--	7.99	--	--
		DO (mg/L)	10.9	--	--	7.4	--	--	9.8	--	--
Lake-wide Average		Temp (°C)	25.5	28.5	16.8	22.7	23.5	15.0	12.7	--	--
		Cond (µS/cm)	946	930	923	1046	980	908	995	--	--
		pH	8.18	*8.58*	7.19	7.95	7.91	7.07	7.72	--	--
		DO (mg/L)	6.9	9.7	**<u>0.1</u>**	5.6	5.7	**<u>0.1</u>**	7.6	--	--

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
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan WQO

Table 3-13. In-Situ Water Quality Parameter Measurements for Canyon Lake - Monthly Means for Each Site (February – June 2022)

Basin	Site	Measure	Feb-22			Apr-22			Jun-22		
			Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo
Main Basin	CL07	Temp (°C)	12.8	--	--	15.8	20.0	13.0	22.0	26.4	14.6
		Cond (µS/cm)	904	--	--	973	977	970	1013	1032	982
		pH	8.01	--	--	7.79	8.44	7.40	7.95	8.42	7.18
		DO (mg/L)	8.6	--	--	3.9	10.5	**<u>0.0</u>**	5.3	9.2	**<u>0.0</u>**
	CL08	Temp (°C)	12.6	--	--	17.5	20.1	13.4	25.3	26.5	21.5
		Cond (µS/cm)	906	--	--	972	971	965	1024	1028	1010
		pH	8.20	--	--	8.01	*8.58*	7.32	8.23	8.40	7.62
		DO (mg/L)	8.0	--	--	5.8	11.1	**<u>0.0</u>**	7.6	9.2	**<u>2.4</u>**
East Basin	CL09	Temp (°C)	12.9	--	--	17.7	20.1	13.3	25.6	26.5	22.2
		Cond (µS/cm)	1008	--	--	1117	1134	1099	1172	1170	1175
		pH	8.21	--	--	7.87	8.35	7.18	8.13	8.30	7.46
		DO (mg/L)	7.2	--	--	5.8	10.3	**<u>0.0</u>**	7.4	9.2	**<u>0.5</u>**
	CL10	Temp (°C)	13.9	--	--	20.3	--	--	26.9	--	--
		Cond (µS/cm)	1006	--	--	1147	--	--	1200	--	--
		pH	*8.65*	--	--	8.34	--	--	8.28	--	--
		DO (mg/L)	11.8	--	--	10.8	--	--	9.9	--	--
Lake-wide Average		Temp (°C)	13.0	--	--	17.8	20.1	13.2	25.0	26.5	19.4
		Cond (µS/cm)	956	--	--	1052	1027	1011	1102	1077	1056
		pH	8.27	--	--	8.00	8.46	7.30	8.15	8.38	7.42
		DO (mg/L)	8.9	--	--	6.5	10.6	**<u>0.0</u>**	7.5	9.2	**<u>1.0</u>**

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
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan WQO

Table 3-14. In-Situ Water Quality Parameter Measurements for Canyon Lake - Monthly Means for Each Basin (August – December 2021)

Basin	Measure	Aug-21			Oct-21			Dec-21		
		Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo
Main	Temp (°C)	23.9	28.6	16.1	22.1	23.5	15.0	13.2	--	--
	Cond (µS/cm)	872	898	839	963	980	908	938	--	--
	pH	7.99	*8.58*	7.25	7.84	7.91	7.07	7.55	--	--
	DO (mg/L)	5.1	9.5	**0.1**	5.1	5.7	**0.1**	6.2	--	--
East	Temp (°C)	27.0	28.4	18.1	23.2	--	--	12.2	--	--
	Cond (µS/cm)	1020	995	1092	1129	--	--	1053	--	--
	pH	8.37	*8.59*	7.08	8.07	--	--	7.89	--	--
	DO (mg/L)	8.7	10.2	**0.2**	6.1	--	--	9.0	--	--
Lake-wide Average	Temp (°C)	25.5	28.5	17.1	22.7	23.5	15.0	12.7	--	--
	Cond (µS/cm)	946	946	965	1046	980	908	995	--	--
	pH	8.18	*8.59*	7.17	7.95	7.91	7.07	7.72	--	--
	DO (mg/L)	6.9	9.8	**0.1**	5.6	5.7	**0.1**	7.6	--	--

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 WQO

Table 3-15. In-Situ Water Quality Parameter Measurements for Canyon Lake - Monthly Means for Each Basin (February – June 2022)

Basin	Measure	Feb-22			Apr-22			Jun-22		
		Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo	Water Column Mean - All	Water Column Mean - Epi	Water Column Mean - Hypo
Main	Temp (°C)	12.7	--	--	16.7	20.0	13.2	23.7	26.5	18.0
	Cond (µS/cm)	905	--	--	972	974	967	1019	1030	996
	pH	8.10	--	--	7.90	*8.51*	7.36	8.09	8.41	7.40
	DO (mg/L)	8.3	--	--	4.8	10.8	**0.0**	6.4	9.2	**1.2**
East	Temp (°C)	13.4	--	--	19.0	20.1	13.3	26.3	26.5	22.2
	Cond (µS/cm)	1007	--	--	1132	1134	1099	1186	1170	1175
	pH	8.43	--	--	8.10	8.35	7.18	8.20	8.30	7.46
	DO (mg/L)	9.5	--	--	8.3	10.3	**0.0**	8.6	9.2	**0.5**
Lake-wide Average	Temp (°C)	13.0	--	--	17.8	20.1	13.2	25.0	26.5	20.1
	Cond (µS/cm)	956	--	--	1052	1054	1033	1102	1100	1085
	pH	8.27	--	--	8.00	8.43	7.27	8.15	8.36	7.43
	DO (mg/L)	8.9	--	--	6.5	10.5	**0.0**	7.5	9.2	**0.8**

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 WQO

Table 3-16. In-Situ Water Quality Parameter Measurements for Canyon Lake - Annual Mean Statistics for Each Site (August 2021 – June 2022) and Comparison to Previous Monitoring Events

		Measure	CL07	CL08	Main Basin	CL09	CL10	East Basin	Lake-wide Average (July 2021-June 2022)	Lake-wide Average (July 2020-June 2021)	Lake-wide Average (July 2019-June 2020)	Lake-wide Average (July 2018-June 2019)
Water Column Mean	Min	Temp (°C)	12.8	12.6	12.7	12.1	12.3	12.2	12.4	12.8	12.1	11.6
		Cond (µS/cm)	863	881	872	1008	1006	1007	939	740	583	519
		pH	7.47	7.63	7.55	7.79	7.99	7.89	7.72	7.45	7.59	7.40
		DO (mg/L)	3.5	5.8	4.6	4.9	7.4	6.1	5.4	3.8	4.3	3.1
	Max	Temp (°C)	22.0	26.2	24.1	25.6	28.5	27.0	25.6	24.3	24.6	26.7
		Cond (µS/cm)	1013	1024	1019	1172	1200	1186	1102	960	894	1069
		pH	8.01	8.23	8.12	8.21	*8.71*	8.46	8.29	8.26	*8.57*	8.20
		DO (mg/L)	8.6	8.0	8.3	8.2	11.8	10.0	9.1	7.6	8.7	8.3
	Average	Temp (°C)	17.7	19.7	18.7	19.5	20.8	20.2	19.4	18.9	17.8	18.6
		Cond (µS/cm)	940	949	945	1080	1095	1088	1016	839	767	839
		pH	7.77	8.05	7.91	7.98	8.37	8.18	8.04	7.92	8.05	7.85
		DO (mg/L)	5.1	6.8	6.0	6.6	10.1	8.4	7.2	5.4	5.8	5.5
Epilimnion	Min	Temp (°C)	20.0	20.1	20.0	20.1	--	20.1	20.1	20.4	24.9	20.2
		Cond (µS/cm)	899	897	898	995	--	995	930	685	594	594
		pH	7.91	8.40	8.16	8.30	--	8.30	8.20	8.21	*8.58*	8.40
		DO (mg/L)	5.7	9.0	7.3	9.2	--	9.2	7.9	7.7	7.3	6.7
	Max	Temp (°C)	28.6	28.7	28.6	28.4	--	28.4	28.5	28.3	27.7	28.1
		Cond (µS/cm)	1032	1028	1030	1170	--	1170	1077	923	716	920
		pH	*8.62*	*8.58*	*8.60*	*8.59*	--	*8.59*	*8.60*	*9.13*	*9.55*	*8.91*
		DO (mg/L)	10.5	11.1	10.8	10.3	--	10.3	10.6	11.2	11.0	9.1
	Average	Temp (°C)	24.6	25.1	24.8	25.0	--	25.0	24.9	24.9	26.5	24.6
		Cond (µS/cm)	972	965	969	1100	--	1100	1012	803	660	734
		pH	8.35	*8.51*	8.43	8.41	--	8.41	8.42	*8.61*	*9.05*	*8.60*
		DO (mg/L)	8.8	9.7	9.3	9.9	--	9.9	9.5	9.2	9.0	7.8
Hypolimnion	Min	Temp (°C)	13.0	13.4	13.2	13.3	--	13.3	13.2	13.7	14.3	12.5
		Cond (µS/cm)	835	843	839	1092	--	1092	923	800	760	657
		pH	7.07	7.25	7.16	7.08	--	7.08	7.13	6.93	7.06	7.06
		DO (mg/L)	0.0	0.0	0.0	0.0	--	0.0	0.0	0.0	0.0	0.2
	Max	Temp (°C)	15.0	21.5	18.2	22.2	--	22.2	19.5	16.9	14.9	17.2
		Cond (µS/cm)	982	1010	996	1175	--	1175	1056	942	788	888
		pH	7.40	7.62	7.51	7.46	--	7.46	7.49	7.29	7.35	7.21
		DO (mg/L)	0.1	2.4	1.3	0.5	--	0.5	1.0	0.8	0.2	0.3
	Average	Temp (°C)	14.3	17.4	15.9	17.9	--	17.9	16.5	15.2	14.6	14.4
		Cond (µS/cm)	924	939	931	1122	--	1122	995	870	776	744
		pH	7.23	7.39	7.31	7.24	--	7.24	7.29	7.10	7.22	7.14
		DO (mg/L)	**0.0**	**0.8**	**0.4**	**0.2**	--	**0.2**	**0.4**	**0.2**	**0.1**	**0.2**

Notes:
-- not applicable due to lack of thermocline
Values reported for epilimnion and hypolimnion are the arithmetic mean of measurements collected across all months sampled in which stratification was present.
Main Basin = mean of Sites CL07 and CL08
East Basin = mean of Sites CL09 and CL10
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 WQO

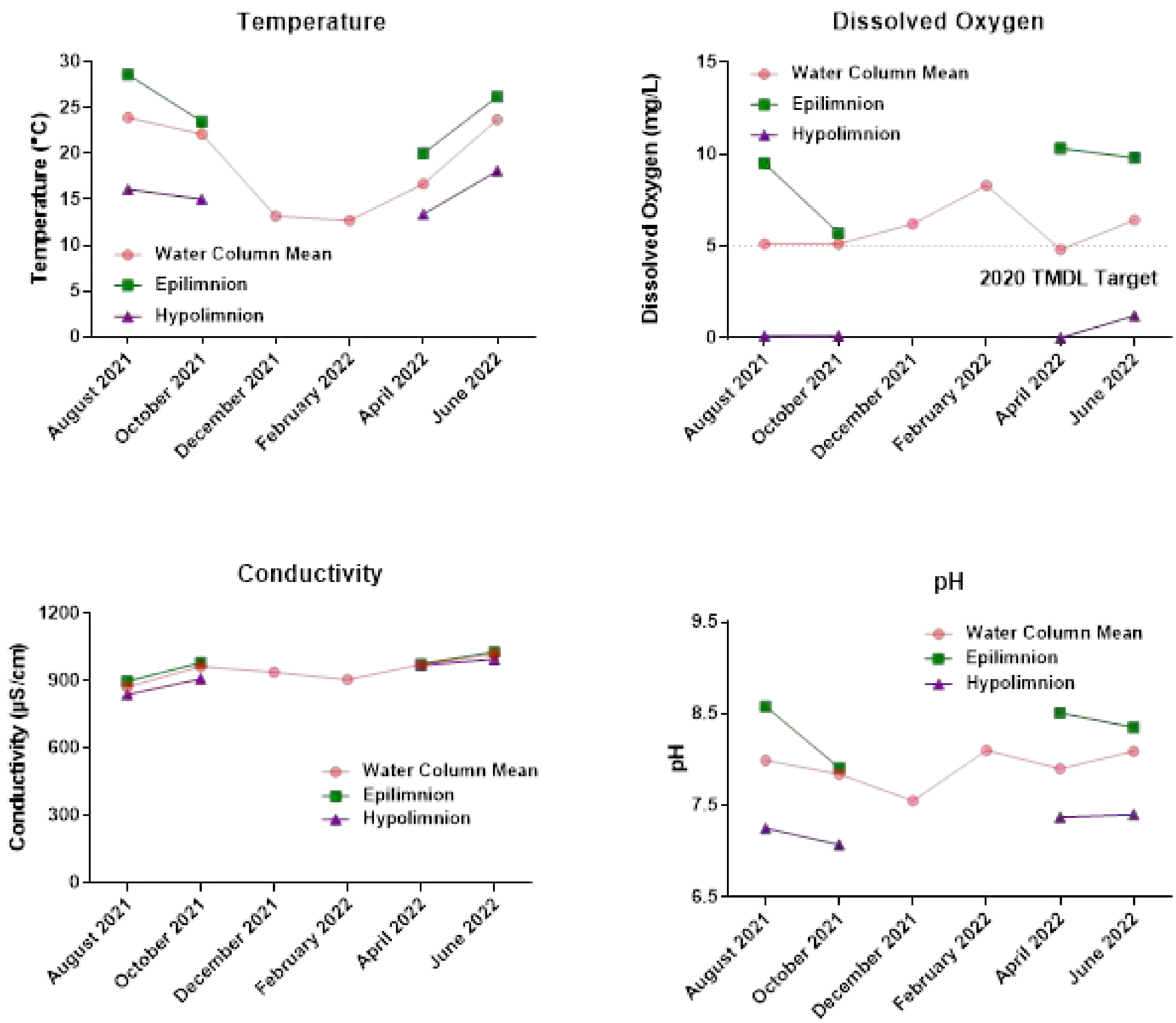


Figure 3-13. Mean In-Situ Physical Water Quality Parameters – Canyon Lake Main Basin

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

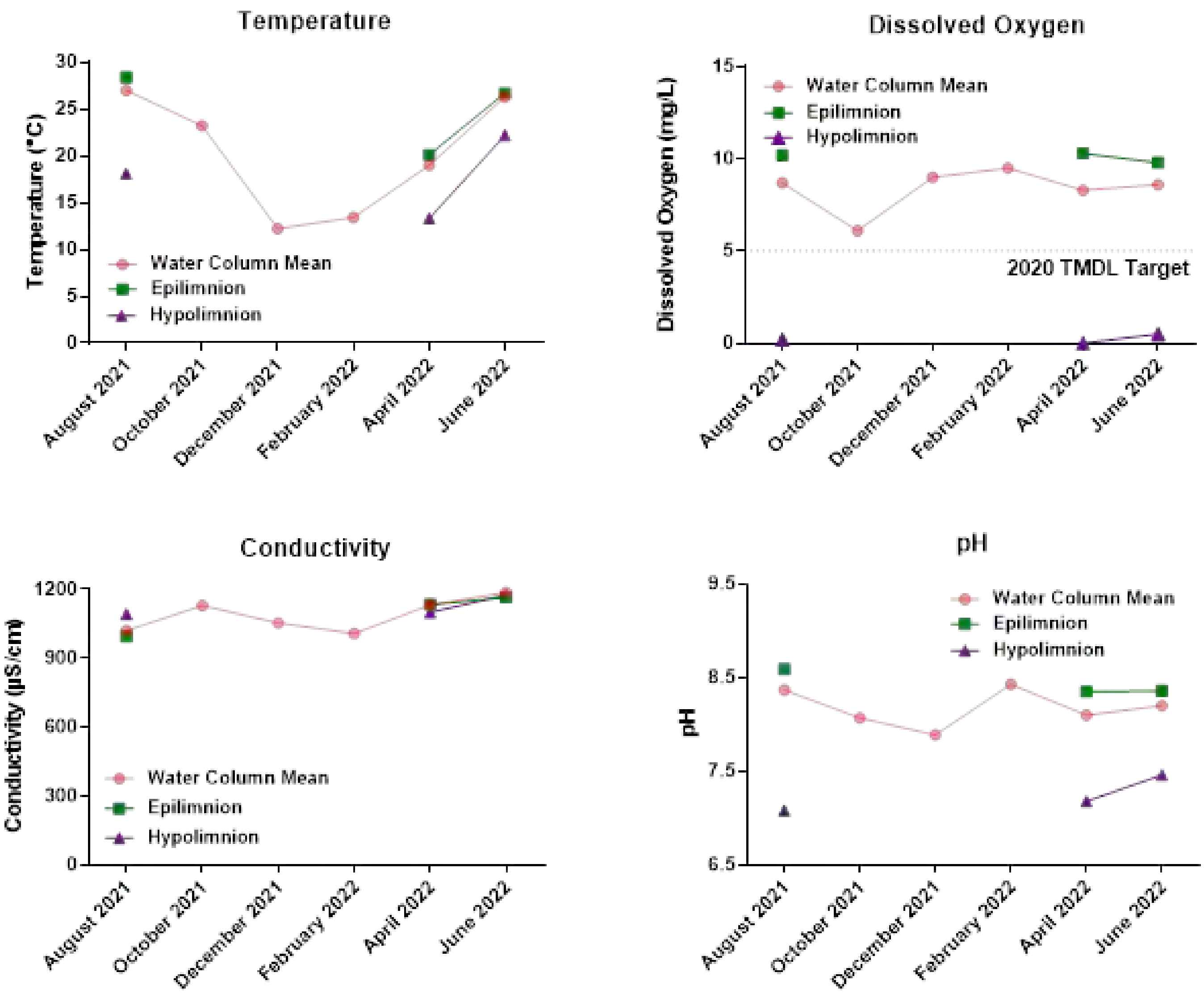


Figure 3-14. Mean In-Situ Physical Water Quality Parameters - Canyon Lake East Basin

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

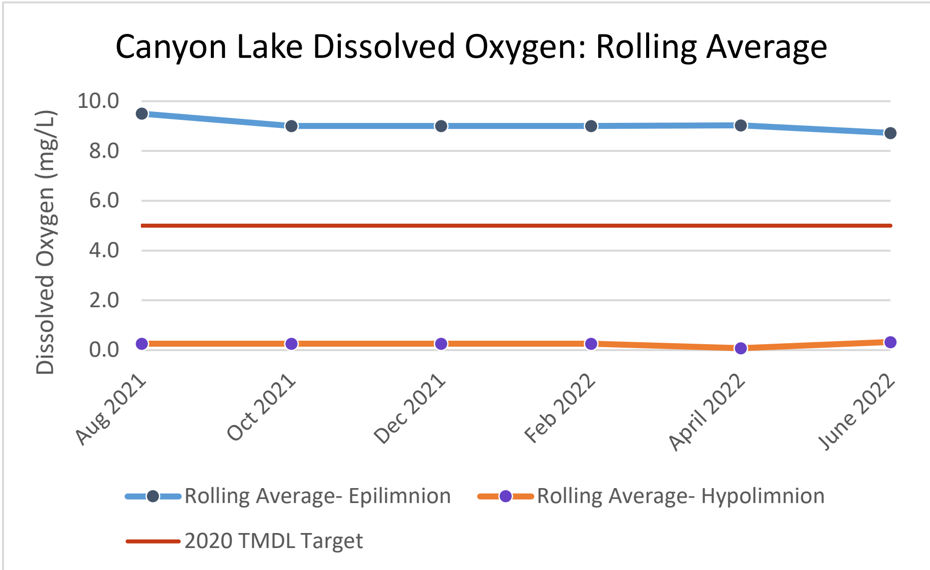


Figure 3-15. Rolling Average Concentrations of Dissolved Oxygen in the Epilimnion and Hypolimnion of Canyon Lake

Means are 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 August 2021 to June 2022. Events in which a thermocline was not present were not included in rolling average.

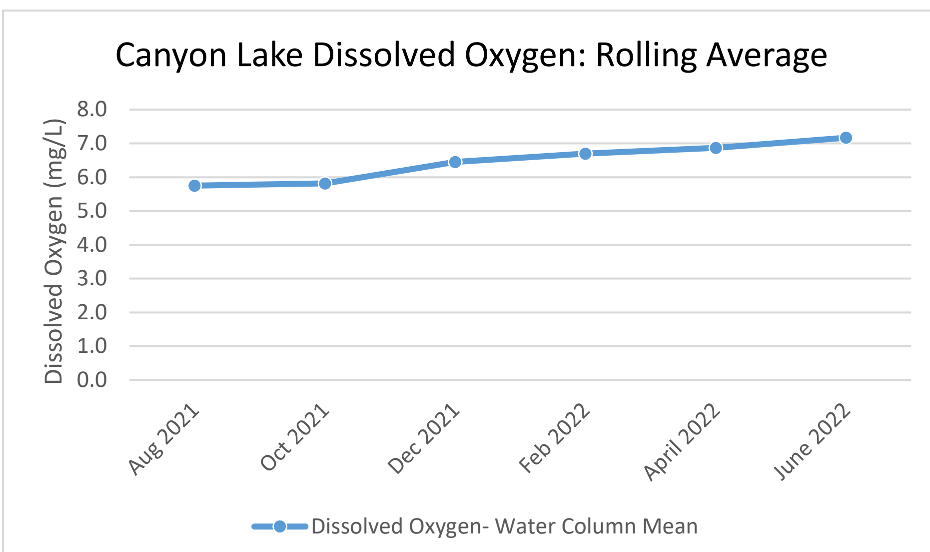


Figure 3-16. Rolling Average Concentration of Dissolved Oxygen Across the Full Vertical Water Column in Canyon Lake

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 August 2021 to June 2022.

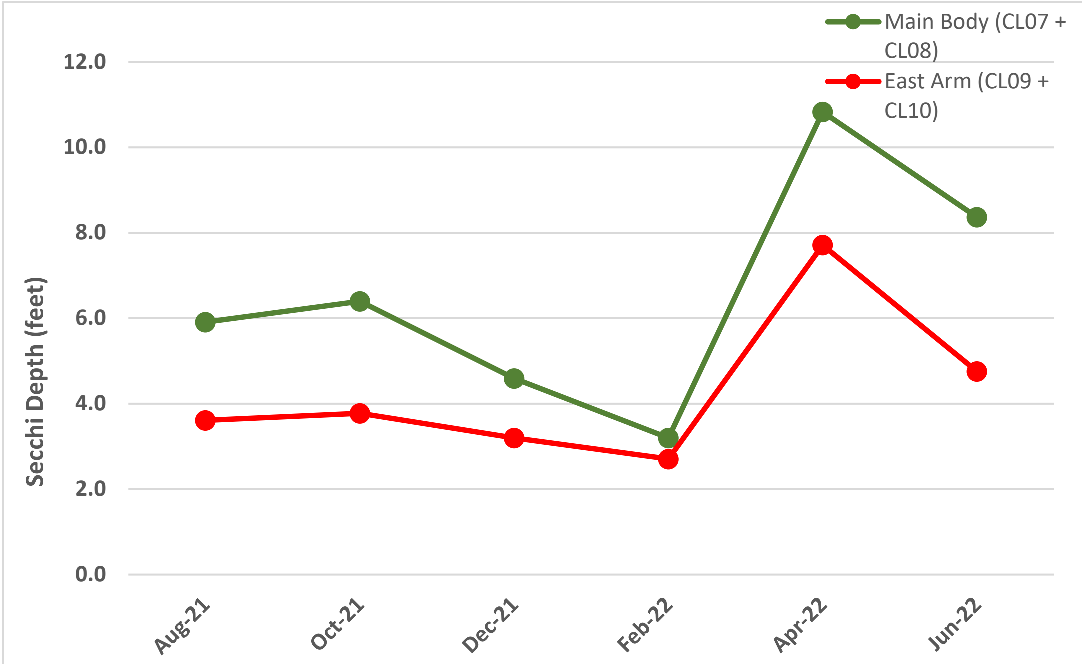


Figure 3-17. In-Situ Water Clarity Using a Secchi Disk– Main and East Basins

Analytical Chemistry

Summaries of analytical chemistry concentrations 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 across the entire monitoring period are presented in Tables 3-19 through 3-21. Concentrations of analytes are presented graphically in Figures 3-18 and 3-19**.**

Depth-integrated concentrations of total nitrogen in the Main Basin (Sites CL07 and CL08) ranged from 0.95 to 5.0 mg/L across the six sampling events, with a Main Basin annual mean of 2.1 mg/L (up from the 2020-21 annual mean of 1.6 mg/L). The higher annual mean is due to atypically high total nitrogen concentrations in August 2021 across all sites ranging from 4.4 to 5.0 mg/L. Total nitrogen concentrations at the two East Basin sites ranged from 0.71 to 4.6 mg/L across the six sampling events, with the annual mean of 1.8 mg/L (an increase from the 2020-21 annual mean of 1.7 mg/L). After the decrease from August to October, the total nitrogen concentrations in both basins remained stable. A decreasing trend in the lake-wide rolling average for total nitrogen was observed across the monitoring year, with concentrations ranging from 1.92 to 2.14 mg/L All points of the rolling average exceeded the current 2020 TMDL target of 0.75 mg/L (Figure 3-20).

Depth-integrated concentrations of total phosphorus in the Main Basin exhibited a gradual decline from August to December, and then remained steady the remainder of the monitoring year. Total phosphorus concentrations ranged from less than the detection limit (<0.003 mg/L) to 0.14 mg/L, with an annual Main Basin mean of 0.049 mg/L (a decrease from the 2020-21 annual mean of 0.096 mg/L). Total phosphorus concentrations in the East Basin decreased from August to

October, and then remained relatively stable in December 2021 and February 2022 before increasing in April and decreasing again in June. Total phosphorus concentrations in the East Basin ranged from below detection limits (<0.003 mg/L) to 0.14 mg/L**,** with an annual mean of 0.059 mg/L (a decrease from the 2020-21 annual mean of 0.099 mg/L). The rolling average for total phosphorus across all sites in Canyon Lake ranged from 0.05 to 0.09 mg/L, with a decreasing trend throughout the monitoring year (Figure 3-20). All points of the rolling average were below the current 2020 TMDL target of 0.1 mg/L (Figure 3-20).

During the 2021-2022 monitoring year, two alum applications occurred in Canyon Lake. The first during the week of October 11, 2021, with pre-alum application TMDL monitoring occurring on October 5. The second alum application was on April 18, 2022, with the pre-alum monitoring occurring on April 13, 2022. While a decline was observed in total phosphorus in the Main Body of Canyon Lake across the three monitoring events spanning August and December 2021, this cannot be solely linked to the alum application, as the total phosphorus had begun its decline between August and October prior to the alum application. Total phosphorus remained stable after the first alum treatment through the December monitoring event and wet weather events and runoff that occurred during this time period. The second treatment did appear to influence phosphorous concentrations, as total phosphorus concentrations decreased in both the Main and East Basins following this application. 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).

The mean depth-integrated concentration of total ammonia for the two sites in the Main Basin were at their highest in October 2021 at a value of 1.35 mg/L, a decrease from the peak concentration last monitoring year (1.5 mg/L in August 2020). Concentrations had then decreased through February 2022, before increasing in April and June 2021. This same pattern was observed for the East Basin, in that higher ammonia concentrations were observed in summer (August 2021) and late spring (June 2022). This pattern is likely tied to the annual stratification cycle of the lake, where the Main Basin exhibits a stratification beginning in early spring (April) through early Fall (October). During this time low dissolved oxygen in the hypolimnion facilitates the release of phosphorus and ammonia from the sediments. Due to the increase depths in the Main Basin, stronger stratification develops accounting for higher ammonia concentrations and longer periods of stratification. Total ammonia concentrations in the Main Basin ranged from values below the detection limit (<0.017) to 2.4 mg/L**,** with an annual mean of 0.73 mg/L. Total ammonia values in the East Basin ranged from values below the detection limit (<0.017 mg/L) to 1.4 mg/L, with an annual mean of 0.36 mg/L, a decrease from the previous monitoring year (0.69 mg/L). The total ammonia concentration of 1.4 mg/L measured in August 2021 at Site CL09 exceeded the corresponding CCC 2004 TMDL target of 1.23 mg/L (Table 3-17). No other concentrations exceeded the CCC or CMC.

Total dissolved solids concentrations for both basins generally displayed an increasing trend across the monitoring year, however a slight decrease was observed in February 2022 as a result of winter storms. The average TDS concentration in the Main Basin ranged from 510 mg/L to 590 mg/L, which is an increase from the previous monitoring year (390 mg/L to 520 mg/L). The average concentrations of TDS in the East Basin were slightly higher and ranged from 600 mg/L to 700 mg/L, also an increase from the previous year (400 mg/L to 620 mg/L). One event, June 2022 at CL10, had exceeded the Basin Plan water quality objective of 700 mg/L for TDS for Canyon Lake.

Chlorophyll-a depth-integrated concentrations in the Main Basin slowly decreased between August and December 2021, before a slight increase in February 2022**.** A sharp decrease in concentrations was observed in April 2022 followed by a larger increase in June. The depth-integrated concentrations in the Main Basin (mean of Sites CL07 and CL08) across all six sampling events ranged from 6.9 to 37 µg/L, with a mean of 20 µg/L (Figure 3-19). Depth-integrated concentrations of chlorophyll-a in the East Basin (Sites CL09 and CL10) exhibited a different pattern than that observed in the Main Basin. The mean East Basin depth-integrated chlorophyll-a decreased between August and October (33 to 20 µg/L), and then remained relatively consistent through February until a large spike in April 2022 up to 47.8 µg/L**,** followed by a decrease in June. It is possible that an influx of nutrients from winter storm events could have caused a short-term spatially variable algal bloom in the east basin in April. The overall annual mean for the East Basin was 29 µg/L. The lake-wide chlorophyll-a depth-integrated rolling average remained below the 2020 TMDL target of 25 µg/L for the entire monitoring year (Figure 3-20).

The large increase in mean depth-integrated concentration of chlorophyll-a for the East Basin in April was solely due to a high chlorophyll-a concentration measured at site CL09 (86 µg/L), as site CL10 reflected a much lower concentration, similar to that in the Main Basin (9.6 µg/L). Historical monitoring data shows that increases in chlorophyll-a have been observed in either April or June at Site CL09 every monitoring year (with the exception of Spring 2020) since the 2016-2017 monitoring cycle (Site CL09 was not included in the TMDL program during the 2015-2016 monitoring year). Although similar spikes are seen on occasion at other sites across Canyon Lake, Site CL09 consistently displays this pattern that appears to correspond with the East Basin stratifying. One anecdotal observation for Site CL09 has been that the sample frequently has a sulfur odor associated with it, which likely indicates stratification and anoxic conditions in the bottom layers of the water column. The spikes in chlorophyll-a at Site CL09 frequently correspond, either during the same event or a subsequent event in June, with an increase in total phosphorus concentration. This correlation in stratification, depth-integrated chlorophyl-a, and total phosphorus has been observed over the last three monitoring years. Interestingly, while at times increasing in spring monitoring events, the surface chlorophyll-a concentration at Site CL09 does not exhibit this same pattern or magnitude of increase. It is likely that as the lake begins to stratify in mid to late spring, anoxic conditions begin to develop near the bottom facilitating the flux of nutrients from the sediment. As this happens, nutrients build up in the hypolimnion and as a result of the shallower depth at Site CL09, enough light penetrates allowing algae to take advantage of this flux of nutrients in the bottom layer, while the upper water column does not contain this nutrient load. This would explain the depth-integrated sample exhibiting the consistent increase in chlorophyll-a, while the surface sample does not, and would also explain why Site CL10, a shallower site which typically does not stratify, does not show the same consistent pattern in chlorophyll-a increase.

Two alum application events were performed this monitoring year: the first on October 11, 2021, and the second April 18, 2022. 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 ranged from values below detection limit (<41 µg/L) to 150 µg/L in the Main Basin and values below detection limit (<41 µg/L) to 190 µg/L in the East Basin among all sampling locations and dates.

Concentrations of total aluminum increased following both alum application events, more so after the Spring application. However, all total aluminum concentrations measured were well below CCC and CMC values of 1000 and 2300 ug/L total aluminum respectively, based on the US EPA's Final Aquatic Life Ambient Water Quality Criteria for Aluminum (US EPA, 2018) when using the annual average lake-wide measured pH, and default total organic carbon and hardness values. Compared to the previous monitoring year, concentrations were higher throughout the Main Basin, but lower overall across the East Basin. Dissolved aluminum concentrations ranged from ND to 130 µg/L in the Main Basin and ND to 100 µg/L in the East Basin. It does not appear that the regular additions of alum to Canyon Lake are causing an increase in aluminum concentration that would produce acute or chronic effects on resident aquatic life.

Table 3-17. Analytical Chemistry Results for Canyon Lake - Monthly Depth-Integrated Results (Aug – Dec 2021)

Compound	Units	MDL	RL	Depth Integrated or Surface Sample	August 2021				October 2021				December 2021			
					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	4.0	10	DI	510	510	600	630	510	550	630	640	590	570	680	670
Total Suspended Solids	mg/L	NA	5	DI	5	5	11	14	5	5	5	9	4	4	6	11
Sulfide	mg/L	0.05-0.2	0.1-0.5	DI	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)
Nitrate as N	mg/L	0.04	0.2	DI	ND (<0.04)	0.049 J	ND (<0.04)	ND (<0.04)	ND (<0.04)	ND (<0.04)	0.046 J	0.054 J	0.094 J	0.11 J	0.16 J	0.14 J
Nitrite as N	mg/L	0.042	0.1	DI	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	0.045 J	0.046 J	ND (<0.042)	ND (<0.042)
Total Kjeldahl Nitrogen	mg/L	0.065-0.13	0.1-0.2	DI	4.8	5.0	4.6	4.4	2.9	0.95	0.89	0.91	1.4	1.5	1.4	1.3
Total Nitrogen[a]	mg/L	NA	--	DI	4.8	5.0	4.6	4.4	2.9	0.95	0.94	1.0	1.5	1.7	1.6	1.4
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	DI	1.9	0.77	**<u>1.4*</u>**	ND (<0.017)	2.4	0.29	0.12	0.057 J	0.71	0.69	0.43	0.37
Unionized Ammonia[b]	mg/L	NA	--	DI	0.053	0.054	0.074	0.0	0.033	0.017	0.003	0.0	0.005	0.006	0.005	0.006
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	DI	0.1	0.017	0.064	ND (<0.003)	0.099	ND (<0.003)	0.007 J	0.006 J	0.004	ND (<0.003)	ND (<0.003)	ND (<0.003)
Total Phosphorus	mg/L	0.003-0.0067	0.01	DI	0.14	0.059	0.14	0.072	0.12	ND (<0.003)	0.026	0.058	0.032	0.027	0.058	0.061
Total Aluminum	µg/L	41	50	DI	46	48	70	130	ND (<41)	45 J	55	180	67	54	180	190
Dissolved Aluminum	µg/L	41	50	DI	ND (<41)	ND (<41)	54	56	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)
Chlorophyll-a																
Chlorophyll-a	µg/L	NA	1.0	Surf (0-2m)	3.0	5	6	7.7	10	9	21	23	9	19	30	23
Chlorophyll-a	µg/L	NA	1.0	DI	19	26	59	6.4	18	19	19	20	9	26	23	26

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+NO_2+NO_3
b - The concentration of unionized ammonia was *calculated* using equation by Thursby (1986), based on site specific pH and temperature recorded at each location.
c – Sample measured out of holding time
ND – Not detected; NA – Not Applicable/ available; NM:LE – Not measured due to laboratory error
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 detection was above the MDL, but below the RL
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL Objective
Italicize – Indicates exceedance of Basin Plan Water Quality Objective
* Exceeds 2004 TMDL targets NH3 CCC

Table 3-18. Analytical Chemistry Results for Canyon Lake- Monthly Depth-Integrated Results (Feb – June 2022)

Compound	Units	MDL	RL	Depth Integrated or Surface Sample	February 2022				April 2022				June 2022			
					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	4.0	10	DI	550	550	620	660	570	570	620	660	560	570	650	700
Total Suspended Solids	mg/L	NA	5	DI	8	7	9	10	2 J	4 J	3 J	7	ND (<5)	ND (<5)	ND (<5)	6
Sulfide	mg/L	0.05-0.2	0.1-0.5	DI	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	0.1	ND (<0.05)	2	3	2	ND (<0.05)
Nitrate as N	mg/L	0.04	0.2	DI	0.46	0.40	0.43	ND (<0.04)	0.082 J	0.14 J	0.11	0.16 J	ND (<0.04)	ND (<0.04)	ND (<0.04)	ND (<0.04)
Nitrite as N	mg/L	0.042	0.1	DI	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)
Total Kjeldahl Nitrogen	mg/L	0.065-0.13	0.1-0.2	DI	0.96	1.1	1.2	1.1	1.1	0.93	1.4	0.77	1.5	1.2	1.8	0.71
Total Nitrogen[a]	mg/L	NA	--	DI	1.4	1.5	1.4	1.1	1.2	1.0	1.5	0.9	1.5	1.2	1.8	0.71
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	DI	ND (<0.017)	0.12	0.22	0.11	0.42	0.24	0.60	0.03 J	0.86	0.37	1.0	ND (<0.047)
Unionized Ammonia[b]	mg/L	NA	--	DI	NM	0.0091	0.016	0.0073	0	0.007	0.013	0.002	0.030	0.027	0.065	0
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	DI	ND (<0.003)	ND (<0.003)	ND (<0.003)	ND (<0.003)	0.023	0.01	0.064	ND (<0.003)	ND (<0.003)	ND (<0.003)	ND (<0.003)	ND (<0.003)
Total Phosphorus	mg/L	0.003-0.0067	0.01	DI	0.034	0.037	0.059	0.033	0.046	0.032	0.14	0.02	0.028	0.033	0.038	ND (<0.003)
Total Aluminum	µg/L	41	50	DI	51	72	66	88	ND (<41)	61	ND (<41)	97	130	150	120	150
Dissolved Aluminum	µg/L	41	50	DI	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	ND (<41)	110	130	100	100
Chlorophyll-a																
Chlorophyll-a	µg/L	NA	1.0	Surf (0-2m)	32.0	34.0	33	13	14.0	12.0	10	9.3	2.1	4	5.1	10.0
Chlorophyll-a	µg/L	NA	1.0	DI	19.0	22.0	22	22	6.9	9.1	86.0	9.6	25	37	42	8.0

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+NO_2+NO_3
b - The concentration of unionized ammonia was calculated using equation by Thursby (1986), based on site specific pH and temperature recorded at each location.
c – Sample measured out of holding time
ND – Not detected; NA – Not Applicable/ available; NM – Not Measured due to meter error
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 detection was above the MDL, but below the RL
Bold Underline - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective
* Exceeds 2004 TMDL Permit NH3 CCC target

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	Depth Integrated or Surface Sample	CL07			CL08			Main Basin		
						Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
General Chemistry														
Total Dissolved Solids	mg/L	4.0	10	700[2]	DI	510	590	548	510	570	553	510	590	551
Total Suspended Solids	mg/L	NA	5	NA	DI	ND (<5)	8	4	ND (<5)	7	4	ND (<5)	8	4
Sulfide	mg/L	0.05-0.2	0.1-0.5	NA	DI	ND (<0.05)	2.0	0.3	ND (<0.05)	3.0	0.50	ND (<0.05)	3.0	0.4
Nitrate as N	mg/L	0.04	0.2	NA	DI	ND (<0.04)	0.46	0.11	ND (<0.04)	0.40	0.12	ND (<0.04)	0.46	0.1
Nitrite as N	mg/L	0.042	0.1	NA	DI	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	0.0
Total Kjeldahl Nitrogen	mg/L	0.065-0.13	0.1-0.2	NA	DI	0.96	4.8	2.1	0.9	5.0	1.8	0.9	5.0	1.9
Total Nitrogen[a]	mg/L	NA	--	0.75[b1]	DI	1.182	4.8	**<u>2.2</u>**	1.0	5.0	**<u>1.9</u>**	1.0	5.0	**<u>2.1</u>**
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	2004- CMC: 2.7-21[c1]; CCC: 0.39-4.5[c1]	DI	ND (<0.017)	2.4	1.0	0.12	0.8	0.4	ND (<0.017)	2.4	0.7
Unionized Ammonia[c]	mg/L	NA	--	NA	DI	0.0	0.053	0.020	0.006	0.054	0.020	0.0	0.054	0.020
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	NA	DI	ND (<0.003)	0.1	0.04	ND (<0.003)	0.017	0.005	ND (<0.003)	0.10	0.021
Total Phosphorus	mg/L	0.003-0.0067	0.01	0.1[b1]	DI	0.028	0.14	0.07	ND (<0.003)	0.06	0.031	ND (<0.003)	0.14	0.049
Total Aluminum	µg/L	41	50	NA	DI	ND (<41)	130	49	45	150	72	ND (<41)	150	60
Dissolved Aluminum	µg/L	41	50	NA	DI	ND (<41)	110	18.3	ND (<41)	130	22	ND (<41)	130	20
Chlorophyll-a														
Chlorophyll-a	µg/L	NA	1.0	25[b1]	Surf (0-2m)	2.1	32	12	3.5	34	14	2.1	34	13
Chlorophyll-a	µg/L	NA	1.0	25[b1]	DI	6.9	25	16	9.1	37	23	6.9	37	20

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

a - Total Nitrogen = TKN+NO_2+NO_3
b - Annual average
c - Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986). The range of TMDL target thresholds apply to individual samples, not applicable *to* annual means.
1 – 2020 TMDL Target, based on Table 5-9n of 2004 TMDL
2 – Santa Ana Region Basin Plan Objective
NA – Not applicable/ available; ND – not detected
DI = Depth integrated; Surf = Surface 0-2m
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
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

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	Depth Integrated or Surface Sample	CL09			CL10			East Basin		
						Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
General Chemistry														
Total Dissolved Solids	mg/L	4.0	10	700[2]	DI	600	680	633	630	700	660	600	700	647
Total Suspended Solids	mg/L	NA	5	NA	DI	ND (<5)	11	5.7	6.0	14	9.5	ND (<5)	14	7.6
Sulfide	mg/L	0.05-0.2	0.1-0.5	NA	DI	ND (<0.05)	2	0.4	ND (<0.05)	ND (<0.05)	ND (<0.05)	ND (<0.05)	2.0	0.18
Nitrate as N	mg/L	0.04	0.2	NA	DI	ND (<0.04)	0.24	0.093	ND (<0.04)	0.16	0.059	ND (<0.04)	0.24	0.076
Nitrite as N	mg/L	0.042	0.1	NA	DI	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)
Total Kjeldahl Nitrogen	mg/L	0.065-0.13	0.1-0.2	NA	DI	0.89	4.6	1.9	0.71	4.4	1.5	0.71	4.6	1.7
Total Nitrogen[a]	mg/L	NA	--	0.75[b1]	DI	0.9	4.6	**<u>2.0</u>**	0.71	4.4	**<u>1.6</u>**	0.71	4.6	**<u>1.8</u>**
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	2004- CMC: 2.7-21[c1]; CCC: 0.39-4.5[c1]	DI	0.12	**<u>1.4</u>**	0.63	ND (<0.17)	0.37	0.09	ND (<0.17)	1.4	0.36
Unionized Ammonia[c]	mg/L	NA	--	NA	DI	0.0033	0.07	0.029	0	0.0073	0.0032	0	0.07	0.016
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	NA	DI	ND (<0.003)	0.064	0.023	ND (<0.003)	0.006	0.001	ND (<0.003)	0.06	0.012
Total Phosphorus	mg/L	0.003-0.0067	0.01	0.1[b1]	DI	0.026	0.14	0.08	ND (<0.003)	0.07	0.041	ND (<0.003)	0.14	0.059
Total Aluminum	µg/L	41	50	NA	DI	ND (<41)	180	82	88	190	139	ND (<41)	190	111
Dissolved Aluminum	µg/L	41	50	NA	DI	ND (<41)	100	26	ND (<41)	100	26	ND (<41)	100	26
Chlorophyll-a														
Chlorophyll-a	µg/L	NA	1.0	25[b1]	Surf (0-2m)	5.1	33	17	7.7	23	14	5.1	33	16
Chlorophyll-a	µg/L	NA	1.0	25[b1]	DI	19.0	86	**<u>42</u>**	6.4	26	15	6.4	86	**<u>29</u>**

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

a - Total Nitrogen = $TKN+NO_2+NO_3$
b - Annual average
c - Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986). The range of TMDL target thresholds apply to individual samples, not applicable to annual means.
1 – 2020 TMDL Target, based on Table 5-9n of 2004 TMDL
2 – 2015 TMDL Target, based on Table 5-9n of 2004 TMDL
3 – Santa Ana Region Basin Plan Water Quality Objective
NA – Not applicable/ available; ND – not detected
DI = Depth integrated; Surf = Surface 0-2m
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
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

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	Depth Integrated or Surface Sample	Main Basin			East Basin			Lake-wide Average		
						Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
General Chemistry														
Total Dissolved Solids	mg/L	4.0	10	700[2]	DI	510	590	551	600	700	647	510	700	599
Total Suspended Solids	mg/L	NA	5	NA	DI	ND (<5)	8.0	4.08	ND (<5)	14	7.6	ND (<5)	14	5.8
Sulfide	mg/L	0.05-0.2	0.1-0.5	NA	DI	ND (<0.05)	3.0	0.4	ND (<0.05)	2.0	0.18	ND (<0.05)	3.0	0.30
Nitrate as N	mg/L	0.04	0.2	NA	DI	ND (<0.04)	0.46	0.11	ND (<0.04)	0.24	0.076	ND (<0.04)	0.46	0.094
Nitrite as N	mg/L	0.042	0.1	NA	DI	ND (<0.042)	ND (<0.042)	0.0	ND (<0.042)	0.0	ND (<0.042)	ND (<0.042)	ND (<0.042)	ND (<0.042)
Total Kjeldahl Nitrogen	mg/L	0.065-0.13	0.1-0.2	NA	DI	0.9	5.0	1.9	0.71	4.6	1.7	0.71	5.0	1.8
Total Nitrogen[a]	mg/L	NA	--	0.75[b1]	DI	1.0	5.0	**<u>2.1</u>**	0.71	4.6	**<u>1.8</u>**	0.71	5.0	**<u>1.9</u>**
Ammonia-Nitrogen	mg/L	0.017-0.047	0.1	2004- CMC: 2.7-21[c1]; CCC: 0.39-4.5[c1]	DI	ND (<0.017)	2.4	0.73	ND (<0.017)	1.4	0.36	ND (<0.017)	2.4	0.55
Unionized Ammonia[c]	mg/L	NA	--	NA	DI	0.0000	0.054	0.020	0.0	0.07	0.016	0.0	0.07	0.018
Ortho Phosphate Phosphorus	mg/L	0.003	0.01	NA	DI	ND (<0.003)	0.10	0.021	ND (<0.003)	0.06	0.012	ND (<0.003)	0.10	0.016
Total Phosphorus	mg/L	0.003-0.0067	0.01	0.1[b1]	DI	ND (<0.003)	0.14	0.049	ND (<0.003)	0.14	0.059	ND (<0.003)	0.14	0.054
Total Aluminum	µg/L	41	50	NA	DI	ND (<41)	150	60	ND (<41)	190	111	ND (<41)	190	85
Dissolved Aluminum	µg/L	41	50	NA	DI	ND (<41)	130	20	ND (<41)	100	26	ND (<41)	130	23
Chlorophyll-a														
Chlorophyll-a	µg/L	NA	1.0	25[b1]	Surf (0-2m)	2.1	34	13	5.1	33	16	2.1	34	14
Chlorophyll-a	µg/L	NA	1.0	25[b1]	DI	6.9	37	20	6.4	86	**<u>29</u>**	6.4	86	24

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

a - Total Nitrogen = $TKN+NO_2+NO_3$
b - Annual average
c - Values calculated using water column mean ammonia, temperature, salinity and pH. Calculated using equation by Thursby (1986). The range of TMDL target thresholds apply to individual samples, not applicable to annual means.
1 – 2020 TMDL Target, based on Table 5-9n of 2004 TMDL
2 – Santa Ana Region Basin Plan Water Quality Objective
NA – Not applicable/ available; ND – not detected
DI = Depth integrated; Surf = Surface 0-2m
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
<u>Bold Underline</u> - Indicates exceedance of 2020 TMDL target
Italicize – Indicates exceedance of Basin Plan Water Quality Objective

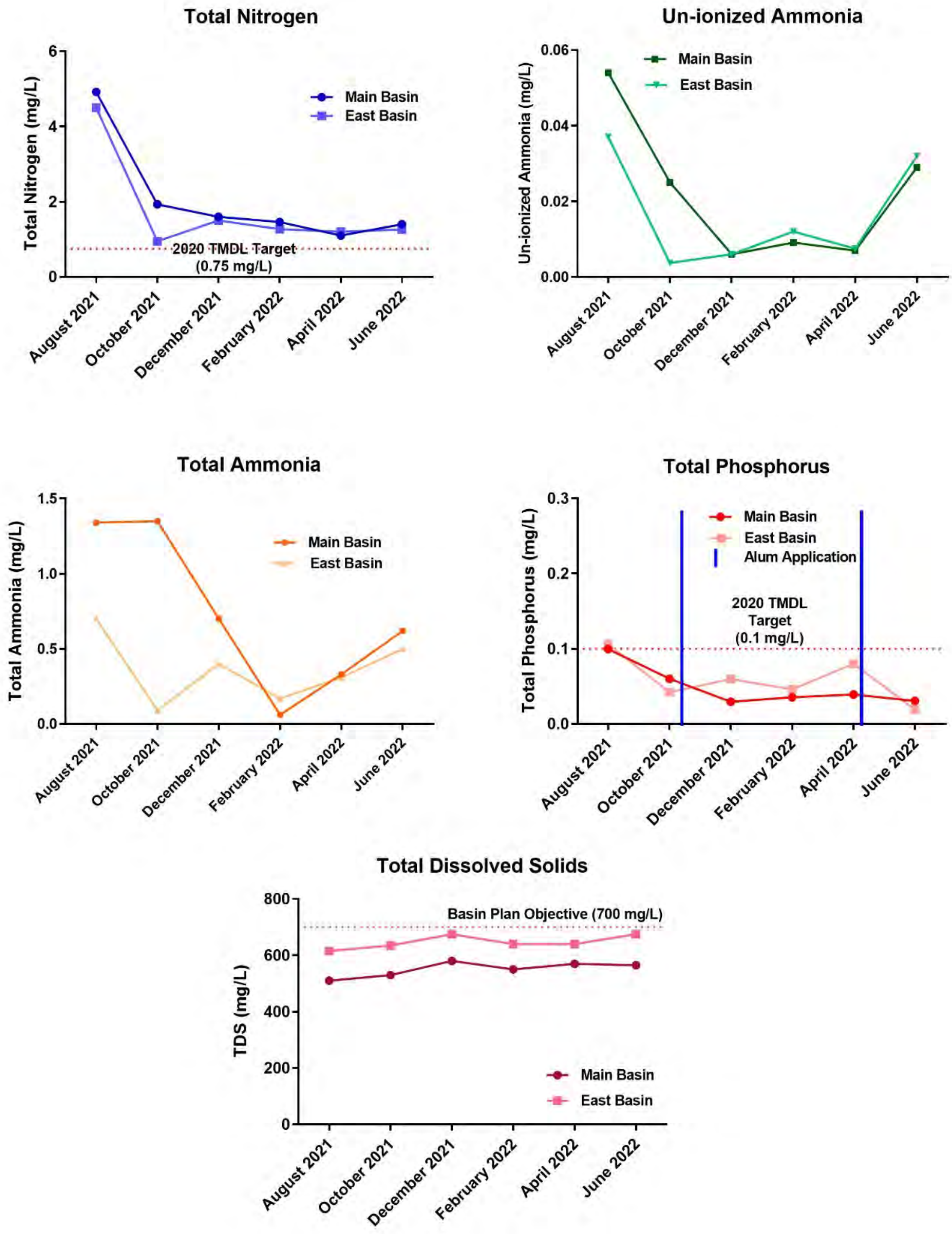


Figure 3-18. Canyon Lake Analytical Chemistry – Depth-Integrated Means

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

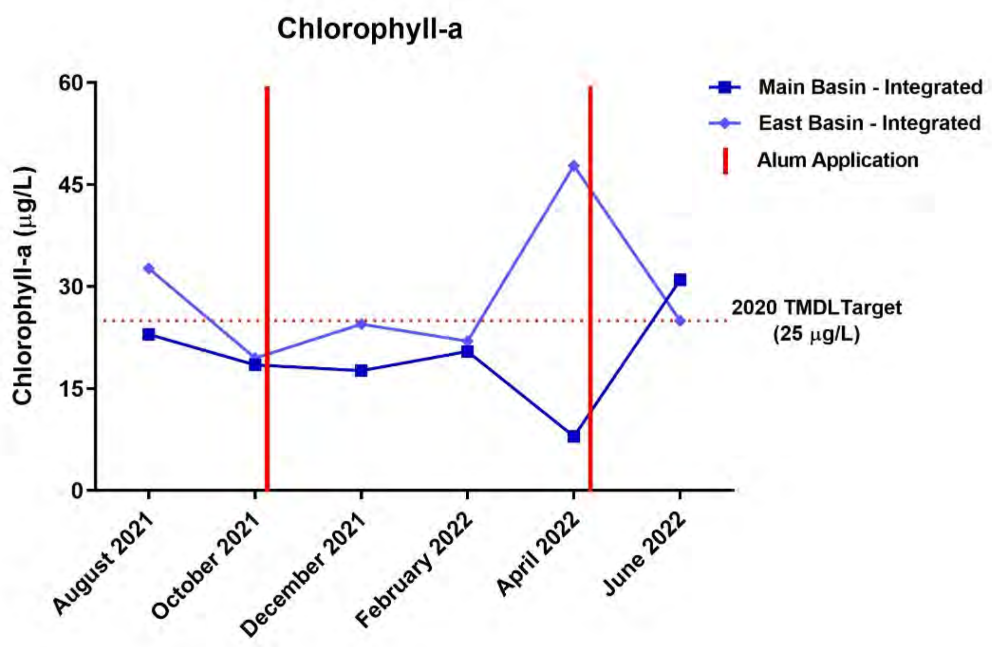


Figure 3-19. Canyon Lake Analytical Chemistry – Depth-Integrated Chlorophyll-a

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

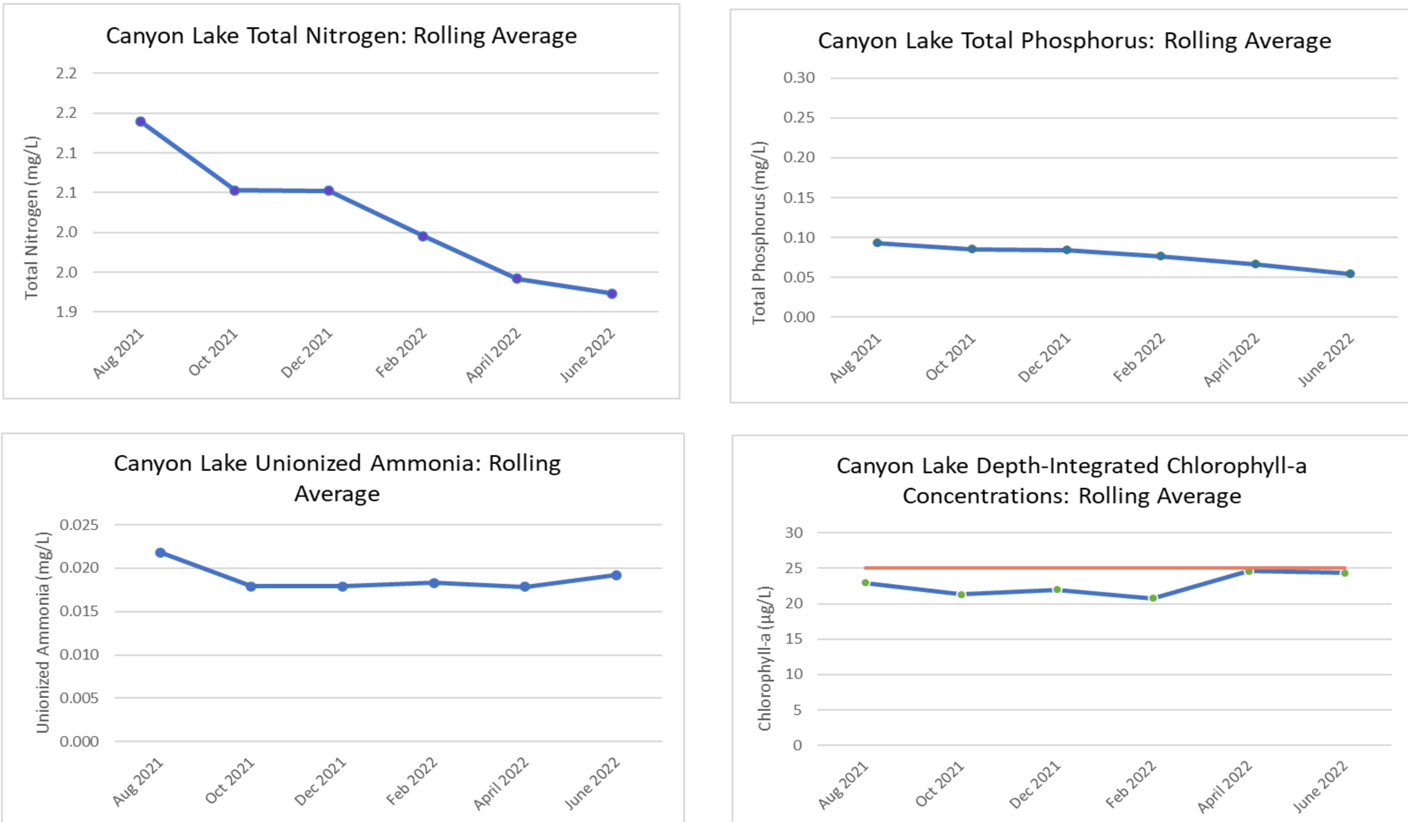


Figure 3-20. Canyon Lake Lake-wide Analytical Chemistry- Rolling Averages

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 2020 to June 2022.

3.5 Satellite Imagery

Beginning with the 2015-2016 FY, 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-feet 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 quantify the data presented in the satellite images, cumulative frequency distribution plots showing lake-wide chlorophyll-a concentrations based on individual pixels from the satellite measurements are provided in Figures 3-23 and 3-24. Satellite derived mean and median concentrations along with measured in-lake chlorophyll-a concentrations in the surface composite (0-2m) sample are provided for each date showing how these single samples compare to concentrations throughout the entire lake. Mean and median lake-wide values were derived from satellite imagery data treating each pixel as a unique individual data point.

The satellite images for Lake Elsinore show the lowest overall chlorophyll-a concentrations in July 2021 increasing during the months following, and then a general decrease from December through June 2022. These generalizations are validated when using satellite pixel data to calculate lake-wide mean and median chlorophyll-a concentrations.

Chlorophyll-a concentrations in Canyon Lake derived from satellite imagery remained relatively low throughout the monitoring period, with a slight increase in chlorophyll-a in September 2021 lake-wide, as well as in December and June for the East Basin. Measured in-lake concentrations of chlorophyll-a in the Main Basin were relatively low and generally tracked with those observed in the satellite images (< 36 mg/L). Edge-interference effects can occur as a result of land and water pixels mixing near the edges of the narrow East Basin channel. This "edge effect" is somewhat diminished during non-summer months when Sentinel-2 satellite data is used[4], which generates a smaller pixel size (10-m) than the LandSat 7/8 satellite (30-m) used during summer months (June – Sept) reducing the possibility of mixing land and water in a single pixel. However, the elevated chlorophyll-a satellite images captured during the non-summer months indicates that the elevated chlorophyll-a observed in the satellite imagery is less-likely to be an edge interference effect.

Of note is that the elevated analytical chlorophyll-a measured at Site CL09 in April 2022 (86 µg/L) was driven by an algal bloom at depth as a result of lake stratification and was not detected by the satellite imagery. Given that the algal bloom was at depth, the Secchi depth recorded during this event increased to nearly 8-feet and hence the satellite imagery depicted the location as having low chlorophyll-a concentration.

[4] The Sentinel-2 satellite data cannot be used during summer months due to a glare from the sun caused by the angle of satellite viewing, and thereby reducing the image quality.

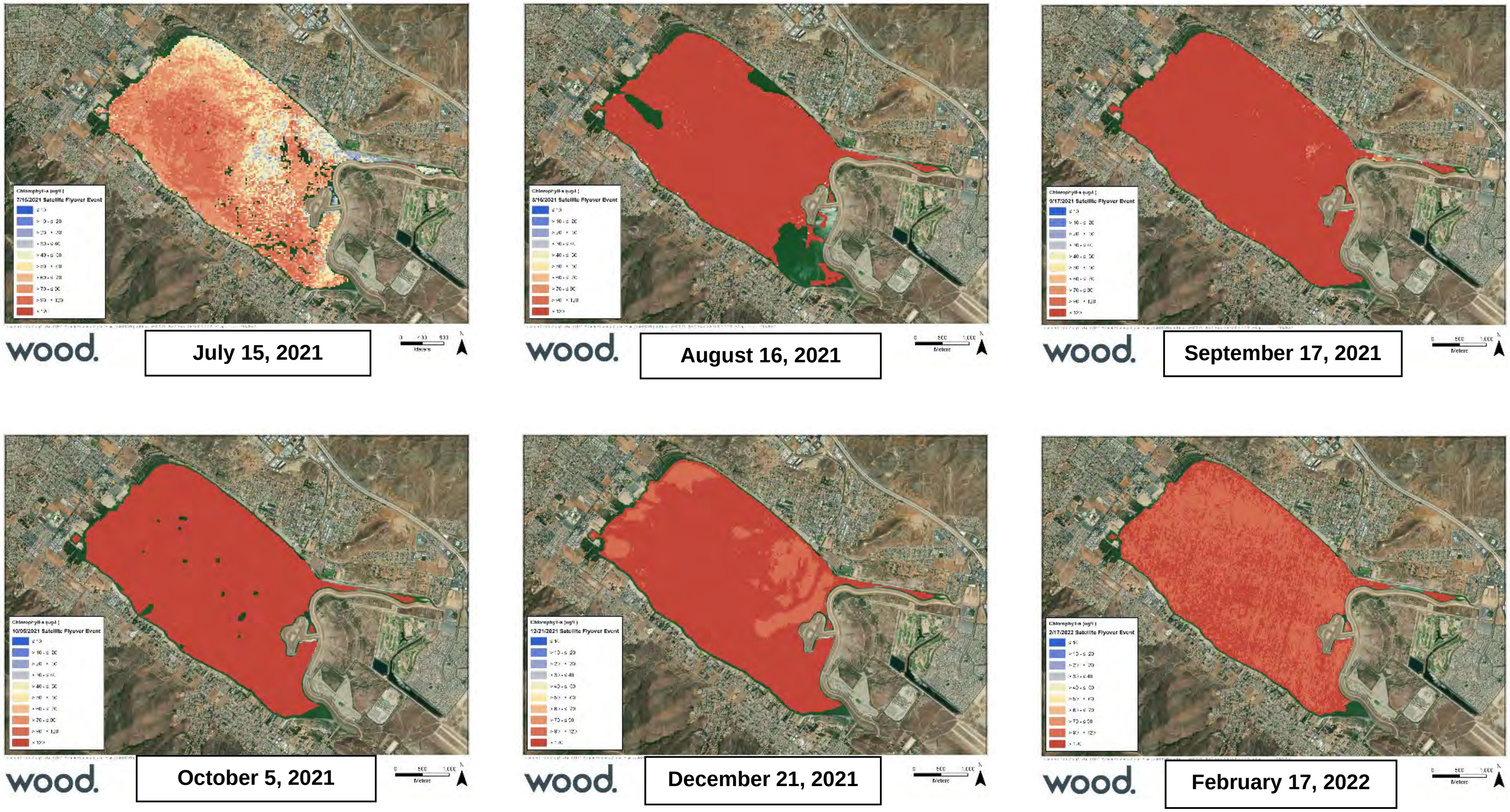


Figure 3-21. Satellite Imagery of Chlorophyll-a Concentrations in Lake Elsinore

(Data gaps in August are due to sunglint. The cross-hatch pattern exhibited by the February imagery is a satellite data source issue that cannot be corrected for)

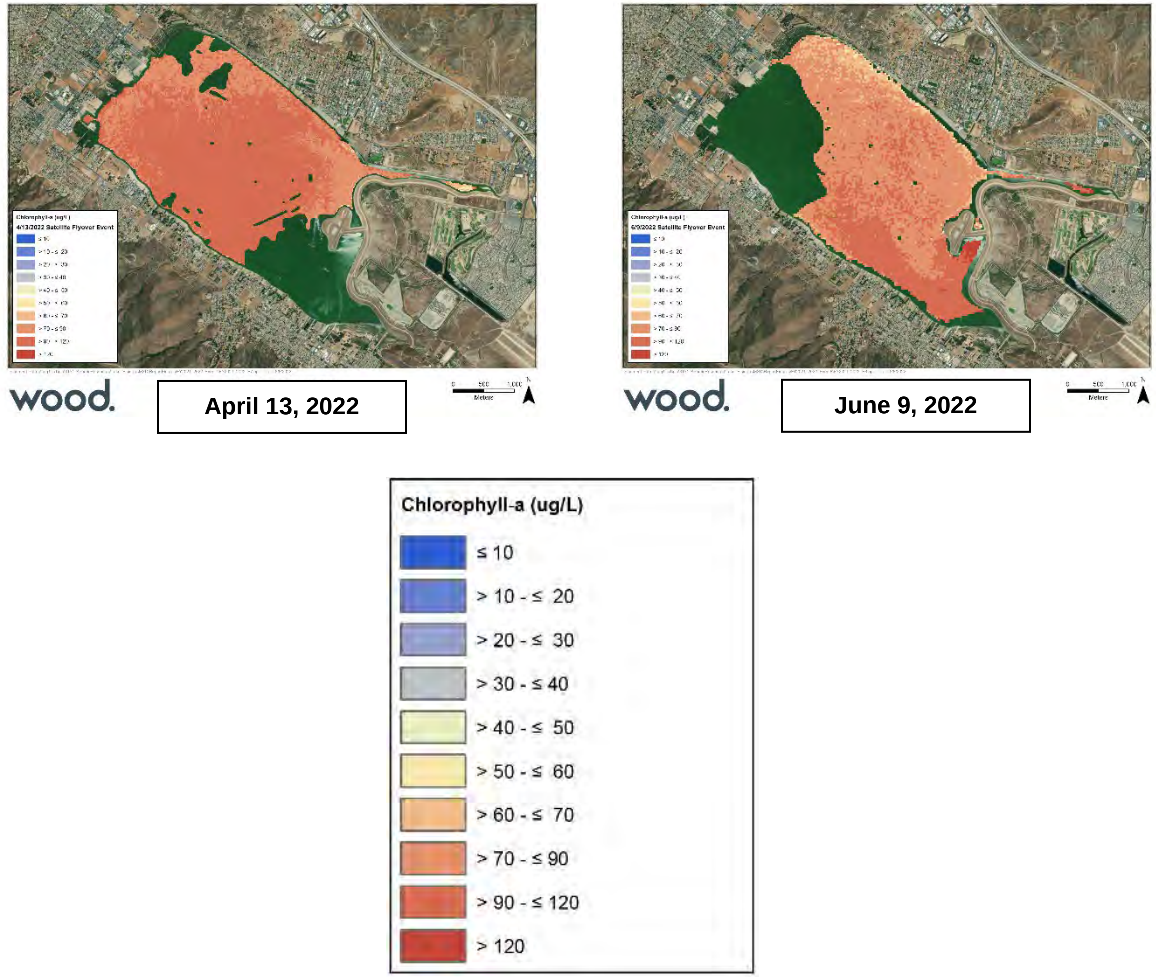


Figure 3-21 (cont.). Satellite Imagery of Chlorophyll-a Concentrations in Lake Elsinore

(Data gaps in April and June are due to sunglint)

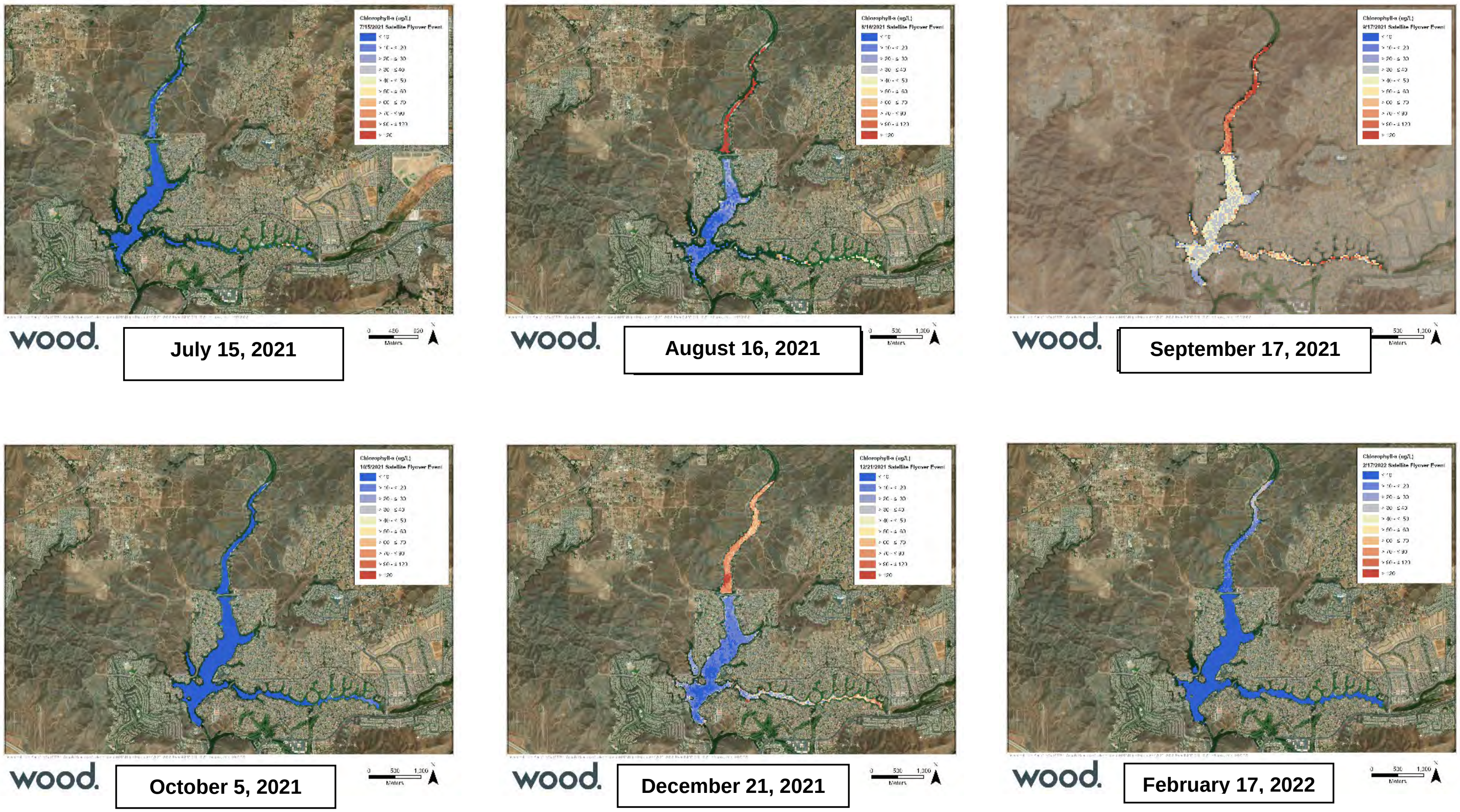


Figure 3-22. Satellite Imagery of Chlorophyll-a Concentrations in Canyon Lake

(Data gaps in July are caused by sunglint)

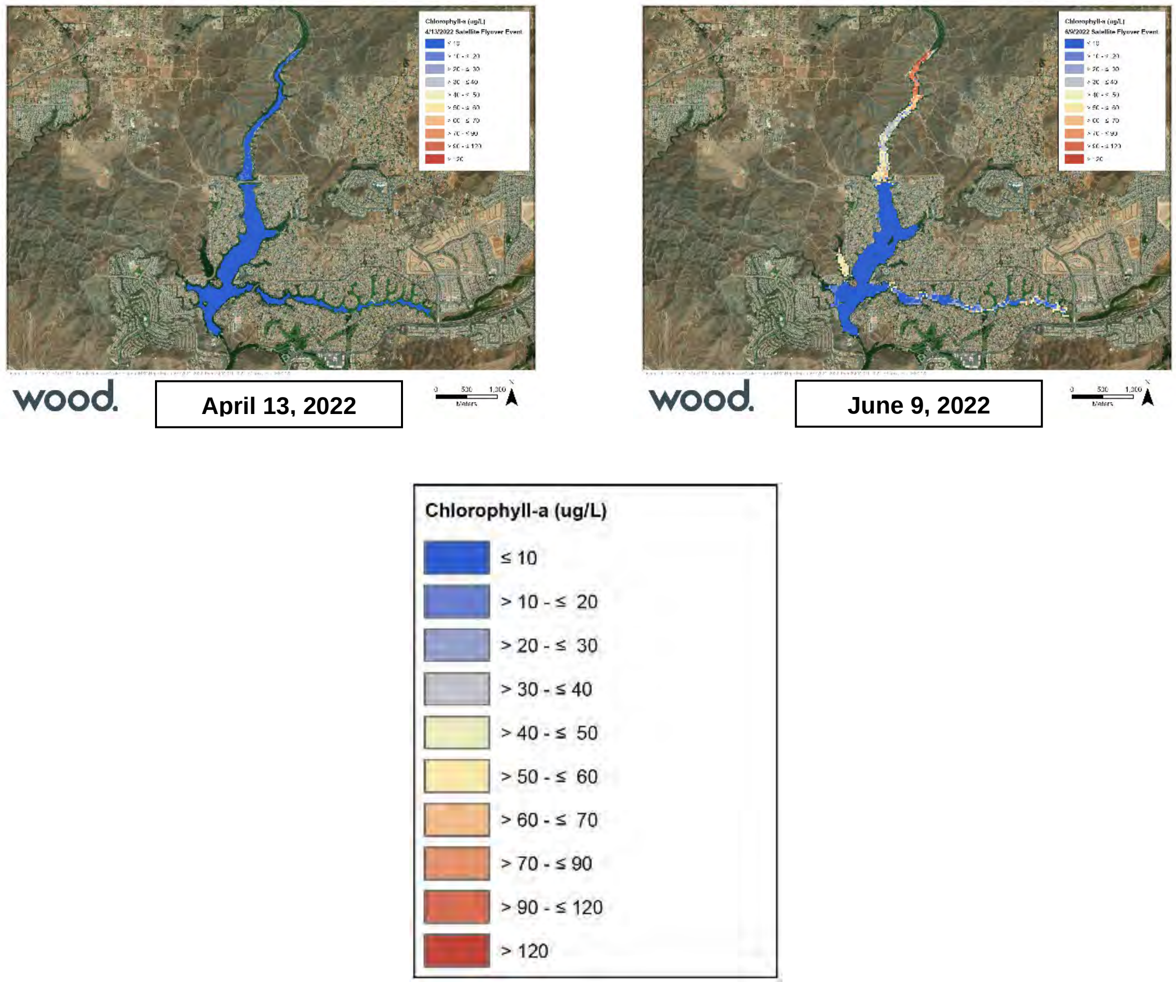


Figure 3-22 (cont.). Satellite Imagery of Chlorophyll-a Concentrations in Canyon Lake

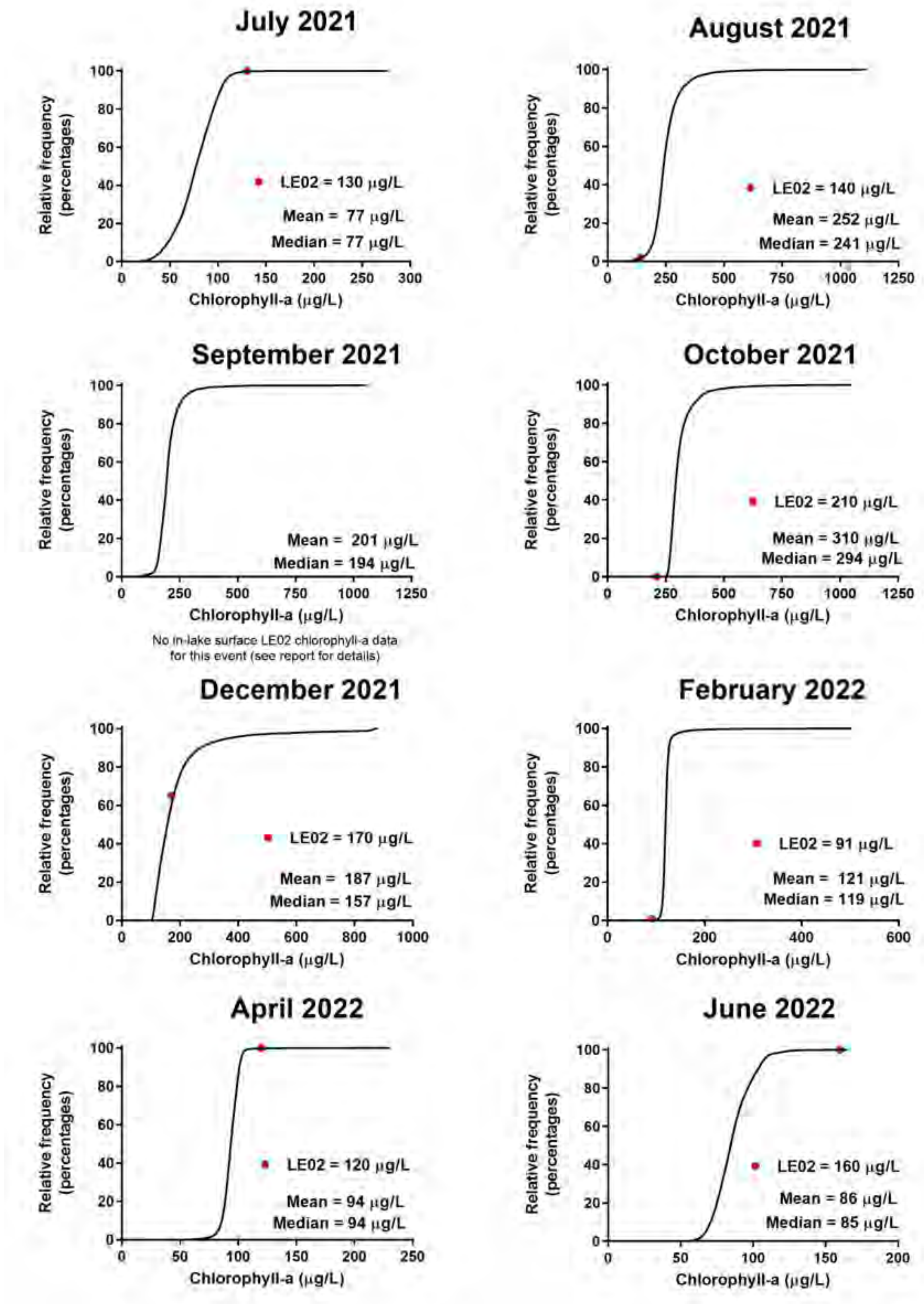


Figure 3-23. Cumulative Distribution of Satellite Derived Chlorophyll-a Concentrations in Lake Elsinore Relative to Measured Chlorophyll-a in Field Collected Samples

Colored dots represent the in-lake surface (0-2m) analytical measured concentration for each event

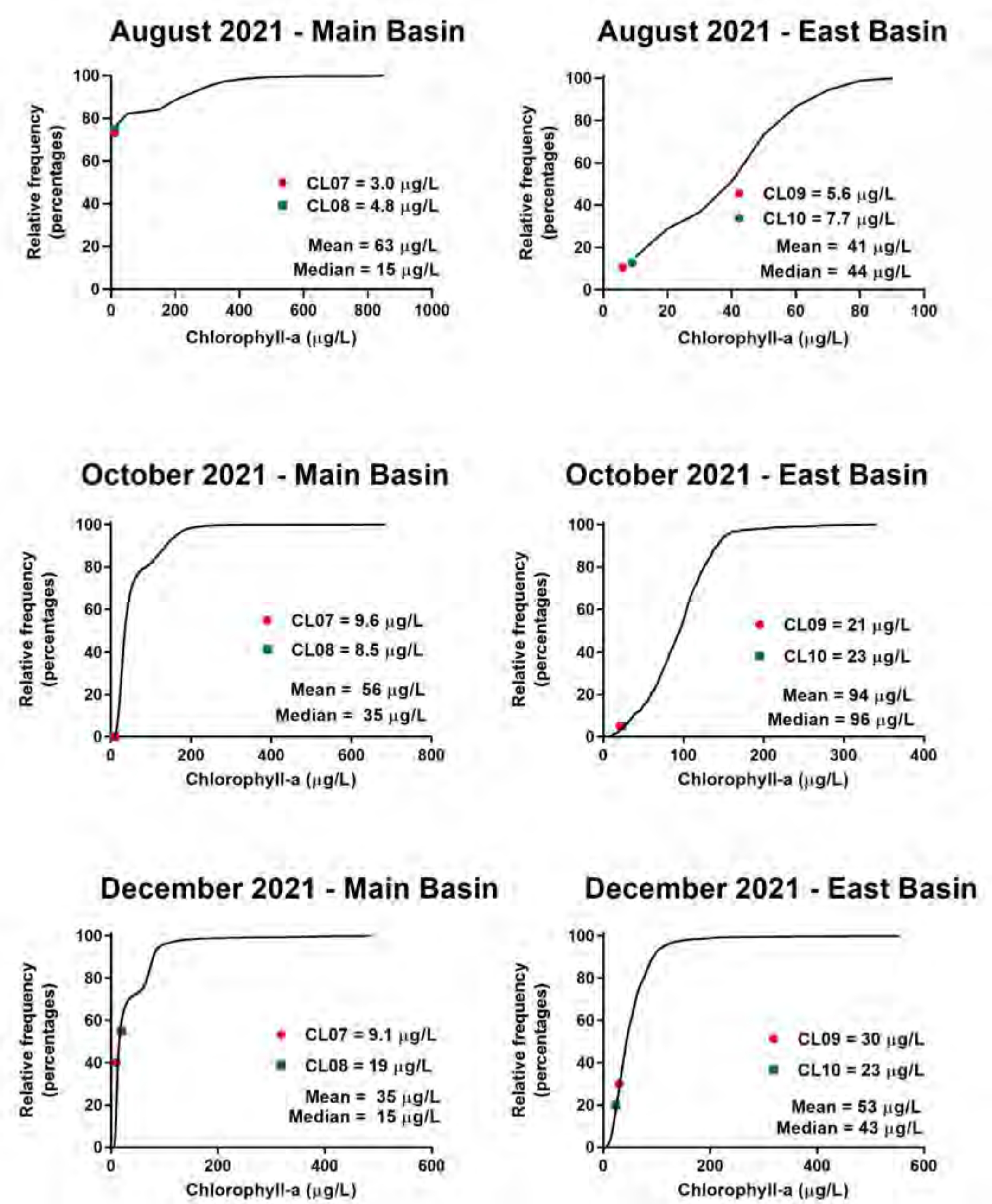


Figure 3-24. Cumulative Distribution of Satellite Derived Chlorophyll-a Concentrations in Canyon Lake Relative to Measured Chlorophyll-a in Field Collected Samples

Colored dots represent the in-lake surface (0-2m) analytical measured concentration for each event

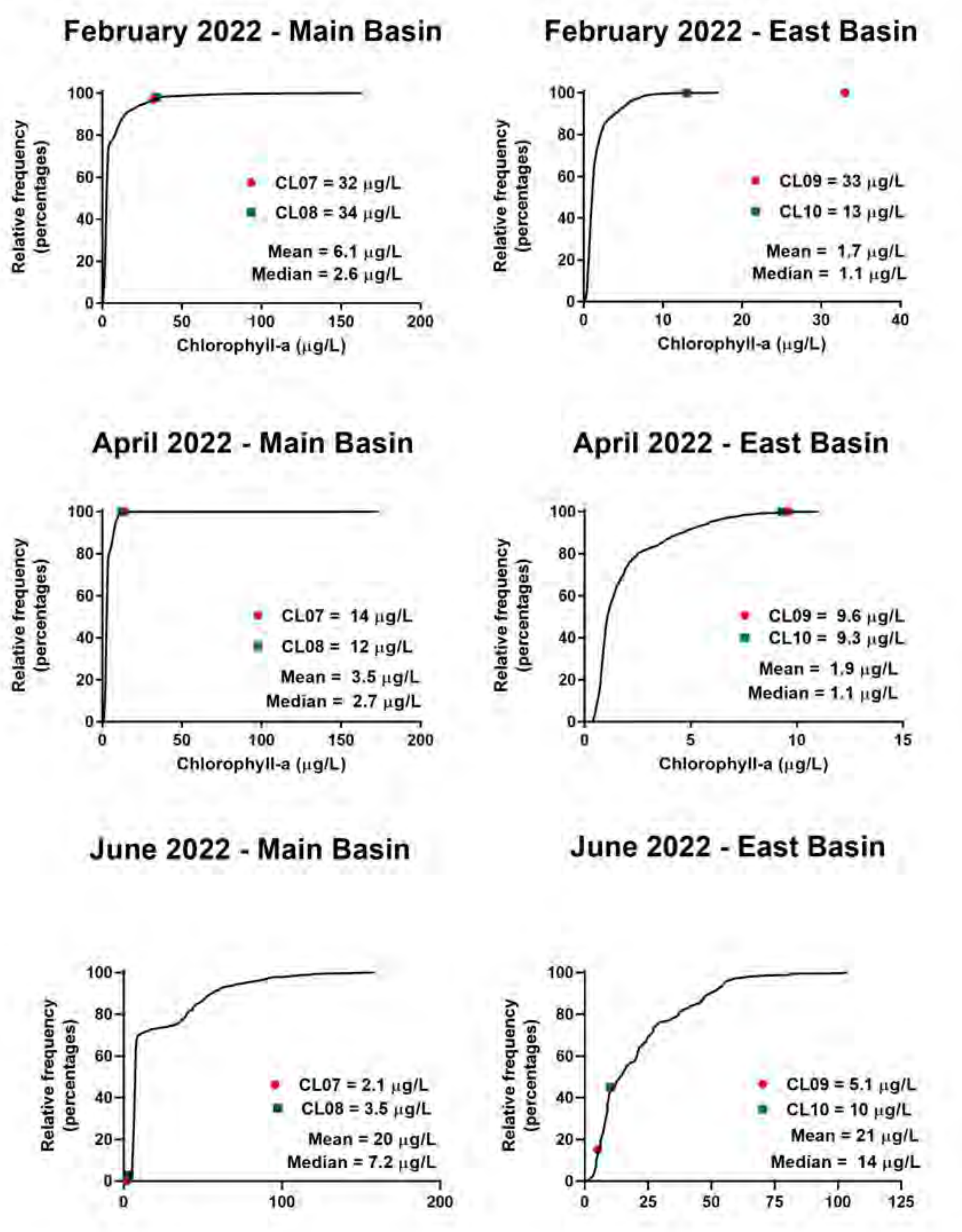


Figure 3-24 (continued). Cumulative Distribution of Satellite Derived Chlorophyll-a Concentrations in Canyon Lake Relative to Measured Chlorophyll-a in Field Collected Samples

Colored dots represent the in-lake surface (0-2m) analytical measured concentration for each event

4.0 Conclusions

Sampling was conducted during the July 2021 to June 2022 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) in order 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 four storm events met mobilization criteria for watershed stormwater sampling, occurring on December 14, 2021; December 29, 2021; March 4, 2022 and March 29, 2022.

The following summarizes the data collected during the 2021-2022 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, 2021 through June 30, 2022 is provided below.

1. Concentrations of nutrients for the three storm events monitored at Salt Creek at Murrieta Road (Station ID 745) ranged from 1.9 to 3.2 mg/L for total nitrogen, and 0.38 to 0.56 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 46,956,321 cubic feet. The estimated annual nutrient load was calculated to be 3,698 kg for total nitrogen and 625 kg for total phosphorus.

2. Concentrations of nutrients for the two storm events monitored at San Jacinto River at Goetz Road (Station ID 759) ranged from 2.1 to 2.7 mg/L for total nitrogen, and 0.41 to 0.79 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 71,751,114 cf. The estimated annual nutrient load was calculated to be 4,976 kg for total nitrogen and 1,282 kg for total phosphorus.

3. Concentrations of nutrients for the single storm event monitored at Canyon Lake Spillway (Station ID 841) were 1.5 mg/L for total nitrogen, and ND (<0.003 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 85,500,117 cf. The estimated annual nutrient load was calculated to be 3,632 kg for total nitrogen and 0 kg for total phosphorus.

4. No flows were observed at San Jacinto River at Ramona Expressway (Station ID 741) during the 2021-2022 monitoring year.

4.2 In-Lake Monitoring

4.2.1 Lake Elsinore

5. The Lake Elsinore annual monitoring year means for total nitrogen and total phosphorus were 4.6 mg/L and 0.19 mg/L, with both exceeding their associated 2020 TMDL target. While the annual mean total phosphorous concentration dropped from the previous monitoring year (0.24 mg/L), total nitrogen exhibited an increase (4.1 mg/L in 2020-2021).

6. The annual mean for total ammonia was 0.17 mg/L, a decrease from the previous monitoring year mean (0.31 mg/L). All total ammonia concentrations were below CMC and CCC 2020 TMDL target, with the exception of the sample collected in July 2021 (0.35 mg/L total ammonia), which exceeded its corresponding CCC TMDL target. The 2020-2021 monitoring year had two total ammonia exceedances of the CCC TMDL target (August and September).

7. The DO concentration 1-m above the lake bottom as a 12-month rolling average remained below the 2020 TMDL target (>5.0 mg/L) for the entire monitoring year. Identical results were observed during the 2020-2021 monitoring year. However, the lake-wide average DO concentration based on all monitored locations and depths during the 2021-2022 monitoring year was 5.4 mg/L, similar to that measured during the three prior monitoring years ranging from 5.1 to 6.6 mg/L.

8. The mean chlorophyll-a concentration observed in samples collected during the summer TMDL compliance period (June 2021 through September 2021) was 147 µg/L for depth-integrated samples and 150 µg/L for surface samples. These concentrations both exceed the 2020 TMDL target of 25 µg/L chlorophyll-a. The summer 2021 chlorophyll-a values were lower than those observed during the previous summer of 2020 (212 µg/L for depth integrated samples and 179 µg/L for surface samples).

4.2.2 Canyon Lake

1. The Canyon Lake annual monitoring year mean for total nitrogen and total phosphorus was 1.9 mg/L and 0.054 mg/L, respectively. Total nitrogen mean exceeded the 0.75 mg/L 2020 TMDL target, but total phosphorus was below its 0.1 mg/L 2020 TMDL target. The annual mean total nitrogen concentration increased from the previous monitoring year (1.65 mg/L), while total phosphorus exhibited a decrease (0.098 mg/L in 2020-2021).

2. The annual lake-wide mean for total ammonia was 0.55 mg/L. This value is lower than the previous monitoring year which had a mean total ammonia of 0.83 mg/L but was more similar to the 0.48 mg/L mean total ammonia observed in the 2019-2020 monitoring year. One sample at Site CL09 (1.4 mg/L in August 2021) exceeded its corresponding total ammonia CCC 2020 TMDL target. No samples exceeded the total ammonia CMC TMDL target. Interestingly, in both this and the previous monitoring year

the annual mean total ammonia concentration was somewhat higher in the Main Basin than the East Basin (0.73 and 0.36 mg/L in 2021-2022, versus 0.97 and 0.69 mg/L in 2020-2021). This is likely due to the deeper water and stronger stratification in the Main Basin resulting in lower dissolved oxygen for a longer time period near the sediment surface in the Main Basin, thereby allowing more ammonia to flux from of the sediment.

3. The DO concentration in the hypolimnion (when the lake was stratified) ranged from 0.0 to 1.0 mg/L. The rolling 12-month mean DO concentration was never above the 2020 TMDL target of >5.0 mg/L in the hypolimnion. 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 processes deplete the oxygen. However, the lake-wide average DO concentration was 7.2 mg/L when averaging values across all monitored sites and depths during the 2021-2022 period. This value was greater than that during the three prior monitoring years ranging from 5.4 to 5.8 mg/L.

4. The mean annual lake-wide depth-integrated chlorophyll-a concentration was 24 µg/L and 14 µg/L for surface samples. Both concentrations are below the 2020 TMDL target of 25 µg/L. A spike in mean chlorophyll-a up to 47.8 µg/L was observed in April 2022 in the East Basin, which was driven by a high chlorophyll-a concentration at site CL09 (86 µg/L). Since Wood has taken over the TMDL monitoring program in 2015, notable spikes in chlorophyll-a have been observed at Site CL09 in either April or June in every year except Spring 2020, just as the East Basin begins to stratify. See results section for further discussion.

5. The highest total aluminum concentration was measured at 190 µg/L at Site CL10 in the East Basin. This was measured during the December 2021 event after the alum application in October 2021. Even this highest concentration observed was well below the conservative EPA CCC of 1000 ug/L total aluminum. It appears that alum is having the desired effect of lowering total phosphorus and chlorophyll-a (both of which were below their respective 2020 TMDL target concentrations), while not posing an aquatic life health risk by remaining well below the CCC and CMC thresholds.

5.0 References

Amec Foster Wheeler. 2016. Quality Assurance Project Plan for Lake Elsinore, Canyon Lake, and San Jacinto River Watershed TMDL Monitoring Program. May 2016.

Amec Foster Wheeler. 2017. Lake Elsinore and Canyon Lake Watersheds Nutrient TMDL Monitoring, 2016-2017 Annual Report. Prepared for the Lake Elsinore & San Jacinto Watersheds Project Authority, August 2017.

Haley & Aldrich, Inc. 2016. Lake Elsinore and Canyon Lake Nutrient TMDL Compliance Monitoring Work Plan for Lake Elsinore and San Jacinto Watershed Authority. Riverside, CA. April 2016.

Lake Elsinore and San Jacinto Watersheds Authority (LESJWA). 2006. Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan. CA Regional Water Quality Control Board, Santa Ana Region. February.

Montgomery Watson and Elsinore Valley Municipal Water District (MWH/ EVMWD). 2009. Canyon Lake Bacteria Characterization Study. Technical Memorandum prepared for the Lake Elsinore and Canyon Lake TMDL Task Force. December 1, 2009

Riverside County Flood Control and Water Conservation District (RCFCWCD). 2021. Hydrologic Data Collection, Rain Fall Reports.

Santa Ana Regional Water Quality Control Board. 2007. Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Nutrient Total Maximum Daily Loads (TMDLs) for Lake Elsinore and Canyon Lake, No. R8-2004-0037.

Santa Ana Regional Water Quality Control Board. 2007. Resolution Approving Plans and Schedules Submitted by the Canyon Lake/Lake Elsinore TMDL Task Force and Individual Discharger Groups Pursuant to the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Loads Specified in the Water Quality Control Plan for the Santa Ana River Basin. Resolution R8-2007-0083.

Thursby, C.B. 1986. Memorandum to David J. Hansen, U.S. EPA, Narragansett, Rhode Island.

United States Environmental Protection Agency (US EPA). 2018. 2018 Final Aquatic Life Ambient Water Quality Criteria for Aluminum. EPA-822-R-18-001. U.S. EPA Office of Water. December 2018. EPA-822-R-18-001

This page intentionally left blank.

APPENDIX A- WATERSHED MONITORING ANALYTICAL REPORTS

Certificate of Analysis

FINAL REPORT

Work Orders:	1L15071	**Report Date:**	1/10/2022
		Received Date:	12/15/2021
Project:	Lake Elsinore/Canyon Lake TMDL Stormwater	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 12/15/21 with the Chain-of-Custody document. The samples were received in good condition, at 3.4 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL Stormwater

Project Manager: John Rudolph

Reported: 01/10/2022 12:13

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
S-03-121421	Austin Kay	1L15071-01	Water	12/14/21 17:45	
S-04-121421	Austin Kay	1L15071-02	Water	12/14/21 19:25	

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL Stormwater

Project Manager: John Rudolph

Reported: 01/10/2022 12:13

Sample Results

Sample: S-03-121421 — Sampled: 12/14/21 17:45 by Austin Kay

1L15071-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W1L1678 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/23/21 10:29 — **Analyst:** heq							
Chemical Oxygen Demand	**40**	2.9	5.0	mg/l	1	01/02/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W1L1132 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/16/21 09:39 — **Analyst:** HEQ							
Biochemical Oxygen Demand	**6.9**	2.0	2.0	mg/l	1	12/21/21	

Sample Results

Sample: S-04-121421 — Sampled: 12/14/21 19:25 by Austin Kay

1L15071-02 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W1L1678 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/23/21 10:29 — **Analyst:** heq							
Chemical Oxygen Demand	**50**	2.9	5.0	mg/l	1	01/02/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W1L1132 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/16/21 09:39 — **Analyst:** HEQ							
Biochemical Oxygen Demand	**8.4**	2.0	2.0	mg/l	1	12/21/21	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL Stormwater

Project Manager: John Rudolph

Reported: 01/10/2022 12:13

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L1132 - SM 5210B											
Blank (W1L1132-BLK1)					**Prepared: 12/16/21**	**Analyzed: 12/21/21**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W1L1132-BLK2)					**Prepared: 12/16/21**	**Analyzed: 12/21/21**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W1L1132-BLK3)					**Prepared: 12/16/21**	**Analyzed: 12/21/21**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
LCS (W1L1132-BS1)					**Prepared: 12/16/21**	**Analyzed: 12/21/21**					
Biochemical Oxygen Demand	186	2.0	2.0	mg/l	198		94	85-115			
Batch: W1L1678 - EPA 410.4											
Blank (W1L1678-BLK1)					**Prepared: 12/23/21**	**Analyzed: 01/02/22**					
Chemical Oxygen Demand	ND	2.9	5.0	mg/l							
LCS (W1L1678-BS1)					**Prepared: 12/23/21**	**Analyzed: 01/02/22**					
Chemical Oxygen Demand	996	2.9	5.0	mg/l	1000		100	90-110			
Matrix Spike (W1L1678-MS1)	**Source: 1L15004-06**				**Prepared: 12/23/21**	**Analyzed: 01/02/22**					
Chemical Oxygen Demand	259	12	20	mg/l	200	56.3	101	90-110			
Matrix Spike (W1L1678-MS2)	**Source: 1L15084-01**				**Prepared: 12/23/21**	**Analyzed: 01/02/22**					
Chemical Oxygen Demand	5970	46	80	mg/l	4000	2130	96	90-110			
Matrix Spike Dup (W1L1678-MSD1)	**Source: 1L15004-06**				**Prepared: 12/23/21**	**Analyzed: 01/02/22**					
Chemical Oxygen Demand	259	12	20	mg/l	200	56.3	101	90-110	0.3	15	
Matrix Spike Dup (W1L1678-MSD2)	**Source: 1L15084-01**				**Prepared: 12/23/21**	**Analyzed: 01/02/22**					
Chemical Oxygen Demand	5970	46	80	mg/l	4000	2130	96	90-110	0	15	

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

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** Lake Elsinore/Canyon Lake TMDL Stormwater **Project Manager:** John Rudolph	**Reported:** 01/10/2022 12:13

Notes and Definitions

Item	Definition
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1L16133	**Report Date:**	1/20/2022
		Received Date:	12/16/2021
Project:	Lake Elsinore and Canyon Lake Nutrient TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 12/16/21 with the Chain-of-Custody document. The samples were received in good condition, at 2.6 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 01/20/2022 12:10

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
S-03-121621	Austin Kay	1L16133-01	Water	12/16/21 10:38	
S-04-121621	Austin Kay	1L16133-02	Water	12/16/21 11:03	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 01/20/2022 12:10

Sample Results

Sample: S-03-121621 — Sampled: 12/16/21 10:38 by Austin Kay

1L16133-01 (Water)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: _Various		**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]		**Prepared:** 12/27/21 13:03				**Analyst:** YMT
Organic Nitrogen, Total	**1.9**	0.10	mg/l	1	12/29/21	
Method: Calculation		**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]		**Prepared:** 12/21/21 13:40				**Analyst:** YMT
Nitrogen, Total	**3.2**	0.20	mg/l	1	12/23/21	
Method: EPA 350.1		**Instr:** AA06				
Batch ID: W1L1796 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/27/21 13:03				**Analyst:** YMT
Ammonia as N	**0.22**	0.10	mg/l	1	12/29/21	
Method: EPA 351.2		**Instr:** AA06				
Batch ID: W1L1483 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/21/21 13:40				**Analyst:** YMT
TKN	**2.1**	0.20	mg/l	1	12/23/21	
Method: EPA 353.2		**Instr:** AA01				
Batch ID: W1L1282 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/17/21 15:05				**Analyst:** ism
Nitrate as N	**1.1**	0.20	mg/l	1	12/17/21 16:07	
Nitrite as N	ND	0.10	mg/l	1	12/17/21 16:07	
NO2+NO3 as N	**1200**	200	ug/l	1	12/17/21	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W1L1224 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/16/21 19:05				**Analyst:** UVVIS04
o-Phosphate as P	**0.23**	0.010	mg/l	1	12/17/21 11:20	**
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W1L1896 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/28/21 13:27				**Analyst:** heq
Phosphorus as P, Total	**0.56**	0.020	mg/l	2	01/04/22	
Method: SM 2540C		**Instr:** OVEN01				
Batch ID: W1L1514 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/21/21 17:18				**Analyst:** jao
Total Dissolved Solids	**430**	10	mg/l	1	12/22/21	
Method: SM 2540D		**Instr:** OVEN15				
Batch ID: W1L1621 **Preparation:** _NONE (WETCHEM)		**Prepared:** 12/22/21 13:03				**Analyst:** ttf
Total Suspended Solids	**73**	5	mg/l	1	12/22/21	
Metals by EPA 200 Series Methods						
Method: Calculation		**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]		**Prepared:** 01/04/22 10:18				**Analyst:** kvm
Hardness as CaCO3, Total	**203**	3.31	mg/l	1	01/10/22	
Method: EPA 200.7		**Instr:** ICP03				
Batch ID: W2A0134 **Preparation:** EPA 200.2		**Prepared:** 01/04/22 10:18				**Analyst:** kvm
Calcium, Total	**49.1**	0.500	mg/l	1	01/10/22	
Magnesium, Total	**19.6**	0.500	mg/l	1	01/10/22	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 01/20/2022 12:10

Sample Results

(Continued)

Sample: S-04-121621 — 1L16133-02 (Water) — Sampled: 12/16/21 11:03 by Austin Kay

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: _Various — **Instr:** [CALC]						
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 12/27/21 13:03 — **Analyst:** YMT						
Organic Nitrogen, Total	**1.5**	0.10	mg/l	1	12/29/21	
Method: Calculation — **Instr:** [CALC]						
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 12/21/21 13:40 — **Analyst:** YMT						
Nitrogen, Total	**2.7**	0.20	mg/l	1	12/23/21	
Method: EPA 350.1 — **Instr:** AA06						
Batch ID: W1L1796 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/27/21 13:03 — **Analyst:** YMT						
Ammonia as N	ND	0.10	mg/l	1	12/29/21	
Method: EPA 351.2 — **Instr:** AA06						
Batch ID: W1L1483 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/21/21 13:40 — **Analyst:** YMT						
TKN	**1.5**	0.20	mg/l	1	12/23/21	
Method: EPA 353.2 — **Instr:** AA01						
Batch ID: W1L1282 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/17/21 15:05 — **Analyst:** ism						
Nitrate as N	**1.2**	0.20	mg/l	1	12/17/21 16:09	
Nitrite as N	ND	0.10	mg/l	1	12/17/21 16:09	
NO2+NO3 as N	**1200**	200	ug/l	1	12/17/21	
Method: EPA 365.3 — **Instr:** UVVIS04						
Batch ID: W1L1224 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/16/21 19:05 — **Analyst:** UVVIS04						
o-Phosphate as P	**0.40**	0.010	mg/l	1	12/17/21 11:21	**
Method: EPA 365.3 — **Instr:** UVVIS04						
Batch ID: W1L1896 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/28/21 13:27 — **Analyst:** heq						
Phosphorus as P, Total	**0.79**	0.020	mg/l	2	01/04/22	
Method: SM 2540C — **Instr:** OVEN01						
Batch ID: W1L1514 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/21/21 17:18 — **Analyst:** jao						
Total Dissolved Solids	**170**	10	mg/l	1	12/22/21	
Method: SM 2540D — **Instr:** OVEN15						
Batch ID: W1L1621 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 13:03 — **Analyst:** ttf						
Total Suspended Solids	**130**	5	mg/l	1	12/22/21	
Metals by EPA 200 Series Methods						
Method: Calculation — **Instr:** [CALC]						
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 01/04/22 10:18 — **Analyst:** kvm						
Hardness as CaCO3, Total	**95.6**	3.31	mg/l	1	01/10/22	
Method: EPA 200.7 — **Instr:** ICP03						
Batch ID: W2A0134 — **Preparation:** EPA 200.2 — **Prepared:** 01/04/22 10:18 — **Analyst:** kvm						
Calcium, Total	**25.1**	0.500	mg/l	1	01/10/22	
Magnesium, Total	**7.98**	0.500	mg/l	1	01/10/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 01/20/2022 12:10

Quality Control Results

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L1224 - EPA 365.3										
Blank (W1L1224-BLK1)				**Prepared: 12/16/21 Analyzed: 12/17/21**						
o-Phosphate as P	ND	0.010	mg/l							
LCS (W1L1224-BS1)				**Prepared: 12/16/21 Analyzed: 12/17/21**						
o-Phosphate as P	0.199	0.010	mg/l	0.200		100	88-111			
Matrix Spike (W1L1224-MS1)	**Source: 1L16110-01**			**Prepared: 12/16/21 Analyzed: 12/17/21**						
o-Phosphate as P	0.232	0.010	mg/l	0.200	0.0150	108	85-112			
Matrix Spike Dup (W1L1224-MSD1)	**Source: 1L16110-01**			**Prepared: 12/16/21 Analyzed: 12/17/21**						
o-Phosphate as P	0.231	0.010	mg/l	0.200	0.0150	108	85-112	0.4	20	
Batch: W1L1282 - EPA 353.2										
Blank (W1L1282-BLK1)				**Prepared & Analyzed: 12/17/21**						
Nitrate as N	ND	0.20	mg/l							
Nitrite as N	ND	0.10	mg/l							
NO2+NO3 as N	ND	200	ug/l							
LCS (W1L1282-BS1)				**Prepared & Analyzed: 12/17/21**						
Nitrate as N	0.997	0.20	mg/l	1.00		100	90-110			
Nitrite as N	0.974	0.10	mg/l	1.00		97	90-110			
NO2+NO3 as N	997	200	ug/l	1000		100	90-110			
Matrix Spike (W1L1282-MS1)	**Source: 1L17056-01**			**Prepared & Analyzed: 12/17/21**						
Nitrate as N	10.2	0.20	mg/l	2.00	8.19	100	90-110			
Nitrite as N	0.994	0.10	mg/l	1.00	ND	99	90-110			
NO2+NO3 as N	10200	200	ug/l	2000	8190	100	90-110			
Matrix Spike Dup (W1L1282-MSD1)	**Source: 1L17056-01**			**Prepared & Analyzed: 12/17/21**						
Nitrate as N	10.2	0.20	mg/l	2.00	8.19	100	90-110	0	20	
Nitrite as N	0.994	0.10	mg/l	1.00	ND	99	90-110	0	20	
NO2+NO3 as N	10200	200	ug/l	2000	8190	100	90-110	0	20	
Batch: W1L1483 - EPA 351.2										
Blank (W1L1483-BLK1)				**Prepared: 12/21/21 Analyzed: 12/23/21**						
TKN	ND	0.10	mg/l							
Blank (W1L1483-BLK2)				**Prepared: 12/21/21 Analyzed: 12/23/21**						
TKN	ND	0.10	mg/l							
LCS (W1L1483-BS1)				**Prepared: 12/21/21 Analyzed: 12/23/21**						
TKN	1.00	0.10	mg/l	1.00		100	90-110			
LCS (W1L1483-BS2)				**Prepared: 12/21/21 Analyzed: 12/23/21**						
TKN	1.00	0.10	mg/l	1.00		100	90-110			
Matrix Spike (W1L1483-MS1)	**Source: 1L21028-01**			**Prepared: 12/21/21 Analyzed: 12/23/21**						
TKN	1.19	0.10	mg/l	1.00	0.188	100	90-110			
Matrix Spike (W1L1483-MS2)	**Source: 1L21052-01**			**Prepared: 12/21/21 Analyzed: 12/23/21**						
TKN	3.46	0.20	mg/l	2.00	1.38	104	90-110			

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 01/20/2022 12:10

Quality Control Results

(Continued)

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L1483 - EPA 351.2 (Continued)										
Matrix Spike Dup (W1L1483-MSD1)	**Source: 1L21028-01**			**Prepared: 12/21/21**	**Analyzed: 12/23/21**					
TKN	1.20	0.10	mg/l	1.00	0.188	101	90-110	0.5	10	
Matrix Spike Dup (W1L1483-MSD2)	**Source: 1L21052-01**			**Prepared: 12/21/21**	**Analyzed: 12/23/21**					
TKN	3.39	0.20	mg/l	2.00	1.38	101	90-110	2	10	
Batch: W1L1514 - SM 2540C										
Blank (W1L1514-BLK1)				**Prepared: 12/21/21**	**Analyzed: 12/22/21**					
Total Dissolved Solids	ND	10	mg/l							
LCS (W1L1514-BS1)				**Prepared: 12/21/21**	**Analyzed: 12/22/21**					
Total Dissolved Solids	811	10	mg/l	824		98	96-102			
Duplicate (W1L1514-DUP1)	**Source: 1L16117-01**			**Prepared: 12/21/21**	**Analyzed: 12/22/21**					
Total Dissolved Solids	27800	10	mg/l		25400			9	10	
Duplicate (W1L1514-DUP2)	**Source: 1L17060-02**			**Prepared: 12/21/21**	**Analyzed: 12/22/21**					
Total Dissolved Solids	3920	10	mg/l		3910			0.3	10	
Batch: W1L1621 - SM 2540D										
Blank (W1L1621-BLK1)				**Prepared & Analyzed: 12/22/21**						
Total Suspended Solids	ND	5	mg/l							
LCS (W1L1621-BS1)				**Prepared & Analyzed: 12/22/21**						
Total Suspended Solids	52.1	5	mg/l	52.5		99	90-110			
Duplicate (W1L1621-DUP1)	**Source: 1L20076-03**			**Prepared & Analyzed: 12/22/21**						
Total Suspended Solids	6.70	5	mg/l		6.40			5	10	
Duplicate (W1L1621-DUP2)	**Source: 1L15006-02**			**Prepared & Analyzed: 12/22/21**						
Total Suspended Solids	13.9	5	mg/l		14.0			0.7	10	
Batch: W1L1796 - EPA 350.1										
Blank (W1L1796-BLK1)				**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	ND	0.10	mg/l							
Blank (W1L1796-BLK2)				**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	ND	0.10	mg/l							
LCS (W1L1796-BS1)				**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.241	0.10	mg/l	0.250		96	90-110			
LCS (W1L1796-BS2)				**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.242	0.10	mg/l	0.250		97	90-110			
Duplicate (W1L1796-DUP1)	**Source: 1L15108-01**			**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.127	0.10	mg/l		0.126			0.3	15	
Matrix Spike (W1L1796-MS1)	**Source: 1L15111-01**			**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.616	0.10	mg/l	0.250	0.379	95	90-110			
Matrix Spike (W1L1796-MS2)	**Source: 1L15120-03**			**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.247	0.10	mg/l	0.250	ND	99	90-110			
Matrix Spike Dup (W1L1796-MSD1)	**Source: 1L15111-01**			**Prepared: 12/27/21**	**Analyzed: 12/29/21**					

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 01/20/2022 12:10

Quality Control Results

(Continued)

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L1796 - EPA 350.1 (Continued)										
Matrix Spike Dup (W1L1796-MSD1)	**Source: 1L15111-01**			**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.617	0.10	mg/l	0.250	0.379	95	90-110	0.06	15	
Matrix Spike Dup (W1L1796-MSD2)	**Source: 1L15120-03**			**Prepared: 12/27/21**	**Analyzed: 12/29/21**					
Ammonia as N	0.249	0.10	mg/l	0.250	ND	99	90-110	0.8	15	
Batch: W1L1896 - EPA 365.3										
Blank (W1L1896-BLK1)				**Prepared: 12/28/21**	**Analyzed: 01/04/22**					
Phosphorus as P, Total	ND	0.010	mg/l							
LCS (W1L1896-BS1)				**Prepared: 12/28/21**	**Analyzed: 01/04/22**					
Phosphorus as P, Total	0.197	0.010	mg/l	0.200		98	90-110			
Matrix Spike (W1L1896-MS1)	**Source: 1L20107-01**			**Prepared: 12/28/21**	**Analyzed: 01/04/22**					
Phosphorus as P, Total	0.380	0.010	mg/l	0.200	0.178	101	90-110			
Matrix Spike Dup (W1L1896-MSD1)	**Source: 1L20107-01**			**Prepared: 12/28/21**	**Analyzed: 01/04/22**					
Phosphorus as P, Total	0.379	0.010	mg/l	0.200	0.178	100	90-110	0.3	20	

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2A0134 - EPA 200.7										
Blank (W2A0134-BLK1)				**Prepared: 01/04/22**	**Analyzed: 01/10/22**					
Calcium, Total	ND	0.500	mg/l							
Magnesium, Total	ND	0.500	mg/l							
LCS (W2A0134-BS1)				**Prepared: 01/04/22**	**Analyzed: 01/10/22**					
Calcium, Total	50.5	0.500	mg/l	50.2		101	85-115			
Magnesium, Total	50.9	0.500	mg/l	50.2		101	85-115			
Matrix Spike (W2A0134-MS1)	**Source: 1L16102-01**			**Prepared: 01/04/22**	**Analyzed: 01/10/22**					
Calcium, Total	111	0.500	mg/l	50.2	60.1	101	70-130			
Magnesium, Total	76.3	0.500	mg/l	50.2	23.5	105	70-130			
Matrix Spike (W2A0134-MS2)	**Source: 1L17013-01**			**Prepared: 01/04/22**	**Analyzed: 01/10/22**					
Calcium, Total	109	0.500	mg/l	50.2	61.4	94	70-130			
Magnesium, Total	74.2	0.500	mg/l	50.2	23.9	100	70-130			
Matrix Spike Dup (W2A0134-MSD1)	**Source: 1L16102-01**			**Prepared: 01/04/22**	**Analyzed: 01/10/22**					
Calcium, Total	110	0.500	mg/l	50.2	60.1	99	70-130	0.9	30	
Magnesium, Total	75.7	0.500	mg/l	50.2	23.5	104	70-130	0.8	30	
Matrix Spike Dup (W2A0134-MSD2)	**Source: 1L17013-01**			**Prepared: 01/04/22**	**Analyzed: 01/10/22**					
Calcium, Total	109	0.500	mg/l	50.2	61.4	95	70-130	0.2	30	
Magnesium, Total	74.3	0.500	mg/l	50.2	23.9	100	70-130	0.06	30	

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

Notes and Definitions

Item	Definition
**	The recommended holding time for field filtering is only 15 minutes. The sample was filtered as soon as possible but it was filtered past holding time. However, the sample was analyzed within holding time.
%REC	Percent Recovery
Dil	Dilution
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1L30028	**Report Date:**	2/01/2022
		Received Date:	12/30/2021
Project:	Lake Elsinore/Canyon Lake Nutrient TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 12/30/21 with the Chain-of-Custody document. The samples were received in good condition, at 4.8 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:20

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CLS-123021	Nick Poser	1L30028-01	Water	12/30/21 09:00	

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

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:20

Sample Results

Sample: CLS-123021 Sampled: 12/30/21 9:00 by Nick Poser

1L30028-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 **Instr:** UVVIS04							
Batch ID: W2A0346 **Preparation:** _NONE (WETCHEM) **Prepared:** 01/05/22 17:39 **Analyst:** heq							
Chemical Oxygen Demand	**15**	2.9	5.0	mg/l	1	01/10/22	
Method: SM 5210B **Instr:** PH13							
Batch ID: W1L2037 **Preparation:** _NONE (WETCHEM) **Prepared:** 12/30/21 13:45 **Analyst:** HEQ							
Biochemical Oxygen Demand	**2.1**	2.0	2.0	mg/l	1	01/04/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:20

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L2037 - SM 5210B											
Blank (W1L2037-BLK1)					**Prepared: 12/30/21**	**Analyzed: 01/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W1L2037-BLK2)					**Prepared: 12/30/21**	**Analyzed: 01/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W1L2037-BLK3)					**Prepared: 12/30/21**	**Analyzed: 01/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
LCS (W1L2037-BS1)					**Prepared: 12/30/21**	**Analyzed: 01/04/22**					
Biochemical Oxygen Demand	194	2.0	2.0	mg/l	198		98	85-115			
Duplicate (W1L2037-DUP1)	**Source: 1L30028-01**				**Prepared: 12/30/21**	**Analyzed: 01/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l		2.06			200	20	R-03
Batch: W2A0346 - EPA 410.4											
Blank (W2A0346-BLK1)					**Prepared: 01/05/22**	**Analyzed: 01/10/22**					
Chemical Oxygen Demand	ND	2.9	5.0	mg/l							
LCS (W2A0346-BS1)					**Prepared: 01/05/22**	**Analyzed: 01/10/22**					
Chemical Oxygen Demand	996	2.9	5.0	mg/l	1000		100	90-110			
Duplicate (W2A0346-DUP1)	**Source: 1L30022-01**				**Prepared: 01/05/22**	**Analyzed: 01/12/22**					
Chemical Oxygen Demand	1340	12	20	mg/l		1440			7	15	
Matrix Spike (W2A0346-MS1)	**Source: 1L30019-01**				**Prepared: 01/05/22**	**Analyzed: 01/10/22**					
Chemical Oxygen Demand	262	12	20	mg/l	200	61.1	100	90-110			
Matrix Spike (W2A0346-MS2)	**Source: 1L30030-01**				**Prepared: 01/05/22**	**Analyzed: 01/10/22**					
Chemical Oxygen Demand	2270	12	20	mg/l	2000	216	103	90-110			
Matrix Spike Dup (W2A0346-MSD1)	**Source: 1L30019-01**				**Prepared: 01/05/22**	**Analyzed: 01/10/22**					
Chemical Oxygen Demand	262	12	20	mg/l	200	61.1	100	90-110	0	15	
Matrix Spike Dup (W2A0346-MSD2)	**Source: 1L30030-01**				**Prepared: 01/05/22**	**Analyzed: 01/10/22**					
Chemical Oxygen Demand	2270	12	20	mg/l	2000	216	103	90-110	0	15	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:20

Notes and Definitions

Item	Definition
R-03	The RPD is not applicable for result below the reporting limit (either ND or J value).
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1L30029	**Report Date:**	2/01/2022
		Received Date:	12/30/2021
Project:	Lake Elsinore and Canyon Lake Nutrient TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 12/30/21 with the Chain-of-Custody document. The samples were received in good condition, at 4.8 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CLS-123021	Nick Poser	1L30029-01	Water	12/30/21 08:10	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Sample Results

Sample: CLS-123021 | Sampled: 12/30/21 8:10 by Nick Poser

1L30029-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 01/19/22 18:02				**Analyst:** YMT
Organic Nitrogen, Total	**0.67**		0.10	mg/l	1	01/21/22	
Method: Calculation			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 01/19/22 18:02				**Analyst:** YMT
Nitrogen, Total	**1.5**		0.10	mg/l	1	01/21/22	
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2A0326 **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/05/22 15:58				**Analyst:** YMT
Ammonia as N	**0.64**	0.017	0.10	mg/l	1	01/13/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2A1289 **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/19/22 18:02				**Analyst:** YMT
TKN	**1.3**	0.065	0.10	mg/l	1	01/21/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1L2048 **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/30/21 13:09				**Analyst:** JOG
Nitrate as N	**0.096**	0.040	0.20	mg/l	1	12/30/21 15:04	J
Nitrite as N	**0.066**	0.042	0.10	mg/l	1	12/30/21 15:04	J
NO2+NO3 as N	**160**	36	200	ug/l	1	12/30/21	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L2017 **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/30/21 17:39				**Analyst:** heq
Phosphorus as P, Total	ND	0.0030	0.010	mg/l	1	01/04/22	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L2059 **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/30/21 17:12				**Analyst:** heq
o-Phosphate as P	**0.0080**	0.0030	0.010	mg/l	1	12/30/21 18:54	**, J
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2A0126 **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/04/22 09:25				**Analyst:** jao
Total Dissolved Solids	**580**	4.0	10	mg/l	1	01/04/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2A0349 **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/05/22 18:10				**Analyst:** ttf
Total Suspended Solids	ND		5	mg/l	1	01/05/22	
Metals by EPA 200 Series Methods							
Method: Calculation			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 01/11/22 19:13				**Analyst:** kvm
Hardness as CaCO3, Total	**287**		3.31	mg/l	1	01/17/22	
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2A0741 **Preparation:** EPA 200.2			**Prepared:** 01/11/22 19:13				**Analyst:** kvm
Calcium, Total	**74.2**	0.160	0.500	mg/l	1	01/17/22	
Magnesium, Total	**24.7**	0.0390	0.500	mg/l	1	01/17/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L2017 - EPA 365.3											
Blank (W1L2017-BLK1)					**Prepared: 12/29/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	ND	0.0030	0.010	mg/l							
LCS (W1L2017-BS1)					**Prepared: 12/29/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	0.202	0.0030	0.010	mg/l	0.200		101	90-110			
Matrix Spike (W1L2017-MS1)	**Source: 1L28036-01**				**Prepared: 12/29/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	0.373	0.0030	0.010	mg/l	0.200	0.181	96	90-110			
Matrix Spike Dup (W1L2017-MSD1)	**Source: 1L28036-01**				**Prepared: 12/29/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	0.376	0.0030	0.010	mg/l	0.200	0.181	97	90-110	0.8	20	
Batch: W1L2048 - EPA 353.2											
Blank (W1L2048-BLK1)					**Prepared & Analyzed: 12/30/21**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
NO2+NO3 as N	ND	36	200	ug/l							
LCS (W1L2048-BS1)					**Prepared & Analyzed: 12/30/21**						
Nitrate as N	0.962	0.040	0.20	mg/l	1.00		96	90-110			
Nitrite as N	0.991	0.042	0.10	mg/l	1.00		99	90-110			
NO2+NO3 as N	962	36	200	ug/l	1000		96	90-110			
Matrix Spike (W1L2048-MS1)	**Source: 1L30038-01**				**Prepared & Analyzed: 12/30/21**						
Nitrate as N	4.80	0.040	0.20	mg/l	2.00	2.78	101	90-110			
Nitrite as N	0.997	0.042	0.10	mg/l	1.00	ND	100	90-110			
NO2+NO3 as N	4800	36	200	ug/l	2000	2800	100	90-110			
Matrix Spike Dup (W1L2048-MSD1)	**Source: 1L30038-01**				**Prepared & Analyzed: 12/30/21**						
Nitrate as N	4.80	0.040	0.20	mg/l	2.00	2.78	101	90-110	0	20	
Nitrite as N	0.997	0.042	0.10	mg/l	1.00	ND	100	90-110	0	20	
NO2+NO3 as N	4800	36	200	ug/l	2000	2800	100	90-110	0	20	
Batch: W1L2059 - EPA 365.3											
Blank (W1L2059-BLK1)					**Prepared & Analyzed: 12/30/21**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W1L2059-BS1)					**Prepared & Analyzed: 12/30/21**						
o-Phosphate as P	0.204	0.0030	0.010	mg/l	0.200		102	88-111			
Matrix Spike (W1L2059-MS1)	**Source: 1L30010-01**				**Prepared & Analyzed: 12/30/21**						
o-Phosphate as P	0.436	0.0030	0.010	mg/l	0.200	0.227	104	85-112			
Matrix Spike Dup (W1L2059-MSD1)	**Source: 1L30010-01**				**Prepared & Analyzed: 12/30/21**						
o-Phosphate as P	0.434	0.0030	0.010	mg/l	0.200	0.227	104	85-112	0.5	20	
Batch: W2A0126 - SM 2540C											
Blank (W2A0126-BLK1)					**Prepared & Analyzed: 01/04/22**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W2A0126-BS1)					**Prepared & Analyzed: 01/04/22**						
Total Dissolved Solids	795	4.0	10	mg/l	824		96	96-102			

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2A0126 - SM 2540C (Continued)											
LCS (W2A0126-BS1)					**Prepared & Analyzed: 01/04/22**						
Duplicate (W2A0126-DUP1)	**Source: 1L30085-08**				**Prepared & Analyzed: 01/04/22**						
Total Dissolved Solids	11800	4.0	10	mg/l		11600			1	10	
Duplicate (W2A0126-DUP2)	**Source: 1L30085-07**				**Prepared & Analyzed: 01/04/22**						
Total Dissolved Solids	7040	4.0	10	mg/l		6840			3	10	
Batch: W2A0326 - EPA 350.1											
Blank (W2A0326-BLK1)					**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
Blank (W2A0326-BLK2)					**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
LCS (W2A0326-BS1)					**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	0.259	0.017	0.10	mg/l	0.250		104	90-110			
LCS (W2A0326-BS2)					**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	0.260	0.017	0.10	mg/l	0.250		104	90-110			
Matrix Spike (W2A0326-MS1)	**Source: 1L30061-01**				**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	0.389	0.017	0.10	mg/l	0.250	0.133	102	90-110			
Matrix Spike (W2A0326-MS2)	**Source: 2A03024-03**				**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	0.346	0.017	0.10	mg/l	0.250	0.0916	102	90-110			
Matrix Spike Dup (W2A0326-MSD1)	**Source: 1L30061-01**				**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	0.390	0.017	0.10	mg/l	0.250	0.133	103	90-110	0.2	15	
Matrix Spike Dup (W2A0326-MSD2)	**Source: 2A03024-03**				**Prepared: 01/05/22 Analyzed: 01/13/22**						
Ammonia as N	0.348	0.017	0.10	mg/l	0.250	0.0916	103	90-110	0.6	15	
Batch: W2A0349 - SM 2540D											
Blank (W2A0349-BLK1)					**Prepared & Analyzed: 01/05/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2A0349-BS1)					**Prepared & Analyzed: 01/05/22**						
Total Suspended Solids	58.0		5	mg/l	58.3		99	90-110			
Duplicate (W2A0349-DUP1)	**Source: 1L30030-01**				**Prepared & Analyzed: 01/05/22**						
Total Suspended Solids	177		5	mg/l		178			0.6	10	
Duplicate (W2A0349-DUP2)	**Source: 2A03031-01**				**Prepared & Analyzed: 01/05/22**						
Total Suspended Solids	30.4		5	mg/l		30.3			0.3	10	
Batch: W2A1289 - EPA 351.2											
Blank (W2A1289-BLK1)					**Prepared: 01/19/22 Analyzed: 01/21/22**						
TKN	ND	0.065	0.10	mg/l							
Blank (W2A1289-BLK2)					**Prepared: 01/19/22 Analyzed: 01/21/22**						
TKN	ND	0.065	0.10	mg/l							
Blank (W2A1289-BLK3)					**Prepared: 01/19/22 Analyzed: 01/24/22**						
TKN	ND	0.065	0.10	mg/l							

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2A1289 - EPA 351.2 (Continued)											
LCS (W2A1289-BS1)					**Prepared: 01/19/22**	**Analyzed: 01/21/22**					
TKN	1.03	0.065	0.10	mg/l	1.00		103	90-110			
LCS (W2A1289-BS2)					**Prepared: 01/19/22**	**Analyzed: 01/21/22**					
TKN	1.02	0.065	0.10	mg/l	1.00		102	90-110			
LCS (W2A1289-BS3)					**Prepared: 01/19/22**	**Analyzed: 01/24/22**					
TKN	1.01	0.065	0.10	mg/l	1.00		101	90-110			
Matrix Spike (W2A1289-MS1)	**Source: 2A06015-01**				**Prepared: 01/19/22**	**Analyzed: 01/21/22**					
TKN	1.27	0.065	0.10	mg/l	1.00	0.219	105	90-110			
Matrix Spike (W2A1289-MS2)	**Source: 2A06015-02**				**Prepared: 01/19/22**	**Analyzed: 01/21/22**					
TKN	1.26	0.065	0.10	mg/l	1.00	0.244	102	90-110			
Matrix Spike (W2A1289-MS3)	**Source: 2A06015-02**				**Prepared: 01/19/22**	**Analyzed: 01/24/22**					
TKN	1.25	0.065	0.10	mg/l	1.00	0.244	101	90-110			
Matrix Spike Dup (W2A1289-MSD1)	**Source: 2A06015-01**				**Prepared: 01/19/22**	**Analyzed: 01/21/22**					
TKN	1.25	0.065	0.10	mg/l	1.00	0.219	103	90-110	1	10	
Matrix Spike Dup (W2A1289-MSD2)	**Source: 2A06015-02**				**Prepared: 01/19/22**	**Analyzed: 01/21/22**					
TKN	1.22	0.065	0.10	mg/l	1.00	0.244	97	90-110	3	10	
Matrix Spike Dup (W2A1289-MSD3)	**Source: 2A06015-02**				**Prepared: 01/19/22**	**Analyzed: 01/24/22**					
TKN	1.25	0.065	0.10	mg/l	1.00	0.244	101	90-110	0.1	10	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2A0741 - EPA 200.7											
Blank (W2A0741-BLK1)					**Prepared: 01/11/22**	**Analyzed: 01/17/22**					
Calcium, Total	ND	0.160	0.500	mg/l							
Magnesium, Total	ND	0.0390	0.500	mg/l							
Blank (W2A0741-BLK2)					**Prepared: 01/11/22**	**Analyzed: 01/19/22**					
Calcium, Total	ND	0.160	0.500	mg/l							
Magnesium, Total	ND	0.0390	0.500	mg/l							
LCS (W2A0741-BS1)					**Prepared: 01/11/22**	**Analyzed: 01/17/22**					
Calcium, Total	51.0	0.160	0.500	mg/l	50.2		102	85-115			
Magnesium, Total	51.5	0.0390	0.500	mg/l	50.2		103	85-115			
LCS (W2A0741-BS2)					**Prepared: 01/11/22**	**Analyzed: 01/19/22**					
Calcium, Total	50.6	0.160	0.500	mg/l	50.2		101	85-115			
Magnesium, Total	51.2	0.0390	0.500	mg/l	50.2		102	85-115			
Matrix Spike (W2A0741-MS1)	**Source: 1L30020-01**				**Prepared: 01/11/22**	**Analyzed: 01/17/22**					
Calcium, Total	53.7	0.160	0.500	mg/l	50.2	3.33	100	70-130			
Magnesium, Total	55.8	0.0390	0.500	mg/l	50.2	4.80	102	70-130			
Matrix Spike (W2A0741-MS2)	**Source: 1L30020-02**				**Prepared: 01/11/22**	**Analyzed: 01/17/22**					
Calcium, Total	55.8	0.160	0.500	mg/l	50.2	5.06	101	70-130			
Magnesium, Total	53.3	0.0390	0.500	mg/l	50.2	1.69	103	70-130			
Matrix Spike (W2A0741-MS3)	**Source: 1L30020-01**				**Prepared: 01/11/22**	**Analyzed: 01/19/22**					
Calcium, Total	53.2	0.160	0.500	mg/l	50.2	3.33	99	70-130			
Magnesium, Total	55.3	0.0390	0.500	mg/l	50.2	4.80	101	70-130			
Matrix Spike Dup (W2A0741-MSD1)	**Source: 1L30020-01**				**Prepared: 01/11/22**	**Analyzed: 01/17/22**					
Calcium, Total	54.4	0.160	0.500	mg/l	50.2	3.33	102	70-130	1	30	
Magnesium, Total	56.6	0.0390	0.500	mg/l	50.2	4.80	103	70-130	1	30	
Matrix Spike Dup (W2A0741-MSD2)	**Source: 1L30020-02**				**Prepared: 01/11/22**	**Analyzed: 01/17/22**					
Calcium, Total	55.6	0.160	0.500	mg/l	50.2	5.06	101	70-130	0.4	30	
Magnesium, Total	53.0	0.0390	0.500	mg/l	50.2	1.69	102	70-130	0.4	30	
Matrix Spike Dup (W2A0741-MSD3)	**Source: 1L30020-01**				**Prepared: 01/11/22**	**Analyzed: 01/19/22**					
Calcium, Total	53.9	0.160	0.500	mg/l	50.2	3.33	101	70-130	1	30	
Magnesium, Total	56.1	0.0390	0.500	mg/l	50.2	4.80	102	70-130	1	30	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore and Canyon Lake Nutrient TMDL

Project Manager: John Rudolph

Reported: 02/01/2022 16:25

Notes and Definitions

Item	Definition
**	The recommended holding time for field filtering is only 15 minutes. The sample was filtered as soon as possible but it was filtered past holding time. However, the sample was analyzed within holding time.
J	Estimated conc. detected <MRL and >MDL.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	2C04079	**Report Date:**	4/22/2022
		Received Date:	3/4/2022
Project:	LECL Nutrient TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 3/04/22 with the Chain-of-Custody document. The samples were received in good condition, at 3.6 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:15

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
S-03-030422	Austin Kay	2C04079-01	Water	03/04/22 10:40	
FB	Austin Kay	2C04079-02	Water	03/04/22 10:50	
S-03-030422-DUP	Austin Kay	2C04079-03	Water	03/04/22 10:40	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:15

Sample Results

Sample: S-03-030422 — Sampled: 03/04/22 10:40 by Austin Kay

2C04079-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W2C0442 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/06/22 10:59 — **Analyst:** heq							
Chemical Oxygen Demand	**72**	2.9	5.0	mg/l	1	03/08/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W2C0435 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/06/22 08:21 — **Analyst:** heq/MPW							
Biochemical Oxygen Demand	**12**	2.0	2.0	mg/l	1	03/11/22	

Sample Results

Sample: FB — Sampled: 03/04/22 10:50 by Austin Kay

2C04079-02 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W2C0442 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/06/22 10:59 — **Analyst:** heq							
Chemical Oxygen Demand	ND	2.9	5.0	mg/l	1	03/08/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W2C0435 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/06/22 08:21 — **Analyst:** heq/MPW							
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l	1	03/11/22	

Sample Results

Sample: S-03-030422-DUP — Sampled: 03/04/22 10:40 by Austin Kay

2C04079-03 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W2C0442 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/06/22 10:59 — **Analyst:** heq							
Chemical Oxygen Demand	**77**	2.9	5.0	mg/l	1	03/08/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W2C0435 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/06/22 08:21 — **Analyst:** heq/MPW							
Biochemical Oxygen Demand	**14**	2.0	2.0	mg/l	1	03/11/22	

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:15

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C0435 - SM 5210B											
Blank (W2C0435-BLK1)					**Prepared: 03/06/22**	**Analyzed: 03/11/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W2C0435-BLK2)					**Prepared: 03/06/22**	**Analyzed: 03/11/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W2C0435-BLK3)					**Prepared: 03/06/22**	**Analyzed: 03/11/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
LCS (W2C0435-BS1)					**Prepared: 03/06/22**	**Analyzed: 03/11/22**					
Biochemical Oxygen Demand	197	2.0	2.0	mg/l	198		99	85-115			
Duplicate (W2C0435-DUP1)	**Source: 2C04079-02**				**Prepared: 03/06/22**	**Analyzed: 03/11/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l		ND				20	
Batch: W2C0442 - EPA 410.4											
Blank (W2C0442-BLK1)					**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	ND	2.9	5.0	mg/l							
LCS (W2C0442-BS1)					**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	1020	2.9	5.0	mg/l	1000		102	90-110			
Duplicate (W2C0442-DUP1)	**Source: 2C03035-01**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	5940	29	50	mg/l		5870			1	15	
Matrix Spike (W2C0442-MS1)	**Source: 2C04080-01**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	236	12	20	mg/l	200	30.0	103	90-110			
Matrix Spike (W2C0442-MS2)	**Source: 2C04082-01**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	2180	12	20	mg/l	2000	192	99	90-110			
Matrix Spike Dup (W2C0442-MSD1)	**Source: 2C04080-01**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	236	12	20	mg/l	200	30.0	103	90-110	0	15	
Matrix Spike Dup (W2C0442-MSD2)	**Source: 2C04082-01**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Chemical Oxygen Demand	2180	12	20	mg/l	2000	192	99	90-110	0	15	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:15

Notes and Definitions

Item	Definition
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	2C04081	**Report Date:**	4/22/2022
		Received Date:	3/4/2022
Project:	LECL Nutrient TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 3/04/22 with the Chain-of-Custody document. The samples were received in good condition, at 3.6 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
S-03-030422	Austin Kay	2C04081-01	Water	03/04/22 13:54	
S-03-030422	Austin Kay	2C04081-02	Water	03/04/22 13:54	
S-03-030422	Austin Kay	2C04081-03	Water	03/04/22 14:15	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Sample Results

Sample: S-03-030422 — 2C04081-01 (Water)

Sampled: 03/04/22 13:54 by Austin Kay

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 03/17/22 12:58				**Analyst:** ymt
Organic Nitrogen, Total	**1.6**	0.017	0.10	mg/l	1	03/23/22	
Method: Calculation			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 03/17/22 12:58				**Analyst:** ymt
Nitrogen, Total	**3.1**	0.036	0.20	mg/l	1	03/23/22	
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2C1004 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/14/22 17:48				**Analyst:** YMT
Ammonia as N	**0.53**	0.017	0.10	mg/l	1	03/16/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2C1272 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/17/22 12:58				**Analyst:** ymt
TKN	**2.1**	0.13	0.20	mg/l	1	03/23/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2C0424 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/05/22 11:34				**Analyst:** JOG
Nitrate as N	**0.92**	0.040	0.20	mg/l	1	03/05/22 13:16	
Nitrite as N	**0.047**	0.042	0.10	mg/l	1	03/05/22 13:16	J
NO2+NO3 as N	**960**	36	200	ug/l	1	03/05/22	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2C0316 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/04/22 16:03				**Analyst:** heq
Phosphorus as P, Total	**0.43**	0.013	0.020	mg/l	1	03/08/22	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2C0403 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/04/22 16:00				**Analyst:** heq
o-Phosphate as P	**0.43**	0.0030	0.010	mg/l	1	03/04/22 16:21	**
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2C0737 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/09/22 18:31				**Analyst:** jao
Total Dissolved Solids	**110**	4.0	10	mg/l	1	03/10/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2C0653 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/09/22 09:54				**Analyst:** ttf
Total Suspended Solids	**43**		5	mg/l	1	03/09/22	
Metals by EPA 200 Series Methods							
Method: Calculation			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 03/06/22 15:18				**Analyst:** kvm
Hardness as CaCO3, Total	**42.2**	0.219	3.31	mg/l	1	03/08/22	
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2C0453 **Preparation:** EPA 200.2			**Prepared:** 03/06/22 15:18				**Analyst:** kvm
Calcium, Total	**12.4**	0.0234	0.500	mg/l	1	03/08/22	
Magnesium, Total	**2.72**	0.0390	0.500	mg/l	1	03/08/22	

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

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** LECL Nutrient TMDL **Project Manager:** John Rudolph	**Reported:** 04/22/2022 13:21

Sample Results

(Continued)

Sample: S-03-030422 — 2C04081-02 (Water) — Sampled: 03/04/22 13:54 by Austin Kay

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 03/17/22 12:58 — **Analyst:** ymt							
Organic Nitrogen, Total	**1.3**	0.017	0.10	mg/l	1	03/23/22	
Method: Calculation — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 03/17/22 12:58 — **Analyst:** ymt							
Nitrogen, Total	**2.8**	0.036	0.20	mg/l	1	03/23/22	
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W2C1004 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/14/22 17:48 — **Analyst:** YMT							
Ammonia as N	**0.53**	0.017	0.10	mg/l	1	03/16/22	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W2C1272 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/17/22 12:58 — **Analyst:** ymt							
TKN	**1.8**	0.13	0.20	mg/l	1	03/23/22	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W2C0424 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/05/22 11:34 — **Analyst:** JOG							
Nitrate as N	**0.92**	0.040	0.20	mg/l	1	03/05/22 13:17	
Nitrite as N	**0.048**	0.042	0.10	mg/l	1	03/05/22 13:17	J
NO2+NO3 as N	**970**	36	200	ug/l	1	03/05/22	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2C0316 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/04/22 16:03 — **Analyst:** heq							
Phosphorus as P, Total	**0.41**	0.013	0.020	mg/l	1	03/08/22	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2C0403 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/04/22 16:00 — **Analyst:** heq							
o-Phosphate as P	**0.45**	0.0030	0.010	mg/l	1	03/04/22 16:21	**
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W2C0737 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/09/22 18:31 — **Analyst:** jao							
Total Dissolved Solids	**110**	4.0	10	mg/l	1	03/10/22	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W2C0653 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/09/22 09:54 — **Analyst:** ttf							
Total Suspended Solids	**93**		5	mg/l	1	03/09/22	
Metals by EPA 200 Series Methods							
Method: Calculation — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 03/06/22 15:18 — **Analyst:** kvm							
Hardness as CaCO3, Total	**42.0**	0.219	3.31	mg/l	1	03/08/22	
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W2C0453 — **Preparation:** EPA 200.2 — **Prepared:** 03/06/22 15:18 — **Analyst:** kvm							
Calcium, Total	**12.3**	0.0234	0.500	mg/l	1	03/08/22	
Magnesium, Total	**2.72**	0.0390	0.500	mg/l	1	03/08/22	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Sample Results

(Continued)

Sample: S-03-030422 — Sampled: 03/04/22 14:15 by Austin Kay

2C04081-03 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 03/17/22 12:58 — **Analyst:** ymt							
Organic Nitrogen, Total	ND	0.017	0.10	mg/l	1	03/23/22	
Method: Calculation — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 03/17/22 12:58 — **Analyst:** ymt							
Nitrogen, Total	ND	0.036	0.10	mg/l	1	03/23/22	
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W2C1004 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/14/22 17:48 — **Analyst:** YMT							
Ammonia as N	ND	0.017	0.10	mg/l	1	03/16/22	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W2C1272 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/17/22 12:58 — **Analyst:** ymt							
TKN	ND	0.065	0.10	mg/l	1	03/23/22	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W2C0424 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/05/22 11:34 — **Analyst:** JOG							
Nitrate as N	ND	0.040	0.20	mg/l	1	03/05/22 13:10	
Nitrite as N	ND	0.042	0.10	mg/l	1	03/05/22 13:10	
NO2+NO3 as N	ND	36	200	ug/l	1	03/05/22	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2C0316 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/04/22 16:03 — **Analyst:** heq							
Phosphorus as P, Total	ND	0.0067	0.010	mg/l	1	03/08/22	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2C0403 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/04/22 16:00 — **Analyst:** heq							
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	03/04/22 16:21	**
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W2C0737 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/09/22 18:31 — **Analyst:** jao							
Total Dissolved Solids	**13**	4.0	10	mg/l	1	03/10/22	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W2C0653 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/09/22 09:54 — **Analyst:** ttf							
Total Suspended Solids	ND		5	mg/l	1	03/09/22	
Metals by EPA 200 Series Methods							
Method: Calculation — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 03/06/22 15:18 — **Analyst:** kvm							
Hardness as CaCO3, Total	ND	0.219	3.31	mg/l	1	03/08/22	
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W2C0453 — **Preparation:** EPA 200.2 — **Prepared:** 03/06/22 15:18 — **Analyst:** kvm							
Calcium, Total	**0.0658**	0.0234	0.500	mg/l	1	03/08/22	J
Magnesium, Total	ND	0.0390	0.500	mg/l	1	03/08/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C0316 - EPA 365.3											
Blank (W2C0316-BLK1)					**Prepared: 03/04/22 Analyzed: 03/08/22**						
Phosphorus as P, Total	ND	0.0067	0.010	mg/l							
LCS (W2C0316-BS1)					**Prepared: 03/04/22 Analyzed: 03/08/22**						
Phosphorus as P, Total	0.192	0.0067	0.010	mg/l	0.200		96	90-110			
Matrix Spike (W2C0316-MS1)	**Source: 2C01076-01**				**Prepared: 03/04/22 Analyzed: 03/08/22**						
Phosphorus as P, Total	0.376	0.0067	0.010	mg/l	0.200	0.179	98	90-110			
Matrix Spike Dup (W2C0316-MSD1)	**Source: 2C01076-01**				**Prepared: 03/04/22 Analyzed: 03/08/22**						
Phosphorus as P, Total	0.376	0.0067	0.010	mg/l	0.200	0.179	98	90-110	0	20	
Batch: W2C0403 - EPA 365.3											
Blank (W2C0403-BLK1)					**Prepared & Analyzed: 03/04/22**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W2C0403-BS1)					**Prepared & Analyzed: 03/04/22**						
o-Phosphate as P	0.201	0.0030	0.010	mg/l	0.200		100	88-111			
Matrix Spike (W2C0403-MS1)	**Source: 2C04049-01**				**Prepared & Analyzed: 03/04/22**						
o-Phosphate as P	0.244	0.0030	0.010	mg/l	0.200	0.0360	104	85-112			
Matrix Spike Dup (W2C0403-MSD1)	**Source: 2C04049-01**				**Prepared & Analyzed: 03/04/22**						
o-Phosphate as P	0.240	0.0030	0.010	mg/l	0.200	0.0360	102	85-112	2	20	
Batch: W2C0424 - EPA 353.2											
Blank (W2C0424-BLK1)					**Prepared & Analyzed: 03/05/22**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
NO2+NO3 as N	ND	36	200	ug/l							
Blank (W2C0424-BLK2)					**Prepared & Analyzed: 03/05/22**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
NO2+NO3 as N	ND	36	200	ug/l							
LCS (W2C0424-BS1)					**Prepared & Analyzed: 03/05/22**						
Nitrate as N	1.01	0.040	0.20	mg/l	1.00		101	90-110			
Nitrite as N	0.991	0.042	0.10	mg/l	1.00		99	90-110			
NO2+NO3 as N	1010	36	200	ug/l	1000		101	90-110			
LCS (W2C0424-BS2)					**Prepared & Analyzed: 03/05/22**						
Nitrate as N	0.123	0.040	0.20	mg/l	0.100		123	90-110			J
Nitrite as N	0.0975	0.042	0.10	mg/l	0.100		97	90-110			J
NO2+NO3 as N	123	36	200	ug/l	100		123	90-110			J
Matrix Spike (W2C0424-MS1)	**Source: 2C04081-03**				**Prepared & Analyzed: 03/05/22**						
Nitrate as N	2.04	0.040	0.20	mg/l	2.00	ND	102	90-110			
Nitrite as N	1.01	0.042	0.10	mg/l	1.00	ND	101	90-110			
NO2+NO3 as N	2040	36	200	ug/l	2000	ND	102	90-110			
Matrix Spike Dup (W2C0424-MSD1)	**Source: 2C04081-03**				**Prepared & Analyzed: 03/05/22**						

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C0424 - EPA 353.2 (Continued)											
Matrix Spike Dup (W2C0424-MSD1)	**Source: 2C04081-03**				**Prepared & Analyzed: 03/05/22**						
Nitrate as N	2.03	0.040	0.20	mg/l	2.00	ND	102	90-110	0.5	20	
Nitrite as N	0.947	0.042	0.10	mg/l	1.00	ND	95	90-110	6	20	
NO2+NO3 as N	2030	36	200	ug/l	2000	ND	102	90-110	0.5	20	
Batch: W2C0653 - SM 2540D											
Blank (W2C0653-BLK1)					**Prepared & Analyzed: 03/09/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2C0653-BS1)					**Prepared & Analyzed: 03/09/22**						
Total Suspended Solids	53.2		5	mg/l	54.0		99	90-110			
Duplicate (W2C0653-DUP1)	**Source: 2C08046-03**				**Prepared & Analyzed: 03/09/22**						
Total Suspended Solids	21.5		5	mg/l		22.0			2	10	
Duplicate (W2C0653-DUP2)	**Source: 2C04081-02**				**Prepared & Analyzed: 03/09/22**						
Total Suspended Solids	93.3		5	mg/l		93.2			0.1	10	
Batch: W2C0737 - SM 2540C											
Blank (W2C0737-BLK1)					**Prepared: 03/09/22 Analyzed: 03/10/22**						
Total Dissolved Solids	5.00	4.0	10	mg/l							J
LCS (W2C0737-BS1)					**Prepared: 03/09/22 Analyzed: 03/10/22**						
Total Dissolved Solids	839	4.0	10	mg/l	824		102	96-102			
Duplicate (W2C0737-DUP1)	**Source: 2C03090-03**				**Prepared: 03/09/22 Analyzed: 03/10/22**						
Total Dissolved Solids	3240	4.0	10	mg/l		3220			0.6	10	
Duplicate (W2C0737-DUP2)	**Source: 2C07021-01**				**Prepared: 03/09/22 Analyzed: 03/10/22**						
Total Dissolved Solids	1010	4.0	10	mg/l		1000			0.5	10	
Batch: W2C1004 - EPA 350.1											
Blank (W2C1004-BLK1)					**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
Blank (W2C1004-BLK2)					**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
LCS (W2C1004-BS1)					**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	0.258	0.017	0.10	mg/l	0.250		103	90-110			
LCS (W2C1004-BS2)					**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	0.256	0.017	0.10	mg/l	0.250		102	90-110			
Matrix Spike (W2C1004-MS1)	**Source: 2C04049-14**				**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	0.288	0.017	0.10	mg/l	0.250	0.0264	104	90-110			
Matrix Spike (W2C1004-MS2)	**Source: 2C04081-03**				**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	0.257	0.017	0.10	mg/l	0.250	ND	103	90-110			
Matrix Spike Dup (W2C1004-MSD1)	**Source: 2C04049-14**				**Prepared: 03/14/22 Analyzed: 03/16/22**						
Ammonia as N	0.287	0.017	0.10	mg/l	0.250	0.0264	104	90-110	0.1	15	
Matrix Spike Dup (W2C1004-MSD2)	**Source: 2C04081-03**				**Prepared: 03/14/22 Analyzed: 03/16/22**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C1004 - EPA 350.1 (Continued)											
Matrix Spike Dup (W2C1004-MSD2)	**Source: 2C04081-03**				**Prepared: 03/14/22**	**Analyzed: 03/16/22**					
Ammonia as N	0.258	0.017	0.10	mg/l	0.250	ND	103	90-110	0.1	15	
Batch: W2C1272 - EPA 351.2											
Blank (W2C1272-BLK1)					**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	ND	0.065	0.10	mg/l							
Blank (W2C1272-BLK2)					**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	ND	0.065	0.10	mg/l							
LCS (W2C1272-BS1)					**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	1.01	0.065	0.10	mg/l	1.00		101	90-110			
LCS (W2C1272-BS2)					**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	0.961	0.065	0.10	mg/l	1.00		96	90-110			
Matrix Spike (W2C1272-MS1)	**Source: 2C10026-01**				**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	1.18	0.065	0.10	mg/l	1.00	0.182	100	90-110			
Matrix Spike (W2C1272-MS2)	**Source: 2C10026-02**				**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	1.17	0.065	0.10	mg/l	1.00	0.198	97	90-110			
Matrix Spike Dup (W2C1272-MSD1)	**Source: 2C10026-01**				**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	1.19	0.065	0.10	mg/l	1.00	0.182	100	90-110	0.6	10	
Matrix Spike Dup (W2C1272-MSD2)	**Source: 2C10026-02**				**Prepared: 03/17/22**	**Analyzed: 03/23/22**					
TKN	1.24	0.065	0.10	mg/l	1.00	0.198	104	90-110	6	10	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C0453 - EPA 200.7											
Blank (W2C0453-BLK1)					**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Calcium, Total	ND	0.0234	0.500	mg/l							
Magnesium, Total	ND	0.0390	0.500	mg/l							
Blank (W2C0453-BLK2)					**Prepared: 03/06/22**	**Analyzed: 03/09/22**					
Calcium, Total	ND	0.0234	0.500	mg/l							
LCS (W2C0453-BS1)					**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Calcium, Total	49.8	0.0234	0.500	mg/l	50.2		99	85-115			
Magnesium, Total	49.4	0.0390	0.500	mg/l	50.2		98	85-115			
LCS (W2C0453-BS2)					**Prepared: 03/06/22**	**Analyzed: 03/09/22**					
Calcium, Total	49.1	0.0234	0.500	mg/l	50.2		98	85-115			
Matrix Spike (W2C0453-MS1)	**Source: 2C01100-03**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Calcium, Total	95.7	0.0234	0.500	mg/l	50.2	47.5	96	70-130			
Magnesium, Total	62.5	0.0390	0.500	mg/l	50.2	13.2	98	70-130			
Matrix Spike (W2C0453-MS2)	**Source: 2C01100-03**				**Prepared: 03/06/22**	**Analyzed: 03/09/22**					
Calcium, Total	94.4	0.0234	0.500	mg/l	50.2	47.5	93	70-130			
Matrix Spike Dup (W2C0453-MSD1)	**Source: 2C01100-03**				**Prepared: 03/06/22**	**Analyzed: 03/08/22**					
Calcium, Total	94.2	0.0234	0.500	mg/l	50.2	47.5	93	70-130	2	30	
Magnesium, Total	61.6	0.0390	0.500	mg/l	50.2	13.2	96	70-130	1	30	
Matrix Spike Dup (W2C0453-MSD2)	**Source: 2C01100-03**				**Prepared: 03/06/22**	**Analyzed: 03/09/22**					
Calcium, Total	92.9	0.0234	0.500	mg/l	50.2	47.5	90	70-130	2	30	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 04/22/2022 13:21

Notes and Definitions

Item	Definition
**	The recommended holding time for field filtering is only 15 minutes. The sample was filtered as soon as possible but it was filtered past holding time. However, the sample was analyzed within holding time.
J	Estimated conc. detected <MRL and >MDL.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	2C29033	**Report Date:**	4/20/2022
		Received Date:	3/29/2022
Project:	Lake Elsinore/Canyon Lake TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 3/29/22 with the Chain-of-Custody document. The samples were received in good condition, at 9.1 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL

Project Manager: John Rudolph

Reported: 04/20/2022 16:54

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
S-03-032922	Austin Kay	2C29033-01	Water	03/29/22 06:00	
S-04-032922	Austin Kay	2C29033-02	Water	03/29/22 08:00	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL

Project Manager: John Rudolph

Reported: 04/20/2022 16:54

Sample Results

Sample: S-03-032922 — 2C29033-01 (Water) — Sampled: 03/29/22 6:00 by Austin Kay

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W2C2211 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/31/22 12:39 — **Analyst:** heq							
Chemical Oxygen Demand	**37**	2.9	5.0	mg/l	1	04/07/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W2C2017 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/29/22 18:39 — **Analyst:** HEQ							
Biochemical Oxygen Demand	**8.5**	2.0	2.0	mg/l	1	04/04/22	

Sample Results

Sample: S-04-032922 — 2C29033-02 (Water) — Sampled: 03/29/22 8:00 by Austin Kay

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 410.4 — **Instr:** UVVIS04							
Batch ID: W2C2211 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/31/22 12:39 — **Analyst:** heq							
Chemical Oxygen Demand	**29**	2.9	5.0	mg/l	1	04/07/22	
Method: SM 5210B — **Instr:** PH13							
Batch ID: W2C2017 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/29/22 18:39 — **Analyst:** HEQ							
Biochemical Oxygen Demand	**7.7**	2.0	2.0	mg/l	1	04/04/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL

Project Manager: John Rudolph

Reported: 04/20/2022 16:54

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C2017 - SM 5210B											
Blank (W2C2017-BLK1)					**Prepared: 03/29/22**	**Analyzed: 04/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W2C2017-BLK2)					**Prepared: 03/29/22**	**Analyzed: 04/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
Blank (W2C2017-BLK3)					**Prepared: 03/29/22**	**Analyzed: 04/04/22**					
Biochemical Oxygen Demand	ND	2.0	2.0	mg/l							
LCS (W2C2017-BS1)					**Prepared: 03/29/22**	**Analyzed: 04/04/22**					
Biochemical Oxygen Demand	178	2.0	2.0	mg/l	198		90	85-115			
Duplicate (W2C2017-DUP1)	**Source: 2C29095-03**				**Prepared: 03/29/22**	**Analyzed: 04/05/22**					
Biochemical Oxygen Demand	5.72	2.0	2.0	mg/l		5.61			2	20	
Batch: W2C2211 - EPA 410.4											
Blank (W2C2211-BLK1)					**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	ND	2.9	5.0	mg/l							
LCS (W2C2211-BS1)					**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	996	2.9	5.0	mg/l	1000		100	90-110			
Duplicate (W2C2211-DUP1)	**Source: 2C31021-01**				**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	715	5.8	10	mg/l		783			9	15	
Matrix Spike (W2C2211-MS1)	**Source: 2C29033-02**				**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	231	12	20	mg/l	200	29.0	101	90-110			
Matrix Spike (W2C2211-MS2)	**Source: 2C31021-01**				**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	2750	12	20	mg/l	2000	783	98	90-110			
Matrix Spike Dup (W2C2211-MSD1)	**Source: 2C29033-02**				**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	230	12	20	mg/l	200	29.0	101	90-110	0.3	15	
Matrix Spike Dup (W2C2211-MSD2)	**Source: 2C31021-01**				**Prepared: 03/31/22**	**Analyzed: 04/07/22**					
Chemical Oxygen Demand	2700	12	20	mg/l	2000	783	96	90-110	2	15	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: Lake Elsinore/Canyon Lake TMDL

Project Manager: John Rudolph

Reported: 04/20/2022 16:54

Notes and Definitions

Item	Definition
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Work Orders:	2C30147	**Report Date:**	5/20/2022
		Received Date:	3/30/2022
Project:	LECL Nutrient TMDL	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 3/30/22 with the Chain-of-Custody document. The samples were received in good condition, at 5.9 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported:
05/20/2022 10:51

Case Narrative

No H2SO4 preserved bottle was recieved for these two samples. Per client request, aliquots were preserved with H2SO4 on 3/31/22 and instructions to proceed with analyses were given. BG 3/31/2022

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
S-03-032922	Client	2C30147-01	Water	03/29/22 16:00	
S-04-032922	Client	2C30147-02	Water	03/30/22 10:30	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported:
05/20/2022 10:51

Sample Results

Sample: S-03-032922 — Sampled: 03/29/22 16:00 by Client

2C30147-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 04/28/22 16:24				**Analyst:** YMT
Organic Nitrogen, Total	**1.0**	0.017	0.10	mg/l	1	04/29/22	
Method: Calculation			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 04/23/22 07:36				**Analyst:** YMT
Nitrogen, Total	**1.9**	0.036	0.10	mg/l	1	04/27/22	
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2D2187 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/28/22 16:24				**Analyst:** YMT
Ammonia as N	**0.17**	0.017	0.10	mg/l	1	04/29/22	O-04
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2D1706 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/23/22 07:36				**Analyst:** YMT
TKN	**1.2**	0.065	0.10	mg/l	1	04/27/22	O-04
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2C2225 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/31/22 14:30				**Analyst:** JOG
Nitrate as N	**0.68**	0.040	0.20	mg/l	1	03/31/22 15:18	FILT
Nitrite as N	**0.044**	0.042	0.10	mg/l	1	03/31/22 15:18	FILT, J
NO2+NO3 as N	**720**	36	200	ug/l	1	03/31/22	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2C2182 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/31/22 09:42				**Analyst:** heq
o-Phosphate as P	**0.34**	0.0030	0.010	mg/l	1	03/31/22 11:40	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2C2214 **Preparation:** _NONE (WETCHEM)			**Prepared:** 03/31/22 13:03				**Analyst:** heq
Phosphorus as P, Total	**0.38**	0.013	0.020	mg/l	1	04/04/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2D0190 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/04/22 18:41				**Analyst:** jao
Total Dissolved Solids	**67**	4.0	10	mg/l	1	04/05/22	
Method: SM 2540D			**Instr:** _ANALYST				
Batch ID: W2D0183 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/04/22 17:16				**Analyst:** ttf
Total Suspended Solids	**29**		5	mg/l	1	04/04/22	
Metals by EPA 200 Series Methods							
Method: Calculation			**Instr:** [CALC]				
Batch ID: [CALC] **Preparation:** [CALC]			**Prepared:** 04/06/22 15:17				**Analyst:** kvm
Hardness as CaCO3, Total	**30.3**	0.219	3.31	mg/l	1	04/08/22	
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2D0419 **Preparation:** EPA 200.2			**Prepared:** 04/06/22 15:17				**Analyst:** kvm
Calcium, Total	**9.12**	0.0234	0.500	mg/l	1	04/08/22	
Magnesium, Total	**1.82**	0.0390	0.500	mg/l	1	04/08/22	

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

www.wecklabs.com

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 05/20/2022 10:51

Sample Results

(Continued)

Sample: S-04-032922 — 2C30147-02 (Water) — Sampled: 03/30/22 10:30 by Client

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 04/28/22 16:24 — **Analyst:** YMT							
Organic Nitrogen, Total	**1.1**	0.017	0.10	mg/l	1	04/29/22	
Method: Calculation — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 04/23/22 07:36 — **Analyst:** YMT							
Nitrogen, Total	**2.1**	0.036	0.10	mg/l	1	04/27/22	
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W2D2187 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/28/22 16:24 — **Analyst:** YMT							
Ammonia as N	**0.032**	0.017	0.10	mg/l	1	04/29/22	O-04, J
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W2D1706 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/23/22 07:36 — **Analyst:** YMT							
TKN	**1.2**	0.065	0.10	mg/l	1	04/27/22	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W2C2225 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/31/22 14:30 — **Analyst:** JOG							
Nitrate as N	**0.89**	0.040	0.20	mg/l	1	03/31/22 15:23	FILT
Nitrite as N	**0.072**	0.042	0.10	mg/l	1	03/31/22 15:23	FILT, J
NO2+NO3 as N	**960**	36	200	ug/l	1	03/31/22	FILT
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2C2182 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/31/22 09:42 — **Analyst:** heq							
o-Phosphate as P	**0.36**	0.0030	0.010	mg/l	1	03/31/22 11:41	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2C2214 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 03/31/22 13:03 — **Analyst:** heq							
Phosphorus as P, Total	**0.41**	0.013	0.020	mg/l	1	04/04/22	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W2D0345 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/06/22 09:47 — **Analyst:** jao							
Total Dissolved Solids	**200**	4.0	10	mg/l	1	04/06/22	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W2D0349 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/06/22 09:59 — **Analyst:** ttf							
Total Suspended Solids	**61**		5	mg/l	1	04/06/22	
Metals by EPA 200 Series Methods							
Method: Calculation — **Instr:** [CALC]							
Batch ID: [CALC] — **Preparation:** [CALC] — **Prepared:** 04/06/22 15:17 — **Analyst:** kvm							
Hardness as CaCO3, Total	**86.2**	0.219	3.31	mg/l	1	04/08/22	
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W2D0419 — **Preparation:** EPA 200.2 — **Prepared:** 04/06/22 15:17 — **Analyst:** kvm							
Calcium, Total	**24.1**	0.0234	0.500	mg/l	1	04/08/22	
Magnesium, Total	**6.32**	0.0390	0.500	mg/l	1	04/08/22	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 05/20/2022 10:51

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2C2182 - EPA 365.3											
Blank (W2C2182-BLK1)					**Prepared & Analyzed: 03/31/22**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W2C2182-BS1)					**Prepared & Analyzed: 03/31/22**						
o-Phosphate as P	0.200	0.0030	0.010	mg/l	0.200		100	88-111			
Matrix Spike (W2C2182-MS1)	**Source: 2C30147-01**				**Prepared & Analyzed: 03/31/22**						
o-Phosphate as P	0.536	0.0030	0.010	mg/l	0.200	0.336	100	85-112			
Matrix Spike Dup (W2C2182-MSD1)	**Source: 2C30147-01**				**Prepared & Analyzed: 03/31/22**						
o-Phosphate as P	0.538	0.0030	0.010	mg/l	0.200	0.336	101	85-112	0.4	20	
Batch: W2C2214 - EPA 365.3											
Blank (W2C2214-BLK1)					**Prepared: 03/31/22 Analyzed: 04/04/22**						
Phosphorus as P, Total	ND	0.0067	0.010	mg/l							
LCS (W2C2214-BS1)					**Prepared: 03/31/22 Analyzed: 04/04/22**						
Phosphorus as P, Total	0.201	0.0067	0.010	mg/l	0.200		100	90-110			
Matrix Spike (W2C2214-MS1)	**Source: 2C29065-01**				**Prepared: 03/31/22 Analyzed: 04/04/22**						
Phosphorus as P, Total	0.394	0.0067	0.010	mg/l	0.200	0.194	100	90-110			
Matrix Spike Dup (W2C2214-MSD1)	**Source: 2C29065-01**				**Prepared: 03/31/22 Analyzed: 04/04/22**						
Phosphorus as P, Total	0.397	0.0067	0.010	mg/l	0.200	0.194	102	90-110	0.8	20	
Batch: W2C2225 - EPA 353.2											
Blank (W2C2225-BLK1)					**Prepared & Analyzed: 03/31/22**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
NO2+NO3 as N	ND	36	200	ug/l							
LCS (W2C2225-BS1)					**Prepared & Analyzed: 03/31/22**						
Nitrate as N	1.02	0.040	0.20	mg/l	1.00		102	90-110			
Nitrite as N	1.02	0.042	0.10	mg/l	1.00		102	90-110			
NO2+NO3 as N	1020	36	200	ug/l	1000		102	90-110			
Matrix Spike (W2C2225-MS1)	**Source: 2C30147-01**				**Prepared & Analyzed: 03/31/22**						
Nitrate as N	2.77	0.040	0.20	mg/l	2.00	0.677	105	90-110			
Nitrite as N	1.11	0.042	0.10	mg/l	1.00	0.0444	107	90-110			
NO2+NO3 as N	2770	36	200	ug/l	2000	721	102	90-110			
Matrix Spike Dup (W2C2225-MSD1)	**Source: 2C30147-01**				**Prepared & Analyzed: 03/31/22**						
Nitrate as N	2.76	0.040	0.20	mg/l	2.00	0.677	104	90-110	0.4	20	
Nitrite as N	1.01	0.042	0.10	mg/l	1.00	0.0444	97	90-110	9	20	
NO2+NO3 as N	2760	36	200	ug/l	2000	721	102	90-110	0.4	20	
Batch: W2D0183 - SM 2540D											
Blank (W2D0183-BLK1)					**Prepared & Analyzed: 04/04/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2D0183-BS1)					**Prepared & Analyzed: 04/04/22**						
Total Suspended Solids	53.9		5	mg/l	52.8		102	90-110			

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 05/20/2022 10:51

Quality Control Results

(Continued)

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

Analyte	Result		MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D0183 - SM 2540D (Continued)											
LCS (W2D0183-BS1)					**Prepared & Analyzed: 04/04/22**						
Duplicate (W2D0183-DUP1)	**Source: 2C29080-01**				**Prepared & Analyzed: 04/04/22**						
Total Suspended Solids	147		5	mg/l		150			2	10	
Duplicate (W2D0183-DUP2)	**Source: 2C29107-04**				**Prepared & Analyzed: 04/04/22**						
Total Suspended Solids	290		5	mg/l		294			2	10	
Batch: W2D0190 - SM 2540C											
Blank (W2D0190-BLK1)					**Prepared: 04/04/22 Analyzed: 04/05/22**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W2D0190-BS1)					**Prepared: 04/04/22 Analyzed: 04/05/22**						
Total Dissolved Solids	823	4.0	10	mg/l	824		100	96-102			
Duplicate (W2D0190-DUP1)	**Source: 2C29100-03**				**Prepared: 04/04/22 Analyzed: 04/05/22**						
Total Dissolved Solids	20400	4.0	10	mg/l		20300			0.3	10	
Duplicate (W2D0190-DUP2)	**Source: 2C29113-01**				**Prepared: 04/04/22 Analyzed: 04/05/22**						
Total Dissolved Solids	34500	4.0	10	mg/l		35300			2	10	
Batch: W2D0345 - SM 2540C											
Blank (W2D0345-BLK1)					**Prepared & Analyzed: 04/06/22**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W2D0345-BS1)					**Prepared & Analyzed: 04/06/22**						
Total Dissolved Solids	827	4.0	10	mg/l	824		100	96-102			
Duplicate (W2D0345-DUP1)	**Source: 2D01051-02**				**Prepared & Analyzed: 04/06/22**						
Total Dissolved Solids	1530	4.0	10	mg/l		1510			0.9	10	
Duplicate (W2D0345-DUP2)	**Source: 2D01051-01**				**Prepared & Analyzed: 04/06/22**						
Total Dissolved Solids	1780	4.0	10	mg/l		1650			7	10	
Batch: W2D0349 - SM 2540D											
Blank (W2D0349-BLK1)					**Prepared & Analyzed: 04/06/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2D0349-BS1)					**Prepared & Analyzed: 04/06/22**						
Total Suspended Solids	53.9		5	mg/l	54.9		98	90-110			
Duplicate (W2D0349-DUP1)	**Source: 2C28012-01**				**Prepared & Analyzed: 04/06/22**						
Total Suspended Solids	17.8		5	mg/l		17.1			4	10	
Duplicate (W2D0349-DUP2)	**Source: 2D05113-02**				**Prepared & Analyzed: 04/06/22**						
Total Suspended Solids	4.40		5	mg/l		4.40			0	10	
Batch: W2D1706 - EPA 351.2											
Blank (W2D1706-BLK1)					**Prepared: 04/23/22 Analyzed: 04/27/22**						
TKN	ND	0.065	0.10	mg/l							
Blank (W2D1706-BLK2)					**Prepared: 04/23/22 Analyzed: 04/27/22**						
TKN	ND	0.065	0.10	mg/l							
LCS (W2D1706-BS1)					**Prepared: 04/23/22 Analyzed: 04/27/22**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 05/20/2022 10:51

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D1706 - EPA 351.2 (Continued)											
LCS (W2D1706-BS1)					**Prepared: 04/23/22**	**Analyzed: 04/27/22**					
TKN	0.955	0.065	0.10	mg/l	1.00		95	90-110			
LCS (W2D1706-BS2)					**Prepared: 04/23/22**	**Analyzed: 04/27/22**					
TKN	0.984	0.065	0.10	mg/l	1.00		98	90-110			
Matrix Spike (W2D1706-MS1)	**Source: 2D14041-01**				**Prepared: 04/23/22**	**Analyzed: 04/27/22**					
TKN	1.14	0.065	0.10	mg/l	1.00	0.231	91	90-110			
Matrix Spike (W2D1706-MS2)	**Source: 2D14041-02**				**Prepared: 04/23/22**	**Analyzed: 04/27/22**					
TKN	1.33	0.065	0.10	mg/l	1.00	0.396	94	90-110			
Matrix Spike Dup (W2D1706-MSD1)	**Source: 2D14041-01**				**Prepared: 04/23/22**	**Analyzed: 04/27/22**					
TKN	1.19	0.065	0.10	mg/l	1.00	0.231	96	90-110	5	10	
Matrix Spike Dup (W2D1706-MSD2)	**Source: 2D14041-02**				**Prepared: 04/23/22**	**Analyzed: 04/27/22**					
TKN	1.32	0.065	0.10	mg/l	1.00	0.396	93	90-110	0.8	10	
Batch: W2D2187 - EPA 350.1											
Blank (W2D2187-BLK1)					**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	ND	0.017	0.10	mg/l							
Blank (W2D2187-BLK2)					**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	ND	0.017	0.10	mg/l							
LCS (W2D2187-BS1)					**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	0.248	0.017	0.10	mg/l	0.250		99	90-110			
LCS (W2D2187-BS2)					**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	0.249	0.017	0.10	mg/l	0.250		100	90-110			
Matrix Spike (W2D2187-MS1)	**Source: 2C17003-01**				**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	0.594	0.017	0.10	mg/l	0.250	0.351	97	90-110			
Matrix Spike (W2D2187-MS2)	**Source: 2D26028-02**				**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	1.80	0.017	0.10	mg/l	0.250	1.58	89	90-110			MS-02
Matrix Spike Dup (W2D2187-MSD1)	**Source: 2C17003-01**				**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	0.593	0.017	0.10	mg/l	0.250	0.351	97	90-110	0.06	15	
Matrix Spike Dup (W2D2187-MSD2)	**Source: 2D26028-02**				**Prepared: 04/28/22**	**Analyzed: 04/29/22**					
Ammonia as N	1.80	0.017	0.10	mg/l	0.250	1.58	90	90-110	0.2	15	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported: 05/20/2022 10:51

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D0419 - EPA 200.7											
Blank (W2D0419-BLK1)					**Prepared: 04/06/22**	**Analyzed: 04/08/22**					
Calcium, Total	ND	0.0234	0.500	mg/l							
Magnesium, Total	ND	0.0390	0.500	mg/l							
LCS (W2D0419-BS1)					**Prepared: 04/06/22**	**Analyzed: 04/08/22**					
Calcium, Total	50.7	0.0234	0.500	mg/l	50.0		101	85-115			
Magnesium, Total	49.7	0.0390	0.500	mg/l	50.0		99	85-115			
Matrix Spike (W2D0419-MS1)	**Source: 2C30147-01**				**Prepared: 04/06/22**	**Analyzed: 04/08/22**					
Calcium, Total	59.7	0.0234	0.500	mg/l	50.0	9.12	101	70-130			
Magnesium, Total	52.2	0.0390	0.500	mg/l	50.0	1.82	101	70-130			
Matrix Spike Dup (W2D0419-MSD1)	**Source: 2C30147-01**				**Prepared: 04/06/22**	**Analyzed: 04/08/22**					
Calcium, Total	59.3	0.0234	0.500	mg/l	50.0	9.12	100	70-130	0.6	30	
Magnesium, Total	51.9	0.0390	0.500	mg/l	50.0	1.82	100	70-130	0.5	30	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LECL Nutrient TMDL

Project Manager: John Rudolph

Reported:
05/20/2022 10:51

Notes and Definitions

Item	Definition
FILT	The sample was filtered prior to analysis.
J	Estimated conc. detected <MRL and >MDL.
MS-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
O-04	This analysis was performed outside the EPA recommended holding time.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

APPENDIX B – WATER COLUMN PROFILE DATA TABLES

Lake Elsinore July 15, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
LE01[a]	8:20	Temp (°C)	27.6	27.6	27.6	27.5	27.3	27.1	27.1	--	27.4
		Sp. Cond (µS/cm)	3614	3616	3615	3613	3611	3610	3609	--	3613
		pH	8.77	8.77	8.76	8.76	8.76	8.73	8.72	--	8.75
		DO (mg/L)	2.0	1.7	1.5	2.1	1.3	0.6	0.3	--	1.4
	16:10	Temp (°C)	29.3	29.3	29.1	27.6	27.6	27.3	27.1	--	28.2
		Sp. Cond (µS/cm)	3614	3615	3612	3611	3606	3606	3607	--	3610
		pH	8.94	8.94	8.91	8.76	8.73	8.69	8.68	--	8.81
		DO (mg/L)	8.2	8.4	7.1	2.5	0.8	0.5	0.1	--	3.9
LE02[b]	08:50	Temp (°C)	27.6	27.5	27.4	27.4	27.4	27.4	27.0	26.9	27.3
		Sp. Cond (µS/cm)	3607	3608	3607	3607	3607	3607	3609	3610	3608
		pH	8.81	8.82	8.79	8.76	8.76	8.74	8.68	8.57	8.74
		DO (mg/L)	4.7	3.4	2.0	1.8	1.8	1.5	0.1	0.1	1.9
	15:50	Temp (°C)	27.9	27.9	27.9	27.7	27.5	27.1	27.1	27.1	27.5
		Sp. Cond (µS/cm)	3608	3608	3608	3607	3605	3604	3604	3604	3606
		pH	8.77	8.76	8.76	8.74	8.71	8.67	8.67	8.67	8.72
		DO (mg/L)	2.9	2.7	2.3	1.8	0.5	0.2	0.1	0.1	1.3
LE03[c]	8:00	Temp (°C)	27.6	27.6	27.6	27.5	27.5	27.3	--	--	27.5
		Sp. Cond (µS/cm)	3613	3613	3614	3614	3613	3614	--	--	3614
		pH	8.76	8.76	8.76	8.75	8.74	8.70	--	--	8.75
		DO (mg/L)	1.9	1.9	1.7	1.6	0.9	0.2	--	--	1.4
	14:20	Temp (°C)	30.5	27.9	27.8	27.4	27.2	26.5	--	--	27.9
		Sp. Cond (µS/cm)	3618	3609	3608	3607	3607	3606	--	--	3609
		pH	8.95	8.77	8.73	8.66	8.64	8.51	--	--	8.71
		DO (mg/L)	10.5	4.4	2.0	0.3	0.2	0.4	--	--	3.0
Lakeshore Sonde	15:20	Temp (°C)	28.9	29.1	28.1	27.7	27.4	27.3	27.1	27.0	27.8
		Sp. Cond (µS/cm)	3610	3610	3609	3606	3605	3605	3605	3604	3607
		pH	8.98	8.97	8.77	8.70	8.71	8.68	8.67	8.62	8.76
		DO (mg/L)	9.9	9.8	1.0	0.8	1.1	0.1	0.1	0.0	2.8
Grand Ave Sonde[d]	14:45	Temp (°C)	29.6	28.5	27.5	27.5	27.4	27.3	26.9	26.7	27.7
		Sp. Cond (µS/cm)	3611	3612	3607	3607	3607	3607	3604	3604	3607
		pH	9.02	8.95	8.70	8.68	8.68	8.68	8.54	8.53	8.72
		DO (mg/L)	11.8	9.6	1.1	0.6	0.4	0.5	0.1	0.1	3.0

a- Bottom measurements taken at 5.5 meters.

b- Bottom measurement taken at 6.5 meters in the afternoon.

c- Bottom measurement taken at 4.5 meters in the morning.

d- Bottom measurement taken at 6.5 meters.

Lake Elsinore August 16, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
LE01	11:05	Temp (°C)	27.7	26.6	26.5	26.3	26.2	26.1	--	--	26.6
		Sp. Cond (µS/cm)	3757	3753	3753	3753	3753	3753	--	--	3754
		pH	8.78	8.67	8.63	8.60	8.59	8.56	--	--	8.64
		DO (mg/L)	7.7	4.8	2.5	2.0	1.5	1.1	--	--	3.3
	14:55	Temp (°C)	29.7	29.4	27.6	27.0	26.6	26.3	--	--	27.8
		Sp. Cond (µS/cm)	3763	3766	3756	3753	3754	3754	--	--	3758
		pH	8.97	8.95	8.85	8.63	8.60	8.54	--	--	8.76
		DO (mg/L)	15.2	14.9	8.7	4.7	1.0	1.0	--	--	7.6
LE02[a]	08:00	Temp (°C)	26.3	26.4	26.4	26.4	26.4	26.4	26.3	26.3	26.4
		Sp. Cond (µS/cm)	3750	3754	3755	3755	3755	3755	3755	3756	3754
		pH	8.66	8.64	8.62	8.60	8.60	8.59	8.58	8.58	8.61
		DO (mg/L)	3.2	2.3	2.0	1.7	1.5	1.4	1.3	1.2	1.8
	14:45	Temp (°C)	28.1	28.0	26.7	26.6	26.5	26.5	26.4	26.4	26.9
		Sp. Cond (µS/cm)	3763	3764	3757	3755	3754	3754	3754	3754	3757
		pH	8.83	8.81	8.61	8.60	8.58	8.56	8.54	8.53	8.63
		DO (mg/L)	8.0	7.0	2.0	2.0	1.9	1.1	0.8	0.6	2.9
LE03	07:50	Temp (°C)	26.8	26.9	26.9	26.8	26.8	26.6	--	--	26.8
		Sp. Cond (µS/cm)	3753	3753	3753	3753	3753	3754	--	--	3753
		pH	8.71	8.70	8.69	8.69	8.69	8.58	--	--	8.68
		DO (mg/L)	4.4	3.9	3.8	3.8	3.9	0.3	--	--	3.3
	14:35	Temp (°C)	31.4	28.2	27.4	26.9	26.8	26.7	--	--	27.9
		Sp. Cond (µS/cm)	3779	3768	3760	3753	3754	3752	--	--	3761
		pH	9.00	8.85	8.65	8.60	8.58	8.54	--	--	8.70
		DO (mg/L)	16.8	16.8	2.8	2.8	2.5	0.6	--	--	7.0
Lakeshore Sonde[a]	10:30	Temp (°C)	27.7	27.5	26.7	26.5	26.5	26.5	26.4	26.4	26.8
		Sp. Cond (µS/cm)	3767	3763	3755	3754	3753	3753	3753	3754	3757
		pH	8.81	8.72	8.67	8.60	8.59	8.57	8.56	8.55	8.63
		DO (mg/L)	8.3	4.2	3.4	2.0	1.6	1.2	0.8	0.4	2.7
Grand Ave Sonde	10:45	Temp (°C)	28.8	27.8	26.8	26.6	26.5	26.4	26.4	--	27.0
		Sp. Cond (µS/cm)	3766	3763	3756	3755	3754	3754	3753	--	3757
		pH	8.95	8.79	8.66	8.62	8.60	8.58	8.56	--	8.68
		DO (mg/L)	13.1	4.7	3.1	2.0	1.7	1.4	0.9	--	3.8

a- Bottom measurements taken at 6.5 meters.

Canyon Lake August 16, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	10 m	11 m	12 m	13 m	14 m	Water Column Mean - All	Water Column Mean - Epilimnion	Water Column Mean - Hypolimnion
CL07	10:35	Temp (°C)	28.9	28.8	28.5	28.4	28.4	27.7	24.9	20.9	18.3	16.5	15.5	14.9	14.6	14.5	14.4	21.7	28.5	14.8
		Sp. Cond (µS/cm)	900	898	896	896	897	903	869	845	837	830	828	829	834	838	841	863	898	834
		pH	8.74	8.69	8.68	8.65	8.64	8.22	7.67	7.29	7.22	7.29	7.30	7.27	7.23	7.22	7.19	7.82	8.60	7.24
		DO (mg/L)	10.3	10.7	10.8	10.6	10.4	6.5	0.6	0.3	0.2	0.1	0.1	0.1	0.0	0.0	0.0	4.0	9.9	0.0
	15:30	Temp (°C)	29.5	28.8	28.6	28.5	28.4	27.7	24.3	21.3	18.5	16.4	15.3	15.0	14.5	14.5	14.4	21.7	28.6	14.7
		Sp. Cond (µS/cm)	897	896	895	898	899	908	855	835	834	833	828	834	840	840	840	862	899	836
		pH	8.81	8.79	8.77	8.71	8.68	7.99	7.84	7.33	7.27	7.30	7.33	7.28	7.23	7.23	7.22	7.85	8.63	7.26
		DO (mg/L)	11.2	11.6	11.5	10.8	10.4	5.2	1.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	4.2	10.1	0.1
CL08	9:46	Temp (°C)	28.8	28.6	28.5	28.5	28.4	27.7	24.8	20.3	17.1	--	--	--	--	--	--	25.9	28.4	17.1
		Sp. Cond (µS/cm)	897	896	896	896	896	896	871	830	846	--	--	--	--	--	--	880	896	846
		pH	8.61	8.62	8.62	8.61	8.57	7.87	7.51	7.24	7.25	--	--	--	--	--	--	8.10	8.48	7.25
		DO (mg/L)	9.5	9.5	9.5	9.3	8.9	4.0	0.1	0.1	0.1	--	--	--	--	--	--	5.7	8.5	0.1
	14:55	Temp (°C)	30.0	29.7	28.8	28.7	28.6	27.9	25.1	20.8	17.8	--	--	--	--	--	--	26.4	29.0	17.8
		Sp. Cond (µS/cm)	899	898	896	897	897	903	868	835	839	--	--	--	--	--	--	881	898	839
		pH	8.80	8.72	8.73	8.70	8.67	8.01	7.54	7.26	7.25	--	--	--	--	--	--	8.19	8.61	7.25
		DO (mg/L)	10.0	10.2	10.5	10.3	10.0	5.1	0.6	0.2	0.1	--	--	--	--	--	--	6.3	9.4	0.1
CL09[a]	09:05	Temp (°C)	28.2	28.1	28.0	28.0	27.6	25.3	18.2	18.7	--	--	--	--	--	--	--	25.3	28.0	18.7
		Sp. Cond (µS/cm)	992	993	994	992	1002	1019	1074	1108	--	--	--	--	--	--	--	1022	995	1108
		pH	8.64	8.64	8.64	8.60	8.06	7.19	7.03	7.09	--	--	--	--	--	--	--	7.99	8.52	7.09
		DO (mg/L)	10.4	10.4	10.3	10.0	7.1	0.1	0.1	0.2	--	--	--	--	--	--	--	6.1	9.6	0.2
	14:30	Temp (°C)	30.1	29.1	28.3	28.2	27.9	26.1	19.5	17.5	--	--	--	--	--	--	--	25.8	28.7	17.5
		Sp. Cond (µS/cm)	999	993	992	990	1003	1030	1088	1075	--	--	--	--	--	--	--	1021	995	1075
		pH	8.80	8.81	8.79	8.70	8.18	7.24	7.06	7.07	--	--	--	--	--	--	--	8.08	8.66	7.07
		DO (mg/L)	11.3	12.0	11.9	11.1	7.9	0.5	0.1	0.1	--	--	--	--	--	--	--	6.9	10.8	0.1
CL10[b]	8:00	Temp (°C)	28.1	28.1	28.1	28.0	--	--	--	--	--	--	--	--	--	--	--	28.1	--	--
		Sp. Cond (µS/cm)	1018	1018	1019	1023	--	--	--	--	--	--	--	--	--	--	--	1020	--	--
		pH	8.59	8.60	8.60	8.58	--	--	--	--	--	--	--	--	--	--	--	8.59	--	--
		DO (mg/L)	10.0	10.0	9.9	9.5	--	--	--	--	--	--	--	--	--	--	--	9.9	--	--
	14:18	Temp (°C)	29.5	28.9	28.4	28.2	--	--	--	--	--	--	--	--	--	--	--	28.8	--	--
		Sp. Cond (µS/cm)	1020	1017	1013	1015	--	--	--	--	--	--	--	--	--	--	--	1016	--	--
		pH	8.88	8.89	8.82	8.69	--	--	--	--	--	--	--	--	--	--	--	8.82	--	--
		DO (mg/L)	12.3	12.5	12.0	10.7	--	--	--	--	--	--	--	--	--	--	--	11.9	--	--

Notes:

Hypolimnion

Epilimnion

Thermocline

No shading indicates no observed thermocline; lake well mixed

a- Bottom measurements taken at 6.5 meters.

b- Bottom measurements taken at 2.5 meters.

Lake Elsinore September 17, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
LE01[a]	7:20	Temp (°C)	25.3	25.3	25.3	25.3	25.3	25.2	25.2	--	25.3
		Sp. Cond (µS/cm)	3983	3986	3988	3989	3989	3990	3990	--	3988
		pH	8.78	8.77	8.77	8.75	8.75	8.74	8.74	--	8.76
		DO (mg/L)	2.9	2.7	2.6	2.4	1.9	1.3	1.2	--	2.1
	14:30	Temp (°C)	26.4	25.4	25.1	25.0	24.9	24.7	24.3	--	25.1
		Sp. Cond (µS/cm)	4003	3990	3990	3989	3989	3989	3963	--	3988
		pH	8.97	8.74	8.70	8.68	8.70	8.70	8.50	--	8.71
		DO (mg/L)	8.2	1.4	0.7	0.2	0.7	0.7	0.1	--	1.7
LE02[b]	8:50	Temp (°C)	25.2	25.2	25.2	25.2	25.2	25.1	25.1	25.1	25.2
		Sp. Cond (µS/cm)	3985	3988	3988	3988	3988	3988	3988	3988	3988
		pH	8.72	8.72	8.72	8.72	8.72	8.71	8.71	8.71	8.72
		DO (mg/L)	1.6	1.1	1.1	1.1	1.1	1.0	0.8	0.6	1.0
	14:15	Temp (°C)	26.3	25.5	25.3	25.2	25.1	25.1	25.1	25.0	25.3
		Sp. Cond (µS/cm)	3993	3991	3991	3989	3988	3988	3988	3988	3990
		pH	9.03	8.77	8.70	8.69	8.69	8.69	8.69	8.69	8.74
		DO (mg/L)	12.1	2.7	0.6	0.5	0.4	0.5	0.5	0.2	2.2
LE03[c]	8:35	Temp (°C)	25.1	25.1	25.2	25.2	25.1	25.1	--	--	25.1
		Sp. Cond (µS/cm)	3986	3988	3987	3987	3986	3986	--	--	3987
		pH	8.73	8.73	8.73	8.73	8.73	8.72	--	--	8.73
		DO (mg/L)	1.7	1.5	1.4	1.4	1.4	1.1	--	--	1.4
	14:00	Temp (°C)	25.8	25.4	25.3	25.2	25.0	25.0	--	--	25.3
		Sp. Cond (µS/cm)	3991	3992	3988	3989	3980	3980	--	--	3987
		pH	8.91	8.72	8.71	8.71	8.73	8.74	--	--	8.75
		DO (mg/L)	9.1	0.9	0.8	1.0	1.5	1.1	--	--	2.4
Lakeshore Sonde[b]	7:45	Temp (°C)	25.1	25.1	25.2	25.2	25.2	25.2	25.2	25.2	25.2
		Sp. Cond (µS/cm)	3986	3985	3988	3988	3988	3988	3987	3988	3987
		pH	8.71	8.72	8.72	8.72	8.72	8.72	8.71	8.71	8.72
		DO (mg/L)	1.3	1.3	1.2	1.2	1.2	1.1	1.0	1.0	1.2
Grand Ave Sonde[a]	8:10	Temp (°C)	25.1	25.1	25.1	25.1	25.1	25.1	25.1	--	25.1
		Sp. Cond (µS/cm)	3983	3991	3986	3985	3986	3986	3994	--	3987
		pH	8.70	8.72	8.72	8.72	8.71	8.71	8.71	--	8.71
		DO (mg/L)	1.0	0.9	0.9	0.8	0.8	0.8	0.8	--	0.9

a- Bottom measurements taken at 5.5 meters.

b- Bottom measurements taken at 6.5 meters.

c- Bottom measurements taken at 4.5 meters.

Lake Elsinore October 5, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
LE01[a]	07:55	Temp (°C)	22.2	22.2	22.2	22.2	22.2	22.2	22.1	--	**22.2**
		Sp. Cond (µS/cm)	4122	4124	4124	4124	4125	4125	4124	--	**4124**
		pH	8.68	8.69	8.68	8.68	8.70	8.71	8.71	--	**8.69**
		DO (mg/L)	3.5	3.5	3.4	3.4	3.4	3.7	3.6	--	**3.5**
	14:48	Temp (°C)	25.2	23.1	22.9	22.7	22.3	22.1	22.0	--	**22.9**
		Sp. Cond (µS/cm)	4159	4127	4126	4124	4117	4108	4100	--	**4123**
		pH	9.04	8.85	8.84	8.81	8.76	8.72	8.71	--	**8.82**
		DO (mg/L)	13.1	7.1	7.0	6.3	4.5	3.8	3.5	--	**6.4**
LE02[b]	08:20	Temp (°C)	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	**22.2**
		Sp. Cond (µS/cm)	4128	4130	4130	4130	4130	4130	4130	4128	**4130**
		pH	8.78	8.75	8.75	8.74	8.74	8.74	8.74	8.74	**8.75**
		DO (mg/L)	4.6	4.2	4.1	3.9	3.8	3.7	3.7	3.3	**3.9**
	14:40	Temp (°C)	25.2	22.9	22.6	22.3	22.2	22.1	22.1	22.1	**22.7**
		Sp. Cond (µS/cm)	4140	4131	4134	4131	4129	4128	4129	4127	**4131**
		pH	9.13	8.91	8.75	8.74	8.71	8.70	8.70	8.63	**8.78**
		DO (mg/L)	14.4	9.5	3.7	3.0	2.5	2.4	2.3	2.1	**5.0**
LE03[c]	08:10	Temp (°C)	22.5	22.5	22.5	22.5	22.5	22.5	--	--	22.5
		Sp. Cond (µS/cm)	4121	4125	4126	4126	4125	4125	--	--	4125
		pH	8.77	8.72	8.70	8.70	8.71	8.70	--	--	8.72
		DO (mg/L)	3.9	3.7	3.5	3.5	3.5	3.4	--	--	3.6
	14:25	Temp (°C)	23.3	23.0	22.7	22.5	22.5	22.5	--	--	22.8
		Sp. Cond (µS/cm)	4121	4127	4128	4129	4129	4129	--	--	4127
		pH	8.89	8.79	8.73	8.71	8.69	8.70	--	--	8.75
		DO (mg/L)	7.3	4.1	3.4	2.8	2.5	2.4	--	--	3.8
Lakeshore Sonde[d]	--	Temp (°C)	--	--	--	--	--	--	--	--	--
		Sp. Cond (µS/cm)	--	--	--	--	--	--	--	--	--
		pH	--	--	--	--	--	--	--	--	--
		DO (mg/L)	--	--	--	--	--	--	--	--	--
Grand Ave Sonde[d]	--	Temp (°C)	--	--	--	--	--	--	--	--	--
		Sp. Cond (µS/cm)	--	--	--	--	--	--	--	--	--
		pH	--	--	--	--	--	--	--	--	--
		DO (mg/L)	--	--	--	--	--	--	--	--	--

a- Bottom measurements taken at 5.5 meters.

b- Bottom measurements taken at 6.5 meters.

c- Bottom measurements taken at 4.5 meters.

d-Lakeshore and Grand Avenue sonde water column profile not recorded, due to excessive wind.

Lake Elsinore December 21, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
LE01	0735	Temp (°C)	11.4	11.4	11.4	11.3	11.2	11.2	--	--	11.3
		Sp. Cond (µS/cm)	3662	3661	3663	3664	3664	3661	--	--	3663
		pH	8.75	8.74	8.74	8.71	8.69	8.67	--	--	8.72
		DO (mg/L)	8.2	8.1	8.1	7.3	6.9	6.0	--	--	7.4
	1445	Temp (°C)	12.2	11.6	11.5	11.4	11.2	11.2	--	--	11.5
		Sp. Cond (µS/cm)	3658	3659	3657	3658	3656	3654	--	--	3657
		pH	8.87	8.72	8.70	8.71	8.68	8.67	--	--	8.73
		DO (mg/L)	11.4	7.6	7.3	7.6	6.9	6.6	--	--	7.9
LE02	0815	Temp (°C)	11.6	11.7	11.7	11.7	11.6	11.6	11.6	--	11.6
		Sp. Cond (µS/cm)	3658	3659	3658	3659	3659	3659	3661	--	3659
		pH	8.72	8.70	8.70	8.70	8.69	8.68	8.62	--	8.69
		DO (mg/L)	7.6	7.4	7.3	7.4	7.2	7.0	5.5	--	7.1
	1458	Temp (°C)	13.4	11.9	11.7	11.6	11.6	11.5	11.5	--	11.9
		Sp. Cond (µS/cm)	3664	3658	3656	3656	3657	3657	3657	--	3658
		pH	8.98	8.77	8.70	8.69	8.71	8.61	8.61	--	8.72
		DO (mg/L)	15.9	9.3	7.9	7.4	8.0	5.7	5.3	--	8.5
LE03	0750	Temp (°C)	12.4	12.3	11.8	11.5	11.4	--	--	--	11.9
		Sp. Cond (µS/cm)	3648	3644	3657	3644	3644	--	--	--	3647
		pH	8.87	8.83	8.70	8.65	8.64	--	--	--	8.74
		DO (mg/L)	12.0	11.4	7.2	6.1	6.1	--	--	--	8.6
	1510	Temp (°C)	13.2	12.0	11.5	11.4	11.4	--	--	--	11.9
		Sp. Cond (µS/cm)	3660	3650	3618	3637	3640	--	--	--	3641
		pH	8.99	8.75	8.71	8.62	8.61	--	--	--	8.74
		DO (mg/L)	16.7	9.2	8.3	6.1	5.8	--	--	--	9.2
Lakeshore Sonde[a]	1110	Temp (°C)	12.1	11.8	11.6	11.6	11.6	11.5	11.5	11.4	11.6
		Sp. Cond (µS/cm)	3673	3663	3657	3657	3657	3657	3659	3658	3660
		pH	8.85	8.79	8.73	8.71	8.72	8.71	8.62	8.61	8.72
		DO (mg/L)	9.7	9.3	7.8	7.8	8.0	7.6	5.5	5.4	7.6
Grand Ave Sonde[b]	1040	Temp (°C)	12.4	12.1	11.8	11.8	11.7	11.7	11.7	--	11.9
		Sp. Cond (µS/cm)	3651	3659	3659	3658	3658	3658	3658	--	3657
		pH	8.85	8.80	8.76	8.74	8.70	8.66	8.66	--	8.74
		DO (mg/L)	11.5	9.9	9.1	8.5	7.3	6.5	6.4	--	8.4

a- Bottom measurements taken at 6.5 meters.

b- Bottom measurements taken at 5.5 meters.

Canyon Lake December 21, 2021 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	10 m	11 m	12 m	13 m	14 m	15 m	Water Column Mean - All	Water Column Mean - Epilimnion	Water Column Mean - Hypolimnion
CL07[a]	1110	Temp (°C)	13.4	13.4	13.2	13.2	13.2	13.1	13.1	13.1	13.1	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.1	--	--
		Sp. Cond (µS/cm)	941	941	941	941	941	940	939	938	937	937	938	938	938	938	942	947	940	--	--
		pH	7.53	7.52	7.51	7.49	7.48	7.47	7.44	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.42	7.42	7.46	--	--
		DO (mg/L)	6.1	6.1	5.8	5.7	5.5	5.3	5.1	5.1	5.2	5.2	5.2	5.2	5.3	5.3	5.3	5.2	5.4	--	--
	1515	Temp (°C)	14.1	13.8	13.5	13.2	13.2	13.2	13.1	13.1	13.1	13.1	13.1	13.0	13.0	13.0	13.0	13.0	13.2	--	--
		Sp. Cond (µS/cm)	942	943	941	941	940	940	939	939	937	937	937	938	938	939	941	957	941	--	--
		pH	7.58	7.59	7.59	7.54	7.52	7.49	7.47	7.46	7.44	7.43	7.43	7.42	7.42	7.42	7.41	7.41	7.48	--	--
		DO (mg/L)	6.9	7.0	6.6	6.0	5.7	5.6	5.3	5.2	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.1	5.6	--	--
CL08[b]	1022	Temp (°C)	13.2	13.2	13.2	13.1	13.1	13.1	13.1	13.1	13.1	13.1	--	--	--	--	--	--	13.1	--	--
		Sp. Cond (µS/cm)	935	935	935	935	935	935	937	936	934	934	--	--	--	--	--	--	935	--	--
		pH	7.69	7.69	7.68	7.65	7.65	7.64	7.56	7.51	7.49	7.48	--	--	--	--	--	--	7.60	--	--
		DO (mg/L)	7.7	7.6	7.5	7.4	7.4	7.3	6.0	5.5	5.3	5.2	--	--	--	--	--	--	6.7	--	--
	1500	Temp (°C)	13.8	13.4	13.3	13.2	13.2	13.2	13.1	13.1	13.1	13.1	--	--	--	--	--	--	13.3	--	--
		Sp. Cond (µS/cm)	937	936	936	936	935	936	937	937	936	936	--	--	--	--	--	--	936	--	--
		pH	7.86	7.86	7.80	7.71	7.68	7.64	7.58	7.52	7.50	7.48	--	--	--	--	--	--	7.66	--	--
		DO (mg/L)	9.0	9.3	8.1	7.7	7.3	7.0	5.9	5.7	5.4	5.3	--	--	--	--	--	--	7.1	--	--
CL09	0917	Temp (°C)	12.0	12.0	12.0	12.0	12.0	11.9	11.9	11.8	--	--	--	--	--	--	--	--	12.0	--	--
		Sp. Cond (µS/cm)	1039	1039	1039	1043	1049	1057	1067	1075	--	--	--	--	--	--	--	--	1051	--	--
		pH	7.77	7.76	7.75	7.73	7.71	7.71	7.77	7.82	--	--	--	--	--	--	--	--	7.75	--	--
		DO (mg/L)	8.1	8.0	7.9	7.6	7.5	7.5	8.2	8.5	--	--	--	--	--	--	--	--	7.9	--	--
	1437	Temp (°C)	13.0	12.4	12.1	12.0	12.0	12.0	12.0	11.8	--	--	--	--	--	--	--	--	12.2	--	--
		Sp. Cond (µS/cm)	1029	1033	1037	1041	1043	1046	1061	1080	--	--	--	--	--	--	--	--	1046	--	--
		pH	7.94	7.94	7.86	7.79	7.76	7.76	7.76	7.83	--	--	--	--	--	--	--	--	7.83	--	--
		DO (mg/L)	9.2	9.4	8.2	8.0	8.0	8.0	8.0	8.6	--	--	--	--	--	--	--	--	8.4	--	--
CL10	0823	Temp (°C)	12.1	12.1	12.1	11.7	--	--	--	--	--	--	--	--	--	--	--	--	12.0	--	--
		Sp. Cond (µS/cm)	1047	1046	1047	1084	--	--	--	--	--	--	--	--	--	--	--	--	1056	--	--
		pH	7.89	7.89	7.89	7.91	--	--	--	--	--	--	--	--	--	--	--	--	7.90	--	--
		DO (mg/L)	9.3	9.2	9.2	9.1	--	--	--	--	--	--	--	--	--	--	--	--	9.2	--	--
	1423	Temp (°C)	12.9	12.8	12.2	12.1	--	--	--	--	--	--	--	--	--	--	--	--	12.5	--	--
		Sp. Cond (µS/cm)	1042	1044	1041	1100	--	--	--	--	--	--	--	--	--	--	--	--	1057	--	--
		pH	8.16	8.18	8.06	7.92	--	--	--	--	--	--	--	--	--	--	--	--	8.08	--	--
		DO (mg/L)	11.1	11.3	10.2	8.9	--	--	--	--	--	--	--	--	--	--	--	--	10.3	--	--

Notes:

Hypolimnion

Epilimnion

Thermocline

No shading indicates no observed thermocline; lake well mixed

a- Bottom measurements taken at 14.5 meters.

b- Bottom measurements taken at 8.5 meters

Lake Elsinore February 17, 2022 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
$LE01_a$	1055	Temp (°C)	13.4	13.3	13.2	13.2	13.2	13.1	13.1	--	13.2
		Sp. Cond (µS/cm)	3657	3657	3657	3657	3657	3658	3657	--	3657
		pH	8.93	8.90	8.89	8.88	8.87	8.87	8.86	--	8.89
		DO (mg/L)	10.9	10.9	10.7	10.5	10.4	10.3	10.3	--	10.6
	1624	Temp (°C)	13.6	13.6	13.6	13.6	13.6	13.1	--	--	13.5
		Sp. Cond (µS/cm)	3656	3656	3657	3657	3657	3661	--	--	3657
		pH	9.02	8.97	8.93	8.92	8.92	8.88	--	--	8.94
		DO (mg/L)	11.4	11.4	11.4	11.3	11.3	9.8	--	--	11.1
$LE02_b$	0818	Temp (°C)	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
		Sp. Cond (µS/cm)	3663	3663	3663	3663	3663	3664	3664	3664	3663
		pH	8.86	8.83	8.83	8.82	8.82	8.82	8.82	8.81	8.83
		DO (mg/L)	9.9	9.9	9.9	9.8	9.8	9.8	9.8	9.7	9.8
	1500	Temp (°C)	13.6	13.6	13.6	13.5	13.4	13.1	13.1	13.0	13.4
		Sp. Cond (µS/cm)	3659	3659	3660	3661	3661	3662	3661	3662	3661
		pH	8.95	8.92	8.91	8.90	8.89	8.88	8.87	8.86	8.90
		DO (mg/L)	11.7	11.7	11.7	11.2	11.2	10.8	10.6	10.4	11.2
$LE03_c$	0800	Temp (°C)	12.9	12.9	12.9	12.9	12.9	12.9	--	--	12.9
		Sp. Cond (µS/cm)	3664	3662	3663	3663	3664	3664	--	--	3663
		pH	8.85	8.84	8.84	8.84	8.84	8.83	--	--	8.84
		DO (mg/L)	10.5	10.4	10.3	10.3	10.2	10.2	--	--	10.3
	1451	Temp (°C)	13.6	13.5	13.5	13.4	12.8	12.8	--	--	13.3
		Sp. Cond (µS/cm)	3665	3663	3662	3664	3665	3662	--	--	3664
		pH	9.03	8.96	8.95	8.93	8.89	8.88	--	--	8.94
		DO (mg/L)	11.8	11.8	11.7	11.5	10.8	10.6	--	--	11.4
Lakeshore Sonde	1600	Temp (°C)	13.5	13.5	13.5	13.4	13.4	13.1	12.9	--	13.3
		Sp. Cond (µS/cm)	3659	3659	3659	3660	3660	3662	3662	--	3660
		pH	8.94	8.93	8.92	8.91	8.90	8.88	8.86	--	8.91
		DO (mg/L)	11.5	11.5	11.5	11.3	10.9	10.2	9.9	--	11.0
Grand Ave Sonde[d]	1530	Temp (°C)	13.4	13.3	13.3	13.3	13.3	13.1	13.0	--	13.2
		Sp. Cond (µS/cm)	3661	3660	3661	3661	3661	3660	3661	--	3661
		pH	9.00	8.94	8.92	8.91	8.90	8.89	8.88	--	8.92
		DO (mg/L)	11.1	11.1	11.1	11.1	10.9	10.3	10.2	--	10.8

a- Bottom measurements taken at 5.3 meters in the morning.

b- Bottom measurements taken at 6.5 meters.

c- Bottom measurements taken at 4.5 meters.

d- Bottom measurements taken at 5.5 meters.

Canyon Lake February 17, 2022 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	10 m	11 m	12 m	13 m	14 m	15 m	Water Column Mean - All	Water Column Mean - Epilimnion	Water Column Mean - Hypolimnion
CL07	1055	Temp (°C)	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
		Sp. Cond (µS/cm)	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
		pH	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
		DO (mg/L)	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
	1525	Temp (°C)	13.9	13.8	13.6	13.5	13.4	13.3	13.3	12.9	12.8	12.6	12.4	12.1	11.9	11.8	11.8	11.7	12.8	--	--
		Sp. Cond (µS/cm)	896	897	898	898	899	899	899	902	902	905	907	910	913	912	912	911	904	--	--
		pH	8.95	8.94	8.82	8.80	8.79	8.13	8.16	8.06	8.02	7.73	7.49	7.38	7.35	7.32	7.39	6.80	8.01	--	--
		DO (mg/L)	12.8	12.7	12.5	12.4	12.2	12.2	12.1	11.6	11.4	9.4	6.5	5.1	2.9	2.3	2.1	0.3	8.6	--	--
CL08	1005	Temp (°C)	13.3	13.2	13.1	13.1	13.1	12.9	12.2	11.9	11.8	11.8	--	--	--	--	--	--	12.6	--	--
		Sp. Cond (µS/cm)	897	897	897	898	902	902	913	915	913	913	--	--	--	--	--	--	905	--	--
		pH	8.83	8.82	8.81	8.80	8.80	8.76	8.33	8.21	8.20	8.17	--	--	--	--	--	--	8.57	--	--
		DO (mg/L)	12.2	12.1	11.9	11.5	11.3	9.5	6.0	3.6	3.1	2.2	--	--	--	--	--	--	8.3	--	--
	1510	Temp (°C)	13.6	13.2	13.2	13.0	13.0	12.5	12.3	11.9	11.8	11.8	--	--	--	--	--	--	12.6	--	--
		Sp. Cond (µS/cm)	898	898	898	900	902	909	911	915	914	914	--	--	--	--	--	--	906	--	--
		pH	8.85	8.75	8.67	8.40	8.35	7.06	7.33	7.06	6.90	6.86	--	--	--	--	--	--	7.82	--	--
		DO (mg/L)	12.4	11.6	11.0	9.9	9.5	7.9	6.3	3.2	2.6	2.3	--	--	--	--	--	--	7.7	--	--
CL09$_{a}$	0900	Temp (°C)	13.3	13.4	13.3	13.1	12.4	12.4	12.3	11.8	--	--	--	--	--	--	--	--	12.8	--	--
		Sp. Cond (µS/cm)	972	972	974	987	1036	1020	1035	1038	--	--	--	--	--	--	--	--	1004	--	--
		pH	8.96	8.90	8.89	8.76	8.30	8.31	8.21	8.01	--	--	--	--	--	--	--	--	8.54	--	--
		DO (mg/L)	14.5	14.2	14.1	12.1	2.9	4.1	1.1	0.5	--	--	--	--	--	--	--	--	7.9	--	--
	1435	Temp (°C)	14.5	14.4	13.4	12.9	12.7	12.3	12.0	11.8	11.7	--	--	--	--	--	--	--	12.9	--	--
		Sp. Cond (µS/cm)	970	968	980	1012	1029	1046	1040	1035	1032	--	--	--	--	--	--	--	1012	--	--
		pH	8.98	8.97	8.93	8.28	8.02	6.98	6.96	6.92	6.92	--	--	--	--	--	--	--	7.88	--	--
		DO (mg/L)	14.9	14.9	14.1	6.8	4.6	1.0	0.8	0.3	0.2	--	--	--	--	--	--	--	6.4	--	--
CL10$_{b}$	0800	Temp (°C)	13.4	13.4	13.3	13.1	13.0	--	--	--	--	--	--	--	--	--	--	--	13.2	--	--
		Sp. Cond (µS/cm)	991	993	992	1022	1058	--	--	--	--	--	--	--	--	--	--	--	1011	--	--
		pH	8.72	8.63	8.67	8.23	8.20	--	--	--	--	--	--	--	--	--	--	--	8.49	--	--
		DO (mg/L)	12.3	12.4	12.3	8.7	6.6	--	--	--	--	--	--	--	--	--	--	--	10.5	--	--
	1415	Temp (°C)	14.8	14.7	14.3	14.1	--	--	--	--	--	--	--	--	--	--	--	--	14.5	--	--
		Sp. Cond (µS/cm)	991	995	1006	1010	--	--	--	--	--	--	--	--	--	--	--	--	1001	--	--
		pH	8.82	8.83	8.80	8.79	--	--	--	--	--	--	--	--	--	--	--	--	8.81	--	--
		DO (mg/L)	13.6	13.6	12.7	12.4	--	--	--	--	--	--	--	--	--	--	--	--	13.1	--	--

Notes:

Hypolimnion

Epilimnion

Thermocline

No shading indicates no observed thermocline; lake well mixed

N/A- not applicable; ME- Meter error during morning water quality sampling.

a- Bottom measurements taken at 7.5 meters in the afternoon.

b- Bottom measurements taken at 3.5 meters in the morning.

Lake Elsinore April 13, 2022 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	Water Column Mean
LE01	1105	Temp (°C)	19.7	19.6	19.5	19.5	19.5	19.3	--	--	19.5
		Sp. Cond (µS/cm)	3675	3672	3673	3674	3676	3684	--	--	3676
		pH	9.15	9.08	9.07	9.05	9.04	9.01	--	--	9.07
		DO (mg/L)	8.4	7.0	6.8	6.6	6.3	5.4	--	--	6.7
	1455	Temp (°C)	22.7	20.0	19.8	19.6	19.5	19.4	--	--	20.2
		Sp. Cond (µS/cm)	3718	3688	3685	3683	3681	3686	--	--	3690
		pH	9.22	9.14	9.07	9.05	9.03	9.03	--	--	9.09
		DO (mg/L)	13.2	8.7	7.7	6.5	6.3	6.4	--	--	8.1
LE02	0755	Temp (°C)	18.7	18.8	18.8	18.8	18.8	18.7	18.7	--	18.8
		Sp. Cond (µS/cm)	3675	3674	3674	3674	3674	3674	3674	--	3674
		pH	8.94	8.93	8.93	8.93	8.92	8.92	8.92	--	8.93
		DO (mg/L)	4.7	4.4	4.4	4.4	4.3	4.3	4.3	--	4.4
	1445	Temp (°C)	24.0	20.2	19.6	19.3	18.7	18.6	18.5	--	19.8
		Sp. Cond (µS/cm)	3712	3701	3684	3684	3680	3680	3680	--	3689
		pH	9.25	9.19	9.04	9.06	8.94	8.93	8.90	--	9.04
		DO (mg/L)	14.2	9.2	6.9	7.2	5.4	4.8	4.1	--	7.4
LE03$_a$	0745	Temp (°C)	18.6	18.6	18.6	18.6	18.6	18.6	--	--	18.6
		Sp. Cond (µS/cm)	3666	3668	3669	3670	3670	3670	--	--	3669
		pH	8.98	8.99	8.99	8.99	8.99	8.99	--	--	8.99
		DO (mg/L)	5.9	5.8	5.7	5.7	5.6	5.7	--	--	5.7
	1435	Temp (°C)	20.4	18.8	18.7	18.5	18.4	18.4	--	--	18.9
		Sp. Cond (µS/cm)	3701	3690	3680	3678	3677	3677	--	--	3684
		pH	9.21	9.13	9.03	8.98	8.95	8.95	--	--	9.04
		DO (mg/L)	11.8	8.0	6.0	5.4	4.7	4.6	--	--	6.8
Lakeshore Sonde$_b$	1050	Temp (°C)	20.7	20.1	19.3	19.1	18.9	18.7	18.7	18.6	19.3
		Sp. Cond (µS/cm)	3683	3681	3677	3673	3675	3675	3674	3674	3677
		pH	9.15	9.16	9.05	9.03	8.98	8.93	8.92	8.92	9.02
		DO (mg/L)	9.8	10.4	6.7	6.1	5.3	4.6	4.5	4.4	6.5
Grand Ave Sonde	1030	Temp (°C)	20.2	19.0	18.5	18.5	18.4	18.4	--	--	18.8
		Sp. Cond (µS/cm)	3683	3690	3675	3674	3674	3674	--	--	3678
		pH	8.97	8.95	8.91	8.91	8.91	8.91	--	--	8.93
		DO (mg/L)	6.5	5.3	4.1	4.1	4.2	4.3	--	--	4.7

a- Bottom measurements taken at 4.5 meters.

b- Bottom measurements taken at 6.5 meters.

Canyon Lake April 13, 2022 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	10 m	11 m	12 m	13 m	14 m	15 m	Water Column Mean - All	Water Column Mean - Epilimnion	Water Column Mean - Hypolimnion
CL07	1045	Temp (°C)	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
		Sp. Cond (µS/cm)	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
		pH	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
		DO (mg/L)	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	N/A	--	--
	1545	Temp (°C)	21.4	21.1	20.2	19.3	19.2	18.8	15.5	14.1	13.4	13.1	13.0	12.9	12.8	12.8	12.8	12.8	15.8	20.0	13.0
		Sp. Cond (µS/cm)	979	981	977	974	975	976	980	970	969	969	969	971	971	971	970	970	973	977	970
		pH	8.55	8.53	8.53	8.52	8.49	8.04	7.45	7.40	7.40	7.41	7.40	7.39	7.38	7.39	7.39	7.40	7.79	8.44	7.40
		DO (mg/L)	10.9	11.0	11.2	11.3	11.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	10.5	0.0
CL08	0950	Temp (°C)	19.8	19.8	19.5	19.4	19.4	17.4	16.0	14.4	13.4	13.1	--	--	--	--	--	--	17.2	19.6	13.3
		Sp. Cond (µS/cm)	968	969	970	971	972	984	979	974	973	942	--	--	--	--	--	--	970	970	957.5
		pH	8.60	8.59	8.55	8.54	8.53	7.74	7.40	7.38	7.34	7.15	--	--	--	--	--	--	7.98	8.56	7.2
		DO (mg/L)	10.8	10.9	10.6	10.5	10.4	0.5	0.0	0.0	0.0	0.0	--	--	--	--	--	--	5.4	10.6	0.0
	1525	Temp (°C)	21.5	21.4	20.4	19.8	19.4	17.8	16.3	14.6	13.6	13.4	--	--	--	--	--	--	17.8	20.5	13.5
		Sp. Cond (µS/cm)	971	972	970	970	971	985	979	971	971	972	--	--	--	--	--	--	973	971	971.5
		pH	8.63	8.61	8.61	8.60	8.57	7.61	7.45	7.40	7.39	7.39	--	--	--	--	--	--	8.03	8.60	7.4
		DO (mg/L)	11.4	11.4	11.7	11.7	11.3	3.2	0.0	0.0	0.0	0.0	--	--	--	--	--	--	6.1	11.5	0.0
CL09[a]	0855	Temp (°C)	19.6	19.7	19.8	19.7	19.7	17.2	15.1	13.2	13.0	--	--	--	--	--	--	--	17.4	19.7	13.1
		Sp. Cond (µS/cm)	1132	1132	1132	1132	1132	1090	1085	1101	1101	--	--	--	--	--	--	--	1115	1132	1101
		pH	8.34	8.32	8.32	8.35	8.36	7.41	7.33	7.15	7.14	--	--	--	--	--	--	--	7.86	8.34	7.15
		DO (mg/L)	9.9	10.0	10.1	10.2	10.2	0.0	0.0	0.0	0.0	--	--	--	--	--	--	--	5.6	10.1	0.0
	1455	Temp (°C)	22.0	20.7	20.2	20.0	19.8	17.5	15.0	13.7	13.2	--	--	--	--	--	--	--	18.0	20.5	13.5
		Sp. Cond (µS/cm)	1134	1133	1137	1138	1139	1097	1089	1094	1100	--	--	--	--	--	--	--	1118	1136	1097
		pH	8.40	8.38	8.36	8.34	8.28	7.47	7.34	7.21	7.18	--	--	--	--	--	--	--	7.88	8.35	7.20
		DO (mg/L)	10.8	10.9	10.7	10.5	9.9	0.0	0.0	0.0	0.0	--	--	--	--	--	--	--	5.9	10.5	0.0
CL10[b]	0800	Temp (°C)	19.8	19.8	19.8	19.8	19.8	--	--	--	--	--	--	--	--	--	--	--	19.8	--	--
		Sp. Cond (µS/cm)	1140	1144	1144	1144	1144	--	--	--	--	--	--	--	--	--	--	--	1143	--	--
		pH	8.21	8.18	8.22	8.27	8.30	--	--	--	--	--	--	--	--	--	--	--	8.24	--	--
		DO (mg/L)	10.2	10.3	10.3	10.2	10.2	--	--	--	--	--	--	--	--	--	--	--	10.3	--	--
	1435	Temp (°C)	22.4	20.6	20.2	20.1	--	--	--	--	--	--	--	--	--	--	--	--	20.8	--	--
		Sp. Cond (µS/cm)	1148	1149	1148	1154	--	--	--	--	--	--	--	--	--	--	--	--	1150	--	--
		pH	8.46	8.43	8.45	8.36	--	--	--	--	--	--	--	--	--	--	--	--	8.43	--	--
		DO (mg/L)	11.6	11.2	11.5	10.6	--	--	--	--	--	--	--	--	--	--	--	--	11.2	--	--

Notes:

Hypolimnion

Epilimnion

Thermocline

No shading indicates no observed thermocline; lake well mixed

N/A- not applicable; ME- meter error

a- Bottom measurements taken at 7.5 meters.

b- Bottom measurements taken at 3.5 meters

Lake Elsinore June 9, 2022 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	Water Column Mean
LE01[a]	1045	Temp (°C)	27.5	24.7	24.2	24.1	23.9	23.9	--	24.7
		Sp. Cond (µS/cm)	4102	4082	4076	4075	4071	4074	--	4080
		pH	9.07	8.85	8.79	8.76	8.75	8.74	--	8.83
		DO (mg/L)	12.1	4.0	2.3	2.1	2.3	2.1	--	4.1
	1510	Temp (°C)	27.7	26.2	25.2	24.5	24.3	24.3	--	25.4
		Sp. Cond (µS/cm)	4103	4092	4089	4078	4076	4076	--	4086
		pH	9.04	9.01	8.97	8.77	8.73	8.72	--	8.87
		DO (mg/L)	13.9	15.8	11.1	3.9	2.7	0.6	--	8.0
LE02[b]	0815	Temp (°C)	24.9	24.8	24.7	23.8	23.4	23.0	22.9	23.9
		Sp. Cond (µS/cm)	4072	4074	4075	4073	4070	4069	4070	4072
		pH	8.90	8.83	8.79	8.69	8.69	8.61	7.40	8.56
		DO (mg/L)	6.4	5.1	3.8	0.2	0.1	0.1	0.1	2.2
	1455	Temp (°C)	29.9	25.3	24.7	24.6	24.3	23.2	--	25.3
		Sp. Cond (µS/cm)	4012	4093	4081	4079	4076	4074	--	4069
		pH	9.09	8.90	8.76	8.75	8.71	8.62	--	8.81
		DO (mg/L)	15.9	9.0	4.0	3.9	2.0	0.4	--	5.9
LE03	0800	Temp (°C)	25.1	25.1	24.8	23.4	23.1	--	--	24.3
		Sp. Cond (µS/cm)	4063	4065	4068	4056	4063	--	--	4063
		pH	8.91	8.88	8.79	8.64	8.61	--	--	8.77
		DO (mg/L)	7.8	6.6	4.7	0.3	0.2	--	--	3.9
	1445	Temp (°C)	28.2	24.8	24.3	23.9	23.8	--	--	25.0
		Sp. Cond (µS/cm)	4103	4084	4081	4076	4075	--	--	4084
		pH	9.11	8.85	8.73	8.67	8.66	--	--	8.80
		DO (mg/L)	16.2	5.0	2.7	0.3	0.3	--	--	4.9
Lakeshore Sonde	1030	Temp (°C)	26.1	24.9	24.6	24.6	23.8	23.5	23.3	24.4
		Sp. Cond (µS/cm)	4089	4085	4080	4078	4090	4075	4073	4081
		pH	9.11	8.89	8.83	8.80	8.71	8.70	8.66	8.81
		DO (mg/L)	11.3	5.9	3.8	3.6	0.6	0.3	0.0	3.6
Grand Ave Sonde	1020	Temp (°C)	25.8	25.1	24.9	24.6	23.9	23.1	--	24.6
		Sp. Cond (µS/cm)	4102	4083	4079	4078	4083	4078	--	4084
		pH	9.02	8.91	8.88	8.83	8.72	8.65	--	8.84
		DO (mg/L)	8.4	6.3	5.3	4.4	0.2	0.2	--	4.1

a- Bottom measurements taken at 4.5 meters.
b- Bottom measurements taken at 5.5 meters.

Canyon Lake June 9, 2022 Water Column Profiles

Site	Time	Measure	Surface	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	10 m	11 m	12 m	13 m	14 m	15 m	Water Column Mean - All	Water Column Mean - Epilimnion	Water Column Mean - Hypolimnion
CL07$_a$	1115	Temp (°C)	27.6	27.1	27.0	26.5	26.2	25.7	25.4	24.7	22.7	20.8	19.3	16.9	15.5	14.7	14.4	14.2	21.8	26.3	14.4
		Sp. Cond (µS/cm)	1033	1031	1030	1030	1030	1028	1041	1036	1019	1010	1003	985	986	983	982	983	1013	1032	983
		pH	8.45	8.41	8.39	8.42	8.43	8.42	8.37	8.30	8.13	7.71	7.49	7.33	7.24	7.20	7.18	7.17	7.92	8.40	7.18
		DO (mg/L)	9.0	9.1	9.1	9.6	9.5	9.4	9.1	8.1	6.3	1.5	0.5	0.2	0.1	0.0	0.0	0.0	5.1	9.1	0.0
	1517	Temp (°C)	28.5	27.6	27.4	26.8	26.3	25.8	25.2	24.6	23.6	21.3	20.1	17.8	16.4	15.2	14.8	14.2	22.2	26.5	14.7
		Sp. Cond (µS/cm)	1035	1033	1031	1029	1028	1030	1038	1035	1023	1009	1006	990	985	981	981	983	1014	1032	982
		pH	8.45	8.46	8.45	8.47	8.49	8.47	8.43	8.35	8.22	7.75	7.63	7.54	7.40	7.24	7.18	7.13	7.98	8.45	7.18
		DO (mg/L)	9.1	9.2	9.2	9.6	9.7	9.7	9.3	8.5	7.6	2.3	1.4	0.7	0.4	0.2	0.1	0.0	5.4	9.3	0.1
CL08$_b$	1026	Temp (°C)	27.1	26.7	26.7	26.6	26.2	25.7	25.2	22.8	21.6	20.4	--	--	--	--	--	--	24.9	26.3	20.4
		Sp. Cond (µS/cm)	1030	1028	1028	1027	1027	1026	1025	1017	1009	1003	--	--	--	--	--	--	1022	1027	1003
		pH	8.44	8.37	8.38	8.40	8.42	8.40	8.36	7.88	7.50	7.42	--	--	--	--	--	--	8.16	8.40	7.42
		DO (mg/L)	8.9	8.9	8.9	8.9	9.3	9.3	9.1	3.8	1.1	0.5	--	--	--	--	--	--	6.9	9.0	0.5
	1453	Temp (°C)	28.3	27.5	27.0	26.7	26.0	25.8	25.6	24.5	23.2	22.5	--	--	--	--	--	--	25.7	26.7	22.5
		Sp. Cond (µS/cm)	1034	1031	1029	1028	1027	1026	1026	1027	1020	1017	--	--	--	--	--	--	1027	1029	1017
		pH	8.39	8.38	8.40	8.40	8.44	8.43	8.40	8.28	8.06	7.81	--	--	--	--	--	--	8.30	8.41	7.81
		DO (mg/L)	9.0	9.1	9.2	9.3	9.6	9.6	9.5	8.5	5.5	4.3	--	--	--	--	--	--	8.4	9.3	4.3
CL09	0928	Temp (°C)	27.0	26.6	26.4	26.0	25.4	24.7	23.6	20.7	--	--	--	--	--	--	--	--	25.1	26.0	20.7
		Sp. Cond (µS/cm)	1152	1150	1157	1205	1202	1181	1171	1175	--	--	--	--	--	--	--	--	1174	1175	1175
		pH	8.52	8.47	8.44	8.27	8.03	7.96	7.67	7.37	--	--	--	--	--	--	--	--	8.09	8.28	7.37
		DO (mg/L)	10.0	10.1	10.1	8.6	6.7	5.9	0.9	0.4	--	--	--	--	--	--	--	--	6.6	8.6	0.4
	1423	Temp (°C)	28.4	27.3	27.0	26.6	26.3	25.7	25.0	23.6	--	--	--	--	--	--	--	--	26.2	26.9	23.6
		Sp. Cond (µS/cm)	1140	1143	1154	1160	1189	1206	1194	1174	--	--	--	--	--	--	--	--	1170	1165	1174
		pH	8.40	8.40	8.37	8.40	8.33	8.06	7.83	7.54	--	--	--	--	--	--	--	--	8.17	8.33	7.54
		DO (mg/L)	10.0	10.5	10.9	11.3	9.6	6.8	5.4	0.6	--	--	--	--	--	--	--	--	8.1	9.9	0.6
CL10$_c$	0825	Temp (°C)	26.5	26.5	26.4	26.0	25.9	--	--	--	--	--	--	--	--	--	--	--	26.3	--	--
		Sp. Cond (µS/cm)	1185	1191	1209	1227	1233	--	--	--	--	--	--	--	--	--	--	--	1209	--	--
		pH	8.39	8.40	8.35	8.08	7.86	--	--	--	--	--	--	--	--	--	--	--	8.22	--	--
		DO (mg/L)	10.4	10.4	9.9	7.6	5.6	--	--	--	--	--	--	--	--	--	--	--	8.8	--	--
	1408	Temp (°C)	28.9	28.0	27.2	26.8	26.7	--	--	--	--	--	--	--	--	--	--	--	27.5	--	--
		Sp. Cond (µS/cm)	1197	1194	1194	1188	1184	--	--	--	--	--	--	--	--	--	--	--	1191	--	--
		pH	8.39	8.31	8.33	8.34	8.33	--	--	--	--	--	--	--	--	--	--	--	8.34	--	--
		DO (mg/L)	10.5	11.0	11.2	11.3	11.1	--	--	--	--	--	--	--	--	--	--	--	11.0	--	--

Notes:

Hypolimnion

Epilimnion

Thermocline

No shading indicates no observed thermocline; lake well mixed

a- Bottom measurements taken at 14.5 meters.

b- Bottom measurements taken at 8.5 meters.

c- Bottom measurements taken at 3.5 meters.

APPENDIX C - LAKE MONITORING ANALYTICAL REPORTS

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1G15080	**Report Date:**	8/12/2021
		Received Date:	7/15/2021
Project:	LE TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 7/15/21 with the Chain-of-Custody document. The samples were received in good condition, at 12.0 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 12:34

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
LE02	Marisa Swiderski	1G15080-01	Water	07/15/21 10:00	

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 12:34

Sample Results

Sample: LE02 — Sampled: 07/15/21 10:00 by Marisa Swiderski

1G15080-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1G1339 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/26/21 17:45				**Analyst:** YMT
Ammonia as N	**0.35**	0.047	0.10	mg/l	1	07/27/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1G1519 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/28/21 15:56				**Analyst:** YMT
TKN	**4.3**	0.065	0.10	mg/l	1	07/30/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1G0830 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/16/21 14:58				**Analyst:** sar
Nitrate as N	ND	0.040	0.20	mg/l	1	07/16/21 17:06	
Nitrite as N	ND	0.042	0.10	mg/l	1	07/16/21 18:01	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1G0839 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/16/21 17:27				**Analyst:** sbn
o-Phosphate as P	**0.012**	0.0030	0.010	mg/l	1	07/16/21 18:23	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1G1173 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/22/21 14:45				**Analyst:** sbn
Phosphorus as P, Total	**0.072**	0.0067	0.010	mg/l	1	07/29/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1G1000 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/20/21 13:52				**Analyst:** blg
Total Dissolved Solids	**2000**	4.0	10	mg/l	1	07/21/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1G0873 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 07/21/21 12:00				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	07/21/21	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 12:34

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1G0830 - EPA 353.2											
Blank (W1G0830-BLK1)					**Prepared & Analyzed: 07/16/21**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W1G0830-BS1)					**Prepared & Analyzed: 07/16/21**						
Nitrate as N	1.02	0.040	0.20	mg/l	1.00		102	90-110			
Nitrite as N	1.06	0.042	0.10	mg/l	1.00		106	90-110			
Matrix Spike (W1G0830-MS1)	**Source: 1G13005-01**				**Prepared & Analyzed: 07/16/21**						
Nitrate as N	3.65	0.040	0.20	mg/l	2.00	1.57	104	90-110			
Nitrite as N	1.07	0.042	0.10	mg/l	1.00	ND	107	90-110			
Matrix Spike (W1G0830-MS2)	**Source: 1G13005-02**				**Prepared & Analyzed: 07/16/21**						
Nitrate as N	3.52	0.040	0.20	mg/l	2.00	1.40	106	90-110			
Nitrite as N	1.09	0.042	0.10	mg/l	1.00	ND	109	90-110			
Matrix Spike Dup (W1G0830-MSD1)	**Source: 1G13005-01**				**Prepared & Analyzed: 07/16/21**						
Nitrate as N	3.65	0.040	0.20	mg/l	2.00	1.57	104	90-110	0	20	
Nitrite as N	1.08	0.042	0.10	mg/l	1.00	ND	108	90-110	0.9	20	
Matrix Spike Dup (W1G0830-MSD2)	**Source: 1G13005-02**				**Prepared & Analyzed: 07/16/21**						
Nitrate as N	3.46	0.040	0.20	mg/l	2.00	1.40	103	90-110	2	20	
Nitrite as N	1.10	0.042	0.10	mg/l	1.00	ND	110	90-110	0.9	20	
Batch: W1G0839 - EPA 365.3											
Blank (W1G0839-BLK1)					**Prepared & Analyzed: 07/16/21**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W1G0839-BS1)					**Prepared & Analyzed: 07/16/21**						
o-Phosphate as P	0.205	0.0030	0.010	mg/l	0.200		102	88-111			
Matrix Spike (W1G0839-MS1)	**Source: 1G15080-01**				**Prepared & Analyzed: 07/16/21**						
o-Phosphate as P	0.218	0.0030	0.010	mg/l	0.200	0.0120	103	85-112			
Matrix Spike Dup (W1G0839-MSD1)	**Source: 1G15080-01**				**Prepared & Analyzed: 07/16/21**						
o-Phosphate as P	0.215	0.0030	0.010	mg/l	0.200	0.0120	102	85-112	1	20	
Batch: W1G0873 - SM 4500S2-D											
Blank (W1G0873-BLK1)					**Prepared & Analyzed: 07/21/21**						
Sulfide, Total	ND	0.050	0.10	mg/l							
LCS (W1G0873-BS1)					**Prepared & Analyzed: 07/21/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.100		100	95-105			
Duplicate (W1G0873-DUP1)	**Source: 1G20040-05**				**Prepared & Analyzed: 07/21/21**						
Sulfide, Total	ND	0.050	0.10	mg/l		ND				20	
Batch: W1G1000 - SM 2540C											
Blank (W1G1000-BLK1)					**Prepared: 07/20/21 Analyzed: 07/21/21**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W1G1000-BS1)					**Prepared: 07/20/21 Analyzed: 07/21/21**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 12:34

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1G1000 - SM 2540C (Continued)											
LCS (W1G1000-BS1)					**Prepared: 07/20/21**	**Analyzed: 07/21/21**					
Total Dissolved Solids	820	4.0	10	mg/l	824		100	96-102			
Duplicate (W1G1000-DUP1)	**Source: 1G15092-03**				**Prepared: 07/20/21**	**Analyzed: 07/21/21**					
Total Dissolved Solids	8060	4.0	10	mg/l		8130			0.9	10	
Duplicate (W1G1000-DUP2)	**Source: 1G15094-02**				**Prepared: 07/20/21**	**Analyzed: 07/21/21**					
Total Dissolved Solids	2680	4.0	10	mg/l		2660			0.9	10	
Batch: W1G1173 - EPA 365.3											
Blank (W1G1173-BLK1)					**Prepared: 07/22/21**	**Analyzed: 07/29/21**					
Phosphorus as P, Total	ND	0.0067	0.010	mg/l							
LCS (W1G1173-BS1)					**Prepared: 07/22/21**	**Analyzed: 07/29/21**					
Phosphorus as P, Total	0.195	0.0067	0.010	mg/l	0.200		97	90-110			
Matrix Spike (W1G1173-MS1)	**Source: 1G15080-01**				**Prepared: 07/22/21**	**Analyzed: 07/29/21**					
Phosphorus as P, Total	0.283	0.0067	0.010	mg/l	0.200	0.0720	106	90-110			
Matrix Spike Dup (W1G1173-MSD1)	**Source: 1G15080-01**				**Prepared: 07/22/21**	**Analyzed: 07/29/21**					
Phosphorus as P, Total	0.280	0.0067	0.010	mg/l	0.200	0.0720	104	90-110	1	20	
Batch: W1G1339 - EPA 350.1											
Blank (W1G1339-BLK1)					**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	ND	0.047	0.10	mg/l							
Blank (W1G1339-BLK2)					**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	ND	0.047	0.10	mg/l							
LCS (W1G1339-BS1)					**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	0.241	0.047	0.10	mg/l	0.250		96	90-110			
LCS (W1G1339-BS2)					**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	0.248	0.047	0.10	mg/l	0.250		99	90-110			
Matrix Spike (W1G1339-MS1)	**Source: 1G19113-04**				**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	0.238	0.047	0.10	mg/l	0.250	ND	95	90-110			
Matrix Spike (W1G1339-MS2)	**Source: 1G20082-01**				**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	0.334	0.047	0.10	mg/l	0.250	0.0865	99	90-110			
Matrix Spike Dup (W1G1339-MSD1)	**Source: 1G19113-04**				**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	0.240	0.047	0.10	mg/l	0.250	ND	96	90-110	0.7	15	
Matrix Spike Dup (W1G1339-MSD2)	**Source: 1G20082-01**				**Prepared: 07/26/21**	**Analyzed: 07/27/21**					
Ammonia as N	0.336	0.047	0.10	mg/l	0.250	0.0865	100	90-110	0.5	15	
Batch: W1G1519 - EPA 351.2											
Blank (W1G1519-BLK1)					**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	ND	0.065	0.10	mg/l							
Blank (W1G1519-BLK2)					**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	ND	0.065	0.10	mg/l							
LCS (W1G1519-BS1)					**Prepared: 07/28/21**	**Analyzed: 07/30/21**					

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 12:34

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1G1519 - EPA 351.2 (Continued)											
LCS (W1G1519-BS1)					**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	1.05	0.065	0.10	mg/l	1.00		105	90-110			
LCS (W1G1519-BS2)					**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	1.06	0.065	0.10	mg/l	1.00		106	90-110			
Matrix Spike (W1G1519-MS1)	**Source: 1G14054-03**				**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	1.27	0.065	0.10	mg/l	1.00	0.660	61	90-110			MS-01
Matrix Spike (W1G1519-MS2)	**Source: 1G20037-01**				**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	1.25	0.065	0.10	mg/l	1.00	0.283	97	90-110			
Matrix Spike Dup (W1G1519-MSD1)	**Source: 1G14054-03**				**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	1.38	0.065	0.10	mg/l	1.00	0.660	72	90-110	9	10	MS-01
Matrix Spike Dup (W1G1519-MSD2)	**Source: 1G20037-01**				**Prepared: 07/28/21**	**Analyzed: 07/30/21**					
TKN	1.21	0.065	0.10	mg/l	1.00	0.283	93	90-110	4	10	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 12:34

Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
MS-01	The spike recovery for this QC sample is outside of established control limits possibly due to sample matrix interference.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1G15083	**Report Date:**	8/12/2021
		Received Date:	7/15/2021
Project:	1915100403 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 7/15/21 with the Chain-of-Custody document. The samples were received in good condition, at 12.0 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100403 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 13:04

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
LE02- Int	Marisa Swiderski	1G15083-01	Water	07/15/21 10:00	
LE02- Surf	Marisa Swiderski	1G15083-02	Water	07/15/21 10:25	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100403 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 13:04

Sample Results Enthalpy Orange

Sample: LE02- Int
1G15083-01 (Water)

Sampled: 07/15/21 10:00 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 271795 **Prepared:** 07/15/21 00:00 **Analyst:** MMP							
Chlorophyll a	**110**	1.0	1.0	mg/M3	1	08/05/21	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100403 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 13:04

Sample Results Enthalpy Orange

(Continued)

Sample: LE02- Surf
1G15083-02 (Water)

Sampled: 07/15/21 10:25 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 271795 **Prepared:** 07/15/21 00:00 **Analyst:** MMP							
Chlorophyll a	**130**	1.0	1.0	mg/M3	1	08/05/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100403 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 08/12/2021 13:04

Notes and Definitions

Item	Definition
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)

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

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

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

Certificate of Analysis

FINAL REPORT

Work Orders:	1H16098	**Report Date:**	9/10/2021
		Received Date:	8/16/2021
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 8/16/21 with the Chain-of-Custody document. The samples were received in good condition, at 4.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported:
09/10/2021 13:27

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07	Kate Buckley	1H16098-01	Water	08/16/21 10:50	
CL08	Kate Buckley	1H16098-02	Water	08/16/21 10:00	
CL09	Kate Buckley	1H16098-03	Water	08/16/21 09:05	
CL10	Kate Buckley	1H16098-04	Water	08/16/21 08:20	
LE02	Kate Buckley	1H16098-05	Water	08/16/21 09:00	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Sample Results

Sample: CL07 — 1H16098-01 (Water)

Sampled: 08/16/21 10:50 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1H1882 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/26/21 15:43				**Analyst:** YMT
Ammonia as N	**1.9**	0.047	0.10	mg/l	1	08/27/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1H1392 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/19/21 17:57				**Analyst:** YMT
TKN	**4.8**	0.065	0.10	mg/l	1	08/23/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1H1123 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/17/21 09:51				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	08/17/21 17:21	
Nitrite as N	ND	0.042	0.10	mg/l	1	08/17/21 17:21	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1H1154 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/17/21 15:03				**Analyst:** sbn
o-Phosphate as P	**0.10**	0.0030	0.010	mg/l	1	08/17/21 16:07	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1H1381 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/19/21 16:58				**Analyst:** sbn
Phosphorus as P, Total	**0.14**	0.0067	0.010	mg/l	1	08/23/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1H1515 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/23/21 10:40				**Analyst:** blg
Total Dissolved Solids	**510**	4.0	10	mg/l	1	08/23/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1H1513 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/23/21 10:33				**Analyst:** blg
Total Suspended Solids	**5**		5	mg/l	1	08/23/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1H1443 **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/20/21 11:53				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	08/20/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1H1531 **Preparation:** EPA 200.2			**Prepared:** 08/23/21 12:48				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	08/25/21	
Aluminum, Total	**0.046**	0.041	0.050	mg/l	1	08/25/21	J

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Sample Results

(Continued)

Sample: CL08 — 1H16098-02 (Water) — Sampled: 08/16/21 10:00 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W1H1882 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/26/21 15:43 — **Analyst:** ymt							
Ammonia as N	**0.77**	0.047	0.10	mg/l	1	08/27/21	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W1H1392 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/19/21 17:57 — **Analyst:** YMT							
TKN	**5.0**	0.13	0.20	mg/l	2	08/23/21	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W1H1123 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/17/21 09:51 — **Analyst:** ISM							
Nitrate as N	**0.049**	0.040	0.20	mg/l	1	08/17/21 17:50	J
Nitrite as N	ND	0.042	0.10	mg/l	1	08/17/21 17:50	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1H1154 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/17/21 15:03 — **Analyst:** sbn							
o-Phosphate as P	**0.017**	0.0030	0.010	mg/l	1	08/17/21 16:08	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1H1381 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/19/21 16:58 — **Analyst:** sbn							
Phosphorus as P, Total	**0.059**	0.0067	0.010	mg/l	1	08/23/21	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W1H1515 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/23/21 10:40 — **Analyst:** blg							
Total Dissolved Solids	**510**	4.0	10	mg/l	1	08/23/21	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W1H1513 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/23/21 10:33 — **Analyst:** blg							
Total Suspended Solids	**5**		5	mg/l	1	08/23/21	
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W1H1443 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/20/21 11:53 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	08/20/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W1H1531 — **Preparation:** EPA 200.2 — **Prepared:** 08/23/21 12:48 — **Analyst:** kvm							
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	08/25/21	
Aluminum, Total	**0.048**	0.041	0.050	mg/l	1	08/25/21	J

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Sample Results

(Continued)

Sample: CL09 — 1H16098-03 (Water) — Sampled: 08/16/21 9:05 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W1H1882 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/26/21 15:43 — **Analyst:** ymt							
Ammonia as N	**1.4**	0.047	0.10	mg/l	1	08/27/21	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W1H1392 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/19/21 17:57 — **Analyst:** YMT							
TKN	**4.6**	0.13	0.20	mg/l	2	08/23/21	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W1H1123 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/17/21 09:51 — **Analyst:** ISM							
Nitrate as N	ND	0.040	0.20	mg/l	1	08/17/21 17:51	
Nitrite as N	ND	0.042	0.10	mg/l	1	08/17/21 17:51	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1H1154 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/17/21 15:03 — **Analyst:** sbn							
o-Phosphate as P	**0.064**	0.0030	0.010	mg/l	1	08/17/21 16:08	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1H1381 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/19/21 16:58 — **Analyst:** sbn							
Phosphorus as P, Total	**0.14**	0.0067	0.010	mg/l	1	08/23/21	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W1H1515 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/23/21 10:40 — **Analyst:** blg							
Total Dissolved Solids	**600**	4.0	10	mg/l	1	08/23/21	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W1H1513 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/23/21 10:33 — **Analyst:** blg							
Total Suspended Solids	**11**		5	mg/l	1	08/23/21	
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W1H1443 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 08/20/21 11:53 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	08/20/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W1H1531 — **Preparation:** EPA 200.2 — **Prepared:** 08/23/21 12:48 — **Analyst:** kvm							
Aluminum, Dissolved	**0.054**	0.041	0.050	mg/l	1	08/25/21	
Aluminum, Total	**0.070**	0.041	0.050	mg/l	1	08/25/21	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Sample Results

(Continued)

Sample: CL10 — 1H16098-04 (Water)

Sampled: 08/16/21 8:20 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1H1882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/26/21 15:43				**Analyst:** ymt
Ammonia as N	ND	0.047	0.10	mg/l	1	08/27/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1H1392 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/19/21 17:57				**Analyst:** YMT
TKN	**4.4**	0.065	0.10	mg/l	1	08/23/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1H1123 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/17/21 09:51				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	08/17/21 17:52	
Nitrite as N	ND	0.042	0.10	mg/l	1	08/17/21 17:52	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1H1154 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/17/21 15:03				**Analyst:** sbn
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	08/17/21 16:09	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1H1381 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/19/21 16:58				**Analyst:** sbn
Phosphorus as P, Total	**0.072**	0.0067	0.010	mg/l	1	08/23/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1H1515 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/23/21 10:40				**Analyst:** blg
Total Dissolved Solids	**630**	4.0	10	mg/l	1	08/23/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1H1513 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/23/21 10:33				**Analyst:** blg
Total Suspended Solids	**14**		5	mg/l	1	08/23/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1H1443 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/20/21 11:53				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	08/20/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1H1531 — **Preparation:** EPA 200.2			**Prepared:** 08/23/21 12:48				**Analyst:** kvm
Aluminum, Dissolved	**0.056**	0.041	0.050	mg/l	1	08/25/21	
Aluminum, Total	**0.13**	0.041	0.050	mg/l	1	08/25/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Sample Results

(Continued)

Sample: LE02 — 1H16098-05 (Water)

Sampled: 08/16/21 9:00 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1H1882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/26/21 15:43				**Analyst:** ymt
Ammonia as N	**0.10**	0.047	0.10	mg/l	1	08/27/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1H1540 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/23/21 13:25				**Analyst:** YMT
TKN	**5.0**	0.26	0.40	mg/l	4	08/26/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1H1123 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/17/21 09:51				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	08/17/21 17:53	
Nitrite as N	ND	0.042	0.10	mg/l	1	08/17/21 17:53	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1H1154 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/17/21 15:03				**Analyst:** sbn
o-Phosphate as P	**0.0040**	0.0030	0.010	mg/l	1	08/17/21 16:10	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1H1381 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/19/21 16:58				**Analyst:** sbn
Phosphorus as P, Total	**0.21**	0.0067	0.010	mg/l	1	08/23/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1H1515 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/23/21 10:40				**Analyst:** blg
Total Dissolved Solids	**2200**	4.0	10	mg/l	1	08/23/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1H1443 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 08/20/21 11:53				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	08/20/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1H1123 - EPA 353.2											
Blank (W1H1123-BLK1)					**Prepared & Analyzed: 08/17/21**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W1H1123-BS1)					**Prepared & Analyzed: 08/17/21**						
Nitrate as N	1.01	0.040	0.20	mg/l	1.00		101	90-110			
Nitrite as N	1.07	0.042	0.10	mg/l	1.00		107	90-110			
Matrix Spike (W1H1123-MS1)	**Source: 1H16098-01**				**Prepared & Analyzed: 08/17/21**						
Nitrate as N	2.04	0.040	0.20	mg/l	2.00	ND	102	90-110			
Nitrite as N	1.08	0.042	0.10	mg/l	1.00	ND	108	90-110			
Matrix Spike (W1H1123-MS2)	**Source: 1H16100-01**				**Prepared & Analyzed: 08/17/21**						
Nitrate as N	144	0.80	4.0	mg/l	40.0	107	95	90-110			
Nitrite as N	19.0	0.84	2.0	mg/l	20.0	ND	95	90-110			
Matrix Spike Dup (W1H1123-MSD1)	**Source: 1H16098-01**				**Prepared & Analyzed: 08/17/21**						
Nitrate as N	2.03	0.040	0.20	mg/l	2.00	ND	102	90-110	0.5	20	
Nitrite as N	1.03	0.042	0.10	mg/l	1.00	ND	103	90-110	5	20	
Matrix Spike Dup (W1H1123-MSD2)	**Source: 1H16100-01**				**Prepared & Analyzed: 08/17/21**						
Nitrate as N	145	0.80	4.0	mg/l	40.0	107	96	90-110	0.4	20	
Nitrite as N	19.4	0.84	2.0	mg/l	20.0	ND	97	90-110	2	20	
Batch: W1H1154 - EPA 365.3											
Blank (W1H1154-BLK1)					**Prepared & Analyzed: 08/17/21**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W1H1154-BS1)					**Prepared & Analyzed: 08/17/21**						
o-Phosphate as P	0.203	0.0030	0.010	mg/l	0.200		102	88-111			
Matrix Spike (W1H1154-MS1)	**Source: 1H16094-01**				**Prepared & Analyzed: 08/17/21**						
o-Phosphate as P	0.207	0.0030	0.010	mg/l	0.200	0.00600	100	85-112			
Matrix Spike Dup (W1H1154-MSD1)	**Source: 1H16094-01**				**Prepared & Analyzed: 08/17/21**						
o-Phosphate as P	0.205	0.0030	0.010	mg/l	0.200	0.00600	100	85-112	1	20	
Batch: W1H1381 - EPA 365.3											
Blank (W1H1381-BLK1)					**Prepared: 08/19/21 Analyzed: 08/23/21**						
Phosphorus as P, Total	ND	0.0067	0.010	mg/l							
LCS (W1H1381-BS1)					**Prepared: 08/19/21 Analyzed: 08/23/21**						
Phosphorus as P, Total	0.210	0.0067	0.010	mg/l	0.200		105	90-110			
Matrix Spike (W1H1381-MS1)	**Source: 1H10099-01**				**Prepared: 08/19/21 Analyzed: 08/23/21**						
Phosphorus as P, Total	0.387	0.0067	0.010	mg/l	0.200	0.185	101	90-110			
Matrix Spike Dup (W1H1381-MSD1)	**Source: 1H10099-01**				**Prepared: 08/19/21 Analyzed: 08/23/21**						
Phosphorus as P, Total	0.389	0.0067	0.010	mg/l	0.200	0.185	102	90-110	0.5	20	
Batch: W1H1392 - EPA 351.2											
Blank (W1H1392-BLK1)					**Prepared: 08/19/21 Analyzed: 08/23/21**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1H1392 - EPA 351.2 (Continued)											
Blank (W1H1392-BLK1)					**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	ND	0.065	0.10	mg/l							
Blank (W1H1392-BLK2)					**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	ND	0.065	0.10	mg/l							
LCS (W1H1392-BS1)					**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	1.03	0.065	0.10	mg/l	1.00		103	90-110			
LCS (W1H1392-BS2)					**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	1.03	0.065	0.10	mg/l	1.00		103	90-110			
Matrix Spike (W1H1392-MS1)	**Source: 1H11068-03**				**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	1.30	0.065	0.10	mg/l	1.00	0.228	107	90-110			
Matrix Spike (W1H1392-MS2)	**Source: 1H12032-01**				**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	1.21	0.065	0.10	mg/l	1.00	0.258	95	90-110			
Matrix Spike Dup (W1H1392-MSD1)	**Source: 1H11068-03**				**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	1.25	0.065	0.10	mg/l	1.00	0.228	102	90-110	4	10	
Matrix Spike Dup (W1H1392-MSD2)	**Source: 1H12032-01**				**Prepared: 08/19/21 Analyzed: 08/23/21**						
TKN	1.26	0.065	0.10	mg/l	1.00	0.258	100	90-110	3	10	
Batch: W1H1443 - SM 4500S2-D											
Blank (W1H1443-BLK1)					**Prepared & Analyzed: 08/20/21**						
Sulfide, Total	ND	0.050	0.10	mg/l							
LCS (W1H1443-BS1)					**Prepared & Analyzed: 08/20/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.100		100	95-105			
Duplicate (W1H1443-DUP1)	**Source: 1H18022-01**				**Prepared & Analyzed: 08/20/21**						
Sulfide, Total	ND	0.050	0.10	mg/l		ND				20	
Batch: W1H1513 - SM 2540D											
Blank (W1H1513-BLK1)					**Prepared & Analyzed: 08/23/21**						
Total Suspended Solids	ND		1	mg/l							
LCS (W1H1513-BS1)					**Prepared & Analyzed: 08/23/21**						
Total Suspended Solids	67.0		1	mg/l	62.3		108	90-110			
Duplicate (W1H1513-DUP1)	**Source: 1H16110-01**				**Prepared & Analyzed: 08/23/21**						
Total Suspended Solids	92.5		1	mg/l		90.5			2	10	
Duplicate (W1H1513-DUP2)	**Source: 1H16110-02**				**Prepared & Analyzed: 08/23/21**						
Total Suspended Solids	264		1	mg/l		293			10	10	
Batch: W1H1515 - SM 2540C											
Blank (W1H1515-BLK1)					**Prepared & Analyzed: 08/23/21**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W1H1515-BS1)					**Prepared & Analyzed: 08/23/21**						
Total Dissolved Solids	820	4.0	10	mg/l	824		100	96-102			
Duplicate (W1H1515-DUP1)	**Source: 1H16098-04**				**Prepared & Analyzed: 08/23/21**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1H1515 - SM 2540C (Continued)											
Duplicate (W1H1515-DUP1)	**Source: 1H16098-04**				**Prepared & Analyzed: 08/23/21**						
Total Dissolved Solids	598	4.0	10	mg/l		626			5	10	
Duplicate (W1H1515-DUP2)	**Source: 1H16098-05**				**Prepared & Analyzed: 08/23/21**						
Total Dissolved Solids	2170	4.0	10	mg/l		2180			0.3	10	
Batch: W1H1540 - EPA 351.2											
Blank (W1H1540-BLK1)					**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	ND	0.065	0.10	mg/l							
Blank (W1H1540-BLK2)					**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	ND	0.065	0.10	mg/l							
LCS (W1H1540-BS1)					**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	1.05	0.065	0.10	mg/l	1.00		105	90-110			
LCS (W1H1540-BS2)					**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	1.06	0.065	0.10	mg/l	1.00		106	90-110			
Duplicate (W1H1540-DUP1)	**Source: 1H09087-01**				**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	0.207	0.065	0.10	mg/l		0.216			4	10	
Matrix Spike (W1H1540-MS1)	**Source: 1H09087-03**				**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	1.00	0.065	0.10	mg/l	1.00	ND	100	90-110			
Matrix Spike (W1H1540-MS2)	**Source: 1H20056-02**				**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	2.27	0.065	0.10	mg/l	1.00	1.25	103	90-110			
Matrix Spike Dup (W1H1540-MSD1)	**Source: 1H09087-03**				**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	1.04	0.065	0.10	mg/l	1.00	ND	104	90-110	4	10	
Matrix Spike Dup (W1H1540-MSD2)	**Source: 1H20056-02**				**Prepared: 08/23/21 Analyzed: 08/26/21**						
TKN	2.18	0.065	0.10	mg/l	1.00	1.25	93	90-110	4	10	
Batch: W1H1882 - EPA 350.1											
Blank (W1H1882-BLK1)					**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	ND	0.047	0.10	mg/l							
Blank (W1H1882-BLK2)					**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	ND	0.047	0.10	mg/l							
LCS (W1H1882-BS1)					**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	0.236	0.047	0.10	mg/l	0.250		95	90-110			
LCS (W1H1882-BS2)					**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	0.240	0.047	0.10	mg/l	0.250		96	90-110			
Matrix Spike (W1H1882-MS1)	**Source: 1G22005-01**				**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	0.486	0.047	0.10	mg/l	0.250	0.245	96	90-110			
Matrix Spike (W1H1882-MS2)	**Source: 1H18073-06**				**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	0.250	0.047	0.10	mg/l	0.250	ND	100	90-110			
Matrix Spike Dup (W1H1882-MSD1)	**Source: 1G22005-01**				**Prepared: 08/26/21 Analyzed: 08/27/21**						
Ammonia as N	0.486	0.047	0.10	mg/l	0.250	0.245	96	90-110	0.1	15	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1H1882 - EPA 350.1 (Continued)											
Matrix Spike Dup (W1H1882-MSD2)	**Source: 1H18073-06**				**Prepared: 08/26/21**	**Analyzed: 08/27/21**					
Ammonia as N	0.251	0.047	0.10	mg/l	0.250	ND	100	90-110	0.5	15	

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1H1531 - EPA 200.7											
Blank (W1H1531-BLK1)					**Prepared: 08/23/21**	**Analyzed: 08/25/21**					
Aluminum, Dissolved	ND	0.041	0.050	mg/l							
Aluminum, Total	ND	0.041	0.050	mg/l							
LCS (W1H1531-BS1)					**Prepared: 08/23/21**	**Analyzed: 08/25/21**					
Aluminum, Dissolved	0.220	0.041	0.050	mg/l	0.200		110	85-115			
Aluminum, Total	0.220	0.041	0.050	mg/l	0.200		110	85-115			
Matrix Spike (W1H1531-MS1)	**Source: 1H16098-01**				**Prepared: 08/23/21**	**Analyzed: 08/25/21**					
Aluminum, Total	0.268	0.041	0.050	mg/l	0.200	0.0457	111	70-130			
Matrix Spike Dup (W1H1531-MSD1)	**Source: 1H16098-01**				**Prepared: 08/23/21**	**Analyzed: 08/25/21**					
Aluminum, Total	0.267	0.041	0.050	mg/l	0.200	0.0457	111	70-130	0.2	30	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/10/2021 13:27

Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Work Orders:	1H16102	**Report Date:**	9/07/2021
		Received Date:	8/16/2021
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 8/16/21 with the Chain-of-Custody document. The samples were received in good condition, at 4.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07 - Int	Marisa Swiderski	1H16102-01	Water	08/16/21 10:50	
CL07 - Surf	Marisa Swiderski	1H16102-02	Water	08/16/21 11:05	
CL08 - Int	Marisa Swiderski	1H16102-03	Water	08/16/21 10:00	
CL08 - Surf	Marisa Swiderski	1H16102-04	Water	08/16/21 10:20	
CL09 - Int	Marisa Swiderski	1H16102-05	Water	08/16/21 09:05	
CL09 - Surf	Marisa Swiderski	1H16102-06	Water	08/16/21 09:15	
CL10 - Int	Marisa Swiderski	1H16102-07	Water	08/16/21 08:20	
CL10 - Surf	Marisa Swiderski	1H16102-08	Water	08/16/21 08:30	
LE02 - Int	Marisa Swiderski	1H16102-09	Water	08/16/21 09:00	

Certificate of Analysis
FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange

Sample: CL07 - Int
1H16102-01 (Water)

Sampled: 08/16/21 10:50 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 273161 **Prepared:** 08/16/21 00:00 **Analyst:** MMP							
Chlorophyll a	**19**	1.0	1.0	mg/M3	1	08/31/21	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 09/07/2021 13:46

Sample Results Enthalpy Orange

(Continued)

Sample: CL07 - Surf
1H16102-02 (Water)

Sampled: 08/16/21 11:05 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 273161		**Prepared:** 08/16/21 00:00				**Analyst:** MMP
Chlorophyll a	**3.0**	1.0	1.0	mg/M3	1	08/31/21	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Int
1H16102-03 (Water)

Sampled: 08/16/21 10:00 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 273161 **Prepared:** 08/16/21 00:00 **Analyst:** MMP							
Chlorophyll a	**26**	1.0	1.0	mg/M3	1	08/31/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Surf
1H16102-04 (Water)

Sampled: 08/16/21 10:20 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 273161		**Prepared:** 08/16/21 00:00				**Analyst:** MMP
Chlorophyll a	**4.8**	1.0	1.0	mg/M3	1	08/31/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Int
1H16102-05 (Water)

Sampled: 08/16/21 9:05 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 273161 **Prepared:** 08/16/21 00:00 **Analyst:** MMP							
Chlorophyll a	**59**	1.0	1.0	mg/M3	1	08/31/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange

(Continued)

Sample: CL09 - Surf
1H16102-06 (Water)

Sampled: 08/16/21 9:15 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 273161 **Prepared:** 08/16/21 00:00 **Analyst:** MMP							
Chlorophyll a	**5.6**	1.0	1.0	mg/M3	1	08/31/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Int
1H16102-07 (Water)

Sampled: 08/16/21 8:20 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 273161		**Prepared:** 08/16/21 00:00				**Analyst:** MMP
Chlorophyll a	**6.4**	1.0	1.0	mg/M3	1	08/31/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Surf
1H16102-08 (Water)

Sampled: 08/16/21 8:30 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 273161		**Prepared:** 08/16/21 00:00				**Analyst:** MMP
Chlorophyll a	**7.7**	1.0	1.0	mg/M3	1	08/31/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Int
1H16102-09 (Water)

Sampled: 08/16/21 9:00 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 273161 **Prepared:** 08/16/21 00:00 **Analyst:** MMP							
Chlorophyll a	**180**	1.0	1.0	mg/M3	1	08/31/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 09/07/2021 13:46

Notes and Definitions

Item	Definition
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1I17064	**Report Date:**	10/19/2021
		Received Date:	9/17/2021
Project:	1915100404 LE TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 9/17/21 with the Chain-of-Custody document. The samples were received in good condition, at 4.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported:
10/19/2021 16:42

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
LE02	Marisa Swiderski	1I17064-01	Water	09/17/21 10:05	
LE02 - Int	Marisa Swiderski	1I17064-02	Water	09/17/21 10:05	
LE02 - Surf	Marisa Swiderski	1I17064-03	Water	09/17/21 10:25	

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Sample Results

Sample: LE02 — Sampled: 09/17/21 10:05 by Marisa Swiderski

1I17064-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1I1550 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/23/21 12:45				**Analyst:** YMT
Ammonia as N	**0.30**	0.047	0.10	mg/l	1	09/24/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1I0990 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/22/21 10:00				**Analyst:** YMT
TKN	**4.7**	0.13	0.20	mg/l	2	09/23/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1I1168 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/17/21 16:48				**Analyst:** aa01
Nitrate as N	ND	0.040	0.20	mg/l	1	09/17/21 17:46	
Nitrite as N	ND	0.042	0.10	mg/l	1	09/17/21 17:46	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1I1162 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/17/21 16:11				**Analyst:** sbn
o-Phosphate as P	**0.0050**	0.0030	0.010	mg/l	1	09/17/21 16:52	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1I1616 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/24/21 09:16				**Analyst:** sbn
Phosphorus as P, Total	**0.21**	0.0030	0.010	mg/l	1	09/29/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1I1493 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/22/21 16:58				**Analyst:** blg
Total Dissolved Solids	**1600**	4.0	10	mg/l	1	09/22/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1I1272 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 09/20/21 17:45				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	09/20/21	

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

www.wecklabs.com

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Sample Results Enthalpy Orange

Sample: LE02 - Int
1I17064-02 (Water)

Sampled: 09/17/21 10:05 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 276109		**Prepared:** 09/17/21 00:00				**Analyst:** MMP
Chlorophyll a	**11**	1.0	1.0	mg/M3	1	10/18/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Sample Results Enthalpy Orange

(Continued)

Sample: LE02 - Surf
1I17064-03 (Water)

Sampled: 09/17/21 10:25 by Marisa Swiderski

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 276109		**Prepared:** 09/17/21 00:00				**Analyst:** MMP
Chlorophyll a	**14**	1.0	1.0	mg/M3	1	10/18/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1I0990 - EPA 351.2											
Blank (W1I0990-BLK1)					**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	ND	0.065	0.10	mg/l							
Blank (W1I0990-BLK2)					**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	ND	0.065	0.10	mg/l							
LCS (W1I0990-BS1)					**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	1.05	0.065	0.10	mg/l	1.00		105	90-110			
LCS (W1I0990-BS2)					**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	1.05	0.065	0.10	mg/l	1.00		105	90-110			
Matrix Spike (W1I0990-MS1)	**Source: 1I15031-03**				**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	1.06	0.065	0.10	mg/l	1.00	0.186	87	90-110			MS-05
Matrix Spike (W1I0990-MS2)	**Source: 1I15055-01**				**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	1.17	0.065	0.10	mg/l	1.00	0.172	100	90-110			
Matrix Spike Dup (W1I0990-MSD1)	**Source: 1I15031-03**				**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	1.19	0.065	0.10	mg/l	1.00	0.186	101	90-110	12	10	MS-05
Matrix Spike Dup (W1I0990-MSD2)	**Source: 1I15055-01**				**Prepared: 09/22/21 Analyzed: 09/23/21**						
TKN	1.15	0.065	0.10	mg/l	1.00	0.172	97	90-110	2	10	
Batch: W1I1162 - EPA 365.3											
Blank (W1I1162-BLK1)					**Prepared & Analyzed: 09/17/21**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W1I1162-BS1)					**Prepared & Analyzed: 09/17/21**						
o-Phosphate as P	0.205	0.0030	0.010	mg/l	0.200		102	88-111			
Matrix Spike (W1I1162-MS1)	**Source: 1I17063-01**				**Prepared & Analyzed: 09/17/21**						
o-Phosphate as P	0.203	0.0030	0.010	mg/l	0.200	0.00900	97	85-112			
Matrix Spike Dup (W1I1162-MSD1)	**Source: 1I17063-01**				**Prepared & Analyzed: 09/17/21**						
o-Phosphate as P	0.208	0.0030	0.010	mg/l	0.200	0.00900	100	85-112	2	20	
Batch: W1I1168 - EPA 353.2											
Blank (W1I1168-BLK1)					**Prepared & Analyzed: 09/17/21**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W1I1168-BS1)					**Prepared & Analyzed: 09/17/21**						
Nitrate as N	1.00	0.040	0.20	mg/l	1.00		100	90-110			
Nitrite as N	1.09	0.042	0.10	mg/l	1.00		109	90-110			
Matrix Spike (W1I1168-MS1)	**Source: 1I16084-01**				**Prepared & Analyzed: 09/17/21**						
Nitrate as N	5.37	0.040	0.20	mg/l	2.00	3.34	102	90-110			
Nitrite as N	1.05	0.042	0.10	mg/l	1.00	ND	105	90-110			
Matrix Spike Dup (W1I1168-MSD1)	**Source: 1I16084-01**				**Prepared & Analyzed: 09/17/21**						
Nitrate as N	5.37	0.040	0.20	mg/l	2.00	3.34	102	90-110	0	20	
Nitrite as N	1.12	0.042	0.10	mg/l	1.00	ND	112	90-110	6	20	MS-01

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1I1272 - SM 4500S2-D											
Blank (W1I1272-BLK1)					**Prepared & Analyzed: 09/20/21**						
Sulfide, Total	ND	0.050	0.10	mg/l							
LCS (W1I1272-BS1)					**Prepared & Analyzed: 09/20/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.0997		100	95-105			
Duplicate (W1I1272-DUP1)	**Source: 1I17049-02**				**Prepared & Analyzed: 09/20/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l		0.100			0	20	
Batch: W1I1493 - SM 2540C											
Blank (W1I1493-BLK1)					**Prepared & Analyzed: 09/22/21**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W1I1493-BS1)					**Prepared & Analyzed: 09/22/21**						
Total Dissolved Solids	819	4.0	10	mg/l	824		99	96-102			
Duplicate (W1I1493-DUP1)	**Source: 1I17048-02**				**Prepared & Analyzed: 09/22/21**						
Total Dissolved Solids	866	4.0	10	mg/l		851			2	10	
Duplicate (W1I1493-DUP2)	**Source: 1I17049-02**				**Prepared & Analyzed: 09/22/21**						
Total Dissolved Solids	837	4.0	10	mg/l		843			0.7	10	
Batch: W1I1550 - EPA 350.1											
Blank (W1I1550-BLK1)					**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	ND	0.047	0.10	mg/l							
Blank (W1I1550-BLK2)					**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	ND	0.047	0.10	mg/l							
LCS (W1I1550-BS1)					**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	0.250	0.047	0.10	mg/l	0.250		100	90-110			
LCS (W1I1550-BS2)					**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	0.255	0.047	0.10	mg/l	0.250		102	90-110			
Matrix Spike (W1I1550-MS1)	**Source: 1I21083-01**				**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	0.261	0.047	0.10	mg/l	0.250	ND	105	90-110			
Matrix Spike (W1I1550-MS2)	**Source: 1I21083-06**				**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	0.281	0.047	0.10	mg/l	0.250	ND	112	90-110			MS-01
Matrix Spike Dup (W1I1550-MSD1)	**Source: 1I21083-01**				**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	0.262	0.047	0.10	mg/l	0.250	ND	105	90-110	0.1	15	
Matrix Spike Dup (W1I1550-MSD2)	**Source: 1I21083-06**				**Prepared: 09/23/21 Analyzed: 09/24/21**						
Ammonia as N	0.280	0.047	0.10	mg/l	0.250	ND	112	90-110	0.5	15	MS-01
Batch: W1I1616 - EPA 365.3											
Blank (W1I1616-BLK1)					**Prepared: 09/24/21 Analyzed: 09/29/21**						
Phosphorus as P, Total	ND	0.0030	0.010	mg/l							
LCS (W1I1616-BS1)					**Prepared: 09/24/21 Analyzed: 09/29/21**						
Phosphorus as P, Total	0.205	0.0030	0.010	mg/l	0.200		102	90-110			
Matrix Spike (W1I1616-MS1)	**Source: 1I17063-01**				**Prepared: 09/24/21 Analyzed: 09/29/21**						

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1I1616 - EPA 365.3 (Continued)											
Matrix Spike (W1I1616-MS1)	**Source: 1I17063-01**				**Prepared: 09/24/21**	**Analyzed: 09/29/21**					
Phosphorus as P, Total	0.414	0.0030	0.010	mg/l	0.200	0.217	98	90-110			
Matrix Spike Dup (W1I1616-MSD1)	**Source: 1I17063-01**				**Prepared: 09/24/21**	**Analyzed: 09/29/21**					
Phosphorus as P, Total	0.421	0.0030	0.010	mg/l	0.200	0.217	102	90-110	2	20	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LE TMDL Monitoring

Project Manager: John Rudolph

Reported: 10/19/2021 16:42

Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
MS-01	The spike recovery for this QC sample is outside of established control limits possibly due to sample matrix interference.
MS-05	The spike recovery and/or RPD were outside acceptance limits for the MS and/or MSD due to possible matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

Certificate of Analysis

FINAL REPORT

Work Orders:	1J05115	**Report Date:**	11/02/2021
		Received Date:	10/5/2021
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 10/05/21 with the Chain-of-Custody document. The samples were received in good condition, at 5.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07	Kate Buckley	1J05115-01	Water	10/05/21 11:05	
CL08	Kate Buckley	1J05115-02	Water	10/05/21 10:25	
CL09	Kate Buckley	1J05115-03	Water	10/05/21 09:25	
CL10	Kate Buckley	1J05115-04	Water	10/05/21 08:25	
LE02	Kate Buckley	1J05115-05	Water	10/05/21 09:25	
CL07 - Int	Kate Buckley	1J05115-06	Water	10/05/21 11:05	
CL07 - Surf	Kate Buckley	1J05115-07	Water	10/05/21 11:15	
CL08 - Int	Kate Buckley	1J05115-08	Water	10/05/21 10:25	
CL08 - Surf	Kate Buckley	1J05115-09	Water	10/05/21 10:15	
CL09 - Int	Kate Buckley	1J05115-10	Water	10/05/21 09:25	
CL09 - Surf	Kate Buckley	1J05115-11	Water	10/05/21 09:15	
CL10 - Int	Kate Buckley	1J05115-12	Water	10/05/21 08:25	
CL10 - Surf	Kate Buckley	1J05115-13	Water	10/05/21 08:15	
LE02 - Int	Kate Buckley	1J05115-14	Water	10/05/21 09:25	
LE02 - Surf	Kate Buckley	1J05115-15	Water	10/05/21 09:45	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results

Sample: CL07 — 1J05115-01 (Water)

Sampled: 10/05/21 11:05 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1J0378 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 17:10				**Analyst:** YMT
Ammonia as N	**2.4**	0.047	0.10	mg/l	1	10/07/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1J0094 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 12:00				**Analyst:** YMT
TKN	**2.9**	0.065	0.10	mg/l	1	10/08/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1J0356 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 14:49				**Analyst:** ism
Nitrate as N	ND	0.040	0.20	mg/l	1	10/06/21 18:31	
Nitrite as N	ND	0.042	0.10	mg/l	1	10/06/21 18:31	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1J0339 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 12:24				**Analyst:** sbn
o-Phosphate as P	**0.099**	0.0030	0.010	mg/l	1	10/06/21 16:22	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1J0466 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/07/21 17:42				**Analyst:** sbn
Phosphorus as P, Total	**0.12**	0.0030	0.010	mg/l	1	10/12/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1J0568 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/11/21 10:53				**Analyst:** blg
Total Dissolved Solids	**510**	4.0	10	mg/l	1	10/11/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1J0536 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/08/21 17:18				**Analyst:** blg
Total Suspended Solids	**5**		5	mg/l	1	10/08/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1J0382 **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 17:27				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	10/07/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1J0703 **Preparation:** EPA 200.2			**Prepared:** 10/12/21 16:01				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	10/18/21	
Aluminum, Total	ND	0.041	0.050	mg/l	1	10/18/21	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results

(Continued)

Sample: CL08 — 1J05115-02 (Water) — Sampled: 10/05/21 10:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1J0378 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 17:10				**Analyst:** YMT
Ammonia as N	**0.29**	0.047	0.10	mg/l	1	10/07/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1J0094 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 12:00				**Analyst:** YMT
TKN	**0.95**	0.065	0.10	mg/l	1	10/08/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1J0356 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 14:49				**Analyst:** ism
Nitrate as N	ND	0.040	0.20	mg/l	1	10/06/21 18:32	
Nitrite as N	ND	0.042	0.10	mg/l	1	10/06/21 18:32	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1J0339 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 12:24				**Analyst:** sbn
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	10/06/21 16:23	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1J0466 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/07/21 17:42				**Analyst:** sbn
Phosphorus as P, Total	ND	0.0030	0.010	mg/l	1	10/12/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1J0568 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/11/21 10:53				**Analyst:** blg
Total Dissolved Solids	**550**	4.0	10	mg/l	1	10/11/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1J0536 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/08/21 17:18				**Analyst:** blg
Total Suspended Solids	**5**		5	mg/l	1	10/08/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1J0382 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 17:27				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	10/07/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1J0703 — **Preparation:** EPA 200.2			**Prepared:** 10/12/21 16:01				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	10/18/21	
Aluminum, Total	**0.045**	0.041	0.050	mg/l	1	10/18/21	J

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results

(Continued)

Sample: CL09 — 1J05115-03 (Water)

Sampled: 10/05/21 9:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W1J0378 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 17:10 — **Analyst:** YMT							
Ammonia as N	**0.12**	0.047	0.10	mg/l	1	10/07/21	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W1J0094 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 12:00 — **Analyst:** YMT							
TKN	**0.89**	0.065	0.10	mg/l	1	10/08/21	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W1J0356 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 14:49 — **Analyst:** ism							
Nitrate as N	**0.046**	0.040	0.20	mg/l	1	10/06/21 18:33	J
Nitrite as N	ND	0.042	0.10	mg/l	1	10/06/21 18:33	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1J0339 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 12:24 — **Analyst:** sbn							
o-Phosphate as P	**0.0070**	0.0030	0.010	mg/l	1	10/06/21 16:25	J
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1J0466 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/07/21 17:42 — **Analyst:** sbn							
Phosphorus as P, Total	**0.026**	0.0030	0.010	mg/l	1	10/12/21	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W1J0568 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/11/21 10:53 — **Analyst:** blg							
Total Dissolved Solids	**630**	4.0	10	mg/l	1	10/11/21	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W1J0371 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 16:37 — **Analyst:** blg							
Total Suspended Solids	**5**		5	mg/l	1	10/07/21	
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W1J0382 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 17:27 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	10/07/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W1J0703 — **Preparation:** EPA 200.2 — **Prepared:** 10/12/21 16:01 — **Analyst:** kvm							
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	10/18/21	
Aluminum, Total	**0.055**	0.041	0.050	mg/l	1	10/18/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results

(Continued)

Sample: CL10 — 1J05115-04 (Water) — Sampled: 10/05/21 8:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W1J0378 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 17:10 — **Analyst:** YMT							
Ammonia as N	**0.057**	0.047	0.10	mg/l	1	10/07/21	J
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W1J0094 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 12:00 — **Analyst:** YMT							
TKN	**0.91**	0.065	0.10	mg/l	1	10/08/21	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W1J0356 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 14:49 — **Analyst:** ism							
Nitrate as N	**0.054**	0.040	0.20	mg/l	1	10/06/21 18:34	J
Nitrite as N	ND	0.042	0.10	mg/l	1	10/06/21 18:34	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1J0339 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 12:24 — **Analyst:** sbn							
o-Phosphate as P	**0.0060**	0.0030	0.010	mg/l	1	10/06/21 16:26	J
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1J0466 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/07/21 17:42 — **Analyst:** sbn							
Phosphorus as P, Total	**0.058**	0.0030	0.010	mg/l	1	10/12/21	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W1J0568 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/11/21 10:53 — **Analyst:** blg							
Total Dissolved Solids	**640**	4.0	10	mg/l	1	10/11/21	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W1J0371 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 16:37 — **Analyst:** blg							
Total Suspended Solids	**9**		5	mg/l	1	10/07/21	
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W1J0382 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 10/06/21 17:27 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	10/07/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W1J0703 — **Preparation:** EPA 200.2 — **Prepared:** 10/12/21 16:01 — **Analyst:** kvm							
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	10/18/21	
Aluminum, Total	**0.18**	0.041	0.050	mg/l	1	10/18/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results

(Continued)

Sample: LE02 — 1J05115-05 (Water)

Sampled: 10/05/21 9:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W1J0378 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 17:10				**Analyst:** YMT
Ammonia as N	**0.17**	0.047	0.10	mg/l	1	10/07/21	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W1J0094 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 12:00				**Analyst:** YMT
TKN	**4.7**	0.065	0.10	mg/l	1	10/08/21	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1J0356 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 14:49				**Analyst:** ism
Nitrate as N	ND	0.040	0.20	mg/l	1	10/06/21 18:35	
Nitrite as N	**0.088**	0.042	0.10	mg/l	1	10/06/21 18:35	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1J0339 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 12:24				**Analyst:** sbn
o-Phosphate as P	**0.012**	0.0030	0.010	mg/l	1	10/06/21 16:28	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1J0466 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/07/21 17:42				**Analyst:** sbn
Phosphorus as P, Total	**0.26**	0.0030	0.010	mg/l	1	10/12/21	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1J0568 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/11/21 10:53				**Analyst:** blg
Total Dissolved Solids	**2300**	4.0	10	mg/l	1	10/11/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1J0382 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 10/06/21 17:27				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	10/07/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange

Sample: CL07 - Int
1J05115-06 (Water)

Sampled: 10/05/21 11:05 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**18**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange (Continued)

Sample: CL07 - Surf
1J05115-07 (Water)

Sampled: 10/05/21 11:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**9.6**	1.0	1.0	mg/M3	1	10/29/21	

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

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Int
1J05115-08 (Water)

Sampled: 10/05/21 10:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**19**	1.0	1.0	mg/M3	1	10/29/21	

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Surf
1J05115-09 (Water)
Sampled: 10/05/21 10:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**8.5**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Int
1J05115-10 (Water)

Sampled: 10/05/21 9:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**19**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange

(Continued)

Sample: CL09 - Surf
1J05115-11 (Water)

Sampled: 10/05/21 9:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**21**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Int
1J05115-12 (Water)

Sampled: 10/05/21 8:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**20**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Surf
1J05115-13 (Water)

Sampled: 10/05/21 8:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**23**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Int
1J05115-14 (Water)

Sampled: 10/05/21 9:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**220**	1.0	1.0	mg/M3	1	10/29/21	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Surf
1J05115-15 (Water)

Sampled: 10/05/21 9:45 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 276909 **Prepared:** 10/05/21 00:00 **Analyst:** MMP							
Chlorophyll a	**210**	1.0	1.0	mg/M3	1	10/29/21	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1J0094 - EPA 351.2											
Blank (W1J0094-BLK1)					**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	ND	0.065	0.10	mg/l							
Blank (W1J0094-BLK2)					**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	ND	0.065	0.10	mg/l							
LCS (W1J0094-BS1)					**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	0.951	0.065	0.10	mg/l	1.00		95	90-110			
LCS (W1J0094-BS2)					**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	0.948	0.065	0.10	mg/l	1.00		95	90-110			
LCS (W1J0094-BS3)					**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	0.0990	0.065	0.10	mg/l	0.100		99	90-110			J
Matrix Spike (W1J0094-MS1)	**Source: 1J05058-01**				**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	1.17	0.065	0.10	mg/l	1.00	0.208	96	90-110			
Matrix Spike (W1J0094-MS2)	**Source: 1J05058-02**				**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	1.26	0.065	0.10	mg/l	1.00	0.262	100	90-110			
Matrix Spike Dup (W1J0094-MSD1)	**Source: 1J05058-01**				**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	1.17	0.065	0.10	mg/l	1.00	0.208	96	90-110	0.3	10	
Matrix Spike Dup (W1J0094-MSD2)	**Source: 1J05058-02**				**Prepared: 10/06/21 Analyzed: 10/08/21**						
TKN	1.19	0.065	0.10	mg/l	1.00	0.262	93	90-110	6	10	
Batch: W1J0339 - EPA 365.3											
Blank (W1J0339-BLK1)					**Prepared & Analyzed: 10/06/21**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W1J0339-BS1)					**Prepared & Analyzed: 10/06/21**						
o-Phosphate as P	0.205	0.0030	0.010	mg/l	0.200		102	88-111			
Matrix Spike (W1J0339-MS1)	**Source: 1J05092-01**				**Prepared & Analyzed: 10/06/21**						
o-Phosphate as P	0.319	0.0030	0.010	mg/l	0.200	0.114	102	85-112			
Matrix Spike Dup (W1J0339-MSD1)	**Source: 1J05092-01**				**Prepared & Analyzed: 10/06/21**						
o-Phosphate as P	0.319	0.0030	0.010	mg/l	0.200	0.114	102	85-112	0	20	
Batch: W1J0356 - EPA 353.2											
Blank (W1J0356-BLK1)					**Prepared & Analyzed: 10/06/21**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W1J0356-BS1)					**Prepared & Analyzed: 10/06/21**						
Nitrate as N	1.02	0.040	0.20	mg/l	1.00		102	90-110			
Nitrite as N	1.05	0.042	0.10	mg/l	1.00		105	90-110			
Matrix Spike (W1J0356-MS1)	**Source: 1I24026-01**				**Prepared & Analyzed: 10/06/21**						
Nitrate as N	4.71	0.040	0.20	mg/l	2.00	2.64	104	90-110			
Nitrite as N	1.02	0.042	0.10	mg/l	1.00	ND	102	90-110			
Matrix Spike (W1J0356-MS2)	**Source: 1J05046-01**				**Prepared & Analyzed: 10/06/21**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1J0356 - EPA 353.2 (Continued)											
Matrix Spike (W1J0356-MS2)	**Source: 1J05046-01**				**Prepared & Analyzed: 10/06/21**						
Nitrate as N	2.42	0.040	0.20	mg/l	2.00	0.388	102	90-110			
Nitrite as N	1.02	0.042	0.10	mg/l	1.00	ND	102	90-110			
Matrix Spike Dup (W1J0356-MSD1)	**Source: 1I24026-01**				**Prepared & Analyzed: 10/06/21**						
Nitrate as N	4.71	0.040	0.20	mg/l	2.00	2.64	104	90-110	0	20	
Nitrite as N	1.09	0.042	0.10	mg/l	1.00	ND	109	90-110	7	20	
Matrix Spike Dup (W1J0356-MSD2)	**Source: 1J05046-01**				**Prepared & Analyzed: 10/06/21**						
Nitrate as N	2.42	0.040	0.20	mg/l	2.00	0.388	102	90-110	0	20	
Nitrite as N	1.04	0.042	0.10	mg/l	1.00	ND	104	90-110	2	20	
Batch: W1J0371 - SM 2540D											
Blank (W1J0371-BLK1)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Total Suspended Solids	ND		5	mg/l							
LCS (W1J0371-BS1)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Total Suspended Solids	62.9		5	mg/l	64.3		98	90-110			
Duplicate (W1J0371-DUP1)	**Source: 1J05042-01**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Total Suspended Solids	27.0		5	mg/l		26.0			4	10	
Duplicate (W1J0371-DUP2)	**Source: 1J05027-01**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Total Suspended Solids	48.0		5	mg/l		52.0			8	10	
Batch: W1J0378 - EPA 350.1											
Blank (W1J0378-BLK1)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	ND	0.047	0.10	mg/l							
Blank (W1J0378-BLK2)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	ND	0.047	0.10	mg/l							
LCS (W1J0378-BS1)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	0.261	0.047	0.10	mg/l	0.250		104	90-110			
LCS (W1J0378-BS2)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	0.253	0.047	0.10	mg/l	0.250		101	90-110			
Matrix Spike (W1J0378-MS1)	**Source: 1I28052-12**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	0.547	0.047	0.10	mg/l	0.250	0.288	104	90-110			
Matrix Spike (W1J0378-MS2)	**Source: 1I28052-13**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	0.567	0.047	0.10	mg/l	0.250	0.317	100	90-110			
Matrix Spike Dup (W1J0378-MSD1)	**Source: 1I28052-12**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	0.546	0.047	0.10	mg/l	0.250	0.288	103	90-110	0.1	15	
Matrix Spike Dup (W1J0378-MSD2)	**Source: 1I28052-13**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Ammonia as N	0.568	0.047	0.10	mg/l	0.250	0.317	100	90-110	0.3	15	
Batch: W1J0382 - SM 4500S2-D											
Blank (W1J0382-BLK1)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Sulfide, Total	ND	0.050	0.10	mg/l							

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1J0382 - SM 4500S2-D (Continued)											
LCS (W1J0382-BS1)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.100		100	95-105			
LCS (W1J0382-BS2)					**Prepared: 10/06/21 Analyzed: 10/07/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.123		81	95-105			
Duplicate (W1J0382-DUP1)	**Source: 1J06043-01**				**Prepared: 10/06/21 Analyzed: 10/07/21**						
Sulfide, Total	ND	0.050	0.10	mg/l		ND				20	
Batch: W1J0466 - EPA 365.3											
Blank (W1J0466-BLK1)					**Prepared: 10/07/21 Analyzed: 10/12/21**						
Phosphorus as P, Total	0.00300	0.0030	0.010	mg/l							J
LCS (W1J0466-BS1)					**Prepared: 10/07/21 Analyzed: 10/12/21**						
Phosphorus as P, Total	0.210	0.0030	0.010	mg/l	0.200		105	90-110			
Matrix Spike (W1J0466-MS1)	**Source: 1J05092-01**				**Prepared: 10/07/21 Analyzed: 10/12/21**						
Phosphorus as P, Total	0.349	0.0030	0.010	mg/l	0.200	0.149	100	90-110			
Matrix Spike Dup (W1J0466-MSD1)	**Source: 1J05092-01**				**Prepared: 10/07/21 Analyzed: 10/12/21**						
Phosphorus as P, Total	0.350	0.0030	0.010	mg/l	0.200	0.149	100	90-110	0.3	20	
Batch: W1J0536 - SM 2540D											
Blank (W1J0536-BLK1)					**Prepared & Analyzed: 10/08/21**						
Total Suspended Solids	ND		5	mg/l							
LCS (W1J0536-BS1)					**Prepared & Analyzed: 10/08/21**						
Total Suspended Solids	57.2		5	mg/l	54.1		106	90-110			
Duplicate (W1J0536-DUP1)	**Source: 1J05026-01**				**Prepared & Analyzed: 10/08/21**						
Total Suspended Solids	97.1		5	mg/l		101			4	10	
Duplicate (W1J0536-DUP2)	**Source: 1J05079-01**				**Prepared & Analyzed: 10/08/21**						
Total Suspended Solids	372		5	mg/l		368			1	10	
Batch: W1J0568 - SM 2540C											
Blank (W1J0568-BLK1)					**Prepared & Analyzed: 10/11/21**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W1J0568-BS1)					**Prepared & Analyzed: 10/11/21**						
Total Dissolved Solids	834	4.0	10	mg/l	824		101	96-102			
Duplicate (W1J0568-DUP1)	**Source: 1J06003-06**				**Prepared & Analyzed: 10/11/21**						
Total Dissolved Solids	1460	4.0	10	mg/l		1520			4	10	
Duplicate (W1J0568-DUP2)	**Source: 1J06058-01**				**Prepared & Analyzed: 10/11/21**						
Total Dissolved Solids	31.0	4.0	10	mg/l		30.0			3	10	

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1J0703 - EPA 200.7											
Blank (W1J0703-BLK1)					**Prepared: 10/12/21**	**Analyzed: 10/18/21**					
Aluminum, Dissolved	ND	0.041	0.050	mg/l							
Aluminum, Total	ND	0.041	0.050	mg/l							
LCS (W1J0703-BS1)					**Prepared: 10/12/21**	**Analyzed: 10/18/21**					
Aluminum, Dissolved	0.211	0.041	0.050	mg/l	0.200		105	85-115			
Aluminum, Total	0.211	0.041	0.050	mg/l	0.200		105	85-115			
Matrix Spike (W1J0703-MS1)	**Source: 1J05115-01**				**Prepared: 10/12/21**	**Analyzed: 10/18/21**					
Aluminum, Dissolved	0.245	0.041	0.050	mg/l	0.200	ND	122	70-130			
Aluminum, Total	0.245	0.041	0.050	mg/l	0.200	ND	122	70-130			
Matrix Spike Dup (W1J0703-MSD1)	**Source: 1J05115-01**				**Prepared: 10/12/21**	**Analyzed: 10/18/21**					
Aluminum, Dissolved	0.244	0.041	0.050	mg/l	0.200	ND	122	70-130	0.2	30	
Aluminum, Total	0.244	0.041	0.050	mg/l	0.200	ND	122	70-130	0.2	30	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 11/02/2021 16:54

Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	1L21130	**Report Date:**	1/25/2022
		Received Date:	12/21/2021
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH #4047 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 12/21/21 with the Chain-of-Custody document. The samples were received in good condition, at 6.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07	Kate Buckley	1L21130-01	Water	12/21/21 11:30	
CL08	Kate Buckley	1L21130-02	Water	12/21/21 10:40	
CL09	Kate Buckley	1L21130-03	Water	12/21/21 09:25	
CL10	Kate Buckley	1L21130-04	Water	12/21/21 08:40	
LE02	Kate Buckley	1L21130-05	Water	12/21/21 09:40	
CL07 - Int	Kate Buckley	1L21130-06	Water	12/21/21 11:30	
CL07 - Surf	Kate Buckley	1L21130-07	Water	12/21/21 11:50	
CL08 - Int	Kate Buckley	1L21130-08	Water	12/21/21 10:40	
CL08 - Surf	Kate Buckley	1L21130-09	Water	12/21/21 10:55	
CL09 - Int	Kate Buckley	1L21130-10	Water	12/21/21 09:25	
CL09 - Surf	Kate Buckley	1L21130-11	Water	12/21/21 09:55	
CL10 - Int	Kate Buckley	1L21130-12	Water	12/21/21 08:40	
CL10 - Surf	Kate Buckley	1L21130-13	Water	12/21/21 08:55	
LE02 - Int	Kate Buckley	1L21130-14	Water	12/21/21 09:40	
LE02 - Surf	Kate Buckley	1L21130-15	Water	12/21/21 10:00	

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results

Sample: CL07 — 1L21130-01 (Water)

Sampled: 12/21/21 11:30 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2A0096 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/03/22 16:50				**Analyst:** YMT
Ammonia as N	**0.71**	0.017	0.10	mg/l	1	01/05/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2A0842 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/12/22 18:29				**Analyst:** ymt
TKN	**1.4**	0.13	0.20	mg/l	1	01/14/22	M-02
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1L1605 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 12:54				**Analyst:** jog
Nitrate as N	**0.094**	0.040	0.20	mg/l	1	12/22/21 17:33	J
Nitrite as N	**0.045**	0.042	0.10	mg/l	1	12/22/21 17:33	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L1557 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 09:32				**Analyst:** heq
o-Phosphate as P	**0.0040**	0.0030	0.010	mg/l	1	12/22/21 15:59	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L1896 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/28/21 13:27				**Analyst:** heq
Phosphorus as P, Total	**0.032**	0.0030	0.010	mg/l	1	01/04/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1L1759 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/27/21 09:34				**Analyst:** jao
Total Dissolved Solids	**590**	4.0	10	mg/l	1	12/27/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1L1665 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/23/21 09:27				**Analyst:** ttf
Total Suspended Solids	**4**		5	mg/l	1	12/23/21	J
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1L1644 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 18:36				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	12/23/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1L2062 — **Preparation:** _NONE (METALS)			**Prepared:** 12/30/21 18:21				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	01/11/22	
Aluminum, Total	**0.067**	0.041	0.050	mg/l	1	01/11/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results

(Continued)

Sample: CL08 — 1L21130-02 (Water) — Sampled: 12/21/21 10:40 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W2A0096 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 01/03/22 16:50 — **Analyst:** YMT							
Ammonia as N	**0.69**	0.017	0.10	mg/l	1	01/05/22	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W2A0842 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 01/12/22 18:29 — **Analyst:** ymt							
TKN	**1.5**	0.13	0.20	mg/l	1	01/14/22	M-02
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W1L1605 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 12:54 — **Analyst:** jog							
Nitrate as N	**0.11**	0.040	0.20	mg/l	1	12/22/21 17:37	J
Nitrite as N	**0.046**	0.042	0.10	mg/l	1	12/22/21 17:37	J
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1L1557 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 09:32 — **Analyst:** heq							
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	12/22/21 16:00	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1L1896 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/28/21 13:27 — **Analyst:** heq							
Phosphorus as P, Total	**0.027**	0.0030	0.010	mg/l	1	01/04/22	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W1L1759 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/27/21 09:34 — **Analyst:** jao							
Total Dissolved Solids	**570**	4.0	10	mg/l	1	12/27/21	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W1L1665 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/23/21 09:27 — **Analyst:** ttf							
Total Suspended Solids	**4**		5	mg/l	1	12/23/21	J
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W1L1644 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 18:36 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	12/23/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W1L2062 — **Preparation:** _NONE (METALS) — **Prepared:** 12/30/21 18:21 — **Analyst:** kvm							
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	01/11/22	
Aluminum, Total	**0.054**	0.041	0.050	mg/l	1	01/11/22	

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 01/25/2022 11:43

Sample Results

(Continued)

Sample: CL09 — 1L21130-03 (Water) — Sampled: 12/21/21 9:25 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2A0096 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/03/22 16:50				**Analyst:** YMT
Ammonia as N	**0.43**	0.017	0.10	mg/l	1	01/05/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2A0842 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/12/22 18:29				**Analyst:** ymt
TKN	**1.4**	0.13	0.20	mg/l	1	01/14/22	M-02
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1L1605 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 12:54				**Analyst:** jog
Nitrate as N	**0.16**	0.040	0.20	mg/l	1	12/22/21 17:39	J
Nitrite as N	ND	0.042	0.10	mg/l	1	12/22/21 17:39	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L1557 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 09:32				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	12/22/21 16:01	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L1896 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/28/21 13:27				**Analyst:** heq
Phosphorus as P, Total	**0.058**	0.0030	0.010	mg/l	1	01/04/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1L1759 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/27/21 09:34				**Analyst:** jao
Total Dissolved Solids	**680**	4.0	10	mg/l	1	12/27/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1L1665 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/23/21 09:27				**Analyst:** ttf
Total Suspended Solids	**6**		5	mg/l	1	12/23/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1L1644 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 18:36				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	12/23/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1L2062 — **Preparation:** _NONE (METALS)			**Prepared:** 12/30/21 18:21				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	01/11/22	
Aluminum, Total	**0.18**	0.041	0.050	mg/l	1	01/11/22	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results

(Continued)

Sample: CL10
1L21130-04 (Water)

Sampled: 12/21/21 8:40 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2A0096 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/03/22 16:50				**Analyst:** YMT
Ammonia as N	**0.37**	0.017	0.10	mg/l	1	01/05/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2A0842 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 01/12/22 18:29				**Analyst:** ymt
TKN	**1.3**	0.13	0.20	mg/l	1	01/14/22	M-02
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W1L1605 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 12:54				**Analyst:** jog
Nitrate as N	**0.14**	0.040	0.20	mg/l	1	12/22/21 17:40	J
Nitrite as N	ND	0.042	0.10	mg/l	1	12/22/21 17:40	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L1557 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 09:32				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	12/22/21 16:01	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W1L1896 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/28/21 13:27				**Analyst:** heq
Phosphorus as P, Total	**0.061**	0.0030	0.010	mg/l	1	01/04/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W1L1759 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/27/21 09:34				**Analyst:** jao
Total Dissolved Solids	**670**	4.0	10	mg/l	1	12/27/21	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W1L1665 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/23/21 09:27				**Analyst:** ttf
Total Suspended Solids	**11**		5	mg/l	1	12/23/21	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W1L1644 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 12/22/21 18:36				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	12/23/21	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W1L2062 — **Preparation:** _NONE (METALS)			**Prepared:** 12/30/21 18:21				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	01/11/22	
Aluminum, Total	**0.19**	0.041	0.050	mg/l	1	01/11/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results

(Continued)

Sample: LE02 — 1L21130-05 (Water)

Sampled: 12/21/21 9:40 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W2A0096 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 01/03/22 16:50 — **Analyst:** YMT							
Ammonia as N	**0.16**	0.017	0.10	mg/l	1	01/05/22	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W2A0842 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 01/12/22 18:29 — **Analyst:** ymt							
TKN	**4.8**	0.13	0.20	mg/l	1	01/14/22	M-02
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W1L1605 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 12:54 — **Analyst:** jog							
Nitrate as N	**0.10**	0.040	0.20	mg/l	1	12/22/21 17:41	J
Nitrite as N	**0.061**	0.042	0.10	mg/l	1	12/22/21 17:41	J
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1L1557 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 09:32 — **Analyst:** heq							
o-Phosphate as P	**0.0050**	0.0030	0.010	mg/l	1	12/22/21 16:02	J
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W1L1896 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/28/21 13:27 — **Analyst:** heq							
Phosphorus as P, Total	**0.28**	0.0030	0.010	mg/l	1	01/04/22	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W1L1759 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/27/21 09:34 — **Analyst:** jao							
Total Dissolved Solids	**2400**	4.0	10	mg/l	1	12/27/21	
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W1L1644 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 12/22/21 18:36 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	12/23/21	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange

Sample: CL07 - Int
1L21130-06 (Water)

Sampled: 12/21/21 11:30 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358		**Prepared:** 12/21/21 00:00				**Analyst:** MMP
Chlorophyll a	**9.3**	1.0	mg/M3	1	01/06/22	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: CL07 - Surf
1L21130-07 (Water)

Sampled: 12/21/21 11:50 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 281358	**Prepared:** 12/21/21 00:00				**Analyst:** MMP
Chlorophyll a	**9.1**	1.0	mg/M3	1	01/06/22	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Int
1L21130-08 (Water)

Sampled: 12/21/21 10:40 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358 **Prepared:** 12/21/21 00:00 **Analyst:** MMP						
Chlorophyll a	**26**	1.0	mg/M3	1	01/06/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Surf
1L21130-09 (Water)

Sampled: 12/21/21 10:55 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358 **Prepared:** 12/21/21 00:00 **Analyst:** MMP						
Chlorophyll a	**19**	1.0	mg/M3	1	01/06/22	

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Int
1L21130-10 (Water)
Sampled: 12/21/21 9:25 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358 **Prepared:** 12/21/21 00:00 **Analyst:** MMP						
Chlorophyll a	**23**	1.0	mg/M3	1	01/06/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Surf
1L21130-11 (Water)

Sampled: 12/21/21 9:55 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358 **Prepared:** 12/21/21 00:00 **Analyst:** MMP						
Chlorophyll a	**30**	1.0	mg/M3	1	01/06/22	

Sample Results Enthalpy Orange

(Continued)

Sample: CL10 - Int
1L21130-12 (Water)

Sampled: 12/21/21 8:40 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358 **Prepared:** 12/21/21 00:00 **Analyst:** MMP						
Chlorophyll a	**26**	1.0	mg/M3	1	01/06/22	

Sample Results Enthalpy Orange

(Continued)

Sample: CL10 - Surf
1L21130-13 (Water)

Sampled: 12/21/21 8:55 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 281358 **Prepared:** 12/21/21 00:00 **Analyst:** MMP						
Chlorophyll a	**23**	1.0	mg/M3	1	01/06/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Int
1L21130-14 (Water)

Sampled: 12/21/21 9:40 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 281358	**Prepared:** 12/21/21 00:00				**Analyst:** MMP
Chlorophyll a	**150**	1.0	mg/M3	1	01/06/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Surf
1L21130-15 (Water)

Sampled: 12/21/21 10:00 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 281358	**Prepared:** 12/21/21 00:00				**Analyst:** MMP
Chlorophyll a	**170**	1.0	mg/M3	1	01/06/22	

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

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 01/25/2022 11:43

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L1557 - EPA 365.3											
Blank (W1L1557-BLK1)					**Prepared & Analyzed: 12/22/21**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W1L1557-BS1)					**Prepared & Analyzed: 12/22/21**						
o-Phosphate as P	0.210	0.0030	0.010	mg/l	0.200		105	88-111			
Matrix Spike (W1L1557-MS1)	**Source: 1L21130-01**				**Prepared & Analyzed: 12/22/21**						
o-Phosphate as P	0.202	0.0030	0.010	mg/l	0.200	0.00400	99	85-112			
Matrix Spike Dup (W1L1557-MSD1)	**Source: 1L21130-01**				**Prepared & Analyzed: 12/22/21**						
o-Phosphate as P	0.202	0.0030	0.010	mg/l	0.200	0.00400	99	85-112	0	20	
Batch: W1L1605 - EPA 353.2											
Blank (W1L1605-BLK1)					**Prepared & Analyzed: 12/22/21**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W1L1605-BS1)					**Prepared & Analyzed: 12/22/21**						
Nitrate as N	1.03	0.040	0.20	mg/l	1.00		103	90-110			
Nitrite as N	1.04	0.042	0.10	mg/l	1.00		104	90-110			
Matrix Spike (W1L1605-MS1)	**Source: 1L21116-03**				**Prepared & Analyzed: 12/22/21**						
Nitrate as N	6.34	0.040	0.20	mg/l	2.00	4.22	106	90-110			
Nitrite as N	1.03	0.042	0.10	mg/l	1.00	ND	103	90-110			
Matrix Spike (W1L1605-MS2)	**Source: 1L22034-02**				**Prepared & Analyzed: 12/22/21**						
Nitrate as N	6.21	0.040	0.20	mg/l	2.00	4.06	108	90-110			
Nitrite as N	1.04	0.042	0.10	mg/l	1.00	ND	104	90-110			
Matrix Spike Dup (W1L1605-MSD1)	**Source: 1L21116-03**				**Prepared & Analyzed: 12/22/21**						
Nitrate as N	6.32	0.040	0.20	mg/l	2.00	4.22	105	90-110	0.3	20	
Nitrite as N	0.975	0.042	0.10	mg/l	1.00	ND	98	90-110	5	20	
Matrix Spike Dup (W1L1605-MSD2)	**Source: 1L22034-02**				**Prepared & Analyzed: 12/22/21**						
Nitrate as N	6.22	0.040	0.20	mg/l	2.00	4.06	108	90-110	0.2	20	
Nitrite as N	1.09	0.042	0.10	mg/l	1.00	ND	109	90-110	5	20	
Batch: W1L1644 - SM 4500S2-D											
Blank (W1L1644-BLK1)					**Prepared: 12/22/21 Analyzed: 12/23/21**						
Sulfide, Total	ND	0.050	0.10	mg/l							
LCS (W1L1644-BS1)					**Prepared: 12/22/21 Analyzed: 12/23/21**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.100		100	95-105			
Duplicate (W1L1644-DUP1)	**Source: 1L09008-01**				**Prepared: 12/22/21 Analyzed: 12/23/21**						
Sulfide, Total	2.00	0.50	1.0	mg/l		2.00			0	20	
Batch: W1L1665 - SM 2540D											
Blank (W1L1665-BLK1)					**Prepared & Analyzed: 12/23/21**						
Total Suspended Solids	ND		5	mg/l							
LCS (W1L1665-BS1)					**Prepared & Analyzed: 12/23/21**						

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L1665 - SM 2540D (Continued)											
LCS (W1L1665-BS1)					**Prepared & Analyzed: 12/23/21**						
Total Suspended Solids	64.7		5	mg/l	65.2		99	90-110			
Duplicate (W1L1665-DUP1)	**Source: 1L17026-01**				**Prepared & Analyzed: 12/23/21**						
Total Suspended Solids	328		5	mg/l		326			0.6	10	
Duplicate (W1L1665-DUP2)	**Source: 1L21130-01**				**Prepared & Analyzed: 12/23/21**						
Total Suspended Solids	4.60		5	mg/l		4.10			11	10	R-03, J
Batch: W1L1759 - SM 2540C											
Blank (W1L1759-BLK1)					**Prepared & Analyzed: 12/27/21**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W1L1759-BS1)					**Prepared & Analyzed: 12/27/21**						
Total Dissolved Solids	793	4.0	10	mg/l	824		96	96-102			
Duplicate (W1L1759-DUP1)	**Source: 1L22035-04**				**Prepared & Analyzed: 12/27/21**						
Total Dissolved Solids	7960	4.0	10	mg/l		7770			2	10	
Duplicate (W1L1759-DUP2)	**Source: 1L21130-05**				**Prepared & Analyzed: 12/27/21**						
Total Dissolved Solids	2340	4.0	10	mg/l		2360			1	10	
Batch: W1L1896 - EPA 365.3											
Blank (W1L1896-BLK1)					**Prepared: 12/28/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	ND	0.0030	0.010	mg/l							
LCS (W1L1896-BS1)					**Prepared: 12/28/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	0.197	0.0030	0.010	mg/l	0.200		98	90-110			
Matrix Spike (W1L1896-MS1)	**Source: 1L20107-01**				**Prepared: 12/28/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	0.380	0.0030	0.010	mg/l	0.200	0.178	101	90-110			
Matrix Spike Dup (W1L1896-MSD1)	**Source: 1L20107-01**				**Prepared: 12/28/21 Analyzed: 01/04/22**						
Phosphorus as P, Total	0.379	0.0030	0.010	mg/l	0.200	0.178	100	90-110	0.3	20	
Batch: W2A0096 - EPA 350.1											
Blank (W2A0096-BLK1)					**Prepared: 01/03/22 Analyzed: 01/05/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
Blank (W2A0096-BLK2)					**Prepared: 01/03/22 Analyzed: 01/05/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
LCS (W2A0096-BS1)					**Prepared: 01/03/22 Analyzed: 01/05/22**						
Ammonia as N	0.249	0.017	0.10	mg/l	0.250		100	90-110			
LCS (W2A0096-BS2)					**Prepared: 01/03/22 Analyzed: 01/05/22**						
Ammonia as N	0.250	0.017	0.10	mg/l	0.250		100	90-110			
Matrix Spike (W2A0096-MS1)	**Source: 1L10007-13**				**Prepared: 01/03/22 Analyzed: 01/05/22**						
Ammonia as N	0.563	0.017	0.10	mg/l	0.250	0.323	96	90-110			
Matrix Spike (W2A0096-MS2)	**Source: 1L20020-02**				**Prepared: 01/03/22 Analyzed: 01/05/22**						
Ammonia as N	0.629	0.017	0.10	mg/l	0.250	0.388	96	90-110			
Matrix Spike Dup (W2A0096-MSD1)	**Source: 1L10007-13**				**Prepared: 01/03/22 Analyzed: 01/05/22**						

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2A0096 - EPA 350.1 (Continued)											
Matrix Spike Dup (W2A0096-MSD1)	**Source: 1L10007-13**				**Prepared: 01/03/22**	**Analyzed: 01/05/22**					
Ammonia as N	0.567	0.017	0.10	mg/l	0.250	0.323	98	90-110	0.7	15	
Matrix Spike Dup (W2A0096-MSD2)	**Source: 1L20020-02**				**Prepared: 01/03/22**	**Analyzed: 01/05/22**					
Ammonia as N	0.626	0.017	0.10	mg/l	0.250	0.388	95	90-110	0.4	15	
Batch: W2A0842 - EPA 351.2											
Blank (W2A0842-BLK1)					**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	ND	0.065	0.10	mg/l							
Blank (W2A0842-BLK2)					**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	ND	0.065	0.10	mg/l							
LCS (W2A0842-BS1)					**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	1.01	0.065	0.10	mg/l	1.00		101	90-110			
LCS (W2A0842-BS2)					**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	0.982	0.065	0.10	mg/l	1.00		98	90-110			
Matrix Spike (W2A0842-MS1)	**Source: 1L28019-01**				**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	1.27	0.065	0.10	mg/l	1.00	0.256	101	90-110			
Matrix Spike (W2A0842-MS2)	**Source: 1L28019-02**				**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	1.20	0.065	0.10	mg/l	1.00	0.200	99	90-110			
Matrix Spike Dup (W2A0842-MSD1)	**Source: 1L28019-01**				**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	1.27	0.065	0.10	mg/l	1.00	0.256	102	90-110	0.1	10	
Matrix Spike Dup (W2A0842-MSD2)	**Source: 1L28019-02**				**Prepared: 01/12/22**	**Analyzed: 01/14/22**					
TKN	1.20	0.065	0.10	mg/l	1.00	0.200	100	90-110	0.1	10	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 01/25/2022 11:43

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W1L2062 - EPA 200.7											
Blank (W1L2062-BLK1)					**Prepared: 12/30/21 Analyzed: 01/11/22**						
Aluminum, Dissolved	ND	0.041	0.050	mg/l							
Aluminum, Total	ND	0.041	0.050	mg/l							
LCS (W1L2062-BS1)					**Prepared: 12/30/21 Analyzed: 01/11/22**						
Aluminum, Dissolved	0.176	0.041	0.050	mg/l	0.200		88	85-115			
Aluminum, Total	0.176	0.041	0.050	mg/l	0.200		88	85-115			
Matrix Spike (W1L2062-MS1)	**Source: 1L21130-01**				**Prepared: 12/30/21 Analyzed: 01/11/22**						
Aluminum, Total	0.305	0.041	0.050	mg/l	0.200	0.0665	119	70-130			
Matrix Spike (W1L2062-MS2)	**Source: 1L21131-06**				**Prepared: 12/30/21 Analyzed: 01/11/22**						
Aluminum, Total	0.342	0.041	0.050	mg/l	0.200	0.0878	127	70-130			
Matrix Spike Dup (W1L2062-MSD1)	**Source: 1L21130-01**				**Prepared: 12/30/21 Analyzed: 01/11/22**						
Aluminum, Total	0.303	0.041	0.050	mg/l	0.200	0.0665	118	70-130	0.7	30	
Matrix Spike Dup (W1L2062-MSD2)	**Source: 1L21131-06**				**Prepared: 12/30/21 Analyzed: 01/11/22**						
Aluminum, Total	0.351	0.041	0.050	mg/l	0.200	0.0878	131	70-130	2	30	MS-02

Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
M-02	Due to the nature of matrix interferences, sample was diluted prior to preparation. The MDL and MRL were raised due to the dilution.
MS-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
R-03	The RPD is not applicable for result below the reporting limit (either ND or J value).
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	2B17092	**Report Date:**	4/06/2022
		Received Date:	2/17/2022
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 2/17/22 with the Chain-of-Custody document. The samples were received in good condition, at 4.0 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07 - Int	Nicholas Jernack	2B17092-01	Water	02/17/22 11:00	
CL07 - Surf	Nicholas Jernack	2B17092-02	Water	02/17/22 11:15	
CL08 - Int	Nicholas Jernack	2B17092-03	Water	02/17/22 10:10	
CL08 - Surf	Nicholas Jernack	2B17092-04	Water	02/17/22 10:25	
CL09 - Int	Nicholas Jernack	2B17092-05	Water	02/17/22 09:15	
CL09 - Surf	Nicholas Jernack	2B17092-06	Water	02/17/22 09:30	
CL10 - Int	Nicholas Jernack	2B17092-07	Water	02/17/22 08:25	
CL10 - Surf	Nicholas Jernack	2B17092-08	Water	02/17/22 08:35	
LE02 - Int	Nicholas Jernack	2B17092-09	Water	02/17/22 09:35	
LE02 - Surf	Nicholas Jernack	2B17092-10	Water	02/17/22 09:45	
CL07	Nicholas Jernack	2B17092-11	Water	02/17/22 11:00	
CL08	Nicholas Jernack	2B17092-12	Water	02/17/22 10:10	
CL09	Nicholas Jernack	2B17092-13	Water	02/17/22 09:15	
CL10	Nicholas Jernack	2B17092-14	Water	02/17/22 08:25	
LE02	Nicholas Jernack	2B17092-15	Water	02/17/22 09:00	

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

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 04/06/2022 16:52

Sample Results

Sample: CL07 — 2B17092-11 (Water) — Sampled: 02/17/22 11:00 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: EPA 350.1		**Instr:** AA06				
Batch ID: W2B1824 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/28/22 12:12				**Analyst:** YMT
Ammonia as N	ND	0.10	mg/l	1	03/02/22	
Method: EPA 351.2		**Instr:** AA06				
Batch ID: W2C0321 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 03/03/22 16:35				**Analyst:** YMT
TKN	**0.96**	0.10	mg/l	1	03/10/22	
Method: EPA 353.2		**Instr:** AA01				
Batch ID: W2B1376 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 15:21				**Analyst:** JOG
Nitrate as N	**0.46**	0.20	mg/l	1	02/18/22 17:36	
Nitrite as N	ND	0.10	mg/l	1	02/18/22 17:36	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1317 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 15:41				**Analyst:** heq
Phosphorus as P, Total	**0.034**	0.010	mg/l	1	02/23/22	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1328 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 18:06				**Analyst:** heq
o-Phosphate as P	ND	0.010	mg/l	1	02/17/22 19:04	
Method: SM 2540C		**Instr:** OVEN01				
Batch ID: W2B1476 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/22/22 17:13				**Analyst:** jao
Total Dissolved Solids	**550**	10	mg/l	1	02/23/22	
Method: SM 2540D		**Instr:** OVEN15				
Batch ID: W2B1510 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/23/22 09:32				**Analyst:** ttf
Total Suspended Solids	**8**	5	mg/l	1	02/23/22	
Method: SM 4500S2-D		**Instr:** _ANALYST				
Batch ID: W2B1366 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 12:23				**Analyst:** ymt
Sulfide, Total	ND	0.10	mg/l	1	02/23/22	
Metals by EPA 200 Series Methods						
Method: EPA 200.7		**Instr:** ICP03				
Batch ID: W2B1393 — **Preparation:** EPA 200.2		**Prepared:** 02/20/22 08:37				**Analyst:** kvm
Aluminum, Dissolved	ND	0.050	mg/l	1	02/28/22	
Aluminum, Total	**0.051**	0.050	mg/l	1	02/28/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results

(Continued)

Sample: CL08 — 2B17092-12 (Water)

Sampled: 02/17/22 10:10 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: EPA 350.1		**Instr:** AA06				
Batch ID: W2B1824 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/28/22 12:12				**Analyst:** YMT
Ammonia as N	**0.12**	0.10	mg/l	1	03/02/22	
Method: EPA 351.2		**Instr:** AA06				
Batch ID: W2C0321 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 03/03/22 16:35				**Analyst:** YMT
TKN	**1.1**	0.10	mg/l	1	03/10/22	
Method: EPA 353.2		**Instr:** AA01				
Batch ID: W2B1376 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 15:21				**Analyst:** JOG
Nitrate as N	**0.40**	0.20	mg/l	1	02/18/22 17:37	
Nitrite as N	ND	0.10	mg/l	1	02/18/22 17:37	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1317 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 15:41				**Analyst:** heq
Phosphorus as P, Total	**0.037**	0.010	mg/l	1	02/23/22	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1328 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 18:06				**Analyst:** heq
o-Phosphate as P	ND	0.010	mg/l	1	02/17/22 19:04	
Method: SM 2540C		**Instr:** OVEN01				
Batch ID: W2B1476 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/22/22 17:13				**Analyst:** jao
Total Dissolved Solids	**550**	10	mg/l	1	02/23/22	
Method: SM 2540D		**Instr:** OVEN15				
Batch ID: W2B1510 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/23/22 09:32				**Analyst:** ttf
Total Suspended Solids	**7**	5	mg/l	1	02/23/22	
Method: SM 4500S2-D		**Instr:** _ANALYST				
Batch ID: W2B1366 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 12:23				**Analyst:** ymt
Sulfide, Total	ND	0.10	mg/l	1	02/23/22	
Metals by EPA 200 Series Methods						
Method: EPA 200.7		**Instr:** ICP03				
Batch ID: W2B1393 — **Preparation:** EPA 200.2		**Prepared:** 02/20/22 08:37				**Analyst:** kvm
Aluminum, Dissolved	ND	0.050	mg/l	1	02/28/22	
Aluminum, Total	**0.072**	0.050	mg/l	1	02/28/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 04/06/2022 16:52

Sample Results

(Continued)

Sample: CL09 — 2B17092-13 (Water) — Sampled: 02/17/22 9:15 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: EPA 350.1		**Instr:** AA06				
Batch ID: W2B1824 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/28/22 12:12				**Analyst:** YMT
Ammonia as N	**0.22**	0.10	mg/l	1	03/02/22	
Method: EPA 351.2		**Instr:** AA06				
Batch ID: W2C0321 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 03/03/22 16:35				**Analyst:** YMT
TKN	**1.2**	0.10	mg/l	1	03/10/22	
Method: EPA 353.2		**Instr:** AA01				
Batch ID: W2B1376 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 15:21				**Analyst:** JOG
Nitrate as N	**0.24**	0.20	mg/l	1	02/18/22 17:38	
Nitrite as N	ND	0.10	mg/l	1	02/18/22 17:38	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1317 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 15:41				**Analyst:** heq
Phosphorus as P, Total	**0.059**	0.010	mg/l	1	02/23/22	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1328 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 18:06				**Analyst:** heq
o-Phosphate as P	ND	0.010	mg/l	1	02/17/22 19:05	
Method: SM 2540C		**Instr:** OVEN01				
Batch ID: W2B1476 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/22/22 17:13				**Analyst:** jao
Total Dissolved Solids	**620**	10	mg/l	1	02/23/22	
Method: SM 2540D		**Instr:** OVEN15				
Batch ID: W2B1510 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/23/22 09:32				**Analyst:** ttf
Total Suspended Solids	**9**	5	mg/l	1	02/23/22	
Method: SM 4500S2-D		**Instr:** _ANALYST				
Batch ID: W2B1366 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 12:23				**Analyst:** ymt
Sulfide, Total	ND	0.10	mg/l	1	02/23/22	
Metals by EPA 200 Series Methods						
Method: EPA 200.7		**Instr:** ICP03				
Batch ID: W2B1393 — **Preparation:** EPA 200.2		**Prepared:** 02/20/22 08:37				**Analyst:** kvm
Aluminum, Dissolved	ND	0.050	mg/l	1	02/28/22	
Aluminum, Total	**0.066**	0.050	mg/l	1	02/28/22	

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results

(Continued)

Sample: CL10 — 2B17092-14 (Water) — Sampled: 02/17/22 8:25 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: EPA 350.1		**Instr:** AA06				
Batch ID: W2B1824 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/28/22 12:12				**Analyst:** YMT
Ammonia as N	**0.11**	0.10	mg/l	1	03/02/22	
Method: EPA 351.2		**Instr:** AA06				
Batch ID: W2C0321 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 03/03/22 16:35				**Analyst:** YMT
TKN	**1.1**	0.10	mg/l	1	03/10/22	
Method: EPA 353.2		**Instr:** AA01				
Batch ID: W2B1376 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 15:21				**Analyst:** JOG
Nitrate as N	ND	0.20	mg/l	1	02/18/22 17:43	
Nitrite as N	ND	0.10	mg/l	1	02/18/22 17:46	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1317 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 15:41				**Analyst:** heq
Phosphorus as P, Total	**0.033**	0.010	mg/l	1	02/23/22	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1328 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 18:06				**Analyst:** heq
o-Phosphate as P	ND	0.010	mg/l	1	02/17/22 19:05	
Method: SM 2540C		**Instr:** OVEN01				
Batch ID: W2B1383 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 18:26				**Analyst:** jao
Total Dissolved Solids	**660**	10	mg/l	1	02/22/22	
Method: SM 2540D		**Instr:** OVEN15				
Batch ID: W2B1510 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/23/22 09:32				**Analyst:** ttf
Total Suspended Solids	**10**	5	mg/l	1	02/23/22	
Method: SM 4500S2-D		**Instr:** _ANALYST				
Batch ID: W2B1366 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 12:23				**Analyst:** ymt
Sulfide, Total	ND	0.10	mg/l	1	02/23/22	
Metals by EPA 200 Series Methods						
Method: EPA 200.7		**Instr:** ICP03				
Batch ID: W2B1393 — **Preparation:** EPA 200.2		**Prepared:** 02/20/22 08:37				**Analyst:** kvm
Aluminum, Dissolved	ND	0.050	mg/l	1	02/28/22	
Aluminum, Total	**0.088**	0.050	mg/l	1	02/28/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results

(Continued)

Sample: LE02 — 2B17092-15 (Water) — Sampled: 02/17/22 9:00 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: EPA 350.1		**Instr:** AA06				
Batch ID: W2B1824 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/28/22 12:12				**Analyst:** YMT
Ammonia as N	ND	0.10	mg/l	1	03/02/22	
Method: EPA 351.2		**Instr:** AA06				
Batch ID: W2C0321 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 03/03/22 16:35				**Analyst:** YMT
TKN	**4.3**	0.10	mg/l	1	03/10/22	
Method: EPA 353.2		**Instr:** AA01				
Batch ID: W2B1376 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 15:21				**Analyst:** JOG
Nitrate as N	ND	0.20	mg/l	1	02/18/22 17:44	
Nitrite as N	ND	0.10	mg/l	1	02/18/22 17:44	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1317 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 15:41				**Analyst:** heq
Phosphorus as P, Total	**0.12**	0.010	mg/l	1	02/23/22	
Method: EPA 365.3		**Instr:** UVVIS04				
Batch ID: W2B1328 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/17/22 18:06				**Analyst:** heq
o-Phosphate as P	**0.011**	0.010	mg/l	1	02/17/22 19:06	
Method: SM 2540C		**Instr:** OVEN01				
Batch ID: W2B1383 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 18:26				**Analyst:** jao
Total Dissolved Solids	**2300**	10	mg/l	1	02/22/22	
Method: SM 4500S2-D		**Instr:** _ANALYST				
Batch ID: W2B1366 — **Preparation:** _NONE (WETCHEM)		**Prepared:** 02/18/22 12:23				**Analyst:** ymt
Sulfide, Total	ND	0.10	mg/l	1	02/23/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange

Sample: CL07 - Int
2B17092-01 (Water)

Sampled: 02/17/22 11:00 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**19**	1.0	mg/M3	1	02/24/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange (Continued)

Sample: CL07 - Surf
2B17092-02 (Water)

Sampled: 02/17/22 11:15 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**32**	1.0	mg/M3	1	02/24/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange

(Continued)

Sample: CL08 - Int
2B17092-03 (Water)

Sampled: 02/17/22 10:10 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 284875 **Prepared:** 02/17/22 00:00 **Analyst:** MMP						
Chlorophyll a	**22**	1.0	mg/M3	1	02/24/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Surf
2B17092-04 (Water)

Sampled: 02/17/22 10:25 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**34**	1.0	mg/M3	1	02/24/22	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange

(Continued)

Sample: CL09 - Int
2B17092-05 (Water)

Sampled: 02/17/22 9:15 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**22**	1.0	mg/M3	1	02/24/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Surf
2B17092-06 (Water)

Sampled: 02/17/22 9:30 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**33**	1.0	mg/M3	1	02/24/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange

(Continued)

Sample: CL10 - Int
2B17092-07 (Water)

Sampled: 02/17/22 8:25 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**22**	1.0	mg/M3	1	02/24/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Surf
2B17092-08 (Water)

Sampled: 02/17/22 8:35 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 284875	**Prepared:** 02/17/22 00:00				**Analyst:** MMP
Chlorophyll a	**13**	1.0	mg/M3	1	02/24/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange

(Continued)

Sample: LE02 - Int
2B17092-09 (Water)

Sampled: 02/17/22 9:35 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 284875 **Prepared:** 02/17/22 00:00 **Analyst:** MMP						
Chlorophyll a	**76**	1.0	mg/M3	1	02/24/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Sample Results Enthalpy Orange

(Continued)

Sample: LE02 - Surf
2B17092-10 (Water)

Sampled: 02/17/22 9:45 by Nicholas Jernack

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 284875 **Prepared:** 02/17/22 00:00 **Analyst:** MMP						
Chlorophyll a	**91**	1.0	mg/M3	1	02/24/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Quality Control Results

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2B1317 - EPA 365.3										
Blank (W2B1317-BLK1)				**Prepared: 02/17/22 Analyzed: 02/23/22**						
Phosphorus as P, Total	ND	0.010	mg/l							
LCS (W2B1317-BS1)				**Prepared: 02/17/22 Analyzed: 02/23/22**						
Phosphorus as P, Total	0.190	0.010	mg/l	0.200		95	90-110			
Matrix Spike (W2B1317-MS1)	**Source: 2B15085-01**			**Prepared: 02/17/22 Analyzed: 02/23/22**						
Phosphorus as P, Total	0.384	0.010	mg/l	0.200	0.169	108	90-110			
Matrix Spike Dup (W2B1317-MSD1)	**Source: 2B15085-01**			**Prepared: 02/17/22 Analyzed: 02/23/22**						
Phosphorus as P, Total	0.383	0.010	mg/l	0.200	0.169	107	90-110	0.3	20	
Batch: W2B1328 - EPA 365.3										
Blank (W2B1328-BLK1)				**Prepared & Analyzed: 02/17/22**						
o-Phosphate as P	ND	0.010	mg/l							
LCS (W2B1328-BS1)				**Prepared & Analyzed: 02/17/22**						
o-Phosphate as P	0.205	0.010	mg/l	0.200		102	88-111			
Matrix Spike (W2B1328-MS1)	**Source: 2B17092-11**			**Prepared & Analyzed: 02/17/22**						
o-Phosphate as P	0.209	0.010	mg/l	0.200	ND	104	85-112			
Matrix Spike Dup (W2B1328-MSD1)	**Source: 2B17092-11**			**Prepared & Analyzed: 02/17/22**						
o-Phosphate as P	0.215	0.010	mg/l	0.200	ND	108	85-112	3	20	
Batch: W2B1366 - SM 4500S2-D										
Blank (W2B1366-BLK1)				**Prepared: 02/18/22 Analyzed: 02/23/22**						
Sulfide, Total	ND	0.10	mg/l							
LCS (W2B1366-BS1)				**Prepared: 02/18/22 Analyzed: 02/23/22**						
Sulfide, Total	0.100	0.10	mg/l	0.100		100	95-105			
Duplicate (W2B1366-DUP1)	**Source: 2B22084-02**			**Prepared: 02/18/22 Analyzed: 02/23/22**						
Sulfide, Total	ND	0.10	mg/l		ND				20	
Batch: W2B1376 - EPA 353.2										
Blank (W2B1376-BLK1)				**Prepared & Analyzed: 02/18/22**						
Nitrate as N	ND	0.20	mg/l							
Nitrite as N	ND	0.10	mg/l							
LCS (W2B1376-BS1)				**Prepared & Analyzed: 02/18/22**						
Nitrate as N	1.02	0.20	mg/l	1.00		102	90-110			
Nitrite as N	1.01	0.10	mg/l	1.00		101	90-110			
Matrix Spike (W2B1376-MS1)	**Source: 2B17069-01**			**Prepared & Analyzed: 02/18/22**						
Nitrate as N	3.84	0.20	mg/l	2.00	1.78	103	90-110			
Nitrite as N	1.03	0.10	mg/l	1.00	ND	103	90-110			
Matrix Spike (W2B1376-MS2)	**Source: 2B18025-01**			**Prepared & Analyzed: 02/18/22**						
Nitrate as N	6.37	0.20	mg/l	2.00	4.30	104	90-110			
Nitrite as N	1.03	0.10	mg/l	1.00	ND	103	90-110			
Matrix Spike Dup (W2B1376-MSD1)	**Source: 2B17069-01**			**Prepared & Analyzed: 02/18/22**						

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Quality Control Results

(Continued)

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2B1376 - EPA 353.2 (Continued)										
Matrix Spike Dup (W2B1376-MSD1)	**Source: 2B17069-01**			**Prepared & Analyzed: 02/18/22**						
Nitrate as N	3.83	0.20	mg/l	2.00	1.78	102	90-110	0.3	20	
Nitrite as N	1.02	0.10	mg/l	1.00	ND	102	90-110	1	20	
Matrix Spike Dup (W2B1376-MSD2)	**Source: 2B18025-01**			**Prepared & Analyzed: 02/18/22**						
Nitrate as N	6.33	0.20	mg/l	2.00	4.30	102	90-110	0.6	20	
Nitrite as N	1.04	0.10	mg/l	1.00	ND	104	90-110	1	20	
Batch: W2B1383 - SM 2540C										
Blank (W2B1383-BLK1)				**Prepared: 02/18/22 Analyzed: 02/22/22**						
Total Dissolved Solids	ND	10	mg/l							
LCS (W2B1383-BS1)				**Prepared: 02/18/22 Analyzed: 02/22/22**						
Total Dissolved Solids	825	10	mg/l	824		100	96-102			
Duplicate (W2B1383-DUP1)	**Source: 2B17096-01**			**Prepared: 02/18/22 Analyzed: 02/22/22**						
Total Dissolved Solids	2140	10	mg/l		2130			0.4	10	
Duplicate (W2B1383-DUP2)	**Source: 2B17092-15**			**Prepared: 02/18/22 Analyzed: 02/22/22**						
Total Dissolved Solids	2260	10	mg/l		2250			0.3	10	
Batch: W2B1476 - SM 2540C										
Blank (W2B1476-BLK1)				**Prepared: 02/22/22 Analyzed: 02/23/22**						
Total Dissolved Solids	ND	10	mg/l							
LCS (W2B1476-BS1)				**Prepared: 02/22/22 Analyzed: 02/23/22**						
Total Dissolved Solids	812	10	mg/l	824		99	96-102			
Duplicate (W2B1476-DUP1)	**Source: 2B03002-01**			**Prepared: 02/22/22 Analyzed: 02/23/22**						
Total Dissolved Solids	2140	10	mg/l		2170			1	10	
Duplicate (W2B1476-DUP2)	**Source: 2B22014-01**			**Prepared: 02/22/22 Analyzed: 02/23/22**						
Total Dissolved Solids	1020	10	mg/l		1030			0.6	10	
Batch: W2B1510 - SM 2540D										
Blank (W2B1510-BLK1)				**Prepared & Analyzed: 02/23/22**						
Total Suspended Solids	ND	5	mg/l							
LCS (W2B1510-BS1)				**Prepared & Analyzed: 02/23/22**						
Total Suspended Solids	54.7	5	mg/l	54.4		101	90-110			
Duplicate (W2B1510-DUP1)	**Source: 2B22013-01**			**Prepared & Analyzed: 02/23/22**						
Total Suspended Solids	77.6	5	mg/l		76.8			1	10	
Duplicate (W2B1510-DUP2)	**Source: 2B18046-01**			**Prepared & Analyzed: 02/23/22**						
Total Suspended Solids	339	5	mg/l		349			3	10	
Batch: W2B1824 - EPA 350.1										
Blank (W2B1824-BLK1)				**Prepared: 02/28/22 Analyzed: 03/02/22**						
Ammonia as N	ND	0.10	mg/l							
Blank (W2B1824-BLK2)				**Prepared: 02/28/22 Analyzed: 03/02/22**						
Ammonia as N	ND	0.10	mg/l							

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Quality Control Results

(Continued)

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2B1824 - EPA 350.1 (Continued)										
LCS (W2B1824-BS1)				**Prepared: 02/28/22**	**Analyzed: 03/02/22**					
Ammonia as N	0.262	0.10	mg/l	0.250		105	90-110			
LCS (W2B1824-BS2)				**Prepared: 02/28/22**	**Analyzed: 03/02/22**					
Ammonia as N	0.261	0.10	mg/l	0.250		104	90-110			
Matrix Spike (W2B1824-MS1)	**Source: 1K11009-04**			**Prepared: 02/28/22**	**Analyzed: 03/02/22**					
Ammonia as N	0.302	0.10	mg/l	0.250	0.0520	100	90-110			
Matrix Spike (W2B1824-MS2)	**Source: 2B22017-01**			**Prepared: 02/28/22**	**Analyzed: 03/02/22**					
Ammonia as N	0.259	0.10	mg/l	0.250	ND	104	90-110			
Matrix Spike Dup (W2B1824-MSD1)	**Source: 1K11009-04**			**Prepared: 02/28/22**	**Analyzed: 03/02/22**					
Ammonia as N	0.300	0.10	mg/l	0.250	0.0520	99	90-110	0.8	15	
Matrix Spike Dup (W2B1824-MSD2)	**Source: 2B22017-01**			**Prepared: 02/28/22**	**Analyzed: 03/02/22**					
Ammonia as N	0.261	0.10	mg/l	0.250	ND	104	90-110	0.6	15	
Batch: W2C0321 - EPA 351.2										
Blank (W2C0321-BLK1)				**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	ND	0.10	mg/l							
Blank (W2C0321-BLK2)				**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	ND	0.10	mg/l							
LCS (W2C0321-BS1)				**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	0.983	0.10	mg/l	1.00		98	90-110			
LCS (W2C0321-BS2)				**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	0.954	0.10	mg/l	1.00		95	90-110			
Matrix Spike (W2C0321-MS1)	**Source: 2B15022-07**			**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	1.20	0.10	mg/l	1.00	0.193	100	90-110			
Matrix Spike (W2C0321-MS2)	**Source: 2B15022-08**			**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	1.23	0.10	mg/l	1.00	0.247	98	90-110			
Matrix Spike Dup (W2C0321-MSD1)	**Source: 2B15022-07**			**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	1.18	0.10	mg/l	1.00	0.193	99	90-110	1	10	
Matrix Spike Dup (W2C0321-MSD2)	**Source: 2B15022-08**			**Prepared: 03/03/22**	**Analyzed: 03/10/22**					
TKN	1.23	0.10	mg/l	1.00	0.247	99	90-110	0.4	10	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 04/06/2022 16:52

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2B1393 - EPA 200.7										
Blank (W2B1393-BLK1)				**Prepared: 02/20/22**	**Analyzed: 02/28/22**					
Aluminum, Dissolved	ND	0.050	mg/l							
Aluminum, Total	ND	0.050	mg/l							
LCS (W2B1393-BS1)				**Prepared: 02/20/22**	**Analyzed: 02/28/22**					
Aluminum, Dissolved	0.197	0.050	mg/l	0.200		99	85-115			
Aluminum, Total	0.197	0.050	mg/l	0.200		99	85-115			
Matrix Spike (W2B1393-MS1)	**Source: 2B17092-11**			**Prepared: 02/20/22**	**Analyzed: 02/28/22**					
Aluminum, Total	0.297	0.050	mg/l	0.200	0.0509	123	70-130			
Matrix Spike (W2B1393-MS2)	**Source: 2B17098-09**			**Prepared: 02/20/22**	**Analyzed: 02/28/22**					
Aluminum, Total	0.426	0.050	mg/l	0.200	0.0771	175	70-130			MS-02
Matrix Spike Dup (W2B1393-MSD1)	**Source: 2B17092-11**			**Prepared: 02/20/22**	**Analyzed: 02/28/22**					
Aluminum, Total	0.305	0.050	mg/l	0.200	0.0509	127	70-130	2	30	
Matrix Spike Dup (W2B1393-MSD2)	**Source: 2B17098-09**			**Prepared: 02/20/22**	**Analyzed: 02/28/22**					
Aluminum, Total	0.453	0.050	mg/l	0.200	0.0771	188	70-130	6	30	MS-02

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

Notes and Definitions

Item	Definition
MS-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
%REC	Percent Recovery
Dil	Dilution
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Work Orders:	2D14012	**Report Date:**	5/27/2022
		Received Date:	4/13/2022
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 4/13/22 with the Chain-of-Custody document. The samples were received in good condition, at 5.8 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07	Kate Buckley	2D14012-01	Water	04/13/22 11:10	
CL08	Kate Buckley	2D14012-02	Water	04/13/22 10:15	
CL09	Kate Buckley	2D14012-03	Water	04/13/22 09:15	
CL10	Kate Buckley	2D14012-04	Water	04/13/22 08:15	
LE02	Kate Buckley	2D14012-05	Water	04/13/22 09:00	
CL07 - Int	Kate Buckley	2D14012-06	Water	04/13/22 11:10	
CL07 - Surf	Kate Buckley	2D14012-07	Water	04/13/22 11:40	
CL08 - Int	Kate Buckley	2D14012-08	Water	04/13/22 10:15	
CL08 - Surf	Kate Buckley	2D14012-09	Water	04/13/22 10:30	
CL09 - Int	Kate Buckley	2D14012-10	Water	04/13/22 09:15	
CL09 - Surf	Kate Buckley	2D14012-11	Water	04/13/22 09:30	
CL10 - Int	Kate Buckley	2D14012-12	Water	04/13/22 08:15	
CL10 - Surf	Kate Buckley	2D14012-13	Water	04/13/22 08:30	
LE02 - Int	Kate Buckley	2D14012-14	Water	04/13/22 09:00	
LE02 - Surf	Kate Buckley	2D14012-15	Water	04/13/22 09:45	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results

Sample: CL07 — 2D14012-01 (Water) — Sampled: 04/13/22 11:10 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2D1152 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 17:30				**Analyst:** ymt
Ammonia as N	**0.42**	0.017	0.10	mg/l	1	04/18/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2D2224 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/29/22 09:33				**Analyst:** YMT
TKN	**1.1**	0.065	0.10	mg/l	1	05/02/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2D1063 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 15:26				**Analyst:** jog
Nitrate as N	**0.082**	0.040	0.20	mg/l	1	04/14/22 18:12	FILT, J
Nitrite as N	ND	0.042	0.10	mg/l	1	04/14/22 18:12	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1071 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 16:28				**Analyst:** heq
o-Phosphate as P	**0.023**	0.0030	0.010	mg/l	1	04/14/22 17:31	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1164 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/17/22 08:00				**Analyst:** heq
Phosphorus as P, Total	**0.046**	0.0067	0.010	mg/l	1	04/19/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2D1427 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/20/22 09:50				**Analyst:** jao
Total Dissolved Solids	**570**	4.0	10	mg/l	1	04/20/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2D1364 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/19/22 14:44				**Analyst:** ttf
Total Suspended Solids	**2**		5	mg/l	1	04/19/22	J
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2D1121 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 10:11				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	04/18/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2D2017 — **Preparation:** EPA 200.2			**Prepared:** 04/27/22 10:30				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	05/03/22	
Aluminum, Total	ND	0.041	0.050	mg/l	1	05/03/22	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results

(Continued)

Sample: CL08 — 2D14012-02 (Water) — Sampled: 04/13/22 10:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1 — **Instr:** AA06							
Batch ID: W2D1152 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/15/22 17:30 — **Analyst:** ymt							
Ammonia as N	**0.24**	0.017	0.10	mg/l	1	04/18/22	
Method: EPA 351.2 — **Instr:** AA06							
Batch ID: W2D2224 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/29/22 09:33 — **Analyst:** YMT							
TKN	**0.93**	0.065	0.10	mg/l	1	05/02/22	
Method: EPA 353.2 — **Instr:** AA01							
Batch ID: W2D1063 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/14/22 15:26 — **Analyst:** jog							
Nitrate as N	**0.14**	0.040	0.20	mg/l	1	04/14/22 18:13	FILT, J
Nitrite as N	ND	0.042	0.10	mg/l	1	04/14/22 18:13	FILT
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2D1071 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/14/22 16:28 — **Analyst:** heq							
o-Phosphate as P	**0.010**	0.0030	0.010	mg/l	1	04/14/22 17:32	
Method: EPA 365.3 — **Instr:** UVVIS04							
Batch ID: W2D1164 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/17/22 08:00 — **Analyst:** heq							
Phosphorus as P, Total	**0.032**	0.0067	0.010	mg/l	1	04/19/22	
Method: SM 2540C — **Instr:** OVEN01							
Batch ID: W2D1388 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/19/22 17:29 — **Analyst:** jao							
Total Dissolved Solids	**570**	4.0	10	mg/l	1	04/19/22	
Method: SM 2540D — **Instr:** OVEN15							
Batch ID: W2D1364 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/19/22 14:44 — **Analyst:** ttf							
Total Suspended Solids	**4**		5	mg/l	1	04/19/22	J
Method: SM 4500S2-D — **Instr:** _ANALYST							
Batch ID: W2D1121 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 04/15/22 10:11 — **Analyst:** ymt							
Sulfide, Total	ND	0.050	0.10	mg/l	1	04/18/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7 — **Instr:** ICP03							
Batch ID: W2D2017 — **Preparation:** EPA 200.2 — **Prepared:** 04/27/22 10:30 — **Analyst:** kvm							
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	05/03/22	
Aluminum, Total	**0.061**	0.041	0.050	mg/l	1	05/03/22	

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results

(Continued)

Sample: CL09 — 2D14012-03 (Water) — Sampled: 04/13/22 9:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2D1152 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 17:30				**Analyst:** ymt
Ammonia as N	**0.60**	0.017	0.10	mg/l	1	04/18/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2D2224 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/29/22 09:33				**Analyst:** YMT
TKN	**1.4**	0.065	0.10	mg/l	1	05/02/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2D1063 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 15:26				**Analyst:** jog
Nitrate as N	**0.11**	0.040	0.20	mg/l	1	04/14/22 18:14	FILT, J
Nitrite as N	ND	0.042	0.10	mg/l	1	04/14/22 18:14	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1071 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 16:28				**Analyst:** heq
o-Phosphate as P	**0.064**	0.0030	0.010	mg/l	1	04/14/22 17:32	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1164 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/17/22 08:00				**Analyst:** heq
Phosphorus as P, Total	**0.14**	0.0067	0.010	mg/l	1	04/19/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2D1388 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/19/22 17:29				**Analyst:** jao
Total Dissolved Solids	**620**	4.0	10	mg/l	1	04/19/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2D1210 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/18/22 11:57				**Analyst:** ttf
Total Suspended Solids	**3**		5	mg/l	1	04/18/22	J
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2D1121 **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 10:11				**Analyst:** ymt
Sulfide, Total	**0.10**	0.050	0.10	mg/l	1	04/18/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2D2017 **Preparation:** EPA 200.2			**Prepared:** 04/27/22 10:30				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	05/03/22	
Aluminum, Total	ND	0.041	0.050	mg/l	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results

(Continued)

Sample: CL10 — 2D14012-04 (Water) — Sampled: 04/13/22 8:15 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2D1152 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 17:30				**Analyst:** ymt
Ammonia as N	**0.028**	0.017	0.10	mg/l	1	04/18/22	J
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2D2224 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/29/22 09:33				**Analyst:** YMT
TKN	**0.77**	0.065	0.10	mg/l	1	05/02/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2D1063 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 15:26				**Analyst:** jog
Nitrate as N	**0.16**	0.040	0.20	mg/l	1	04/14/22 18:15	FILT, J
Nitrite as N	ND	0.042	0.10	mg/l	1	04/14/22 18:15	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1071 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 16:28				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	04/14/22 17:33	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1164 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/17/22 08:00				**Analyst:** heq
Phosphorus as P, Total	**0.020**	0.0067	0.010	mg/l	1	04/19/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2D1388 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/19/22 17:29				**Analyst:** jao
Total Dissolved Solids	**660**	4.0	10	mg/l	1	04/19/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2D1210 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/18/22 11:57				**Analyst:** ttf
Total Suspended Solids	**7**		5	mg/l	1	04/18/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2D1121 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 10:11				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	04/18/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2D2017 — **Preparation:** EPA 200.2			**Prepared:** 04/27/22 10:30				**Analyst:** kvm
Aluminum, Dissolved	ND	0.041	0.050	mg/l	1	05/03/22	
Aluminum, Total	**0.097**	0.041	0.050	mg/l	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results

(Continued)

Sample: LE02 — 2D14012-05 (Water) — Sampled: 04/13/22 9:00 by Kate Buckley

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2D1152 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 17:30				**Analyst:** ymt
Ammonia as N	**0.025**	0.017	0.10	mg/l	1	04/18/22	J
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2D2224 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/29/22 09:33				**Analyst:** YMT
TKN	**4.5**	0.065	0.10	mg/l	1	05/02/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2D1063 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 15:26				**Analyst:** jog
Nitrate as N	ND	0.040	0.20	mg/l	1	04/14/22 18:16	FILT
Nitrite as N	ND	0.042	0.10	mg/l	1	04/14/22 18:16	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1071 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/14/22 16:28				**Analyst:** heq
o-Phosphate as P	**0.0040**	0.0030	0.010	mg/l	1	04/14/22 17:33	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2D1164 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/17/22 08:00				**Analyst:** heq
Phosphorus as P, Total	**0.23**	0.0067	0.010	mg/l	1	04/19/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2D1388 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/19/22 17:29				**Analyst:** jao
Total Dissolved Solids	**2300**	4.0	10	mg/l	1	04/19/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2D1121 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 04/15/22 10:11				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	04/18/22	

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

www.wecklabs.com

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange

Sample: CL07 - Int
2D14012-06 (Water)

Sampled: 04/13/22 11:10 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 288729 **Prepared:** 04/13/22 00:00 **Analyst:** ATP						
Chlorophyll a	**6.9**	1.0	mg/M3	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange (Continued)

Sample: CL07 - Surf
2D14012-07 (Water)

Sampled: 04/13/22 11:40 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 288729 **Prepared:** 04/13/22 00:00 **Analyst:** ATP						
Chlorophyll a	**14**	1.0	mg/M3	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange (Continued)

Sample: CL08 - Int
2D14012-08 (Water)

Sampled: 04/13/22 10:15 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 288729	**Prepared:** 04/13/22 00:00				**Analyst:** ATP
Chlorophyll a	**9.1**	1.0	mg/M3	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange

(Continued)

Sample: CL08 - Surf
2D14012-09 (Water)

Sampled: 04/13/22 10:30 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 288729	**Prepared:** 04/13/22 00:00				**Analyst:** ATP
Chlorophyll a	**12**	1.0	mg/M3	1	05/03/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Int
2D14012-10 (Water)

Sampled: 04/13/22 9:15 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 288729	**Prepared:** 04/13/22 00:00				**Analyst:** ATP
Chlorophyll a	**86**	1.0	mg/M3	1	05/03/22	

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

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Surf
2D14012-11 (Water)

Sampled: 04/13/22 9:30 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 288729 **Prepared:** 04/13/22 00:00 **Analyst:** ATP						
Chlorophyll a	**9.6**	1.0	mg/M3	1	05/03/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Int
2D14012-12 (Water)

Sampled: 04/13/22 8:15 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 288729	**Prepared:** 04/13/22 00:00				**Analyst:** ATP
Chlorophyll a	**9.6**	1.0	mg/M3	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange

(Continued)

Sample: CL10 - Surf
2D14012-13 (Water)

Sampled: 04/13/22 8:30 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 288729	**Prepared:** 04/13/22 00:00				**Analyst:** ATP
Chlorophyll a	**9.3**	1.0	mg/M3	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Int
2D14012-14 (Water)

Sampled: 04/13/22 9:00 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll **Batch ID:** 288729 **Prepared:** 04/13/22 00:00 **Analyst:** ATP						
Chlorophyll a	**70**	1.0	mg/M3	1	05/03/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Sample Results Enthalpy Orange (Continued)

Sample: LE02 - Surf
2D14012-15 (Water)

Sampled: 04/13/22 9:45 by Kate Buckley

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H						
Method: Chlorophyll	**Batch ID:** 288729	**Prepared:** 04/13/22 00:00				**Analyst:** ATP
Chlorophyll a	**120**	1.0	mg/M3	1	05/03/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D1063 - EPA 353.2											
Blank (W2D1063-BLK1)					**Prepared & Analyzed: 04/14/22**						
Nitrate as N	ND	0.040	0.15	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W2D1063-BS1)					**Prepared & Analyzed: 04/14/22**						
Nitrate as N	1.02	0.040	0.15	mg/l	1.00		102	90-110			
Nitrite as N	0.980	0.042	0.10	mg/l	1.00		98	90-110			
Matrix Spike (W2D1063-MS1)	**Source: 2D13167-01**				**Prepared & Analyzed: 04/14/22**						
Nitrate as N	3.06	0.040	0.15	mg/l	2.00	1.03	102	90-110			
Nitrite as N	0.960	0.042	0.10	mg/l	1.00	ND	96	90-110			
Matrix Spike (W2D1063-MS2)	**Source: 2D14046-01**				**Prepared & Analyzed: 04/14/22**						
Nitrate as N	6.78	0.040	0.15	mg/l	2.00	4.62	108	90-110			
Nitrite as N	0.987	0.042	0.10	mg/l	1.00	ND	99	90-110			
Matrix Spike Dup (W2D1063-MSD1)	**Source: 2D13167-01**				**Prepared & Analyzed: 04/14/22**						
Nitrate as N	3.12	0.040	0.15	mg/l	2.00	1.03	104	90-110	2	20	
Nitrite as N	0.963	0.042	0.10	mg/l	1.00	ND	96	90-110	0.3	20	
Matrix Spike Dup (W2D1063-MSD2)	**Source: 2D14046-01**				**Prepared & Analyzed: 04/14/22**						
Nitrate as N	6.66	0.040	0.15	mg/l	2.00	4.62	102	90-110	2	20	
Nitrite as N	1.02	0.042	0.10	mg/l	1.00	ND	102	90-110	3	20	
Batch: W2D1071 - EPA 365.3											
Blank (W2D1071-BLK1)					**Prepared & Analyzed: 04/14/22**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W2D1071-BS1)					**Prepared & Analyzed: 04/14/22**						
o-Phosphate as P	0.196	0.0030	0.010	mg/l	0.200		98	88-111			
Matrix Spike (W2D1071-MS1)	**Source: 2D13176-01**				**Prepared & Analyzed: 04/14/22**						
o-Phosphate as P	0.206	0.0030	0.010	mg/l	0.200	0.00700	100	85-112			
Matrix Spike Dup (W2D1071-MSD1)	**Source: 2D13176-01**				**Prepared & Analyzed: 04/14/22**						
o-Phosphate as P	0.205	0.0030	0.010	mg/l	0.200	0.00700	99	85-112	0.5	20	
Batch: W2D1121 - SM 4500S2-D											
Blank (W2D1121-BLK1)					**Prepared: 04/15/22 Analyzed: 04/18/22**						
Sulfide, Total	ND	0.050	0.10	mg/l							
LCS (W2D1121-BS1)					**Prepared: 04/15/22 Analyzed: 04/18/22**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.0989		101	95-105			
Duplicate (W2D1121-DUP1)	**Source: 2D14012-03**				**Prepared: 04/15/22 Analyzed: 04/18/22**						
Sulfide, Total	0.100	0.050	0.10	mg/l		0.100			0	20	
Batch: W2D1152 - EPA 350.1											
Blank (W2D1152-BLK1)					**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
Blank (W2D1152-BLK2)					**Prepared: 04/15/22 Analyzed: 04/18/22**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D1152 - EPA 350.1 (Continued)											
Blank (W2D1152-BLK2)					**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	ND	0.017	0.10	mg/l							
LCS (W2D1152-BS1)					**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	0.240	0.017	0.10	mg/l	0.250		96	90-110			
LCS (W2D1152-BS2)					**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	0.245	0.017	0.10	mg/l	0.250		98	90-110			
Matrix Spike (W2D1152-MS1)	**Source: 2D13144-01**				**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	0.582	0.017	0.10	mg/l	0.250	0.341	96	90-110			
Matrix Spike (W2D1152-MS2)	**Source: 2D14012-03**				**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	0.843	0.017	0.10	mg/l	0.250	0.600	97	90-110			
Matrix Spike Dup (W2D1152-MSD1)	**Source: 2D13144-01**				**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	0.577	0.017	0.10	mg/l	0.250	0.341	94	90-110	0.9	15	
Matrix Spike Dup (W2D1152-MSD2)	**Source: 2D14012-03**				**Prepared: 04/15/22 Analyzed: 04/18/22**						
Ammonia as N	0.854	0.017	0.10	mg/l	0.250	0.600	101	90-110	1	15	
Batch: W2D1164 - EPA 365.3											
Blank (W2D1164-BLK1)					**Prepared: 04/17/22 Analyzed: 04/19/22**						
Phosphorus as P, Total	ND	0.0067	0.010	mg/l							
LCS (W2D1164-BS1)					**Prepared: 04/17/22 Analyzed: 04/19/22**						
Phosphorus as P, Total	0.196	0.0067	0.010	mg/l	0.200		98	90-110			
Matrix Spike (W2D1164-MS1)	**Source: 2D12041-01**				**Prepared: 04/17/22 Analyzed: 04/19/22**						
Phosphorus as P, Total	0.367	0.0067	0.010	mg/l	0.200	0.167	100	90-110			
Matrix Spike Dup (W2D1164-MSD1)	**Source: 2D12041-01**				**Prepared: 04/17/22 Analyzed: 04/19/22**						
Phosphorus as P, Total	0.367	0.0067	0.010	mg/l	0.200	0.167	100	90-110	0	20	
Batch: W2D1210 - SM 2540D											
Blank (W2D1210-BLK1)					**Prepared & Analyzed: 04/18/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2D1210-BS1)					**Prepared & Analyzed: 04/18/22**						
Total Suspended Solids	51.9		5	mg/l	50.0		104	90-110			
Duplicate (W2D1210-DUP1)	**Source: 2D14078-01**				**Prepared & Analyzed: 04/18/22**						
Total Suspended Solids	634		5	mg/l		638			0.6	10	
Duplicate (W2D1210-DUP2)	**Source: 2D12028-01**				**Prepared & Analyzed: 04/18/22**						
Total Suspended Solids	127		5	mg/l		126			0.8	10	
Batch: W2D1364 - SM 2540D											
Blank (W2D1364-BLK1)					**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2D1364-BS1)					**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	56.5		5	mg/l	55.8		101	90-110			
LCS (W2D1364-BS2)					**Prepared & Analyzed: 04/19/22**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D1364 - SM 2540D (Continued)											
LCS (W2D1364-BS2)					**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	232		5	mg/l	234		99	90-110			
LCS (W2D1364-BS3)					**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	241		5	mg/l	244		99	90-110			
LCS (W2D1364-BS4)					**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	231		5	mg/l	231		100	90-110			
LCS (W2D1364-BS5)					**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	225		5	mg/l	225		100	90-110			
Duplicate (W2D1364-DUP1)	**Source: 2D13138-02**				**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	8.70		5	mg/l		8.30			5	10	
Duplicate (W2D1364-DUP2)	**Source: 2D13050-01**				**Prepared & Analyzed: 04/19/22**						
Total Suspended Solids	272		5	mg/l		276			1	10	
Batch: W2D1388 - SM 2540C											
Blank (W2D1388-BLK1)					**Prepared & Analyzed: 04/19/22**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W2D1388-BS1)					**Prepared & Analyzed: 04/19/22**						
Total Dissolved Solids	837	4.0	10	mg/l	824		102	96-102			
Duplicate (W2D1388-DUP1)	**Source: 2D13183-06**				**Prepared & Analyzed: 04/19/22**						
Total Dissolved Solids	37500	4.0	10	mg/l		37200			0.9	10	
Duplicate (W2D1388-DUP2)	**Source: 2D13183-05**				**Prepared & Analyzed: 04/19/22**						
Total Dissolved Solids	4040	4.0	10	mg/l		4120			2	10	
Batch: W2D1427 - SM 2540C											
Blank (W2D1427-BLK1)					**Prepared & Analyzed: 04/20/22**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W2D1427-BS1)					**Prepared & Analyzed: 04/20/22**						
Total Dissolved Solids	813	4.0	10	mg/l	824		99	96-102			
Duplicate (W2D1427-DUP1)	**Source: 2D13183-07**				**Prepared & Analyzed: 04/20/22**						
Total Dissolved Solids	3770	4.0	10	mg/l		3790			0.6	10	
Duplicate (W2D1427-DUP2)	**Source: 2D13183-09**				**Prepared & Analyzed: 04/20/22**						
Total Dissolved Solids	1430	4.0	10	mg/l		1390			3	10	
Batch: W2D2224 - EPA 351.2											
Blank (W2D2224-BLK1)					**Prepared: 04/29/22 Analyzed: 05/02/22**						
TKN	ND	0.065	0.10	mg/l							
Blank (W2D2224-BLK2)					**Prepared: 04/29/22 Analyzed: 05/02/22**						
TKN	ND	0.065	0.10	mg/l							
LCS (W2D2224-BS1)					**Prepared: 04/29/22 Analyzed: 05/02/22**						
TKN	0.932	0.065	0.10	mg/l	1.00		93	90-110			
LCS (W2D2224-BS2)					**Prepared: 04/29/22 Analyzed: 05/02/22**						

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D2224 - EPA 351.2 (Continued)											
LCS (W2D2224-BS2)					**Prepared: 04/29/22**	**Analyzed: 05/02/22**					
TKN	0.930	0.065	0.10	mg/l	1.00		93	90-110			
Matrix Spike (W2D2224-MS1)	**Source: 2D19026-02**				**Prepared: 04/29/22**	**Analyzed: 05/02/22**					
TKN	1.14	0.065	0.10	mg/l	1.00	0.137	100	90-110			
Matrix Spike (W2D2224-MS2)	**Source: 2D19026-03**				**Prepared: 04/29/22**	**Analyzed: 05/02/22**					
TKN	1.12	0.065	0.10	mg/l	1.00	0.111	101	90-110			
Matrix Spike Dup (W2D2224-MSD1)	**Source: 2D19026-02**				**Prepared: 04/29/22**	**Analyzed: 05/02/22**					
TKN	1.14	0.065	0.10	mg/l	1.00	0.137	100	90-110	0.05	10	
Matrix Spike Dup (W2D2224-MSD2)	**Source: 2D19026-03**				**Prepared: 04/29/22**	**Analyzed: 05/02/22**					
TKN	1.12	0.065	0.10	mg/l	1.00	0.111	101	90-110	0.02	10	

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2D2017 - EPA 200.7											
Blank (W2D2017-BLK1)					**Prepared: 04/27/22**	**Analyzed: 05/03/22**					
Aluminum, Dissolved	ND	0.041	0.050	mg/l							
Aluminum, Total	ND	0.041	0.050	mg/l							
LCS (W2D2017-BS1)					**Prepared: 04/27/22**	**Analyzed: 05/03/22**					
Aluminum, Dissolved	0.189	0.041	0.050	mg/l	0.200		94	85-115			
Aluminum, Total	0.189	0.041	0.050	mg/l	0.200		94	85-115			
Matrix Spike (W2D2017-MS1)	**Source: 2D14012-01**				**Prepared: 04/27/22**	**Analyzed: 05/03/22**					
Aluminum, Dissolved	0.260	0.041	0.050	mg/l	0.200	ND	130	70-130			
Aluminum, Total	0.260	0.041	0.050	mg/l	0.200	ND	130	70-130			
Matrix Spike (W2D2017-MS2)	**Source: 2D14020-01**				**Prepared: 04/27/22**	**Analyzed: 05/03/22**					
Aluminum, Total	0.276	0.041	0.050	mg/l	0.200	ND	138	70-130			MS-02
Matrix Spike Dup (W2D2017-MSD1)	**Source: 2D14012-01**				**Prepared: 04/27/22**	**Analyzed: 05/03/22**					
Aluminum, Total	0.264	0.041	0.050	mg/l	0.200	ND	132	70-130	1	30	MS-02
Matrix Spike Dup (W2D2017-MSD2)	**Source: 2D14020-01**				**Prepared: 04/27/22**	**Analyzed: 05/03/22**					
Aluminum, Total	0.272	0.041	0.050	mg/l	0.200	ND	136	70-130	1	30	MS-02

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 05/27/2022 17:57

Notes and Definitions

Item	Definition
FILT	The sample was filtered prior to analysis.
J	Estimated conc. detected <MRL and >MDL.
MS-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	2F09089	**Report Date:**	6/29/2022
		Received Date:	6/9/2022
Project:	1915100404 LECL TMDL Monitoring	**Turnaround Time:**	Normal
		Phones:	(858) 514-6465
		Fax:	(858) 278-5300
Attn:	John Rudolph	**P.O. #:**	C015101084
Client:	Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Billing Code:**	

DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • HW-DOH #4047 • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

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

Dear John Rudolph,

Enclosed are the results of analyses for samples received 6/09/22 with the Chain-of-Custody document. The samples were received in good condition, at 11.6 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Chris Samatmanakit
Project Manager

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
CL07	Nicholas Jernack	2F09089-01	Water	06/09/22 11:30	
CL08	Nicholas Jernack	2F09089-02	Water	06/09/22 10:40	
CL09	Nicholas Jernack	2F09089-03	Water	06/09/22 09:45	
CL10	Nicholas Jernack	2F09089-04	Water	06/09/22 08:45	
LE02	Nicholas Jernack	2F09089-05	Water	06/09/22 09:10	
CL07 - Int	Nicholas Jernack	2F09089-06	Water	06/09/22 11:30	
CL07 - Surf	Nicholas Jernack	2F09089-07	Water	06/09/22 11:40	
CL08 - Int	Nicholas Jernack	2F09089-08	Water	06/09/22 10:40	
CL08 - Surf	Nicholas Jernack	2F09089-09	Water	06/09/22 10:55	
CL09 - Int	Nicholas Jernack	2F09089-10	Water	06/09/22 09:45	
CL09 - Surf	Nicholas Jernack	2F09089-11	Water	06/09/22 09:55	
CL10 - Int	Nicholas Jernack	2F09089-12	Water	06/09/22 08:45	
CL10 - Surf	Nicholas Jernack	2F09089-13	Water	06/09/22 09:05	
LE02 - Int	Nicholas Jernack	2F09089-14	Water	06/09/22 09:10	
LE02 - Surf	Nicholas Jernack	2F09089-15	Water	06/09/22 09:45	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results

Sample: CL07 — Sampled: 06/09/22 11:30 by Nicholas Jernack

2F09089-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2F1044 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/14/22 12:33				**Analyst:** YMT
Ammonia as N	**0.86**	0.017	0.10	mg/l	1	06/15/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2F0882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/11/22 08:39				**Analyst:** YMT
TKN	**1.5**	0.065	0.10	mg/l	1	06/16/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2F0867 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 14:09				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	06/10/22 17:07	FILT
Nitrite as N	ND	0.042	0.10	mg/l	1	06/10/22 17:07	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0801 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/09/22 17:43				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	06/09/22 18:20	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0891 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/12/22 08:03				**Analyst:** heq
Phosphorus as P, Total	**0.028**	0.0067	0.010	mg/l	1	06/13/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2F0871 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 16:12				**Analyst:** jao
Total Dissolved Solids	**560**	4.0	10	mg/l	1	06/13/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2F1193 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/15/22 15:17				**Analyst:** ttf
Total Suspended Solids	ND		5	mg/l	1	06/15/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2F0850 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 11:01				**Analyst:** ymt
Sulfide, Total	**2.0**	0.25	0.50	mg/l	5	06/10/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2F0966 — **Preparation:** EPA 200.2			**Prepared:** 06/13/22 16:53				**Analyst:** kvm
Aluminum, Dissolved	**0.11**	0.041	0.050	mg/l	1	06/15/22	
Aluminum, Total	**0.13**	0.041	0.050	mg/l	1	06/15/22	

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results

(Continued)

Sample: CL08 — 2F09089-02 (Water)

Sampled: 06/09/22 10:40 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2F1044 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/14/22 12:33				**Analyst:** YMT
Ammonia as N	**0.37**	0.017	0.10	mg/l	1	06/15/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2F0882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/11/22 08:39				**Analyst:** YMT
TKN	**1.2**	0.065	0.10	mg/l	1	06/16/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2F0867 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 14:09				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	06/10/22 17:08	FILT
Nitrite as N	ND	0.042	0.10	mg/l	1	06/10/22 17:08	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0801 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/09/22 17:43				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	06/09/22 18:21	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0891 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/12/22 08:03				**Analyst:** heq
Phosphorus as P, Total	**0.033**	0.0067	0.010	mg/l	1	06/13/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2F0871 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 16:12				**Analyst:** jao
Total Dissolved Solids	**570**	4.0	10	mg/l	1	06/13/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2F1193 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/15/22 15:17				**Analyst:** ttf
Total Suspended Solids	ND		5	mg/l	1	06/15/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2F0850 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 11:01				**Analyst:** ymt
Sulfide, Total	**3.0**	0.25	0.50	mg/l	5	06/10/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2F0966 — **Preparation:** EPA 200.2			**Prepared:** 06/13/22 16:53				**Analyst:** kvm
Aluminum, Dissolved	**0.13**	0.041	0.050	mg/l	1	06/15/22	
Aluminum, Total	**0.15**	0.041	0.050	mg/l	1	06/15/22	

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results

(Continued)

Sample: CL09 — 2F09089-03 (Water)

Sampled: 06/09/22 9:45 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2F1044 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/14/22 12:33				**Analyst:** YMT
Ammonia as N	**1.0**	0.017	0.10	mg/l	1	06/15/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2F0882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/11/22 08:39				**Analyst:** YMT
TKN	**1.8**	0.065	0.10	mg/l	1	06/16/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2F0867 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 14:09				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	06/10/22 17:09	FILT
Nitrite as N	ND	0.042	0.10	mg/l	1	06/10/22 17:09	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0801 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/09/22 17:43				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	06/09/22 18:21	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0891 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/12/22 08:03				**Analyst:** heq
Phosphorus as P, Total	**0.038**	0.0067	0.010	mg/l	1	06/13/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2F0871 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 16:12				**Analyst:** jao
Total Dissolved Solids	**650**	4.0	10	mg/l	1	06/13/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2F1193 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/15/22 15:17				**Analyst:** ttf
Total Suspended Solids	ND		5	mg/l	1	06/15/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2F0850 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 11:01				**Analyst:** ymt
Sulfide, Total	**2.0**	0.25	0.50	mg/l	5	06/10/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2F0966 — **Preparation:** EPA 200.2			**Prepared:** 06/13/22 16:53				**Analyst:** kvm
Aluminum, Dissolved	**0.10**	0.041	0.050	mg/l	1	06/15/22	
Aluminum, Total	**0.12**	0.041	0.050	mg/l	1	06/15/22	

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

www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results

(Continued)

Sample: CL10 — 2F09089-04 (Water)

Sampled: 06/09/22 8:45 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2F1044 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/14/22 12:33				**Analyst:** YMT
Ammonia as N	ND	0.017	0.10	mg/l	1	06/15/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2F0882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/11/22 08:39				**Analyst:** YMT
TKN	**0.71**	0.065	0.10	mg/l	1	06/16/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2F0867 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 14:09				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	06/10/22 17:10	FILT
Nitrite as N	ND	0.042	0.10	mg/l	1	06/10/22 17:10	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0801 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/09/22 17:43				**Analyst:** heq
o-Phosphate as P	ND	0.0030	0.010	mg/l	1	06/09/22 18:22	
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0891 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/12/22 08:03				**Analyst:** heq
Phosphorus as P, Total	ND	0.0067	0.010	mg/l	1	06/13/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2F0871 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 16:12				**Analyst:** jao
Total Dissolved Solids	**700**	4.0	10	mg/l	1	06/13/22	
Method: SM 2540D			**Instr:** OVEN15				
Batch ID: W2F1055 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/14/22 13:15				**Analyst:** ttf
Total Suspended Solids	**6**		5	mg/l	1	06/14/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2F0850 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 11:01				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	06/10/22	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W2F0966 — **Preparation:** EPA 200.2			**Prepared:** 06/13/22 16:53				**Analyst:** kvm
Aluminum, Dissolved	**0.10**	0.041	0.050	mg/l	1	06/15/22	
Aluminum, Total	**0.15**	0.041	0.050	mg/l	1	06/15/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results

(Continued)

Sample: LE02 — 2F09089-05 (Water) — Sampled: 06/09/22 9:10 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: EPA 350.1			**Instr:** AA06				
Batch ID: W2F1044 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/14/22 12:33				**Analyst:** YMT
Ammonia as N	**0.29**	0.017	0.10	mg/l	1	06/15/22	
Method: EPA 351.2			**Instr:** AA06				
Batch ID: W2F0882 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/11/22 08:39				**Analyst:** YMT
TKN	**4.4**	0.065	0.10	mg/l	1	06/16/22	
Method: EPA 353.2			**Instr:** AA01				
Batch ID: W2F0867 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 14:09				**Analyst:** ISM
Nitrate as N	ND	0.040	0.20	mg/l	1	06/10/22 16:56	FILT
Nitrite as N	ND	0.042	0.10	mg/l	1	06/10/22 16:56	FILT
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0801 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/09/22 17:43				**Analyst:** heq
o-Phosphate as P	**0.0030**	0.0030	0.010	mg/l	1	06/09/22 18:22	J
Method: EPA 365.3			**Instr:** UVVIS04				
Batch ID: W2F0891 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/12/22 08:03				**Analyst:** heq
Phosphorus as P, Total	**0.17**	0.0067	0.010	mg/l	1	06/13/22	
Method: SM 2540C			**Instr:** OVEN01				
Batch ID: W2F0871 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 16:12				**Analyst:** jao
Total Dissolved Solids	**2400**	4.0	10	mg/l	1	06/13/22	
Method: SM 4500S2-D			**Instr:** _ANALYST				
Batch ID: W2F0850 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/10/22 11:01				**Analyst:** ymt
Sulfide, Total	ND	0.050	0.10	mg/l	1	06/10/22	

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

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

Sample: CL07 - Int
2F09089-06 (Water)

Sampled: 06/09/22 11:30 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**25**	1.0	1.0	mg/M3	1	06/23/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

(Continued)

Sample: CL07 - Surf
2F09089-07 (Water)

Sampled: 06/09/22 11:40 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**2.1**	1.0	1.0	mg/M3	1	06/23/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

(Continued)

Sample: CL08 - Int
2F09089-08 (Water)

Sampled: 06/09/22 10:40 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800			**Prepared:** 06/09/22 00:00				**Analyst:** KXP
Chlorophyll a	**37**	1.0	1.0	mg/M3	1	06/23/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

(Continued)

Sample: CL08 - Surf
2F09089-09 (Water)

Sampled: 06/09/22 10:55 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**3.5**	1.0	1.0	mg/M3	1	06/23/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange (Continued)

Sample: CL09 - Int
2F09089-10 (Water)

Sampled: 06/09/22 9:45 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**42**	1.0	1.0	mg/M3	1	06/23/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

(Continued)

Sample: CL09 - Surf
2F09089-11 (Water)

Sampled: 06/09/22 9:55 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**5.1**	1.0	1.0	mg/M3	1	06/23/22	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange (Continued)

Sample: CL10 - Int
2F09089-12 (Water)

Sampled: 06/09/22 8:45 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**8.0**	1.0	1.0	mg/M3	1	06/23/22	

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

Certificate of Analysis
FINAL REPORT

WECK LABORATORIES, INC.

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported:
06/29/2022 11:42

Sample Results Enthalpy Orange
(Continued)

Sample: CL10 - Surf
2F09089-13 (Water)

Sampled: 06/09/22 9:05 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**10**	1.0	1.0	mg/M3	1	06/23/22	

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

(Continued)

Sample: LE02 - Int
2F09089-14 (Water)

Sampled: 06/09/22 9:10 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll	**Batch ID:** 291800		**Prepared:** 06/09/22 00:00				**Analyst:** KXP
Chlorophyll a	**120**	1.0	1.0	mg/M3	1	06/23/22	

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

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Sample Results Enthalpy Orange

(Continued)

Sample: LE02 - Surf
2F09089-15 (Water)

Sampled: 06/09/22 9:45 by Nicholas Jernack

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
SM 10200-H							
Method: Chlorophyll **Batch ID:** 291800 **Prepared:** 06/09/22 00:00 **Analyst:** KXP							
Chlorophyll a	**160**	1.0	1.0	mg/M3	1	06/23/22	

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Quality Control Results

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2F0801 - EPA 365.3											
Blank (W2F0801-BLK1)					**Prepared & Analyzed: 06/09/22**						
o-Phosphate as P	ND	0.0030	0.010	mg/l							
LCS (W2F0801-BS1)					**Prepared & Analyzed: 06/09/22**						
o-Phosphate as P	0.193	0.0030	0.010	mg/l	0.200		96	88-111			
Matrix Spike (W2F0801-MS1)	**Source: 2F09075-01**				**Prepared & Analyzed: 06/09/22**						
o-Phosphate as P	0.380	0.0030	0.010	mg/l	0.200	0.196	92	85-112			
Matrix Spike Dup (W2F0801-MSD1)	**Source: 2F09075-01**				**Prepared & Analyzed: 06/09/22**						
o-Phosphate as P	0.370	0.0030	0.010	mg/l	0.200	0.196	87	85-112	3	20	
Batch: W2F0850 - SM 4500S2-D											
Blank (W2F0850-BLK1)					**Prepared & Analyzed: 06/10/22**						
Sulfide, Total	ND	0.050	0.10	mg/l							
LCS (W2F0850-BS1)					**Prepared & Analyzed: 06/10/22**						
Sulfide, Total	0.100	0.050	0.10	mg/l	0.100		100	90-110			
Duplicate (W2F0850-DUP1)	**Source: 2F07101-02**				**Prepared & Analyzed: 06/10/22**						
Sulfide, Total	0.400	0.050	0.10	mg/l		0.400			0	20	
Duplicate (W2F0850-DUP2)	**Source: 2F09089-01**				**Prepared & Analyzed: 06/10/22**						
Sulfide, Total	2.00	0.50	1.0	mg/l		2.00			0	20	
Duplicate (W2F0850-DUP3)	**Source: 2F09089-02**				**Prepared & Analyzed: 06/10/22**						
Sulfide, Total	3.00	0.50	1.0	mg/l		3.00			0	20	
Duplicate (W2F0850-DUP4)	**Source: 2F09089-03**				**Prepared & Analyzed: 06/10/22**						
Sulfide, Total	2.00	0.50	1.0	mg/l		2.00			0	20	
Batch: W2F0867 - EPA 353.2											
Blank (W2F0867-BLK1)					**Prepared & Analyzed: 06/10/22**						
Nitrate as N	ND	0.040	0.20	mg/l							
Nitrite as N	ND	0.042	0.10	mg/l							
LCS (W2F0867-BS1)					**Prepared & Analyzed: 06/10/22**						
Nitrate as N	0.965	0.040	0.20	mg/l	1.00		96	90-110			
Nitrite as N	0.935	0.042	0.10	mg/l	1.00		94	90-110			
Duplicate (W2F0867-DUP1)	**Source: 2F10064-01**				**Prepared & Analyzed: 06/10/22**						
Nitrate as N	0.0543	0.040	0.20	mg/l		0.0740			31	20	J, R-03
Nitrite as N	ND	0.042	0.10	mg/l		ND				20	
Matrix Spike (W2F0867-MS1)	**Source: 2F09089-05**				**Prepared & Analyzed: 06/10/22**						
Nitrate as N	1.99	0.040	0.20	mg/l	2.00	ND	100	90-110			
Nitrite as N	0.952	0.042	0.10	mg/l	1.00	ND	95	90-110			
Matrix Spike (W2F0867-MS2)	**Source: 2F09090-01**				**Prepared & Analyzed: 06/10/22**						
Nitrate as N	1.93	0.040	0.20	mg/l	2.00	ND	96	90-110			
Nitrite as N	0.941	0.042	0.10	mg/l	1.00	ND	94	90-110			
Matrix Spike Dup (W2F0867-MSD1)	**Source: 2F09089-05**				**Prepared & Analyzed: 06/10/22**						
Nitrate as N	1.97	0.040	0.20	mg/l	2.00	ND	98	90-110	1	20	

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2F0867 - EPA 353.2 (Continued)											
Matrix Spike Dup (W2F0867-MSD1)	**Source: 2F09089-05**				**Prepared & Analyzed: 06/10/22**						
Nitrite as N	0.979	0.042	0.10	mg/l	1.00	ND	98	90-110	3	20	
Matrix Spike Dup (W2F0867-MSD2)	**Source: 2F09090-01**				**Prepared & Analyzed: 06/10/22**						
Nitrate as N	1.95	0.040	0.20	mg/l	2.00	ND	98	90-110	1	20	
Nitrite as N	0.982	0.042	0.10	mg/l	1.00	ND	98	90-110	4	20	
Batch: W2F0871 - SM 2540C											
Blank (W2F0871-BLK1)					**Prepared: 06/10/22 Analyzed: 06/13/22**						
Total Dissolved Solids	ND	4.0	10	mg/l							
LCS (W2F0871-BS1)					**Prepared: 06/10/22 Analyzed: 06/13/22**						
Total Dissolved Solids	816	4.0	10	mg/l	824		99	96-102			
Duplicate (W2F0871-DUP1)	**Source: 2F09089-05**				**Prepared: 06/10/22 Analyzed: 06/13/22**						
Total Dissolved Solids	2420	4.0	10	mg/l		2360			3	10	
Duplicate (W2F0871-DUP2)	**Source: 2F09075-01**				**Prepared: 06/10/22 Analyzed: 06/13/22**						
Total Dissolved Solids	1730	4.0	10	mg/l		1770			2	10	
Batch: W2F0882 - EPA 351.2											
Blank (W2F0882-BLK1)					**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	ND	0.065	0.10	mg/l							
Blank (W2F0882-BLK2)					**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	ND	0.065	0.10	mg/l							
LCS (W2F0882-BS1)					**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	0.969	0.065	0.10	mg/l	1.00		97	90-110			
LCS (W2F0882-BS2)					**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	0.945	0.065	0.10	mg/l	1.00		95	90-110			
Matrix Spike (W2F0882-MS1)	**Source: 2F09051-02**				**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	1.19	0.065	0.10	mg/l	1.00	0.214	97	90-110			
Matrix Spike (W2F0882-MS2)	**Source: 2F09051-03**				**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	1.14	0.065	0.10	mg/l	1.00	0.240	90	90-110			
Matrix Spike Dup (W2F0882-MSD1)	**Source: 2F09051-02**				**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	1.15	0.065	0.10	mg/l	1.00	0.214	94	90-110	3	10	
Matrix Spike Dup (W2F0882-MSD2)	**Source: 2F09051-03**				**Prepared: 06/11/22 Analyzed: 06/16/22**						
TKN	1.15	0.065	0.10	mg/l	1.00	0.240	91	90-110	0.7	10	
Batch: W2F0891 - EPA 365.3											
Blank (W2F0891-BLK1)					**Prepared: 06/12/22 Analyzed: 06/13/22**						
Phosphorus as P, Total	ND	0.0067	0.010	mg/l							
LCS (W2F0891-BS1)					**Prepared: 06/12/22 Analyzed: 06/13/22**						
Phosphorus as P, Total	0.193	0.0067	0.010	mg/l	0.200		96	90-110			
Matrix Spike (W2F0891-MS1)	**Source: 2F07058-01**				**Prepared: 06/12/22 Analyzed: 06/13/22**						
Phosphorus as P, Total	0.342	0.0067	0.010	mg/l	0.200	0.138	102	90-110			

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

www.wecklabs.com

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Quality Control Results

(Continued)

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

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2F0891 - EPA 365.3 (Continued)											
Matrix Spike Dup (W2F0891-MSD1)	**Source: 2F07058-01**				**Prepared: 06/12/22**	**Analyzed: 06/13/22**					
Phosphorus as P, Total	0.344	0.0067	0.010	mg/l	0.200	0.138	103	90-110	0.6	20	
Batch: W2F1044 - EPA 350.1											
Blank (W2F1044-BLK1)					**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	ND	0.017	0.10	mg/l							
Blank (W2F1044-BLK2)					**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	ND	0.017	0.10	mg/l							
LCS (W2F1044-BS1)					**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.270	0.017	0.10	mg/l	0.250		108	90-110			
LCS (W2F1044-BS2)					**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.266	0.017	0.10	mg/l	0.250		106	90-110			
Duplicate (W2F1044-DUP1)	**Source: 2F10064-01**				**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.0345	0.017	0.10	mg/l		0.0357			3	15	J
Matrix Spike (W2F1044-MS1)	**Source: 2F09052-04**				**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.246	0.017	0.10	mg/l	0.250	ND	98	90-110			
Matrix Spike (W2F1044-MS2)	**Source: 2F09075-04**				**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.302	0.017	0.10	mg/l	0.250	0.0593	97	90-110			
Matrix Spike Dup (W2F1044-MSD1)	**Source: 2F09052-04**				**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.248	0.017	0.10	mg/l	0.250	ND	99	90-110	0.7	15	
Matrix Spike Dup (W2F1044-MSD2)	**Source: 2F09075-04**				**Prepared: 06/14/22**	**Analyzed: 06/15/22**					
Ammonia as N	0.303	0.017	0.10	mg/l	0.250	0.0593	97	90-110	0.4	15	
Batch: W2F1055 - SM 2540D											
Blank (W2F1055-BLK1)					**Prepared & Analyzed: 06/14/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2F1055-BS1)					**Prepared & Analyzed: 06/14/22**						
Total Suspended Solids	65.0		5	mg/l	60.8		107	90-110			
Duplicate (W2F1055-DUP1)	**Source: 2F10064-01**				**Prepared & Analyzed: 06/14/22**						
Total Suspended Solids	7.30		5	mg/l		7.30			0	10	
Duplicate (W2F1055-DUP2)	**Source: 2F09036-02**				**Prepared & Analyzed: 06/14/22**						
Total Suspended Solids	1050		5	mg/l		1100			4	10	
Batch: W2F1193 - SM 2540D											
Blank (W2F1193-BLK1)					**Prepared & Analyzed: 06/15/22**						
Total Suspended Solids	ND		5	mg/l							
LCS (W2F1193-BS1)					**Prepared & Analyzed: 06/15/22**						
Total Suspended Solids	64.3		5	mg/l	60.0		107	90-110			
Duplicate (W2F1193-DUP1)	**Source: 2F09035-01**				**Prepared & Analyzed: 06/15/22**						
Total Suspended Solids	167		5	mg/l		162			3	10	
Duplicate (W2F1193-DUP2)	**Source: 2F10046-01**				**Prepared & Analyzed: 06/15/22**						

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

Wood - San Diego
9177 Sky Park Court, Ste A
San Diego, CA 92123

Project Number: 1915100404 LECL TMDL Monitoring

Project Manager: John Rudolph

Reported: 06/29/2022 11:42

Quality Control Results

(Continued)

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

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2F1193 - SM 2540D (Continued)										
Duplicate (W2F1193-DUP2)	**Source: 2F10046-01**			**Prepared & Analyzed: 06/15/22**						
Total Suspended Solids	1040	5	mg/l		980			6	10	

Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2F0966 - EPA 200.7											
Blank (W2F0966-BLK1)					**Prepared: 06/13/22**	**Analyzed: 06/15/22**					
Aluminum, Dissolved	ND	0.041	0.050	mg/l							
Aluminum, Total	ND	0.041	0.050	mg/l							
LCS (W2F0966-BS1)					**Prepared: 06/13/22**	**Analyzed: 06/15/22**					
Aluminum, Dissolved	0.215	0.041	0.050	mg/l	0.200		108	85-115			
Aluminum, Total	0.215	0.041	0.050	mg/l	0.200		108	85-115			
Matrix Spike (W2F0966-MS1)	**Source: 2F09089-01**				**Prepared: 06/13/22**	**Analyzed: 06/15/22**					
Aluminum, Dissolved	0.344	0.041	0.050	mg/l	0.200	0.115	115	70-130			
Aluminum, Total	0.344	0.041	0.050	mg/l	0.200	0.131	106	70-130			
Matrix Spike (W2F0966-MS2)	**Source: 2F09090-06**				**Prepared: 06/13/22**	**Analyzed: 06/15/22**					
Aluminum, Total	0.340	0.041	0.050	mg/l	0.200	0.0966	122	70-130			
Matrix Spike Dup (W2F0966-MSD1)	**Source: 2F09089-01**				**Prepared: 06/13/22**	**Analyzed: 06/15/22**					
Aluminum, Dissolved	0.347	0.041	0.050	mg/l	0.200	0.115	116	70-130	0.8	30	
Aluminum, Total	0.347	0.041	0.050	mg/l	0.200	0.131	108	70-130	0.8	30	
Matrix Spike Dup (W2F0966-MSD2)	**Source: 2F09090-06**				**Prepared: 06/13/22**	**Analyzed: 06/15/22**					
Aluminum, Total	0.328	0.041	0.050	mg/l	0.200	0.0966	116	70-130	4	30	

Wood - San Diego 9177 Sky Park Court, Ste A San Diego, CA 92123	**Project Number:** 1915100404 LECL TMDL Monitoring **Project Manager:** John Rudolph	**Reported:** 06/29/2022 11:42

Notes and Definitions

Item	Definition
FILT	The sample was filtered prior to analysis.
J	Estimated conc. detected <MRL and >MDL.
R-03	The RPD is not applicable for result below the reporting limit (either ND or J value).
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

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

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

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

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

www.wecklabs.com

APPENDIX D - SATELLITE DATA REPORTS

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date: 2021-07-30
Version: 9

Clients: Wood Plc.
Reference: 2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	e-mail	Phone
Philip Klinger	klinger@eomap.de	+49 8152 99861 13
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 16

detect more.

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	Point of Contact
John D. Rudolph	Philip Klinger
john.rudolph@woodplc.com	klinger@eomap.de, +49 (0)8152 9986115

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2021-07-30
Version	9

1.1 List of all delivered scenes

Sensor	Time of record
Landsat-8	2021-07-15 18:22:27 UTC

1.2 Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3 List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs9_20210739.pdf	PDF	Delivery Report
CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030_wgs84_xyz.txt	ASCII	Product text file, real values
CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030.kmz	KMZ	GoogleEarth overlay
CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030_metadata.xml	XML	Metadata
CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4 File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5 Notes (e.g. technical issues, exceptional conditions, etc.)

- Sunglint and haze on parts of Lake Elsinore which was corrected for, however values might still be slightly biased and overall noise is increased.

Data Analyst	QA/QC
Philip Klinger	Hendrik Bernert
Philip Klinger	Hendrik Bernert

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1 2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings "Water Quality in Europe: Challenges and Best Practice" UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

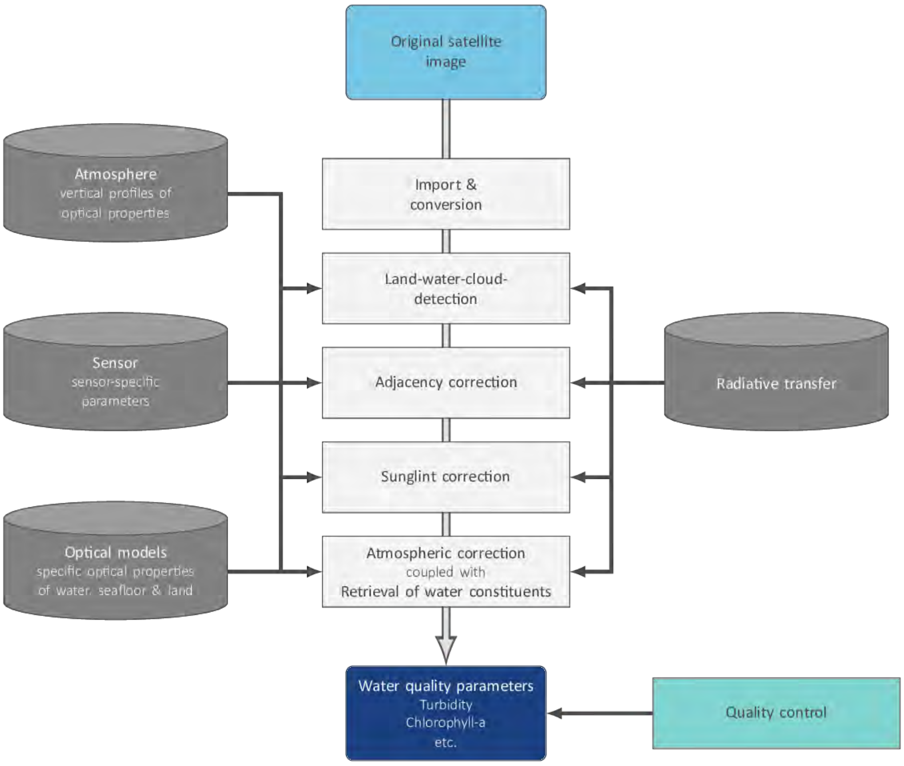


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

4.1 Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2021-07-15 is shown in Figure 2.

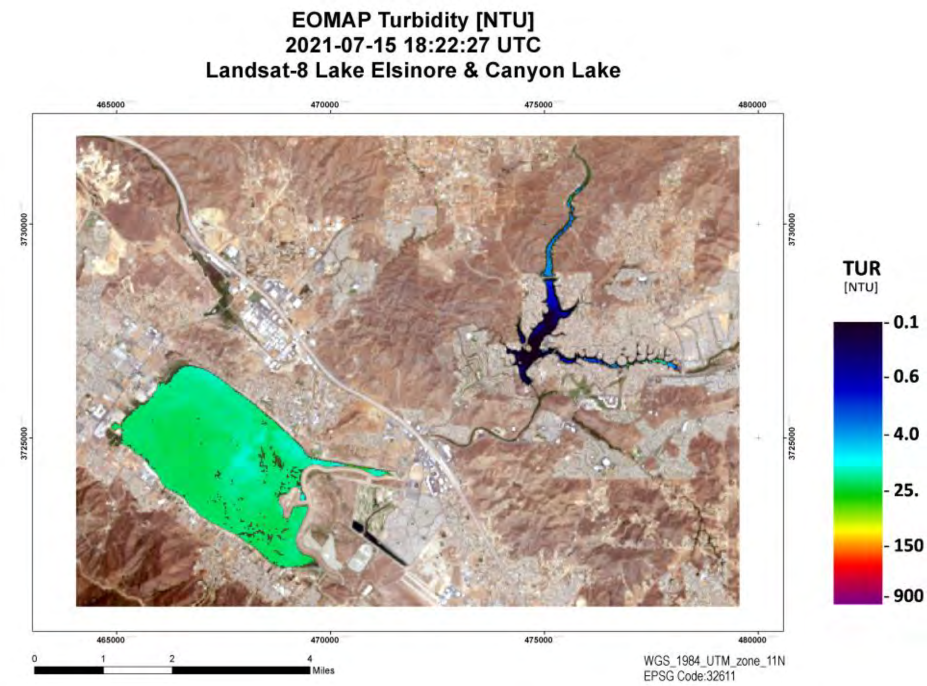


Figure 2: Turbidity product from 2021-07-15

4.2 Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2021-07-15 is shown in Figure 3.

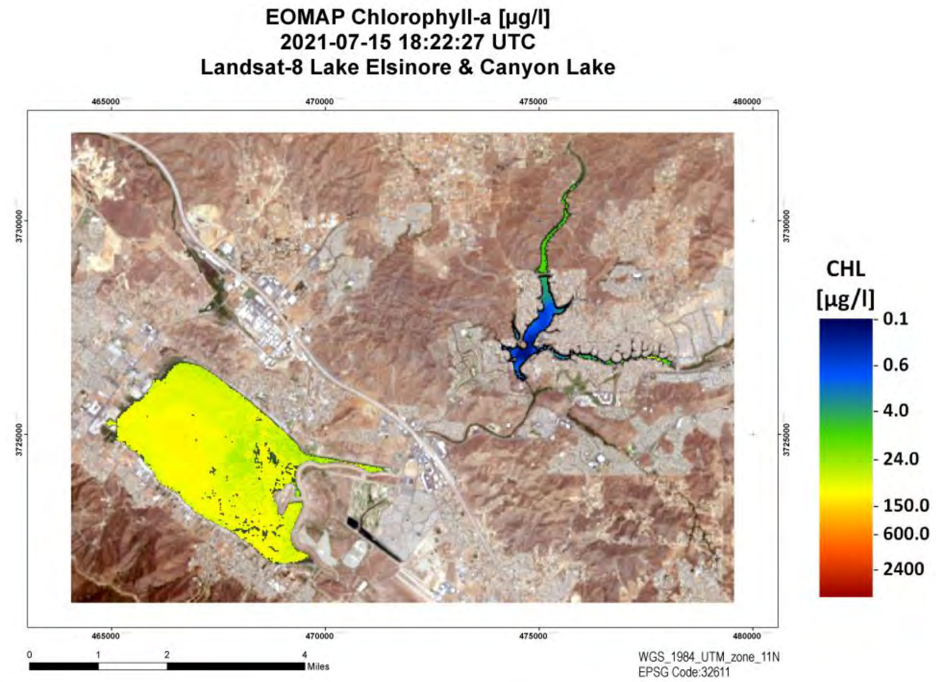


Figure 3: Chlorophyll-a product from 2021-07-15

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

4.3 Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2021-07-15 is shown in Figure 4.

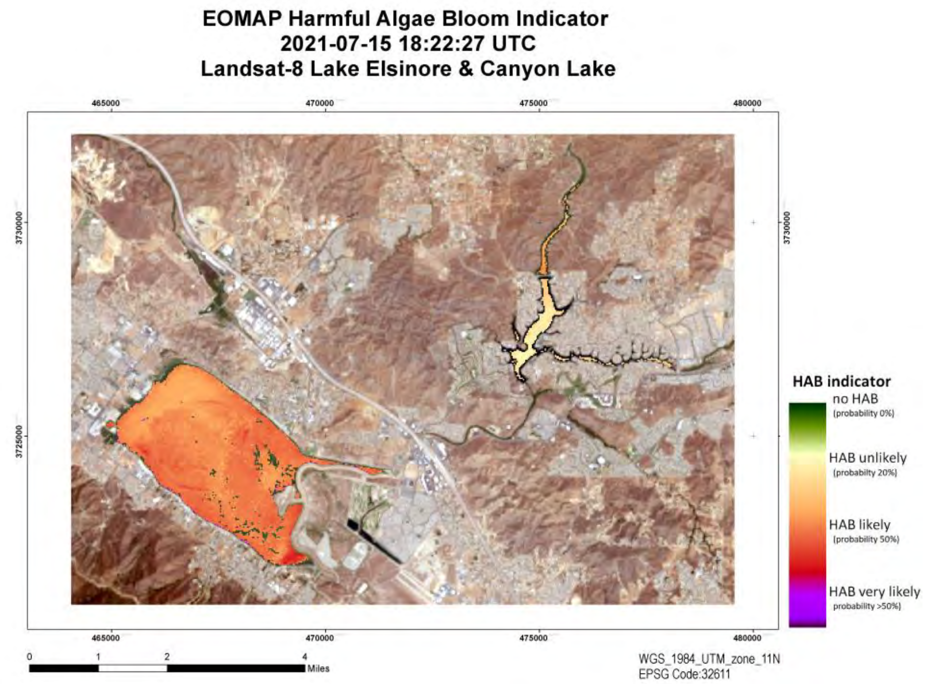


Figure 4: Harmful Algae Bloom Indicator product from 2021-07-15

4.4 True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

- The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

  - QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
  - QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

EOMAP detect more.

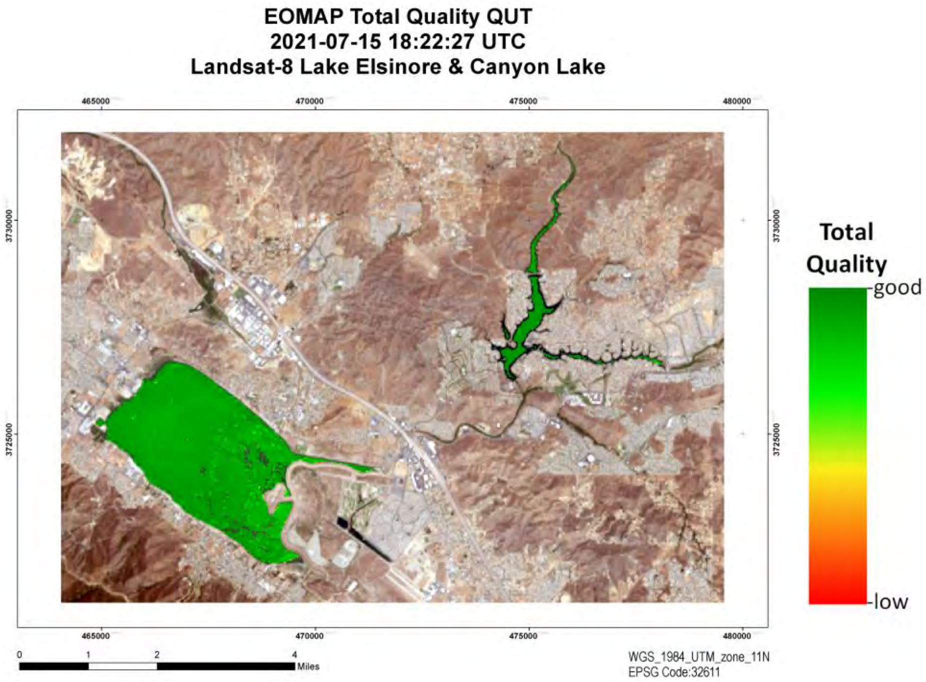


Figure 5: QUT product from 2021-07-15

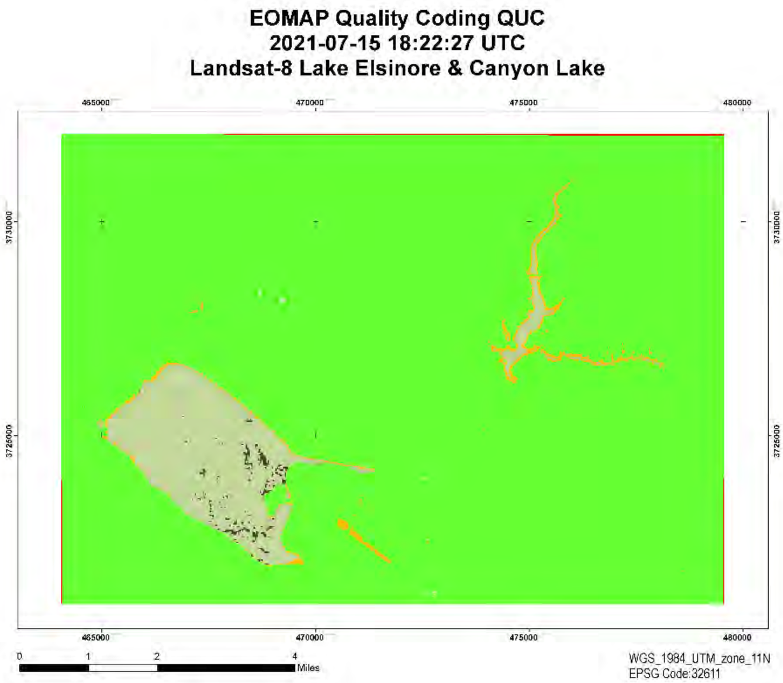


Figure 6: QUC product from 2021-07-15

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in
Figure 7 .

Professional version allow combination of the two most relevant flags:

First number = most relevant flag
1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle

Examples: 25 Warning flag for large zenit solar angle and Whitecaps
114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.
As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.
Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Sentinel-3: PEPS https://peps.cnes.fr
- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home
- MODIS Aqua and Terra: USGS https://earthexplorer.usgs.gov/

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date: 2021-10-13
Version: 10.1

Clients: Wood Plc.
Reference: 2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	e-mail	Phone
Philip Klinger	klinger@eomap.de	+49 8152 99861 13
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 16

detect more.

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	Point of Contact
John D. Rudolph	Philip Klinger
john.rudolph@woodplc.com	klinger@eomap.de, +49 (0)8152 9986115

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2021-10-13
Version	10

1.1 List of all delivered scenes

Sensor	Time of record
Landsat-8	2021-08-16 18:22:42 UTC
Landsat-8	2021-09-17 18:22:50 UTC
Sentinel-2	2021-10-05 18:44:59 UTC

1.2 Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3 List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs10_20211013.pdf	PDF	Delivery Report
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030_wgs84_xyz.txt	ASCII	Product text file, real values
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030.kmz	KMZ	GoogleEarth overlay
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030_metadata.xml	XML	Metadata

CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4 File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5 Notes (e.g. technical issues, exceptional conditions, etc.)

- Haze/cirrus clouds on parts of Lake Elsinore which required flagging and leads to slightly increased noise in the results.

Data Analyst	QA/QC
Philip Klinger	Hendrik Bernert
Philip Klinger	Hendrik Bernert

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1] [2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

---

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings "Water Quality in Europe: Challenges and Best Practice" UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

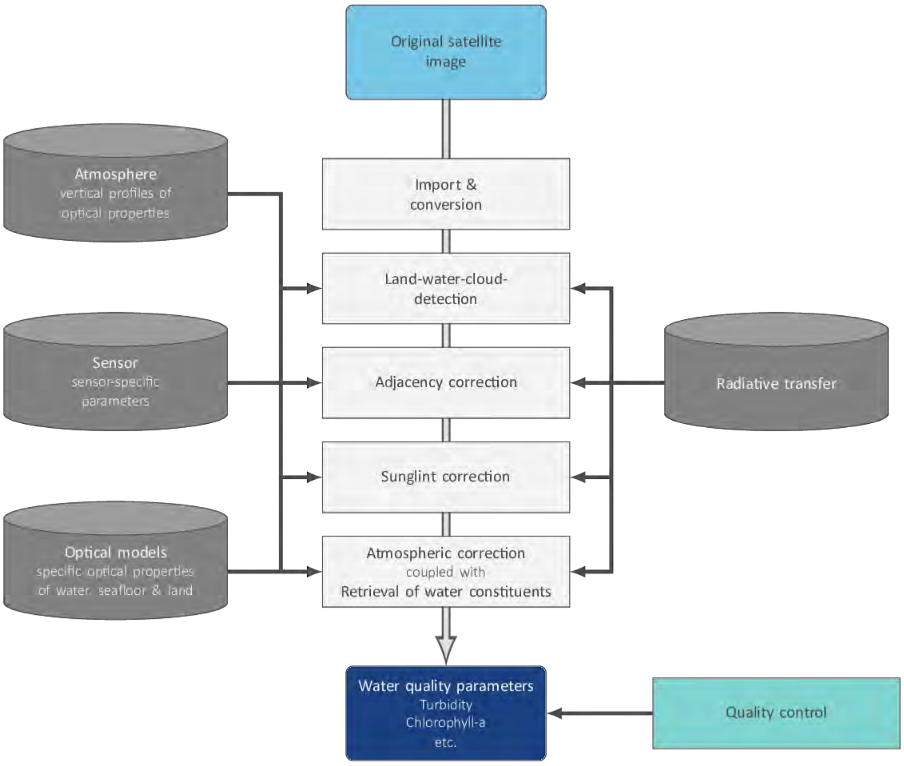


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

4.1 Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2021-08-16 is shown in Figure 2.

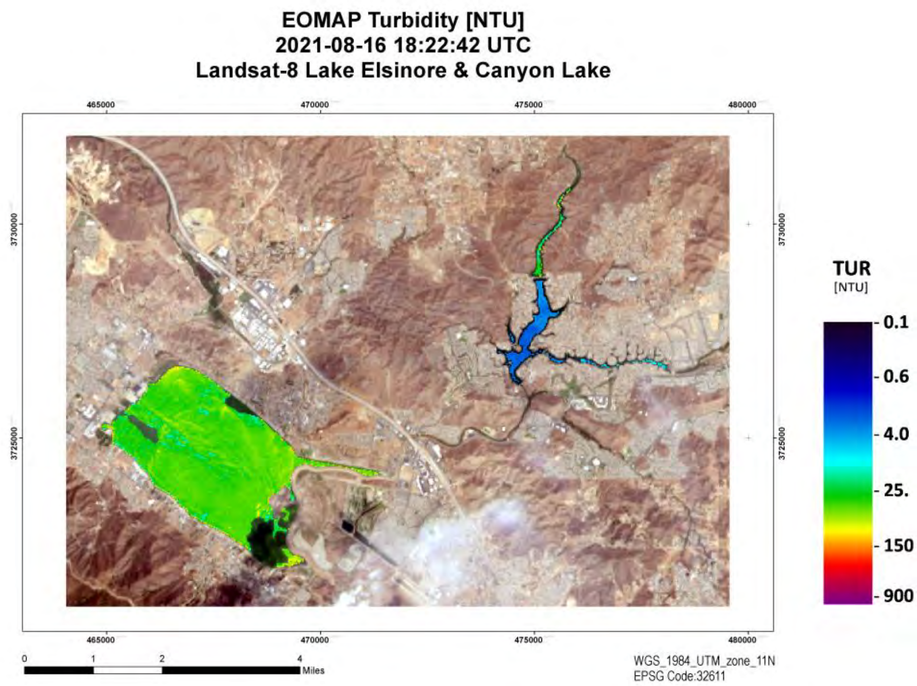


Figure 2: Turbidity product from 2021-08-16

4.2 Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2021-08-16 is shown in Figure 3.

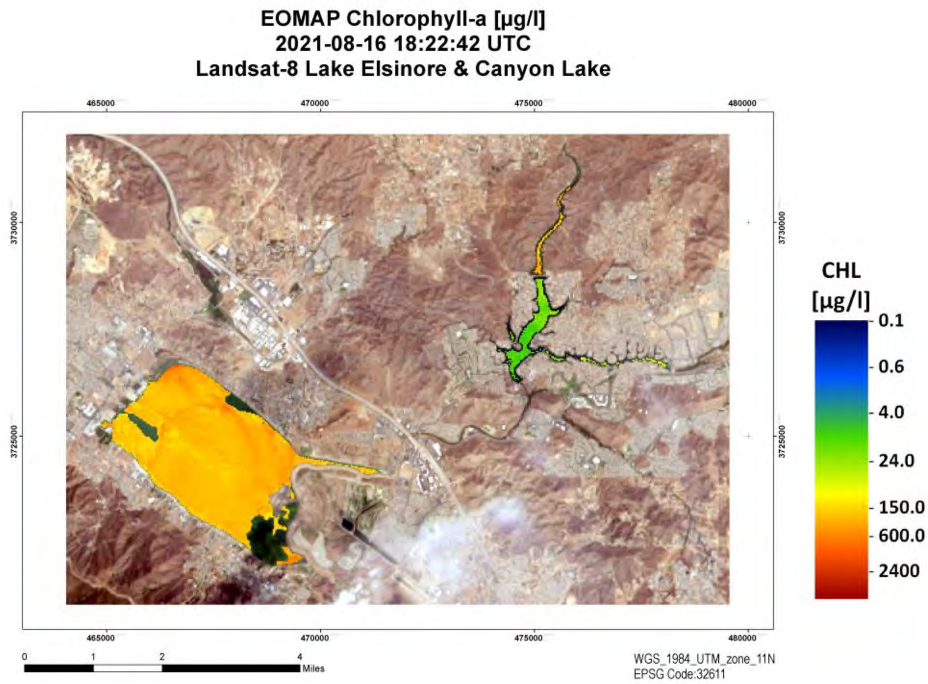


Figure 3: Chlorophyll-a product from 2021-08-16

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

4.3 Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2021-08-16 is shown in Figure 4.

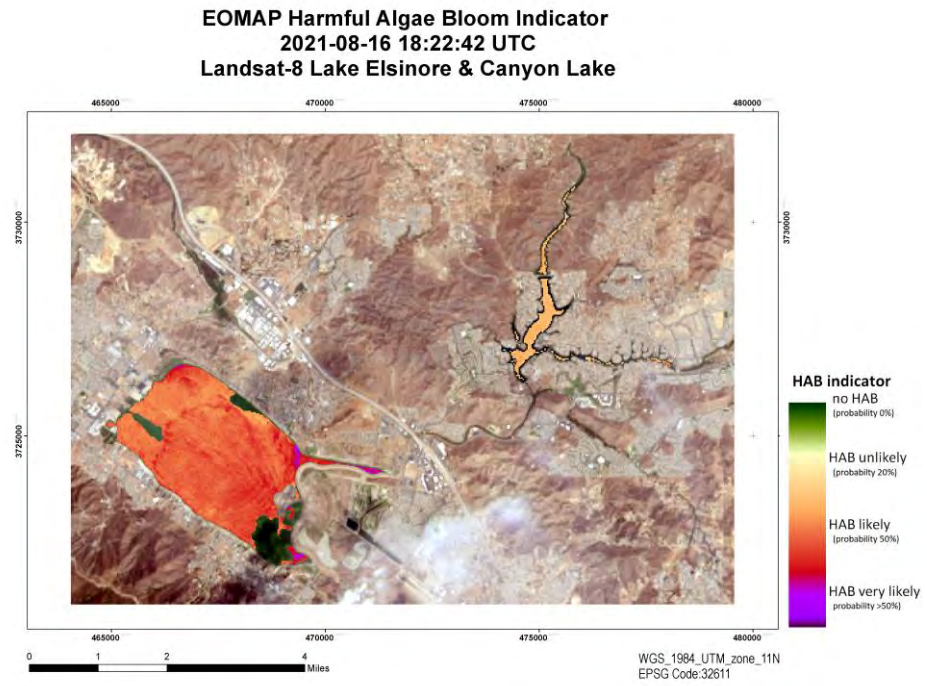


Figure 4: Harmful Algae Bloom Indicator product from 2021-08-16

4.4 True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

- The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

  - QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
  - QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

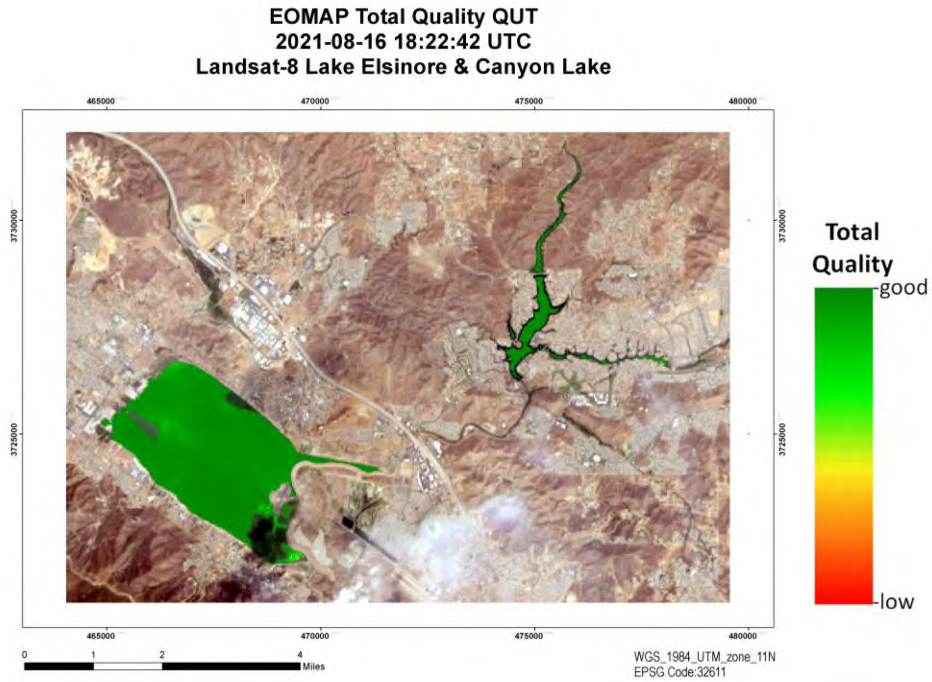


Figure 5: QUT product from 2021-08-16

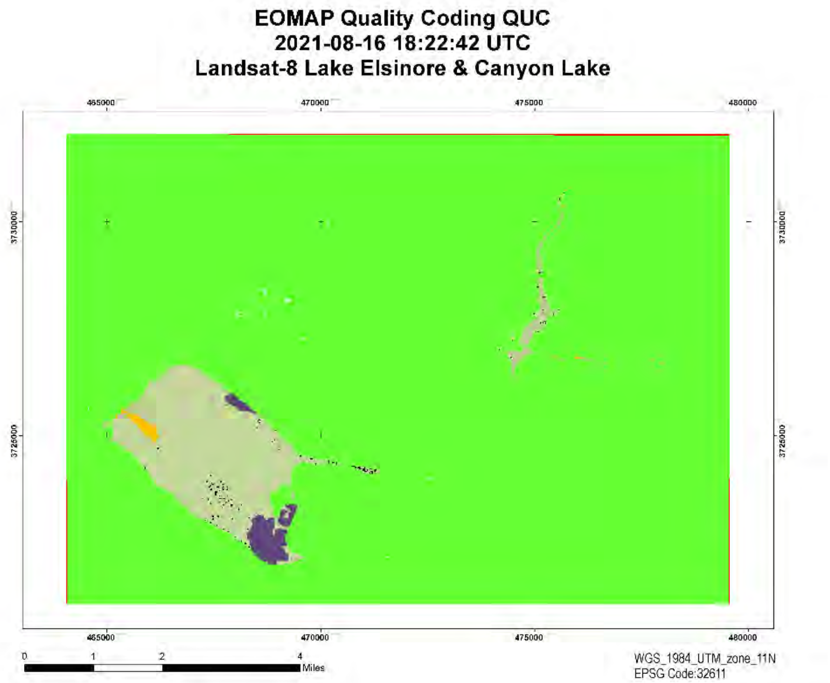


Figure 6: QUC product from 2021-08-16

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in Figure 7 .

Professional version allow combination of the two most relevant flags:

First number = most relevant flag

1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle

Examples: 25 Warning flag for large zenit solar angle and Whitecaps

114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.
As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.
Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Sentinel-3: PEPS https://peps.cnes.fr
- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home
- MODIS Aqua and Terra: USGS https://earthexplorer.usgs.gov/

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date: 2021-10-13
Version: 10.2

Clients: Wood Plc.
Reference: 2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	e-mail	Phone
Philip Klinger	klinger@eomap.de	+49 8152 99861 13
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 16

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	Point of Contact
John D. Rudolph	Philip Klinger
john.rudolph@woodplc.com	klinger@eomap.de, +49 (0)8152 9986115

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2021-10-13
Version	10

1.1 List of all delivered scenes

Sensor	Time of record
Landsat-8	2021-08-16 18:22:42 UTC
Landsat-8	2021-09-17 18:22:50 UTC
Sentinel-2	2021-10-05 18:44:59 UTC

1.2 Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3 List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs10_20211013.pdf	PDF	Delivery Report
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030_wgs84_xyz.txt	ASCII	Product text file, real values
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030.kmz	KMZ	GoogleEarth overlay
CHL_us-california_040037_EOMAP_20210816_182242_LSAT8_m0030_metadata.xml	XML	Metadata

CHL_us-california_040037_EOMAP_20210715_182227_LSAT8_m0030_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4 File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5 Notes (e.g. technical issues, exceptional conditions, etc.)

Data Analyst	QA/QC
Philip Klinger	Hendrik Bernert
Philip Klinger	Hendrik Bernert

detect more.

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1] [2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings "Water Quality in Europe: Challenges and Best Practice" UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

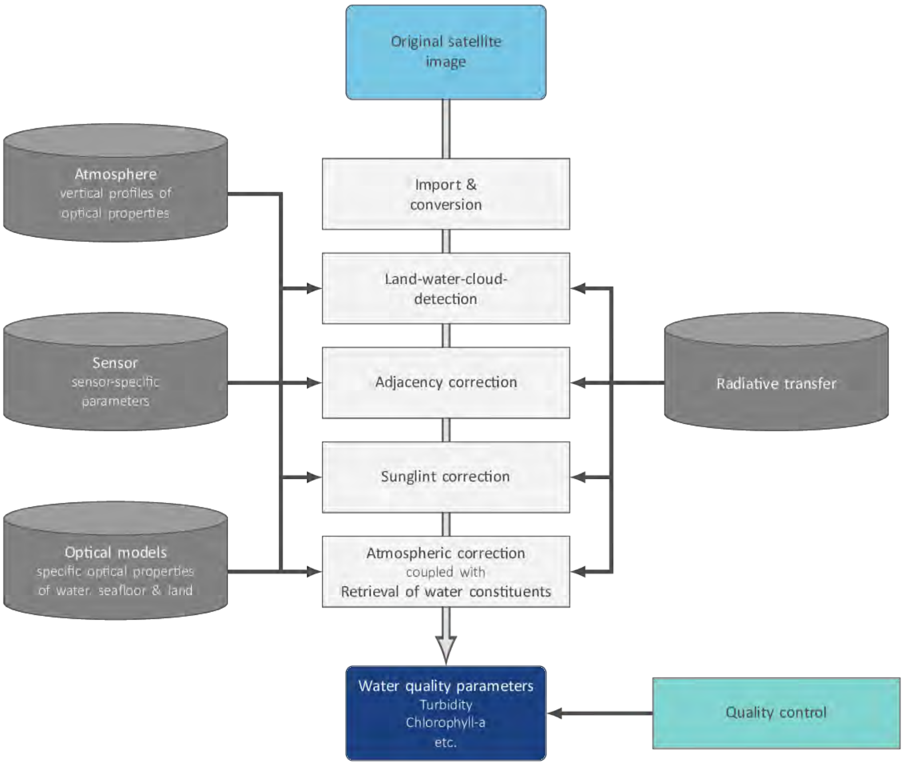


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

4.1 Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2021-09-17 is shown in Figure 2.

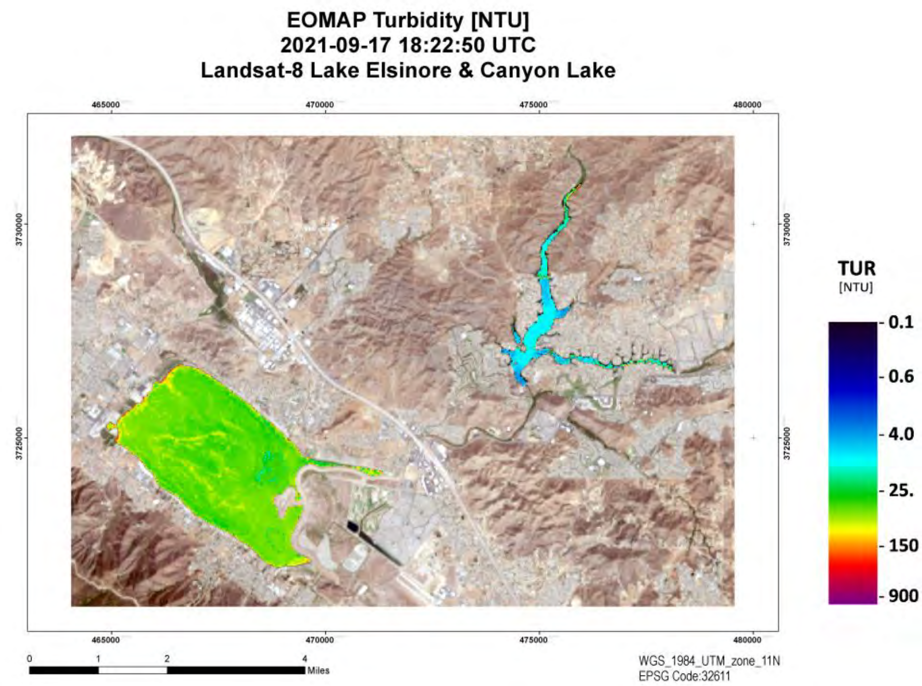


Figure 2: Turbidity product from 2021-09-17

4.2 Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2021-09-17 is shown in Figure 3.

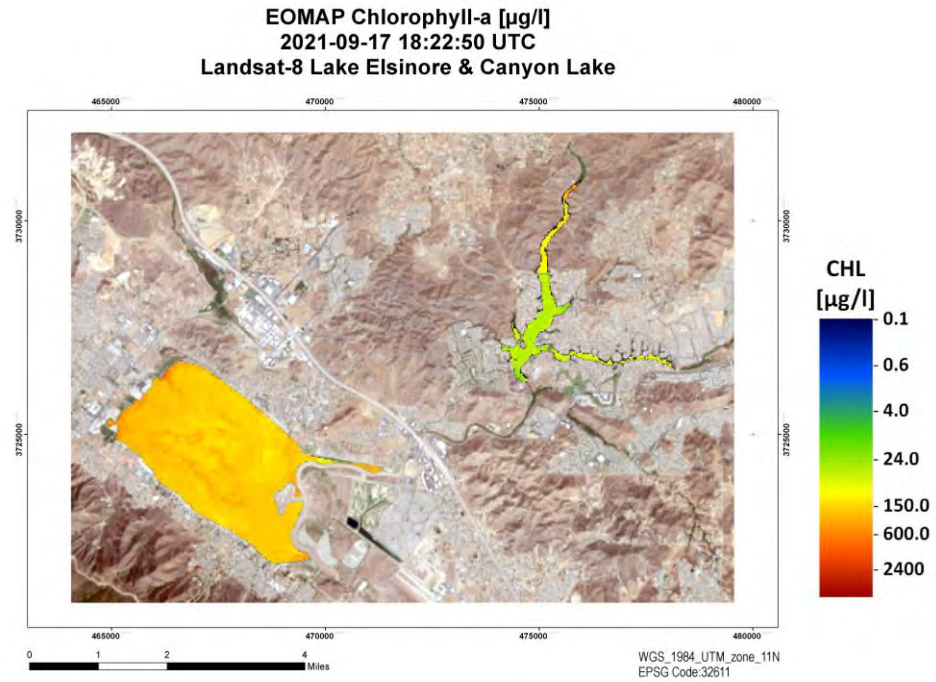


Figure 3: Chlorophyll-a product from 2021-09-17

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

4.3 Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2021-09-17 is shown in Figure 4.

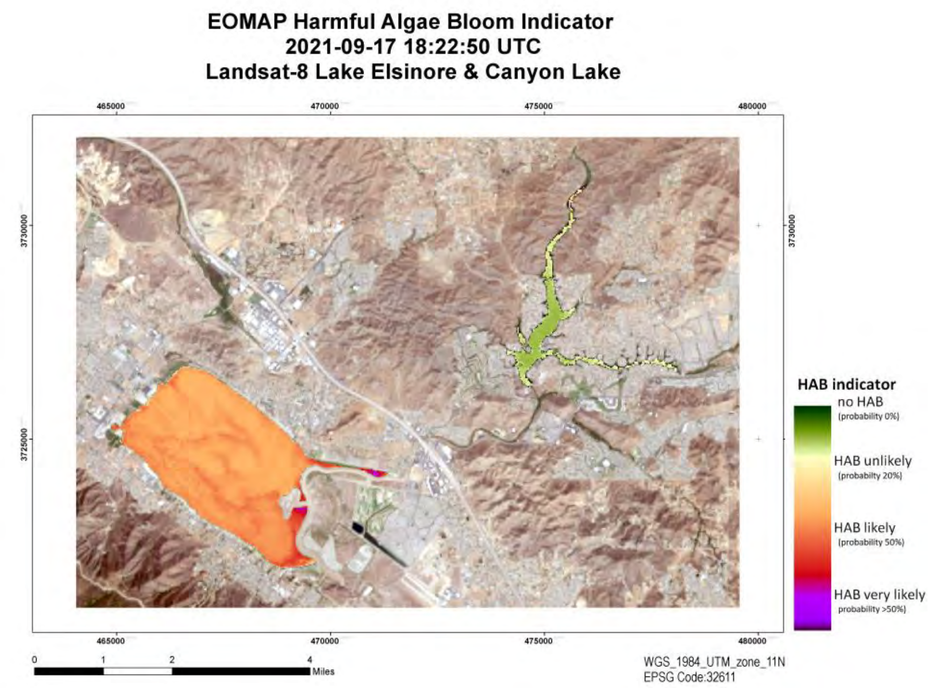


Figure 4: Harmful Algae Bloom Indicator product from 2021-09-17

4.4 True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

- The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

  - QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
  - QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

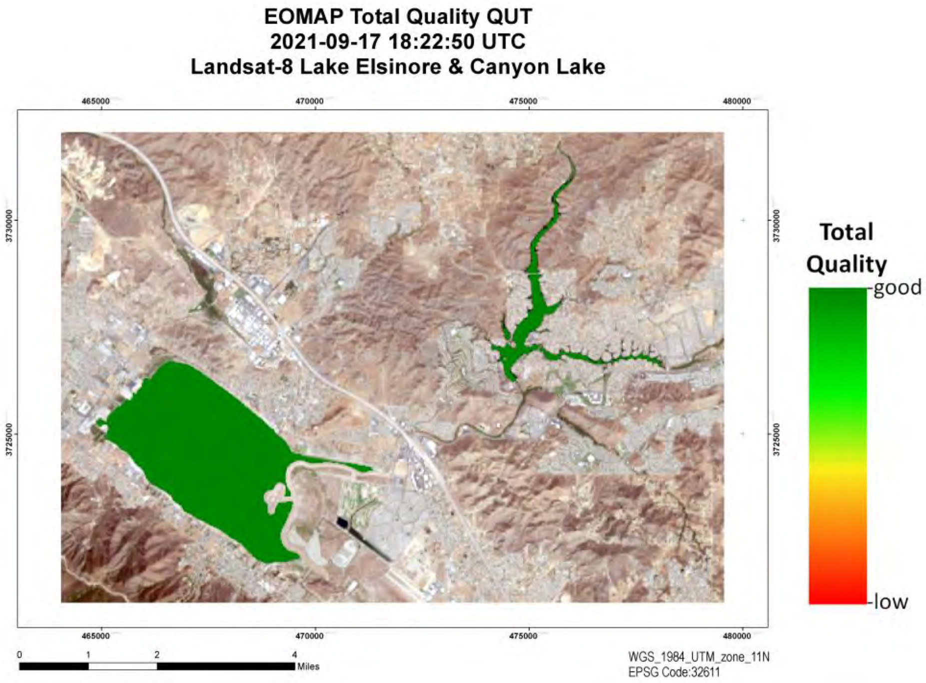


Figure 5: QUT product from 2021-09-17

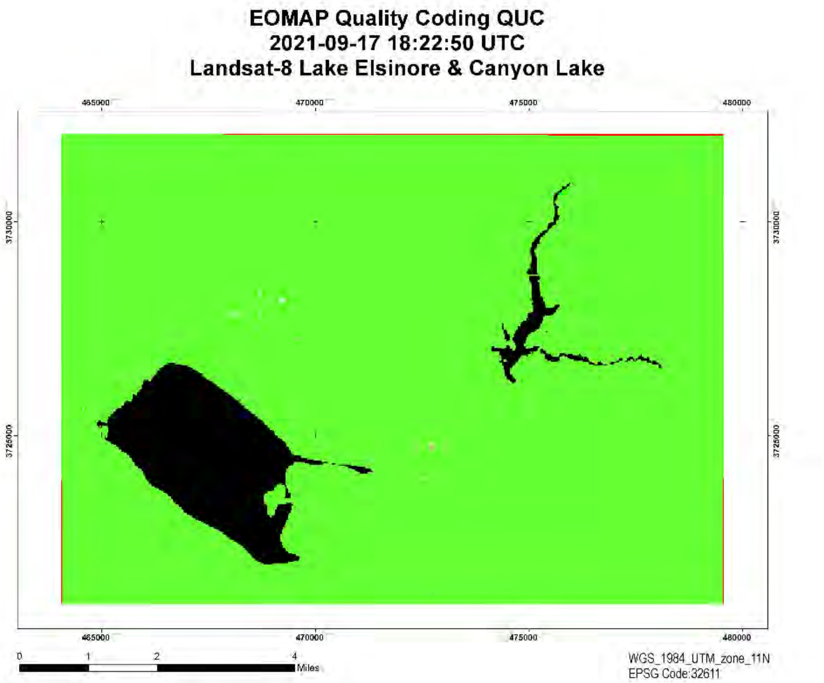


Figure 6: QUC product from 2021-09-17

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in Figure 7 .

Professional version allow combination of the two most relevant flags:
First number = most relevant flag
1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle
Examples: 25 Warning flag for large zenit solar angle and Whitecaps
114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.
As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.
Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Sentinel-3: PEPS https://peps.cnes.fr
- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home
- MODIS Aqua and Terra: USGS https://earthexplorer.usgs.gov/

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date: 2022-07-22
Version: 10.4

Clients: Wood Plc.
Reference: 2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	Email	Phone
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 14
Minha Sultan	sultan@eomap.de	+49 8152 99861 14

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	Point of Contact
John D. Rudolph	Hendrik Bernert
john.rudolph@woodplc.com	bernert@eomap.de, +49 (0)8152 9986114

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2022-07-22
Version	10.4

1.1. List of all delivered scenes

Sensor	Time of record
Sentinel-2	2021-10-05 18:44:59 UTC

1.2. Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3. List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs10.4_20220722.pdf	PDF	Delivery Report
CHL_us-california_11smt_EOMAP_20211005_184459_SENT2_m0010.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_11smt_EOMAP_20211005_184459_SENT2_m0010_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_11smt_EOMAP_20211005_184459_SENT2_m0010_32bit_wgs84.txt	ASCII	Product text file, real values
CHL_us-california_11smt_EOMAP_20211005_184459_SENT2_m0010.kmz	KMZ	GoogleEarth overlay
CHL_us-california_11smt_EOMAP_20211005_184459_SENT2_m0010.xml	XML	Metadata
CHL_us-california_11smt_EOMAP_20211005_184459_SENT2_m0010_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4. File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5. Notes (e.g. technical issues, exceptional conditions, etc.)

- None

Data Analyst	QA/QC
Hendrik Bernert	Minha Sultan

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1 2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

---

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings “Water Quality in Europe: Challenges and Best Practice” UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

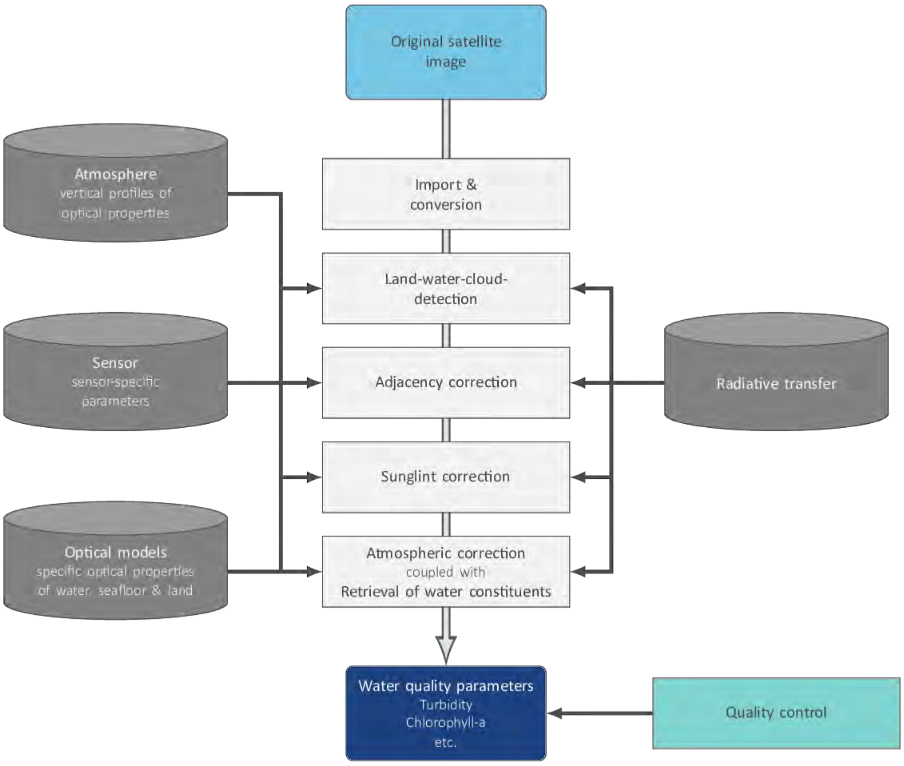


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

3.1. Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2021-10-05 is shown in Figure 2.

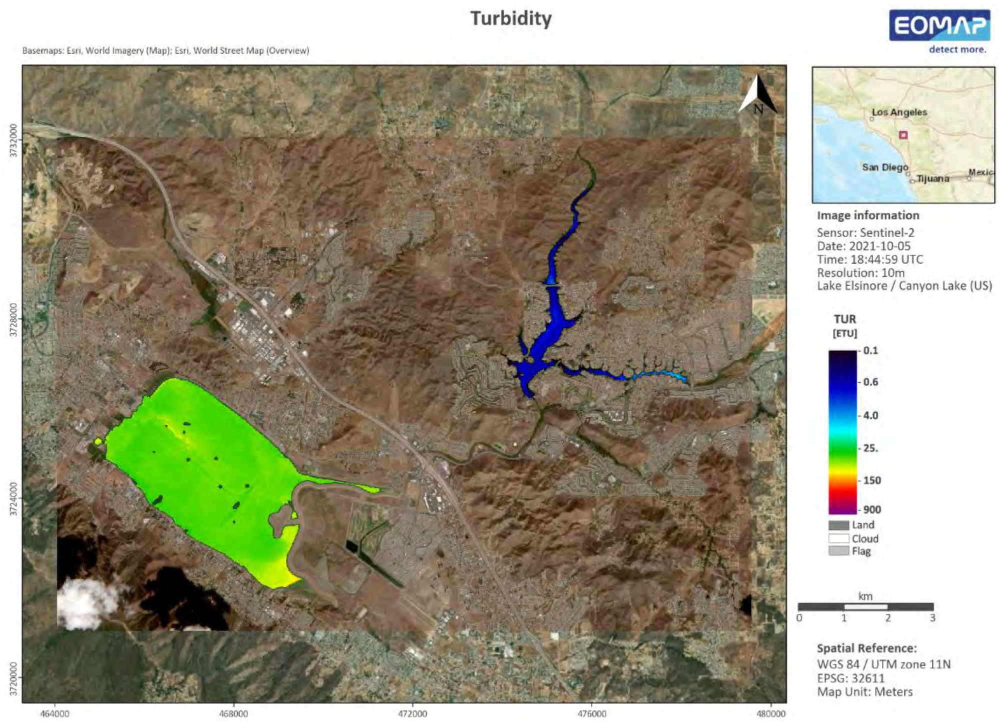


Figure 2: Turbidity product from 2021-10-05

3.2. Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2021-10-05 is shown in Figure 3.

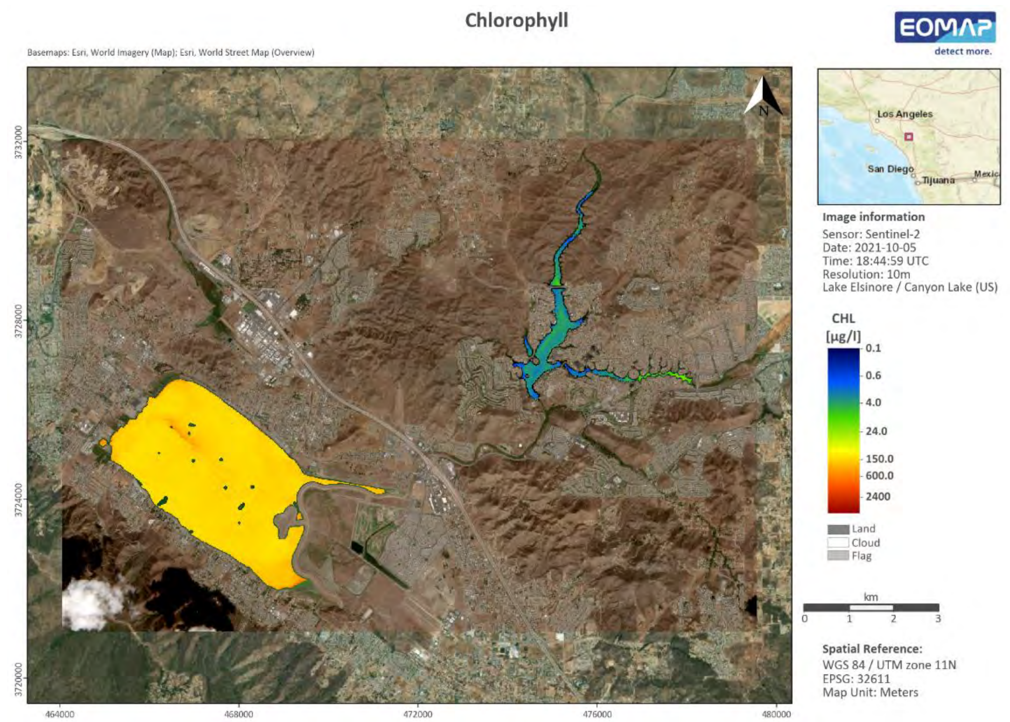


Figure 3: Chlorophyll-a product from 2021-10-05

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

3.3. Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2021-10-05 is shown in Figure 4.

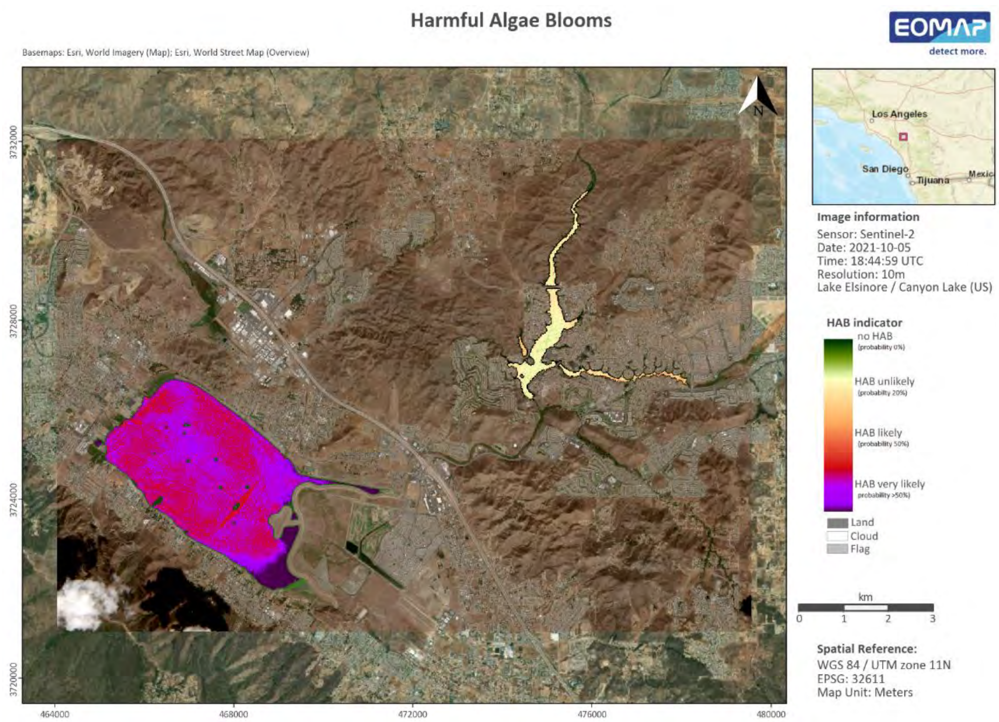


Figure 4: Harmful Algae Bloom Indicator product from 2021-10-05

3.4. True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

- QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
- QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

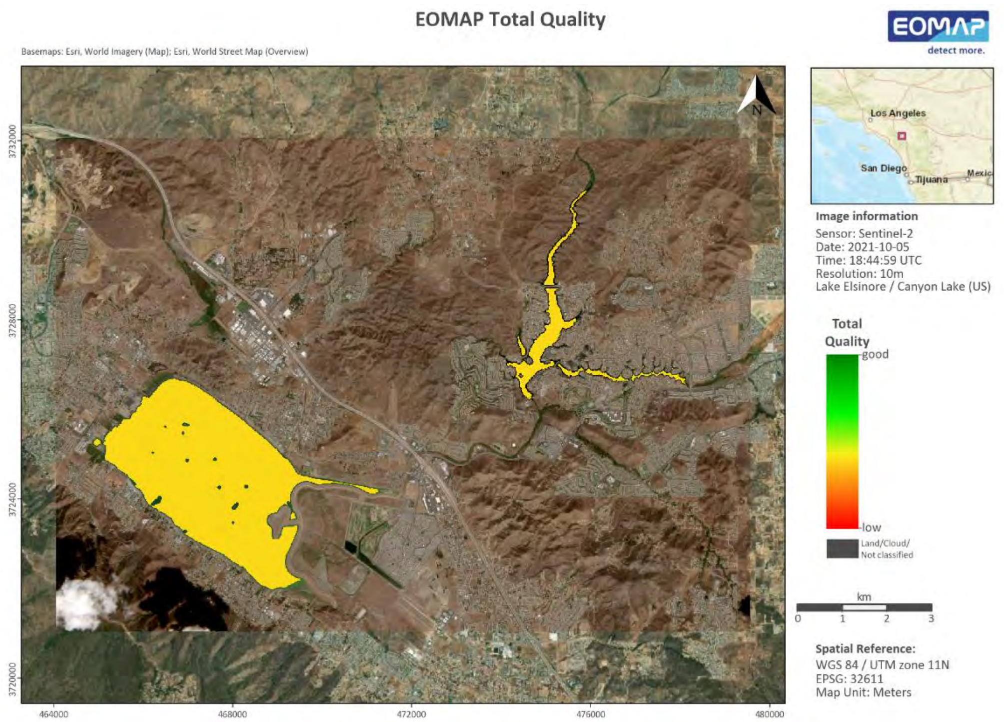


Figure 5: QUT product from 2021-10-05

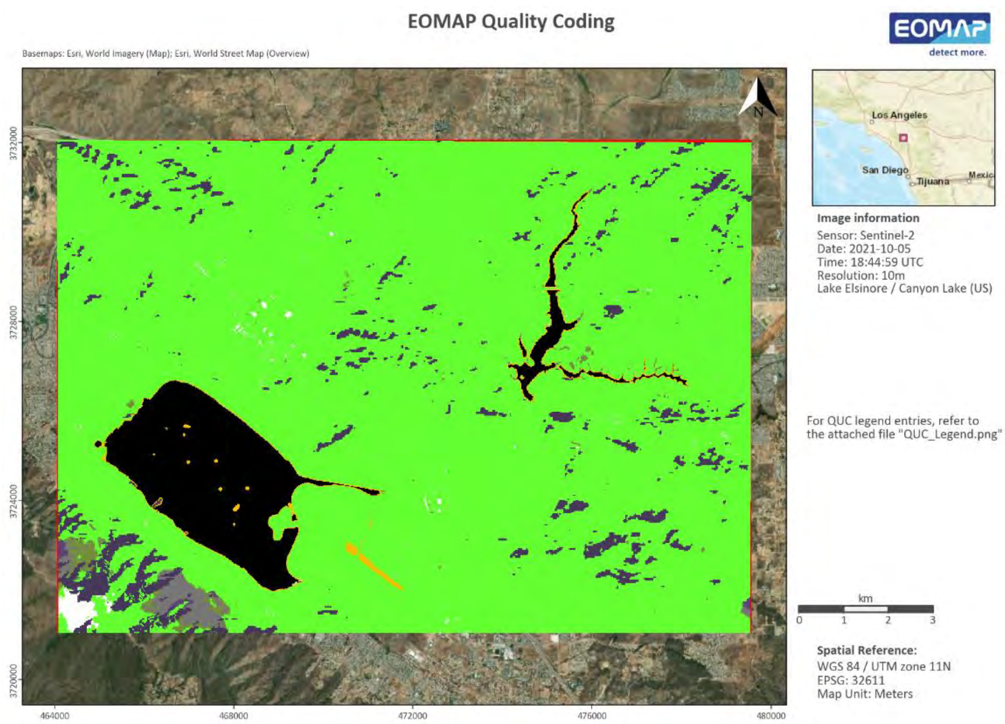


Figure 6: QUC product from 2021-10-05

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in
Figure 7.

Professional version allow combination of the two most relevant flags:
First number = most relevant flag
1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle
Examples: 25 Warning flag for large zenit solar angle and Whitecaps
114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.
As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.
Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8/9: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Landsat-9 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date:	2022-01-04
Version:	11
Clients:	Wood Plc.
Reference:	2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	e-mail	Phone
Philip Klinger	klinger@eomap.de	+49 8152 99861 13
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 16

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	Point of Contact
John D. Rudolph	Philip Klinger
john.rudolph@woodplc.com	klinger@eomap.de, +49 (0)8152 9986115

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2022-01-04
Version	11

1.1 List of all delivered scenes

Sensor	Time of record
Sentinel-2	2021-12-19 18:45:00 UTC

1.2 Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3 List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs11_20211219.pdf	PDF	Delivery Report
CHL_us-california_11smt_EOMAP_20211219_184500_SENT2_m0010.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_11smt_EOMAP_20211219_184500_SENT2_m0010_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_11smt_EOMAP_20211219_184500_SENT2_m0010_wgs84_xyz.txt	ASCII	Product text file, real values
CHL_us-california_11smt_EOMAP_20211219_184500_SENT2_m0010.kmz	KMZ	GoogleEarth overlay
CHL_us-california_11smt_EOMAP_20211219_184500_SENT2_m0010_metadata.xml	XML	Metadata
CHL_us-california_11smt_EOMAP_20211219_184500_SENT2_m0010_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4 File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5 Notes (e.g. technical issues, exceptional conditions, etc.)

- Extreme CHL values in parts of Lake Elsinore, possibly due to formation of algal matts

Data Analyst	QA/QC
Philip Klinger	Hendrik Bernert
Philip Klinger	Hendrik Bernert

detect more.

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1] [2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

---

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings “Water Quality in Europe: Challenges and Best Practice” UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

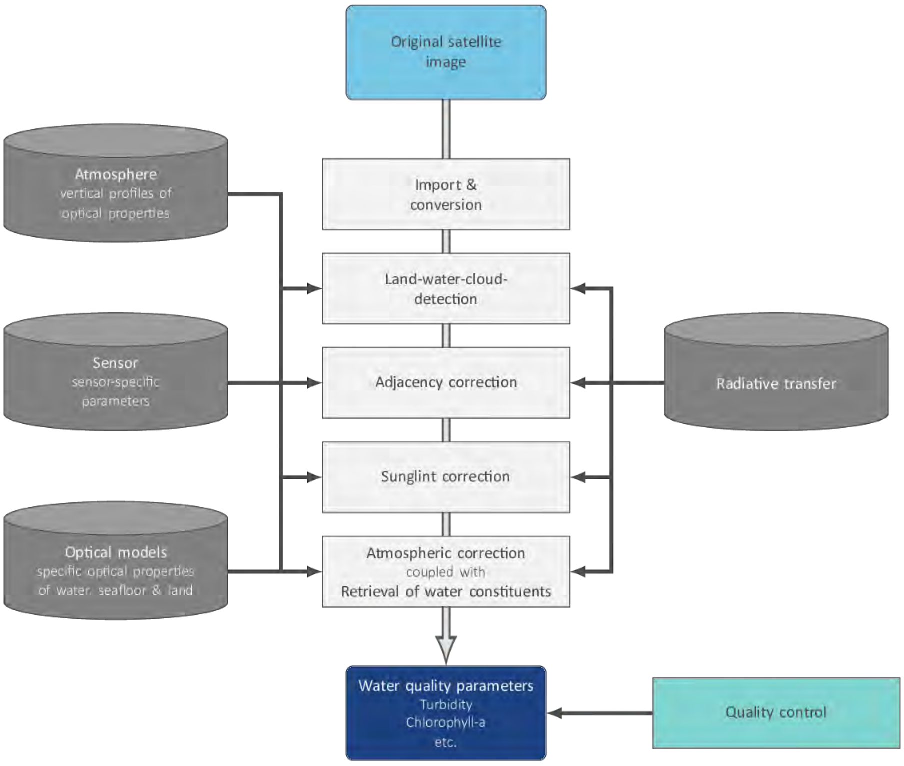


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

4.1 Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2021-12-19 is shown in Figure 2.

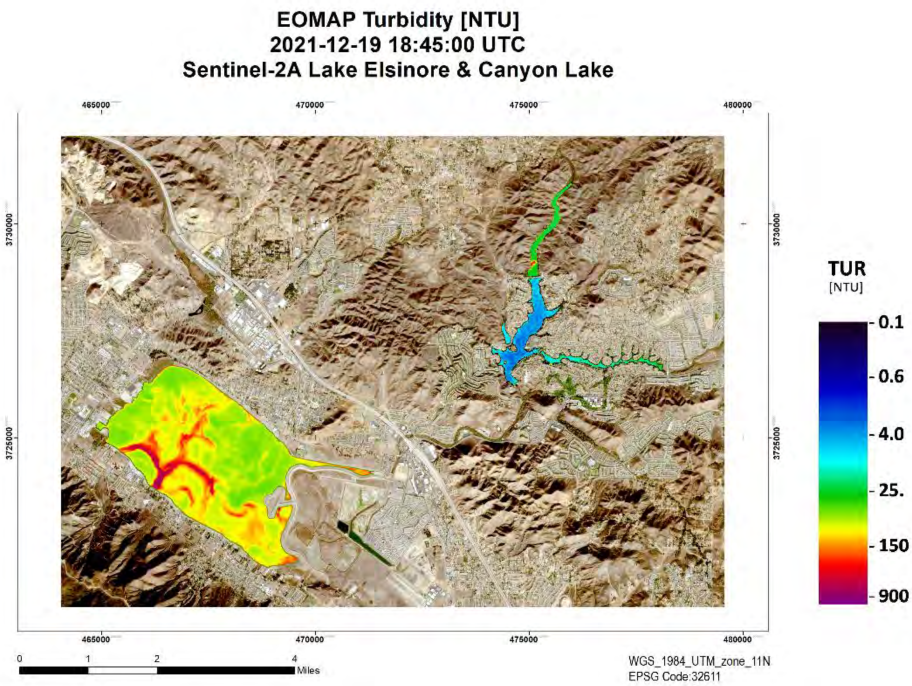


Figure 2: Turbidity product from 2021-12-19

4.2 Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2021-12-19 is shown in Figure 3.

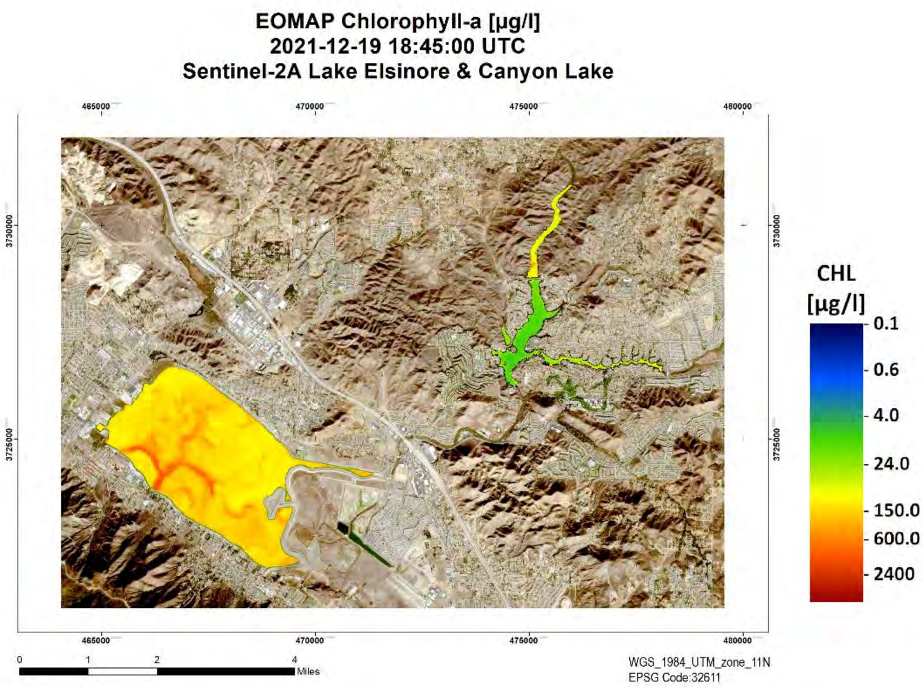


Figure 3: Chlorophyll-a product from 2021-12-19

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

4.3 Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2021-12-19 is shown in Figure 4.

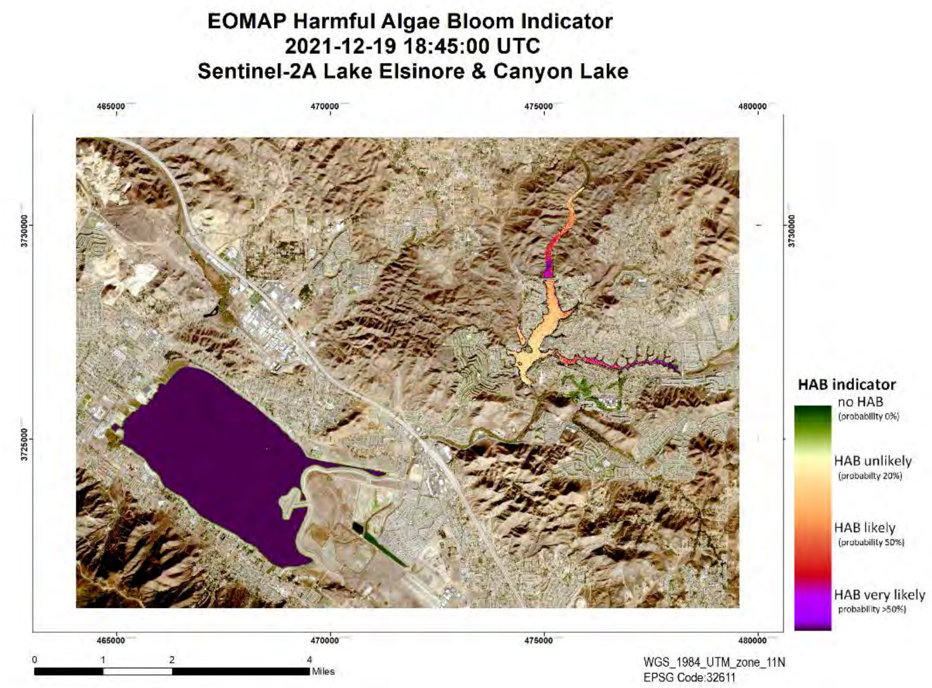


Figure 4: Harmful Algae Bloom Indicator product from 2021-12-19

4.4 True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

- The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

  - QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
  - QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

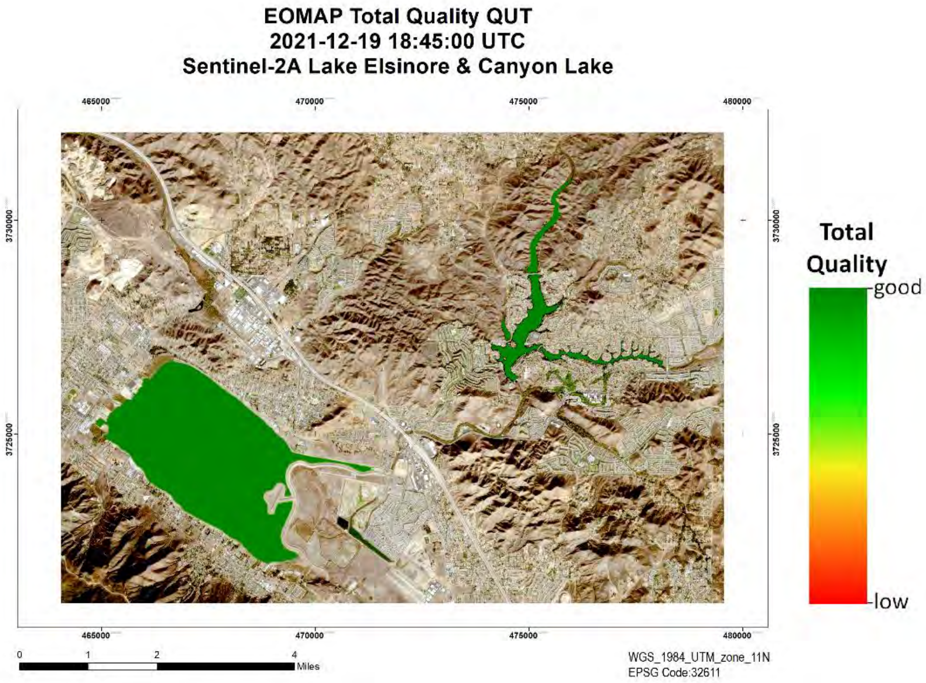


Figure 5: QUT product from 2021-12-19

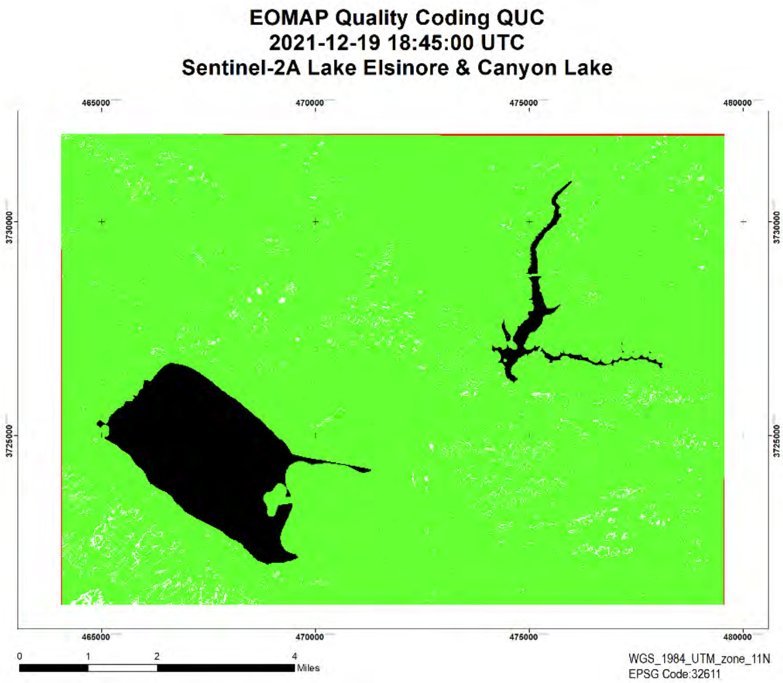


Figure 6: QUC product from 2021-12-19

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in
Figure 7 .

Professional version allow combination of the two most relevant flags:

First number = most relevant flag
1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle

Examples: 25 Warning flag for large zenit solar angle and Whitecaps
114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.
As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.
Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

EOMAP
detect more.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date:	2022-02-23
Version:	12
Clients:	Wood Plc.
Reference:	2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	e-mail	Phone
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 15
Philip Klinger	klinger@eomap.de	+49 8152 99861 13

detect more.

CONTENT

EOMAP detect more.

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	Point of Contact
John D. Rudolph	Philip Klinger
john.rudolph@woodplc.com	klinger@eomap.de, +49 (0)8152 9986115

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2022-02-23
Version	12

1.1. List of all delivered scenes

Sensor	Time of record
Sentinel-2	2022-02-17 18:45:02 UTC

1.2. Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3. List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs11_20211219.pdf	PDF	Delivery Report
CHL_us-california_11smt_EOMAP_20220217_184502_SENT2_m0010.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_11smt_EOMAP_20220217_184502_SENT2_m0010_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_11smt_EOMAP_20220217_184502_SENT2_m0010_wgs84_xyz.txt	ASCII	Product text file, real values
CHL_us-california_11smt_EOMAP_20220217_184502_SENT2_m0010.kmz	KMZ	GoogleEarth overlay
CHL_us-california_11smt_EOMAP_20220217_184502_SENT2_m0010_metadata.xml	XML	Metadata
CHL_us-california_11smt_EOMAP_20220217_184502_SENT2_m0010_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4. File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5. Notes (e.g. technical issues, exceptional conditions, etc.)

- None

Data Analyst	QA/QC
Hendrik Bernert	Philip Klinger

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1] [2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

---

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings “Water Quality in Europe: Challenges and Best Practice” UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

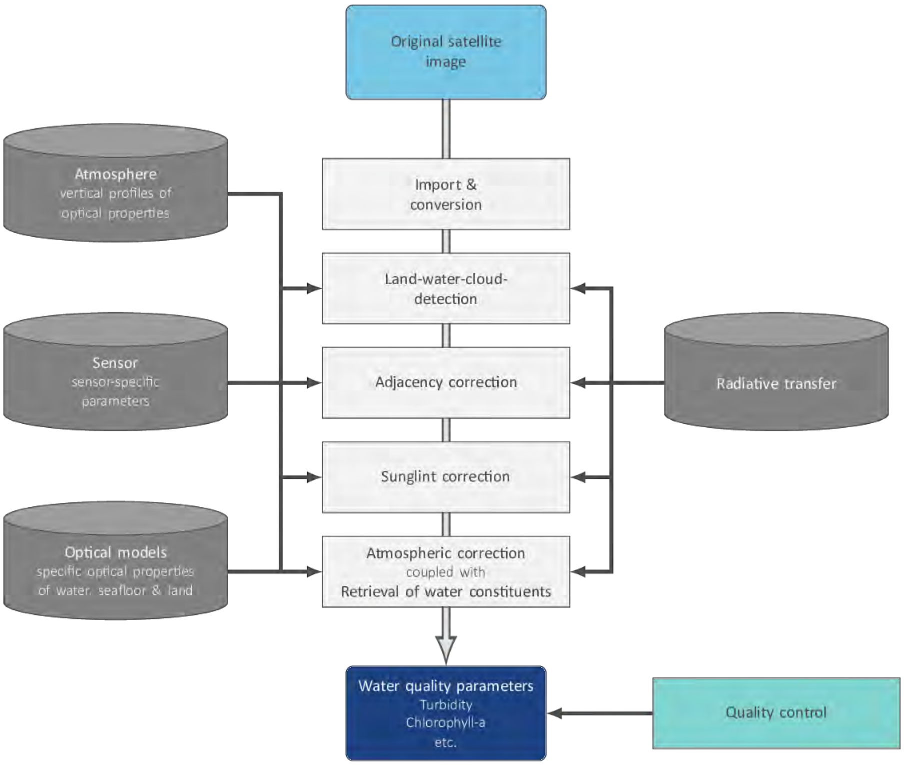


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

3.1. Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2022-02-17 is shown in Figure 2.

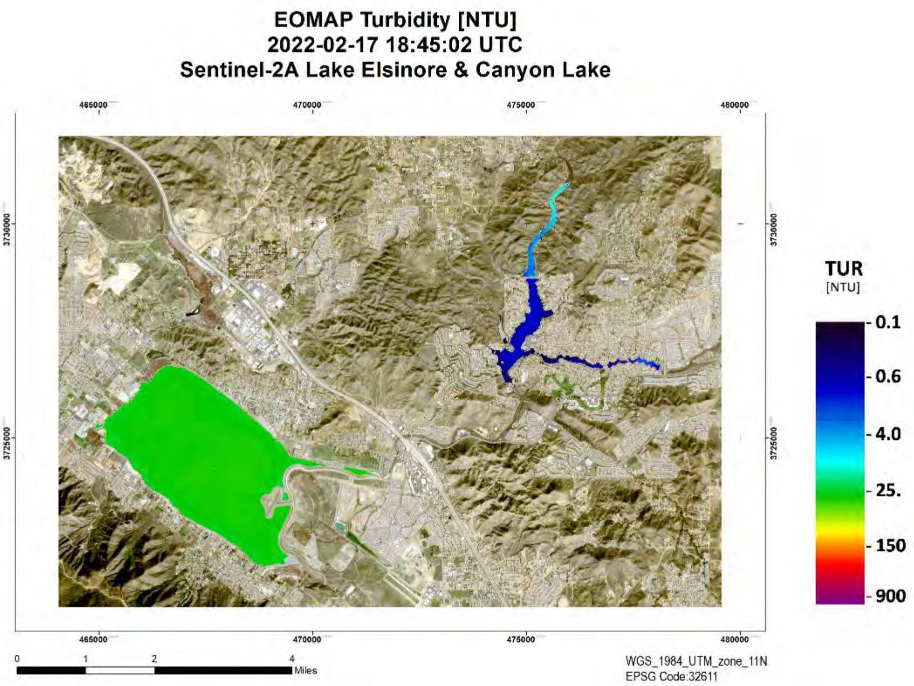


Figure 2: Turbidity product from 2022-02-17

3.2. Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2022-02-17 is shown in Figure 3.

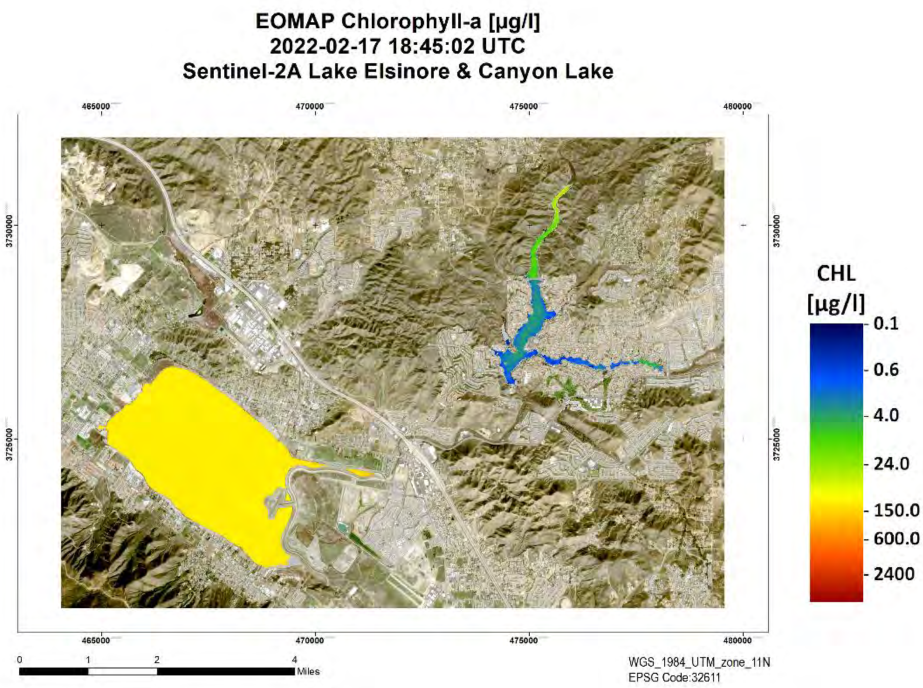


Figure 3: Chlorophyll-a product from 2022-02-17

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

3.3. Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2022-02-17 is shown in Figure 4.

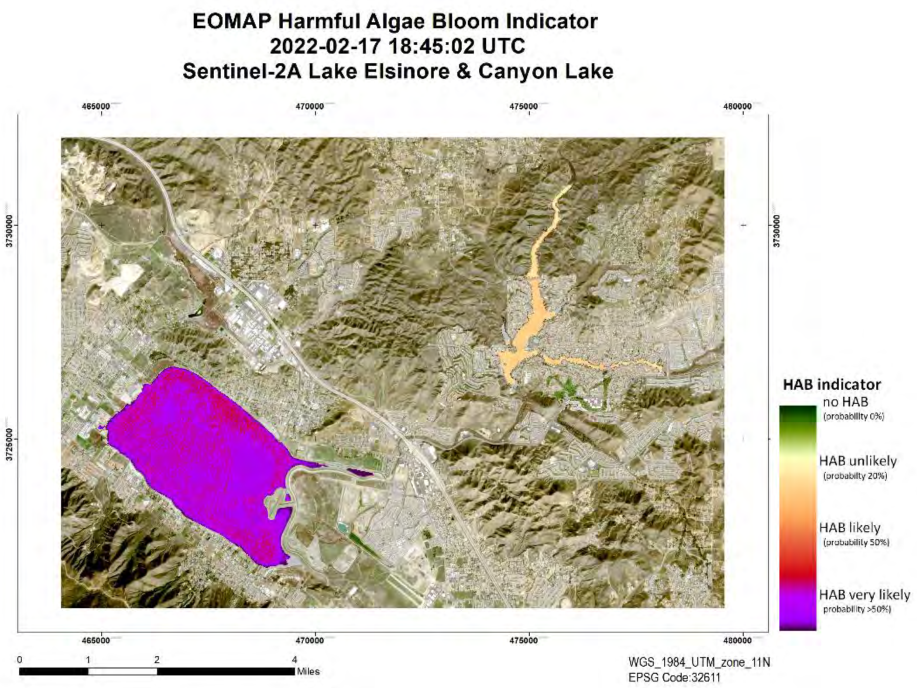


Figure 4: Harmful Algae Bloom Indicator product from 2022-02-17

3.4. True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

- QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
- QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

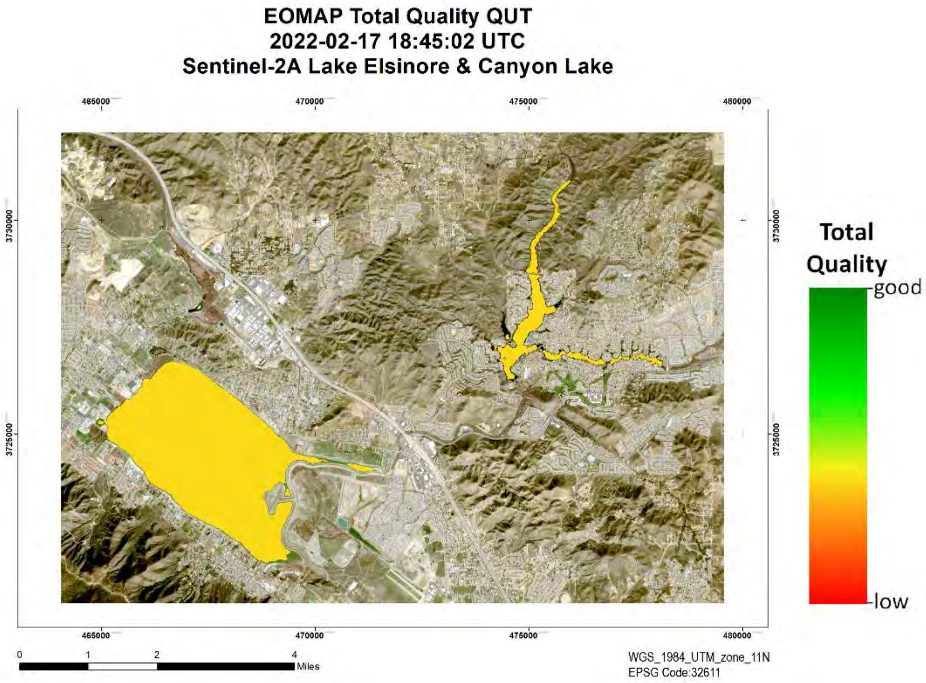


Figure 5: QUT product from 2022-02-17

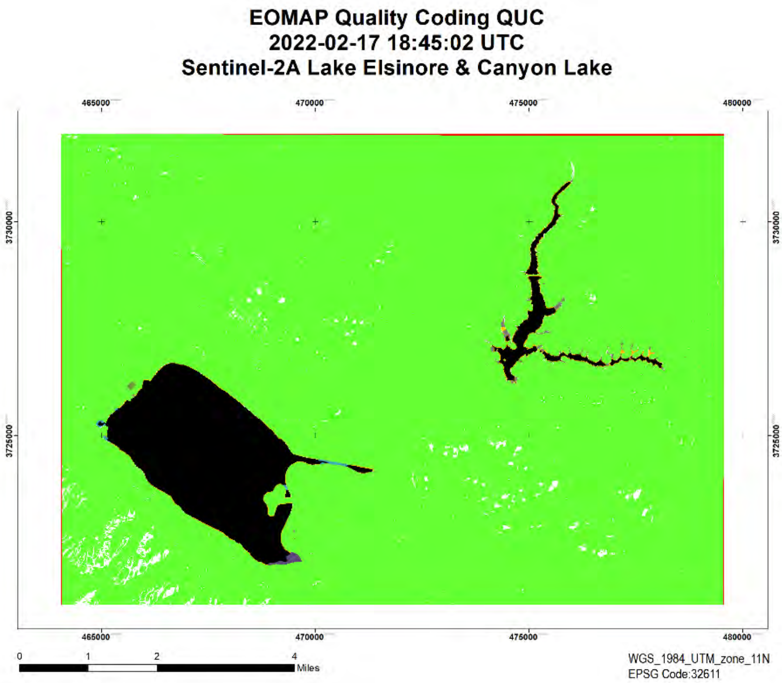


Figure 6: QUC product from 2022-02-17

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in

Figure 7 .

Professional version allow combination of the two most relevant flags:

First number = most relevant flag

1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle

Examples: 25 Warning flag for large zenit solar angle and Whitecaps

114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.

As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.

Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

detect more.

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date:	2022-04-14
Version:	13
Clients:	Wood Plc.
Reference:	2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	Email	Phone
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 14
Philip Klinger	klinger@eomap.de	+49 8152 99861 13

detect more.

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	**Point of Contact**
John D. Rudolph	Hendrik Bernert
john.rudolph@woodplc.com	bernert@eomap.de, +49 (0)8152 9986114

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2022-04-14
Version	13

1.1. List of all delivered scenes

Sensor	Time of record
Sentinel-2	2022-04-13 18:44:55 UTC

1.2. Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3. List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs11_20211219.pdf	PDF	Delivery Report
CHL_us-california_11smt_EOMAP_20220413_184455_SENT2_m0010.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_11smt_EOMAP_20220413_184455_SENT2_m0010_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_11smt_EOMAP_20220413_184455_SENT2_m0010_wgs84_xyz.txt	ASCII	Product text file, real values
CHL_us-california_11smt_EOMAP_20220413_184455_SENT2_m0010.kmz	KMZ	GoogleEarth overlay
CHL_us-california_11smt_EOMAP_20220413_184455_SENT2_m0010_metadata.xml	XML	Metadata
CHL_us-california_11smt_EOMAP_20220413_184455_SENT2_m0010_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4. File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5. Notes (e.g. technical issues, exceptional conditions, etc.)

- None

Data Analyst	QA/QC
Hendrik Bernert	Philip Klinger
Hendrik Bernert	Philip Klinger

EOMAP detect more.

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1] [2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

---

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings “Water Quality in Europe: Challenges and Best Practice” UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

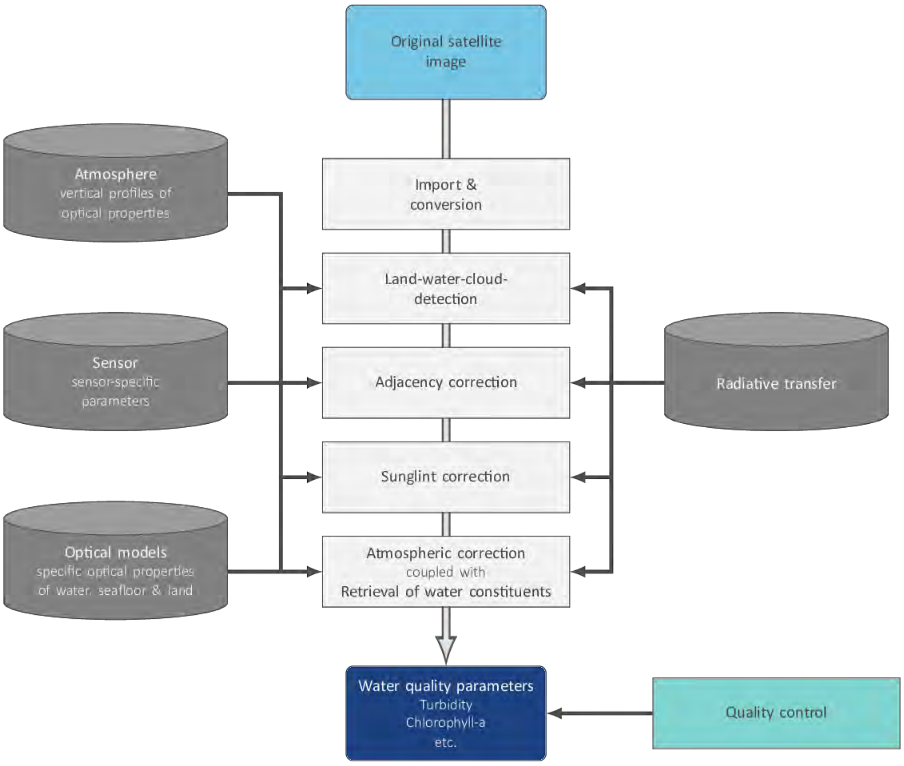


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

3.1. Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2022-04-13 is shown in Figure 2.

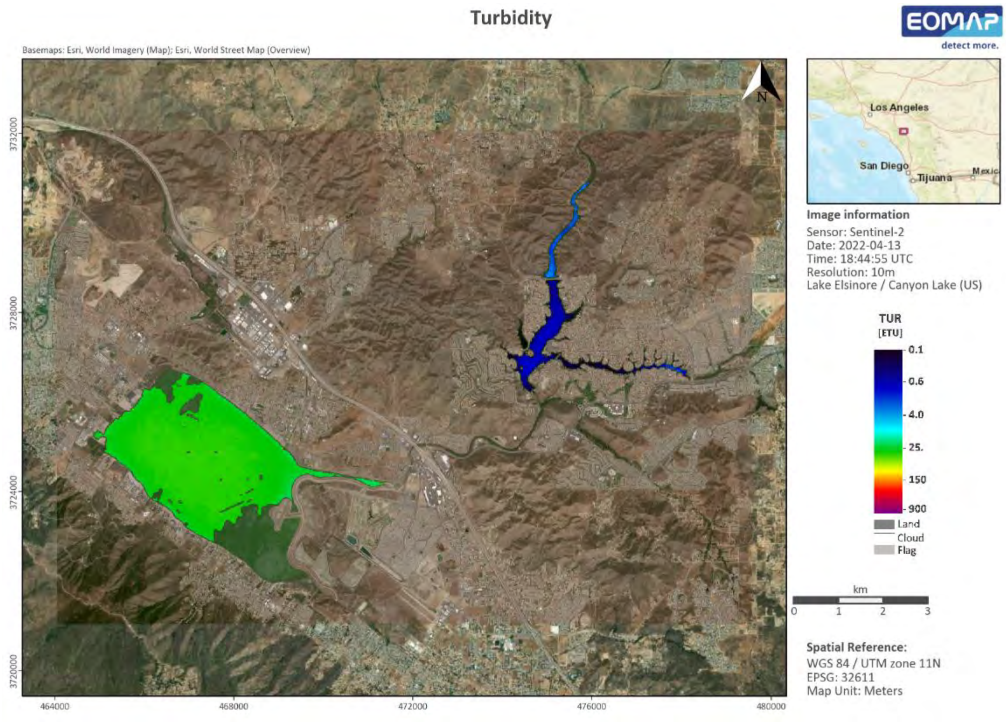


Figure 2: Turbidity product from 2022-04-13

3.2. Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2022-04-13 is shown in Figure 3.

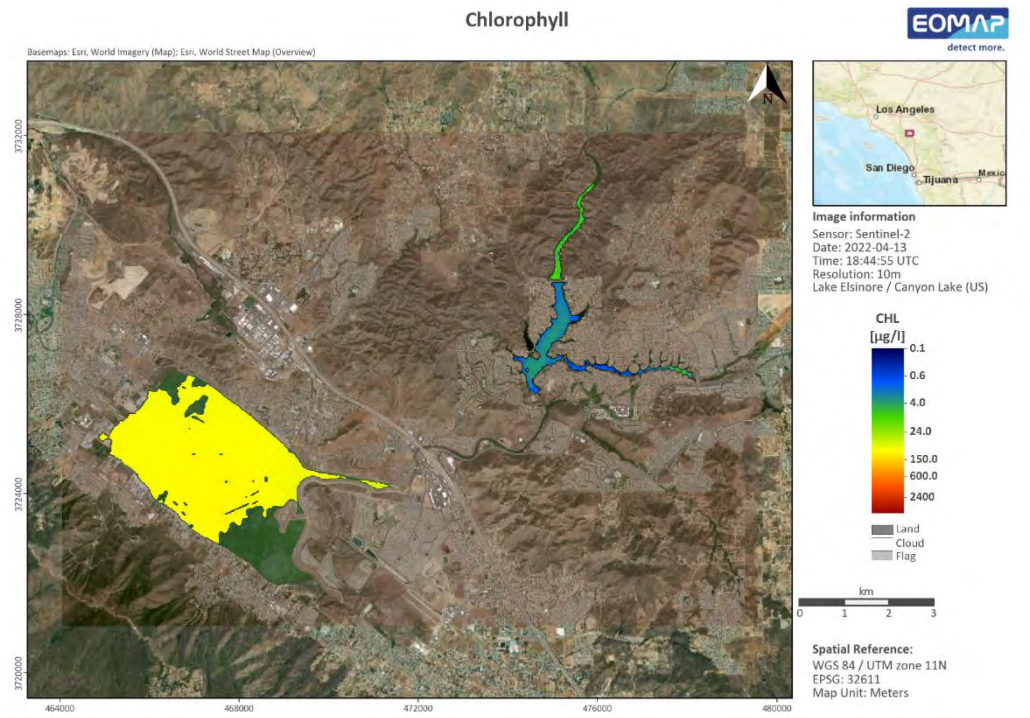


Figure 3: Chlorophyll-a product from 2022-04-13

9 Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

10 Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

3.3. Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2022-04-13 is shown in Figure 4.

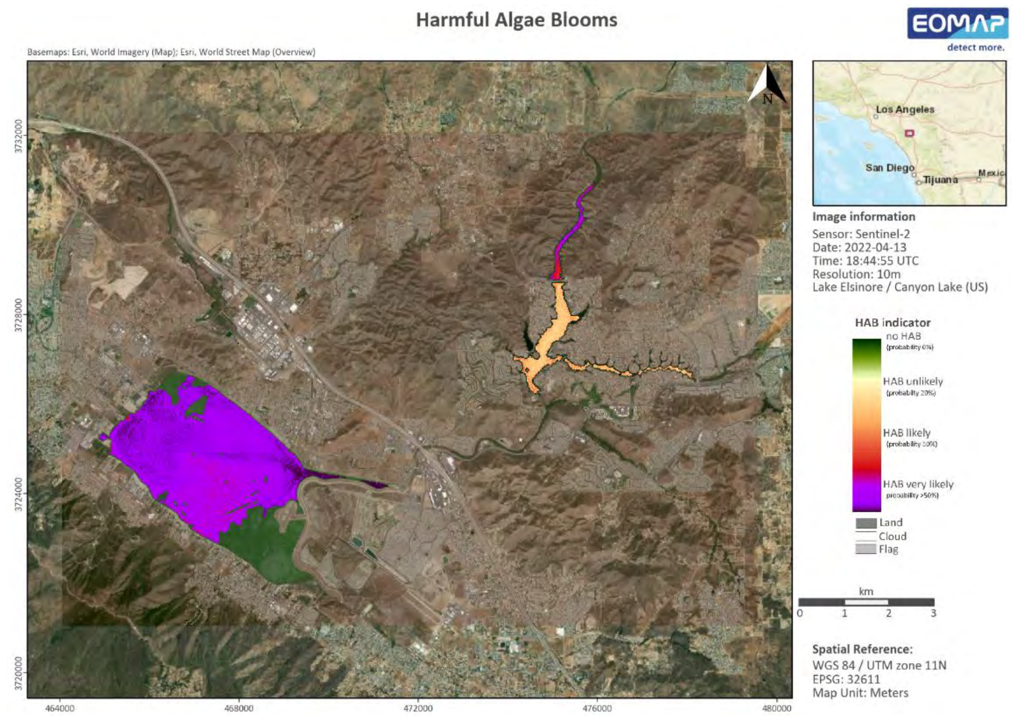


Figure 4: Harmful Algae Bloom Indicator product from 2022-04-13

3.4. True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

- QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
- QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

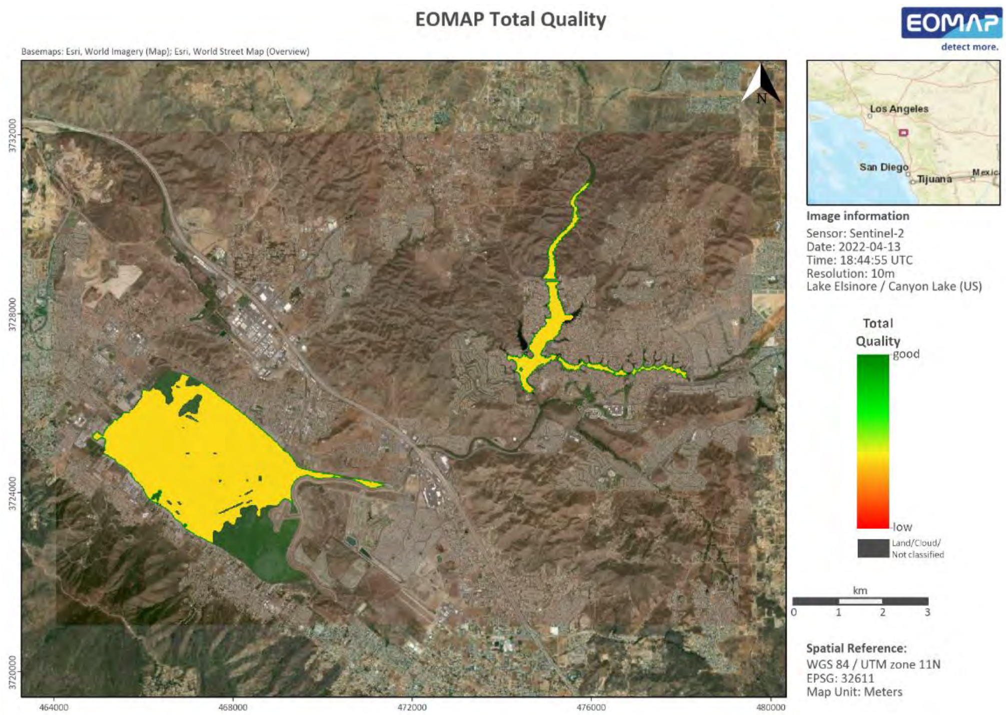


Figure 5: QUT product from 2022-04-13

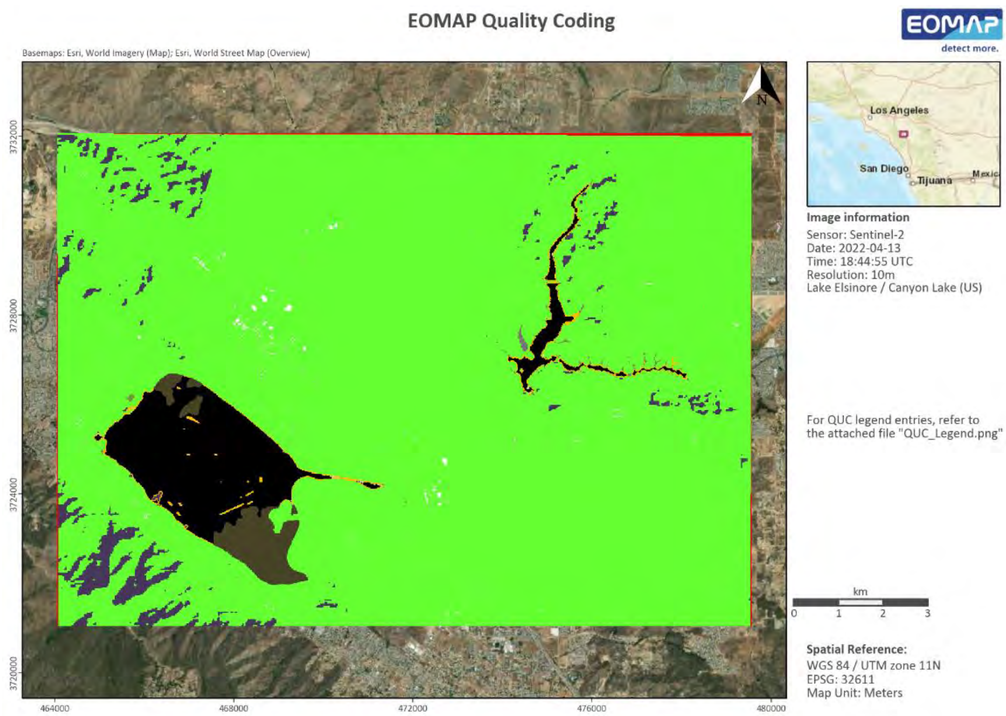


Figure 6: QUC product from 2022-04-13

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in Figure 7.

Professional version allow combination of the two most relevant flags:

First number = most relevant flag

1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle

Examples: 25 Warning flag for large zenit solar angle and Whitecaps

114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.

As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.

Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

Delivery report

Water Quality Monitoring: Lake Elsinore & Canyon Lake

Date: 2022-06-13
Version: 14.2

Clients: Wood Plc.
Reference: 2370_Delivery_EOMAP2WoodPlc

EOMAP GmbH & Co.KG,
Schlosshof 4, 82229 Seefeld
Germany

Authors:	Email	Phone
Hendrik Bernert	bernert@eomap.de	+49 8152 99861 14
Minha Sultan	sultan@eomap.de	+49 8152 99861 14

CONTENT

1. Service Provision Report

Contractor Details	Service Provider Details
Wood Environment & Infrastructure Solutions, Inc.	EOMAP GmbH & Co. KG
9210 Sky Park Court, Suite 200	Schlosshof 4, 82229 Seefeld, Germany
San Diego, CA 92123, USA	
Point of Contact	**Point of Contact**
John D. Rudolph	Hendrik Bernert
john.rudolph@woodplc.com	bernert@eomap.de, +49 (0)8152 9986114

Contractor PO / Reference number	
Contractor project title	
Service Provider reference number	2370
Date of delivery	2022-06-13
Version	14.2

1.1. List of all delivered scenes

Sensor	Time of record
Landsat-9	2022-06-08 18:22:05 UTC

1.2. Content

Product	Abbreviation	Yes/No
Total Absorption	ABS	☐
Aerosol Optical Thickness	AOT	☐
Yellow Substances	CDM	☐
Chlorophyll-a	CHL	☒
Ratio of Absorption and Scattering	DIV	☐
Harmful Algae Bloom Indicator	HAB	☒
Diffuse Attenuation Coefficient	KDC	☐
Quality Coding	QUC	☒
Total Quality	QUT	☒
True Color/False Color Composite	RGB	☒
Remote Sensing Reflectance	RRS	☐
Secchi Disc Depth	SDD	☐
Sum of Inorganic Absorption	SIA	☐
Sum if Organic Absorption	SOA	☐
Surface Temperature	SST	☐
Turbidity	TUR	☒
Trophic State Index (Chlorophyll)	TSC	☐
Total Suspended Matter	TSM	☐
Light Penetration Depth	Z90	☐
Water Body Extent	WEX	☐

1.3. List of delivered files (one product example)

File name	File format	Content
2370_Delivery_EOMAP2WoodPlc_Vs14_2_20220613.pdf	PDF	Delivery Report
CHL_us-california_040037_EOMAP_20220608_182205_LSAT9_m0030.tif	GeoTIFF	Product raster file, 8bit scaled and coloured
CHL_us-california_040037_EOMAP_20220608_182205_LSAT9_m0030_32bit.tif	GeoTIFF	Product raster file, 32bit real values
CHL_us-california_040037_EOMAP_20220608_182205_LSAT9_m0030_32bit_wgs84.txt	ASCII	Product text file, real values
CHL_us-california_040037_EOMAP_20220608_182205_LSAT9_m0030.kmz	KMZ	GoogleEarth overlay
CHL_us-california_040037_EOMAP_20220608_182205_LSAT9_m0030.xml	XML	Metadata
CHL_us-california_040037_EOMAP_20220608_182205_LSAT9_m0030_overview.pdf	PDF	Overview PDF, metadata and quicklook

1.4. File naming

[Product abbreviation]_[Country code]-[Area]_EOMAP_[Date of satellite image recording]_[Time of satellite image recording]_[sensor code]_[spatial resolution]_[optional]

With

[Product abbreviation]	see list of product abbreviations
[Country code]	Country ID following ISO 3166 ALPHA-2 standards
[Area]	name of city/region or other relevant area characterization
[Date of satellite image rec.]	Satellite image date used for the analysis in YYMMDD (YY= Year, MM = Month, DD = Date) in UTC
[Time of satellite image rec.]	Satellite image date used for the analysis in HHMMSS (HH= Hours, MM = Minute, SS = Seconds) in UTC time
[sensor code]	Sensor in use
[spatial resolution]	Spatial resolution/grid spacing in meters
[optional]	is an optional parameter which can is used to support the intuitive use of the data, such as 'metadata' or 'XYZQ' for metadata files and ASCII XYZQ files.

1.5. Notes (e.g. technical issues, exceptional conditions, etc.)

- None

Data Analyst	QA/QC
Hendrik Bernert	
Hendrik Bernert	Minha Sultan

2. Methodology: Modular Inversion and Processing System (MIP)

For the retrieval of satellite-derived water quality data, the physics-based Modular Inversion and Processing System (MIP), developed by EOMAP, has been applied to the satellite imagery. This sensor-independent approach includes all the relevant processing steps to guarantee a robust, standardised and operational retrieval of water quality parameters from various satellite data sources. The advantage of physics-based methods is that they do not require a priori information about the study area and can therefore be applied independently of satellite type and study area.

MIP imbeds sensor-independent algorithms and processing modules to derive consistent water quality parameters for multiple scales through a number of different satellite sensors. The algorithms take all relevant environmental impacts into account and do so for each individual measurement and pixel according to the current state-of-the-art, including:

a. water, land, cloud identification
b. estimation and correction of atmosphere and aerosol impacts[1] [2]
c. correction altitude level impacts[3]
d. correction of adjacency impact (light scattering into the water signal from adjacent land surfaces)[4]
e. correction[5] or flagging[6] of sunglitter impact
f. retrieval of in-water absorption and scattering as physical measures[7]
g. accounting for varying spectral slopes of specific inherent optical properties[8]
h. provision of uncertainty measures and flagging procedures
i. accounting for the full bidirectional effects in the atmosphere, at the water-atmosphere boundary layers and in-water, using a fully coupled radiative transfer model
j. application of procedures to minimize errors, resulting from the coupled interaction of light between atmosphere, water surface and in-water on the signal, through coupled inversion procedures

The different workflow steps from satellite raw imagery import to value-added water quality retrieval are displayed in Figure 1.

---

[1] Heege, T., Kiselev, V., Wettle, M., Hung N.N. (2014): Operational multi-sensor monitoring of turbidity for the entire Mekong Delta . Int. J. Remote Sensing, Special Issues Remote Sensing of the Mekong, Vol. 35 (8), pp. 2910-2926

[2] Richter, R., Heege, T., Kiselev, V., Schläpfer, D. (2014): Correction of ozone influence on TOA radiance. Int. J. of Remote Sensing. Vol. 35(23), pp. 8044-8056, doi: 10.1080/01431161.2014.978041

[3] Heege, T., Fischer, J. (2004): Mapping of water constituents in Lake Constance using multispectral airborne scanner data and a physically based processing scheme. Can. J. Remote Sensing, Vol. 30, No. 1, pp. 77-86

[4] Kiselev, V., Bulgarelli, B. and Heege, T., (2015). Sensor independent adjacency correction algorithm for coastal and inland water systems. Remote Sensing of Environment, 157: 85-95. , ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.07.025

[5] Heege, T. & Fischer, J. (2000): Sun glitter correction in remote sensing imaging spectrometry. SPIE Ocean Optics XV Conference, Monaco, Oct. 16-20.

[6] EU FP7-Projekt GLASS: WP4 Validation report (29.2.2016): www.glass-project.eu/assets/Deliverables/GLaSS-D4.2.pdf

[7] Bumberger J., Heege T., Klinger P., et al. (2017): Towards a Harmonized Validation Procedure for Inland Water Optical Remote Sensing Data using Inherent Optical Properties, Rem. Sens. 2017(9), 21p, submitted 28 Feb. 2017

[8] Heege T., Schenk K., Klinger P., Broszeit A., Wenzel J., Kiselev V. (2015): Monitoring status and trends of water quality in inland waters using earth observation technologies. Proceedings “Water Quality in Europe: Challenges and Best Practice” UNESCO-IHP European Regional Consultation Workshop, Koblenz, Germany, Dec 2015, p. 1-4

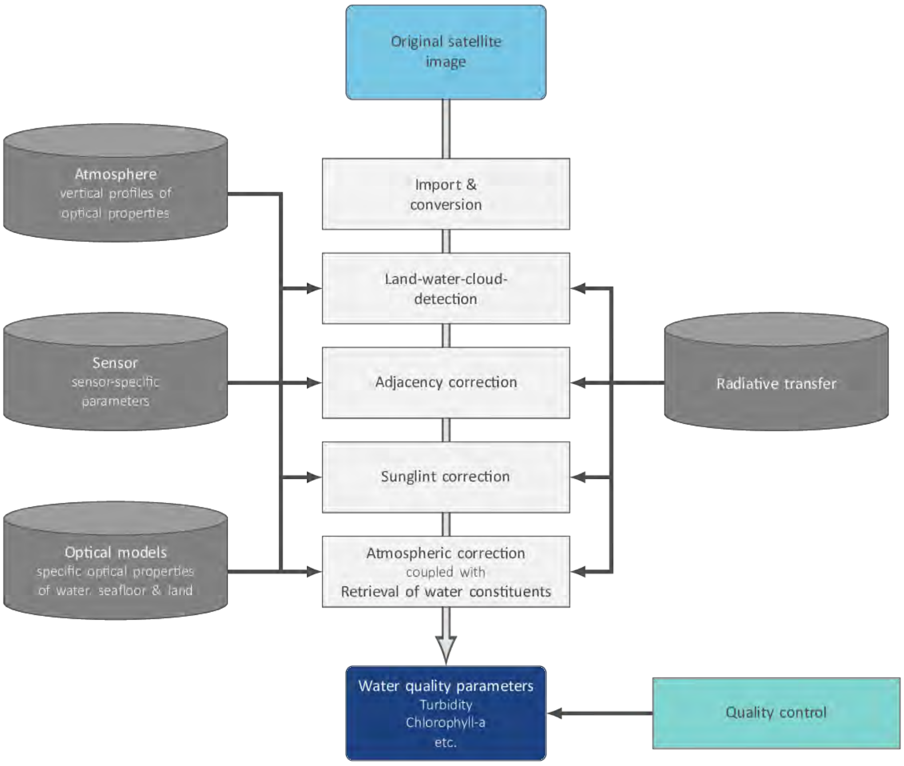


Figure 1: EOMAP's physics-based workflow to derive satellite-based water quality

MIP is the most established, sensor-independent and operational aquatic remote sensing processing system for the full range of high, medium and low-resolution satellite sensors. Fully-automated water monitoring processors are installed in satellite ground segments worldwide (Europe, Australia, Asia and America), to ensure fast and efficient access to a wide range of satellite data. The data processing and orchestration software, the EOMAP Workflow System (EWS) allows for continuous, daily production.

3. Products

3.1. Turbidity (TUR)

Turbidity (TUR) is a key parameter of water quality and is linearly related to the backward scattering of light of organic and inorganic particles in water. Turbidity is also linearly related to Total Suspended Matter (TSM) at low to moderate turbidity values. The measurement unit is Nephelometric Turbidity Unit (NTU). Satellite-derived turbidity is determined by the backward scattering of light between 450 to 800nm, which is physically retrieved using satellite data. The standard relation of EOMAP concentrations to inherent optical properties is defined as 1 NTU = 0.0118 1/m backward scattering at 550nm, or 1 NTU = 0.619 1/m total scattering at 550nm for an assumed ratio bb/b = 0.019. The linear relation between turbidity and suspended matter/solids in low to moderate concentrations is in most cases a regional constant, but can vary with particle size distribution. Note that the geometrical properties of an in-situ measurement device, and the wavelength in use, may differ in comparison to the satellite product. For example, the standard FTU determination, a measure of turbidity similar to NTU, is based on the measurement of light scattered within a 90° angle from a beam directed at the water sample. Alongside temporal differences in satellite and in situ measurements, different sampling depths and the measurement location, this needs to be considered when comparing and interpreting satellite derived vs. in situ measured turbidity values. The Turbidity product from 2022-06-08 is shown in Figure 2.

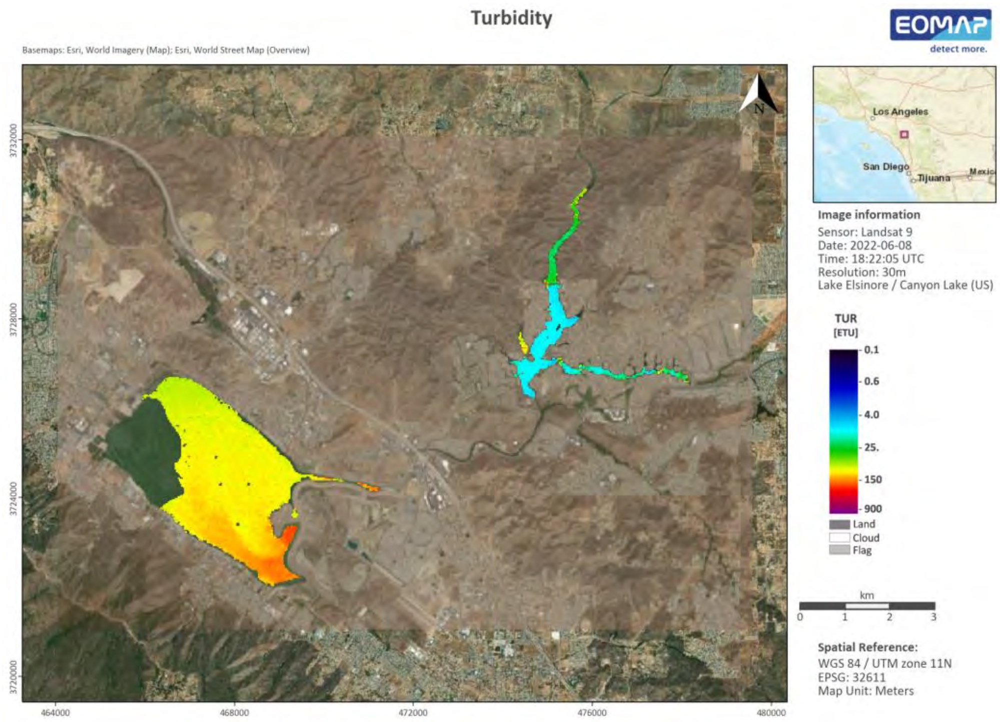


Figure 2: Turbidity product from 2022-06-08

3.2. Chlorophyll-a (CHL)

Chlorophyll-a (CHL) retrieval is based on the derived information of in-water organic absorption, in-water turbidity and spectral characteristics of each water body. Chlorophyll-a in [µg/l], is provided as a measure linearly related to the pigment-specific absorption at 440nm, with 1 µg/l Chl equal to 0.035 1/m pigment absorption. Phaeophytin and further pigments cannot be discriminated methodologically with the spectral resolution provided by Landsat 8/Sentinel-2 and similar sensors and is therefore included in this product. The pigment-related absorption is always smaller than the absorption of organic components (SOA). For clear water conditions (low chlorophyll/total suspended solids), the specific absorption chlorophyll increases significantly (Bricaud et al. 1995[9]). Chlorophyll values can vary over 4 magnitudes, for marine waters or clear lakes typical concentrations between 0.01 and 10 µg/l, while for eutrophic lakes concentrations can reach 100 µg/l and more. The chlorophyll products are typically reliable within a range of 10 – 50 % in comparison to in situ measures (Broszeit 2015[10]), which are typically based on one of three different methods, which include photometric, fluorescence and HPLC approaches and their subcategories. The Chlorophyll-a product from 2022-06-08 is shown in Figure 3.

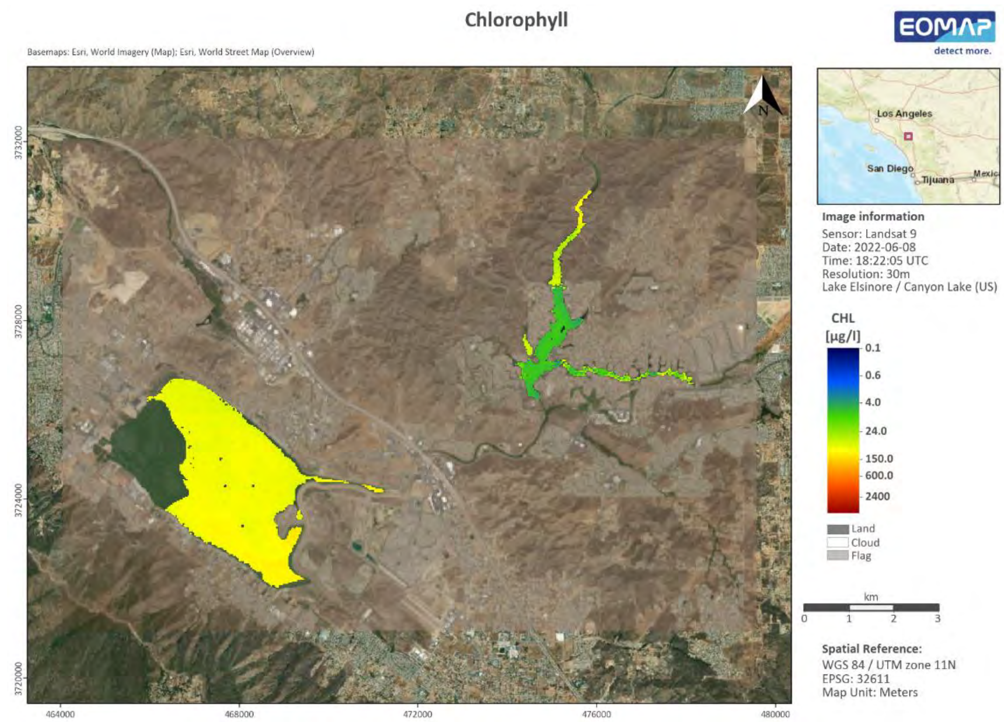


Figure 3: Chlorophyll-a product from 2022-06-08

[9] Bricaud, A., Babin, M., Morel, A., Claustre, H. (1995): Variability in the chlorophyll-specific absorption coefficients of natural phytoplankton: Analysis and parametrization. Journal of Geophysical Research Atmospheres, 100(C7):13,321-13,332

[10] Broszeit, A., 2015. Assessing long-term inland water quality using satellite imagery: A Feasibility and validation study of different lake types. MSc Thesis, Julius-Maximilian-University Würzburg, 96p

3.3. Harmful Algae Bloom Indicator (HAB)

The **Harmful Algae Bloom Indicator** (HAB) refers to the presence of cyanobacteria. It is sensitive to the appearance of cyanobacteria-related pigments, i.e. phycocyanin and phycoerythrin. Both pigments show absorption features in green wavelengths from 500 nm to approx. 640 nm; phycoerythrin shows its absorption maximum at 540-570 nm, phycocyanin at 610-620 (Colyer et al. 2005). Most satellite sensors support the identification of this feature with only two bands, i.e. one in the green wavelength region (e.g. L7 and L8 at 530 – 590 nm) and in the red wavelength region at approx. 640 – 670 nm. The used standard parameterisation of phytoplankton absorption in MIP as described above, however, does not account phycocyanin and phycoerythrin absorption in the retrieval process. The modelled phytoplankton absorption therefore lacks the absorption features of these pigments. Nonetheless, if these pigments are present in the water a slight spectral mismatch between modelled water leaving reflectance ($R_{modelled}$) and satellite derived reflectance ($R_{satellite}$) occurs. The algorithm then compares the slope of $R_{modelled}$ and $R_{satellite}$ between the green and red band ($\delta R = R_{green} - R_{red}$) in order to classify pixels with regard to phycocyanin and phycoerythrin occurrence, i.e. harmful algae bloom probability. The HAB indicator from 2022-06-08 is shown in Figure 4.

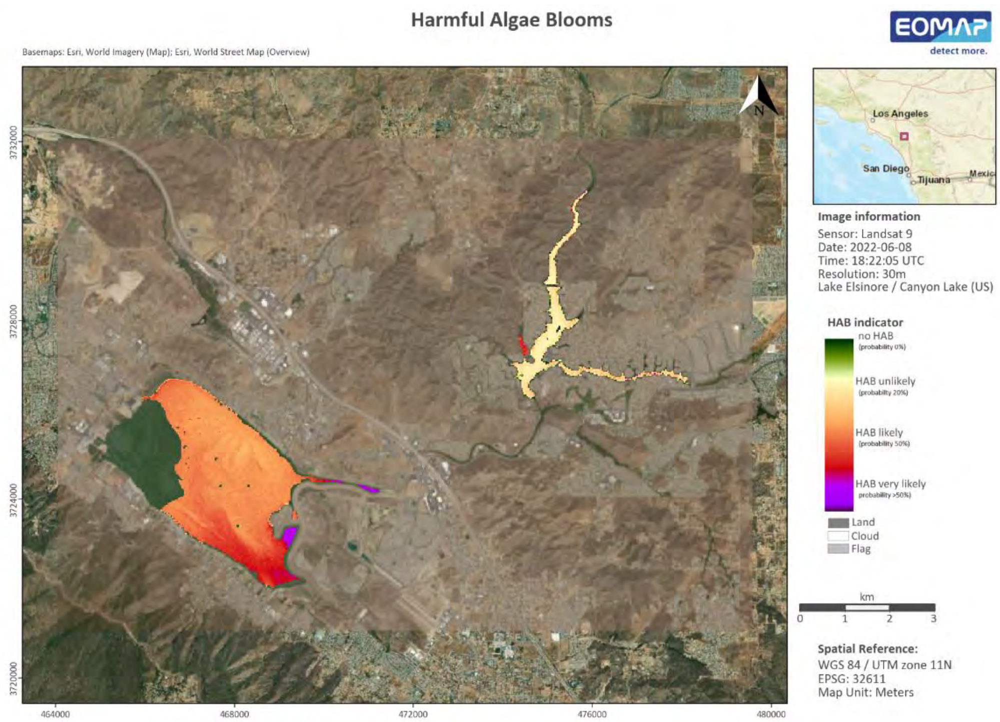


Figure 4: Harmful Algae Bloom Indicator product from 2022-06-08

3.4. True color composite (RGB)

RGB composite images represent the area of interest in true colour or false colour modes by combining predefined bands, depending on the sensor in use.

4. Quality Control and Flagging

As a standard output of the processing, an accuracy or quality indicator is calculated for each retrieved parameter and for each detected water pixel. This measure comprises a comprehensive range of factors that can impact the derived product quality, including:

- the geometry between sun, target, and sensor,
- the estimated sun glint probability,
- the retrieved aerosol optical depth,
- residuals of the measured and modelled sensor radiance and subsurface reflectance,
- the comparison of retrieved water species concentrations to extreme values as defined in the configuration files,
- pixels affected by cloud shadow and
- shallow water areas.

Threshold values define distinct values when a parameter is assumed to influence the quality. All parameters are integrated into one remaining quality parameter, allowing both an improved flagging and a quality weighting of pixels, that can later be merged into integrated 3rd level products.

The quality information is part of each standard geodata delivery and is visualized by two different 8bit GeoTIFFs:

- QUT - Total Quality, quantifying the overall quality of each pixel from low to high. Only valid water pixels - excluding land, cloud or flagged pixels - are represented in QUT indicator (Figure 5).
- QUC – EOMAP Quality coding (Figure 6), revealing the processor's internal quality check, split into the defined indicators (e.g. sunglint, shallow water risk, etc.). These are classified into 'no quality concerns', 'quality risk and 'bad quality' (flag). Note that 'quality risk' pixels are marked as such but not flagged.

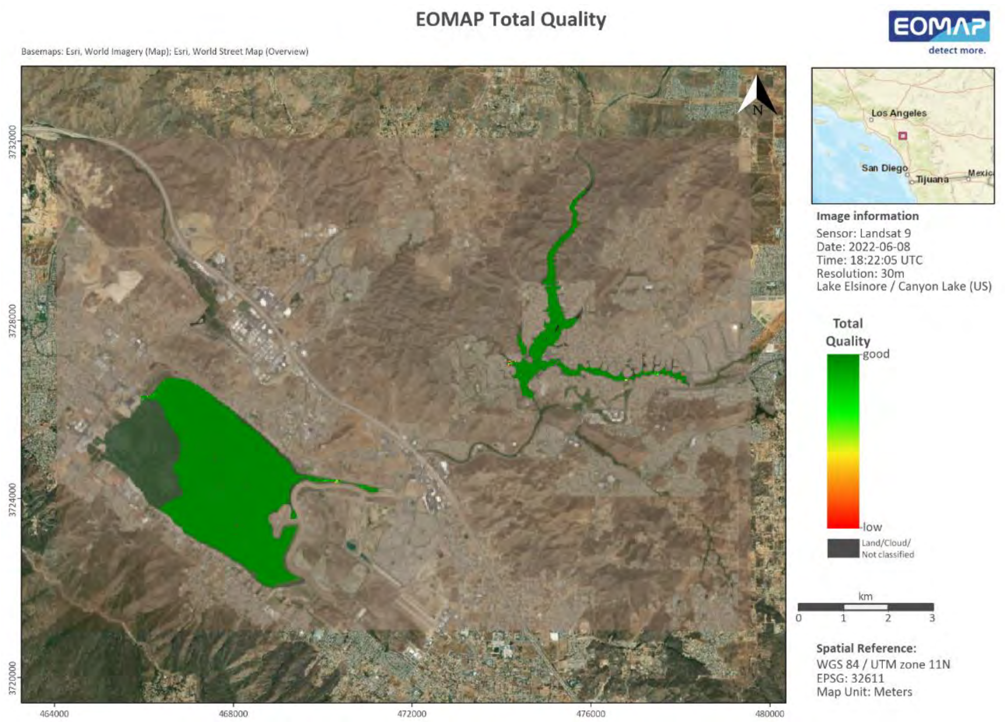


Figure 5: QUT product from 2022-06-08

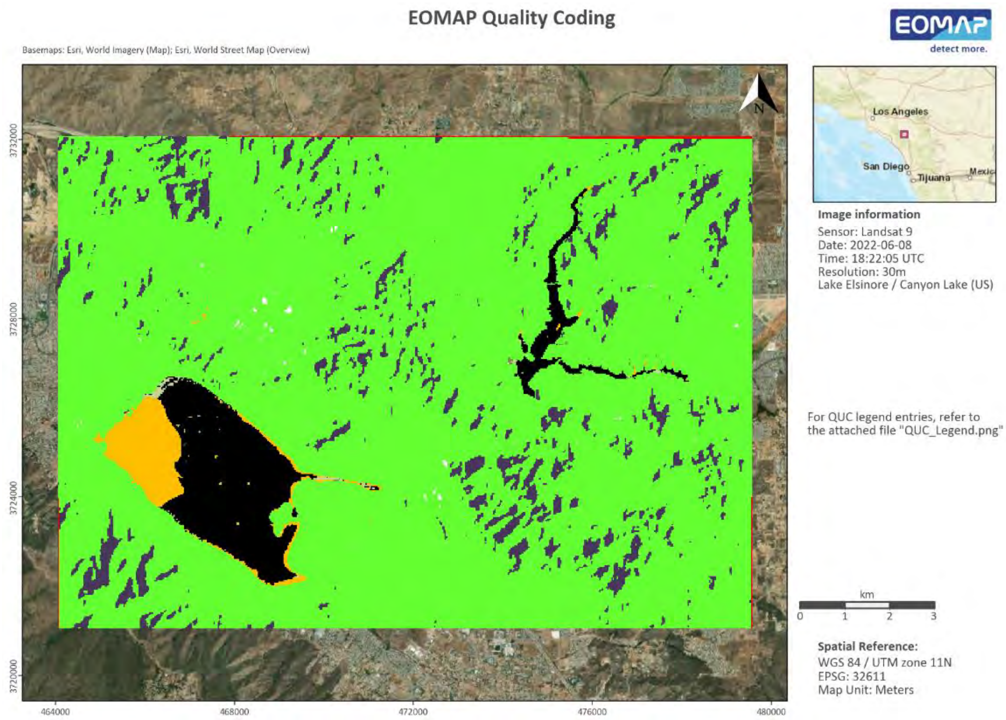


Figure 6: QUC product from 2022-06-08

The QUC file indicates the main quality influencing parameter using a specific EOMAP quality coding classification scheme with corresponding grey values (GV), shown in
Figure 7.

Professional version allow combination of the two most relevant flags:
First number = most relevant flag
1-digit-number refer to second relevant flag, e.g. 1 for sunglint risk, 2 for large solar zenith angle
Examples: 25 Warning flag for large zenit solar angle and Whitecaps
114 Critical flag for sunglint, plus warning for aerosol above limits

GV	GV range	Flag status	Flag description	Color code	Color
0	0	Water	No risk identified	0 0 0	
10	10 - 19	Warning	sunglint risk	148 138 84	
20	20 - 29	Warning	large solar zenith angle	83 141 213	
30	30 - 39	Warning	large spacecraft zenith angle	218 150 148	
40	40 - 49	Warning	Aerosol above limit or Cirrus risk	196 215 155	
50	50 - 59	Warning	Cloud Shadow	177 160 199	
60	60 - 69	Warning	Shallow water risk	146 205 220	
70	70 - 79	Warning	Mixed pixel risk	250 191 143	
80	80 - 89	Warning	Retrieved concentration at configuration limit	190 190 190	
90	90 - 99	Warning	Retrieval / processor warning	210 210 210	
110	110 - 119	Critical	sunglint risk	73 69 41	
120	120 - 129	Critical	large solar zenith angle	22 54 92	
130	130 - 139	Critical	large spacecraft zenith angle	150 54 52	
140	140 - 149	Critical	Aerosol above limit or Cirrus risk	118 147 60	
150	150 - 159	Critical	Cloud Shadow	96 73 122	
160	160 - 169	Critical	Shallow water risk	49 134 155	
170	170 - 179	Critical	Mixed pixel risk	226 107 10	
180	180 - 189	Critical	Retrieved concentration at configuration limit	120 120 120	
190	190 - 199	Critical	Retrieval / processor warning	130 130 130	
220	220	No value	Transition Zone	102 255 51	
221	221	Unreliable	Shallow water automatically	146 205 220	
222	222	Unreliable	Shallow water manually	60 159 186	
223	223	Unreliable	Floating material	32 95 107	
230	230	No water	Land	102 255 51	
232	232	Unreliable	Invalid pixel manually	255 192 0	
240	240	No water	Cloud	255 255 255	
242	242	Unreliable	Cloud Shadow manually	96 73 122	
244	244	Unreliable	Hill shadow	73 57 93	
250	250	No retrieval	No retrieval / out of AOI or image extend	255 0 0	

Figure 7: EOMAP QUC quality coding

EOMAP's water quality products are accompanied by the processor's internal quality control mechanisms QUT and QUC, resulting in pixel flagging in case of unreliable values. Moreover, a manual quality check and - if required - additional masking is applied to each product.
As an example, cloud shadow effects typically occur in the vicinity of clouds, resulting in unrealistically low water parameter values. In order to detect and flag these areas, EOMAP has developed a specific algorithm based on geometric models, considering the sun angle and sensor viewing geometry, the retrieved aerosol properties, the height of the clouds, an analysis of the blue channel radiances and a statistical anomaly detection of the water species concentrations. When applying this cloud shadow detection algorithm, approx. 85% of the cloud shadows are detected and masked. Remaining cloud shadows are manually flagged and can be identified in the QUC file by GV 242.
Due to the spatial extent of single pixels (Sentinel-2: 10*10m, Landsat 8/9: 30*30m), it is likely that spectral mixing of signals from land and water can affect the pixels along the edge of the water body, leading to unreliable retrieval of water parameter values. Such pixels are labelled with the quality flag 'transition zone'. EOMAP uses a high-resolution land-water-mask database to determine the land-water-boundary, which is then filtered to create a transition zone that is automatically flagged during processing. In the 8bit water constituent products the transition zone is marked by GV 251, whereas in the QUC product it is 220.

5. Data Format

The water quality data is delivered as 32bit real value GeoTIFF as well as 8bit scaled and colored GeoTIFF for easier visualization. The colours currently used are a suggestion/standard, but can be changed according to client specific request. In addition, 2.5

6. Data Sources

EOMAP uses the following data hubs to access and download satellite raw data from different sensors:

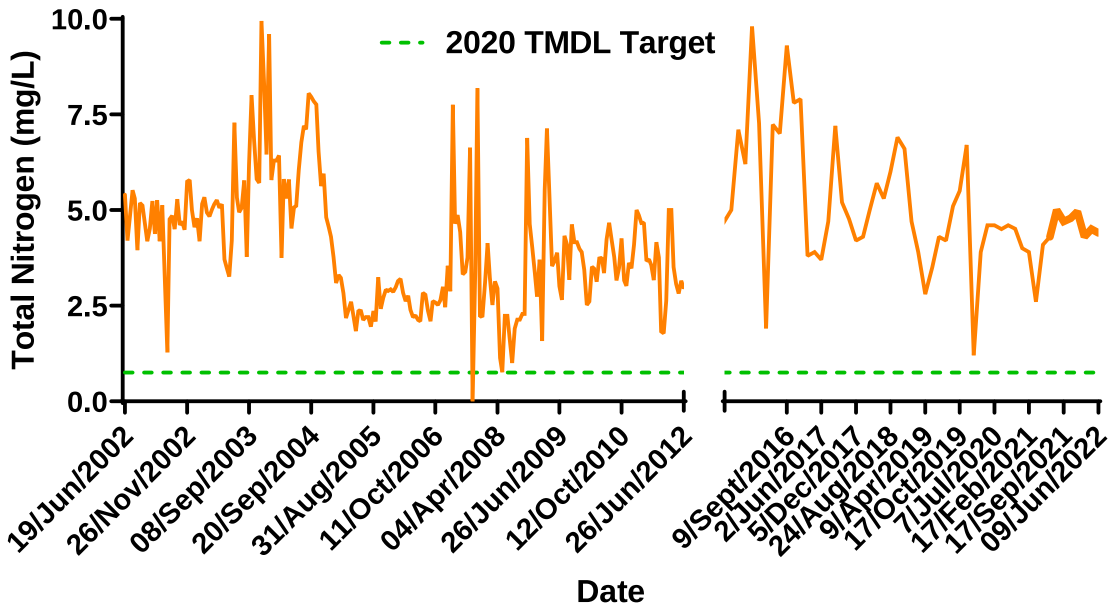
- Landsat-8 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Landsat-9 Amazon Web Services, https://landsat-pds.s3.amazonaws.com
- Sentinel-2: ESA Sentinel HUB https://scihub.copernicus.eu/dhus/#/home

EOMAP
Schlosshof 4
82229 Seefeld
Germany
+49 (0)8152 99861 10
info@eomap.com
www.eomap.com

This page intentionally left blank.

APPENDIX E - CURRENT DATA IN HISTORICAL CONTEXT

Lake Elsinore- Historical Monitoring Results

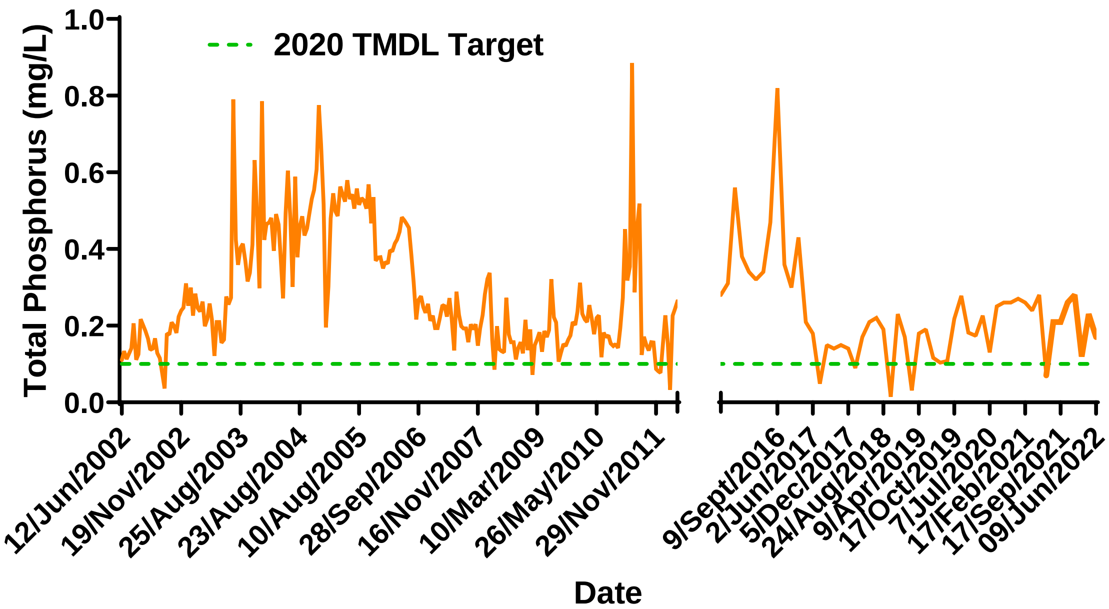


No data available from June 2012-July2015

TMDL target of 0.75 mg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2021-June 2022

Lake Elsinore- Historical Monitoring Results (continued)

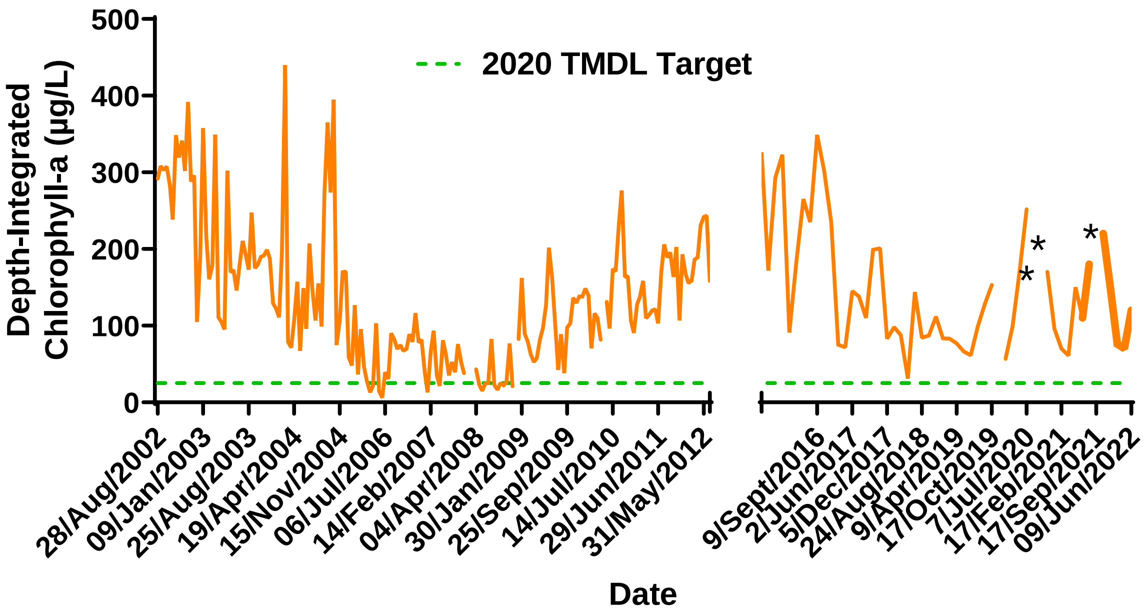


No data available from June 2012-July2015

TMDL target of 0.1 mg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2021-June 2022

Lake Elsinore- Historical Monitoring Results (continued)

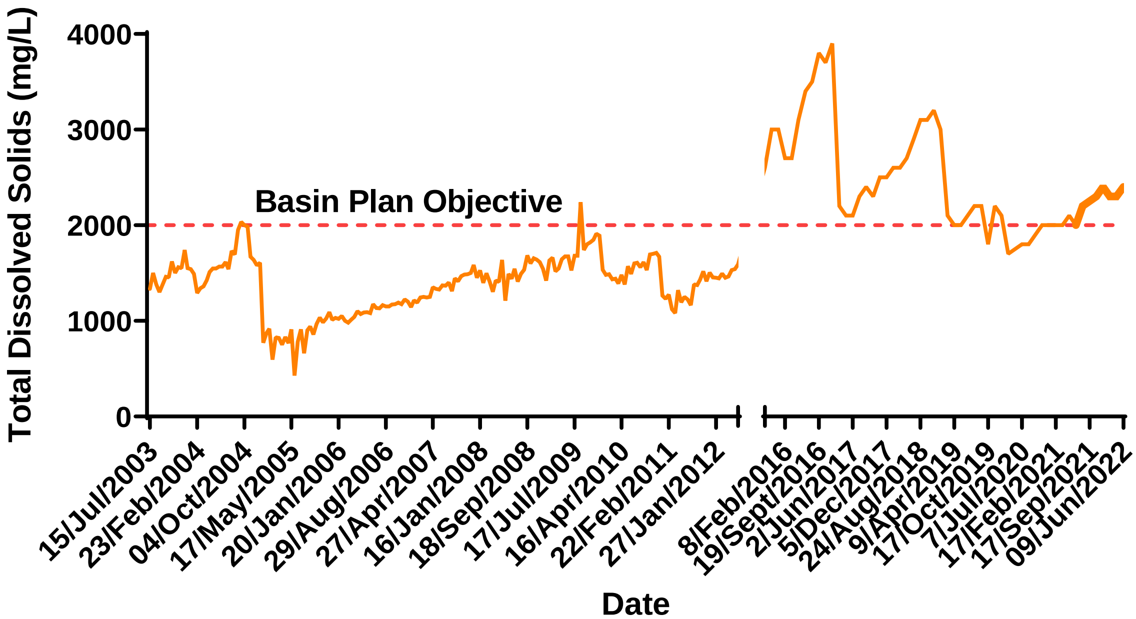


No data available from June 2012-July2015

TMDL target of 25 µg/L is summer average to be attained by 2020

Bold represents current monitoring year July 2021- June 2022
***Not measured due to laboratory error. See report for details.**

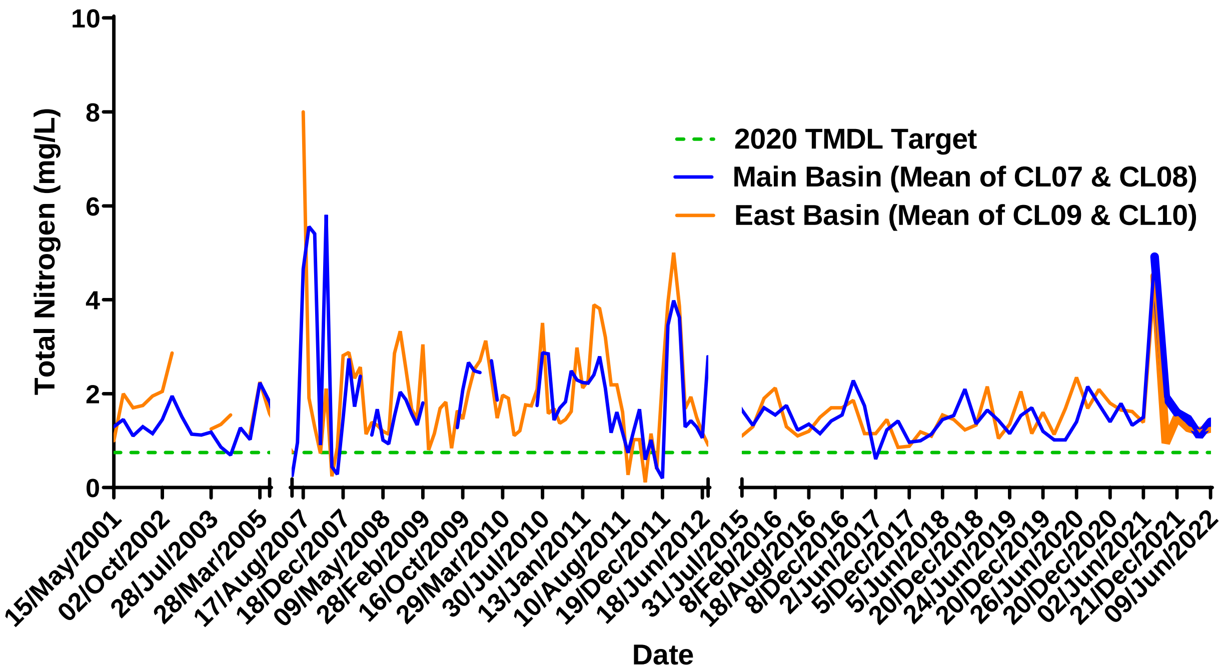
Lake Elsinore- Historical Monitoring Results (continued)



No data available from June 2012-July 2015

Bold represents current monitoring year July 2021-June 2022
*** not measured due to laboratory error. See report for details.**

Canyon Lake- Historical Monitoring Results

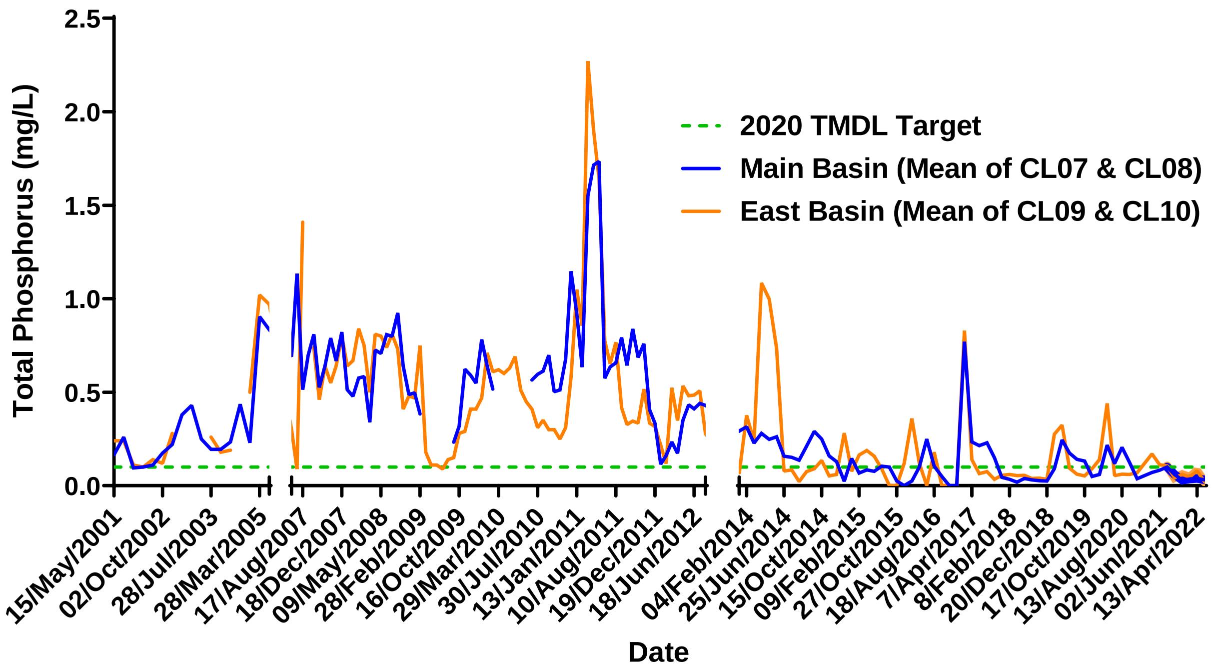


No data available from May 2005-July 2007; June 2012-July2015

TMDL target of 0.75 mg/L is annual average to be attained by 2020

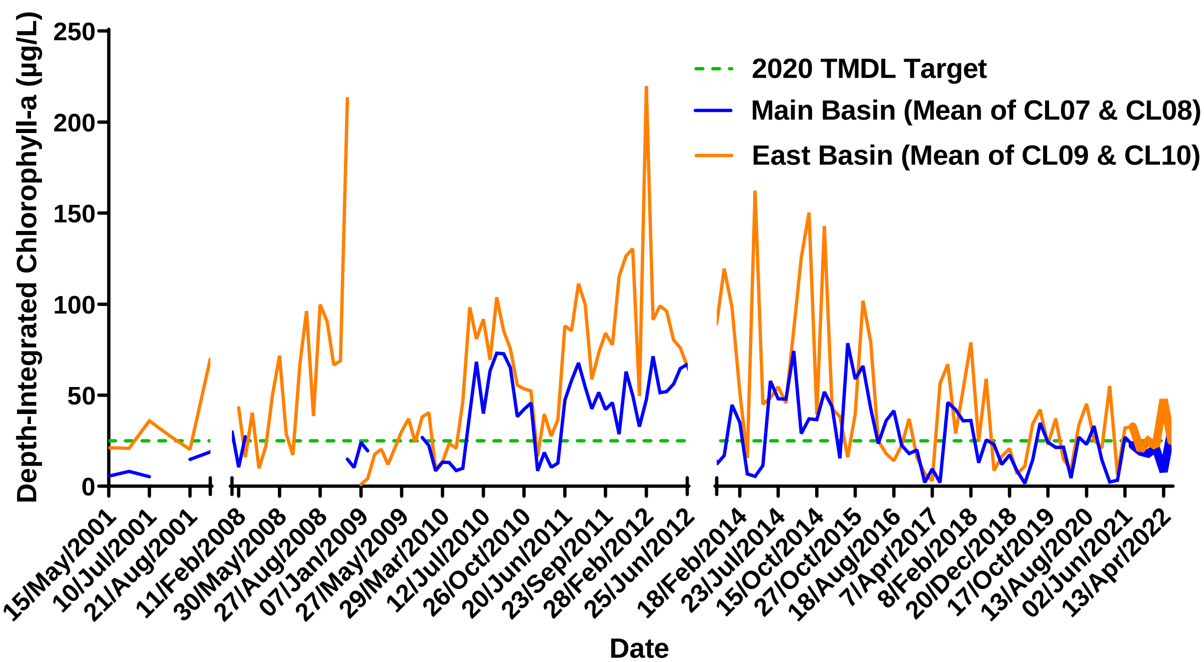
Bold represents current monitoring year July 2021-June 2022

Canyon Lake- Historical Monitoring Results (continued)



No data available from May 2005-July 2007; June 2012-Sept 2013
TMDL target of 0.1 mg/L is annual average to be attained by 2020
Bold represents current monitoring year July 2021-June 2022

Canyon Lake- Historical Monitoring Results (continued)

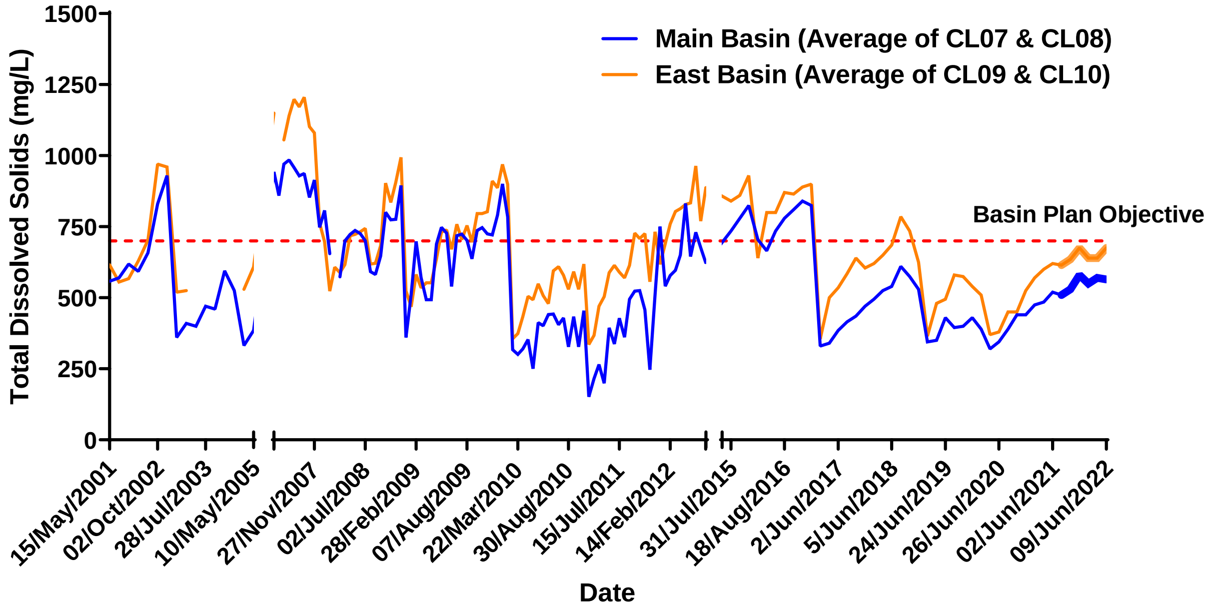


No data available from June 2012-July2015

2020 TMDL target of 25 µg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2021-June 2022

Canyon Lake- Historical Monitoring Results (continued)



No data available from May 2005-July 2007; June 2012-July2015
Bold represents current monitoring year July 2021-June 2022