Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2018-19 Summary

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ALTA ENVIRONMENTAL

September 25, 2019

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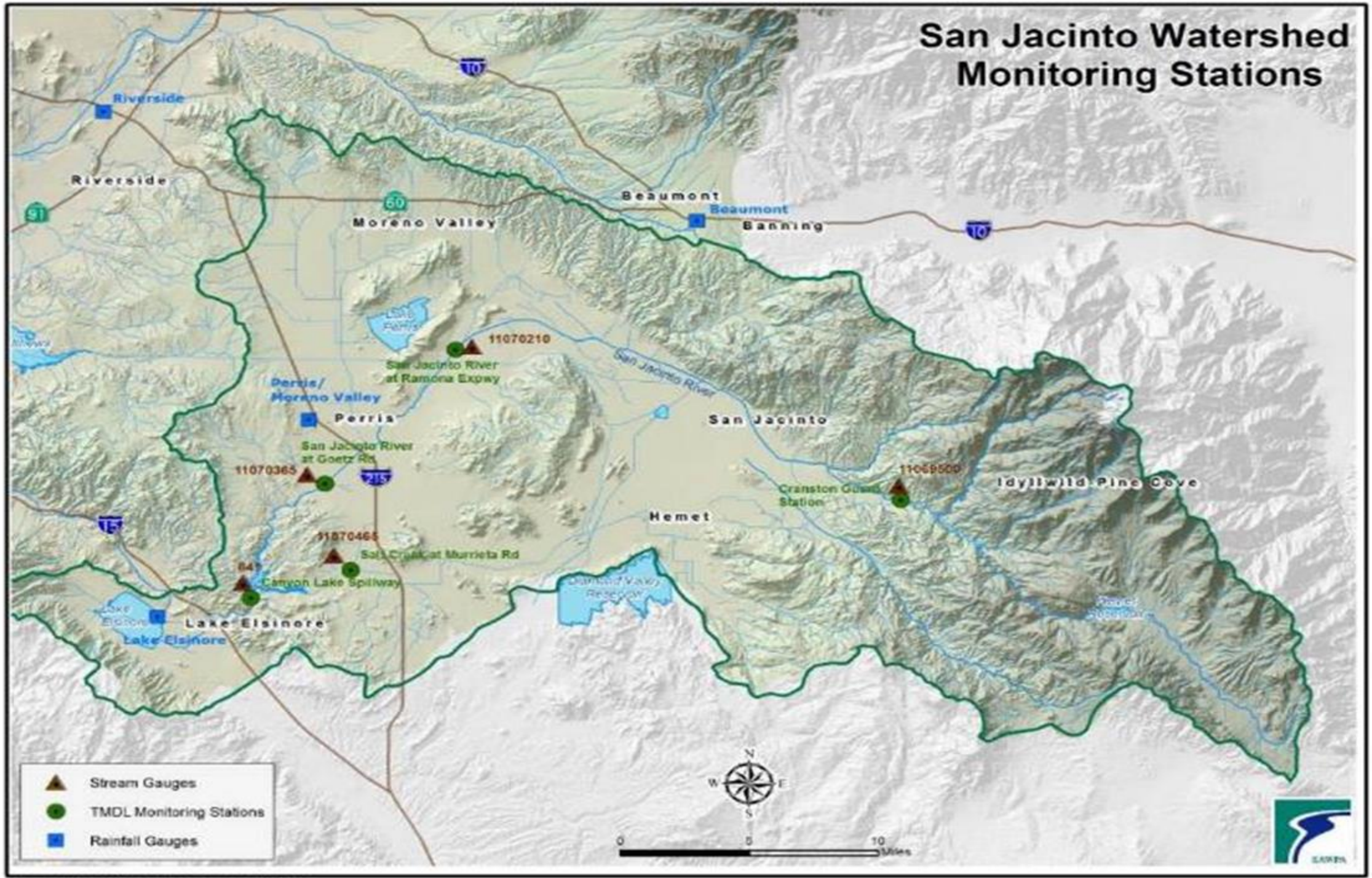
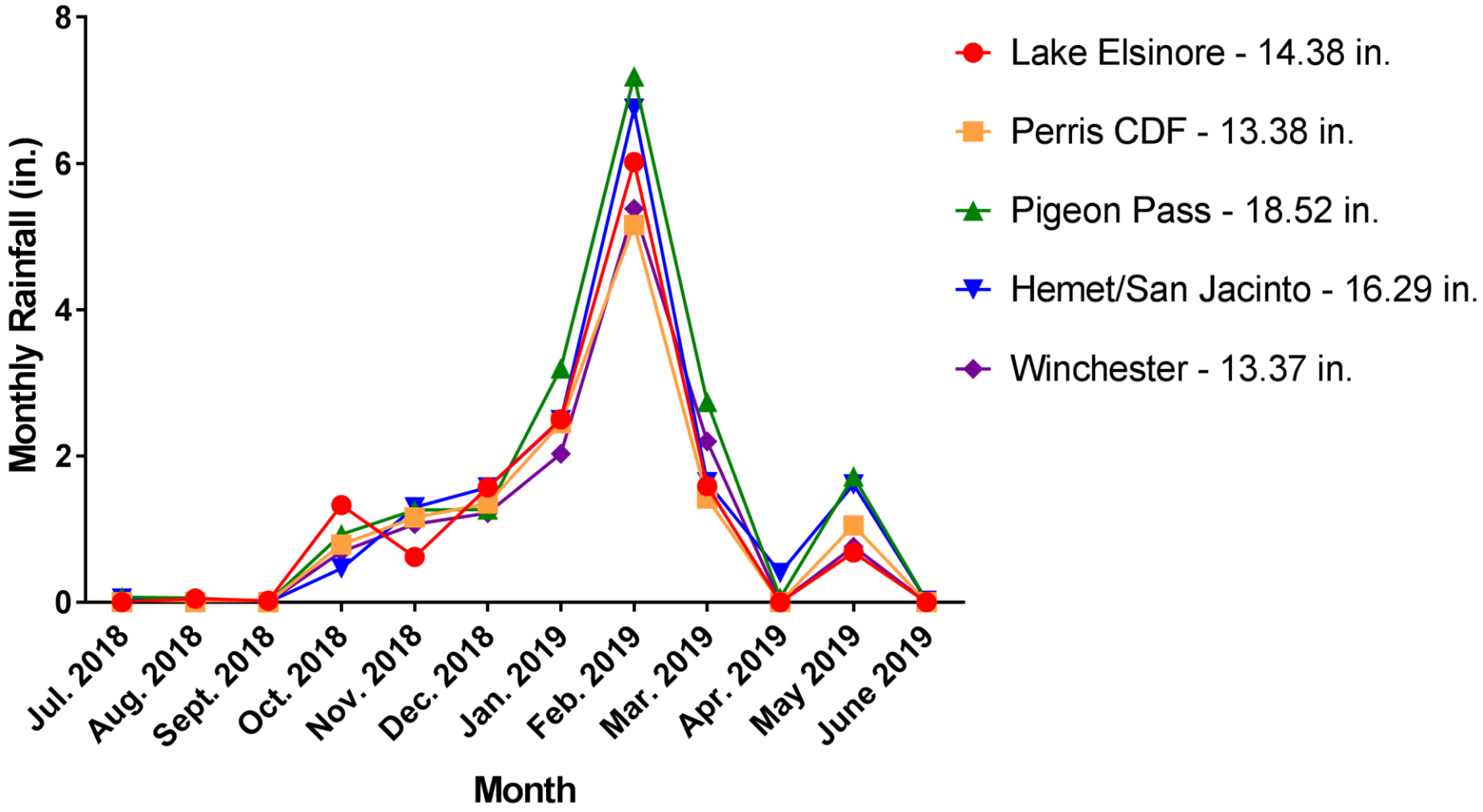
Watershed Monitoring


San Jacinto Watershed
Monitoring Stations
Riverside
Riverside
Moreno Valley
Beaumont
Beaumont
Banning
11070210
San Jacinto River
at Ramona Expwy
Perris/
Moreno Valley
Perris
San Jacinto River
San Jacinto
San Jacinto River
at Goetz Rd
11070365
11069509
Cranston Guard
Station
Idyllwild Pine Cove
Hemet
11070465
Salt Creek at Murrieta Rd
Canyon Lake Spillway
Lake Elsinore
Lake Elsinore
Stream Gauges
TMDL Monitoring Stations
Rainfall Gauges
N
W
E
S
0
5
10
Miles

Summary of 2018-2019 Rainfall

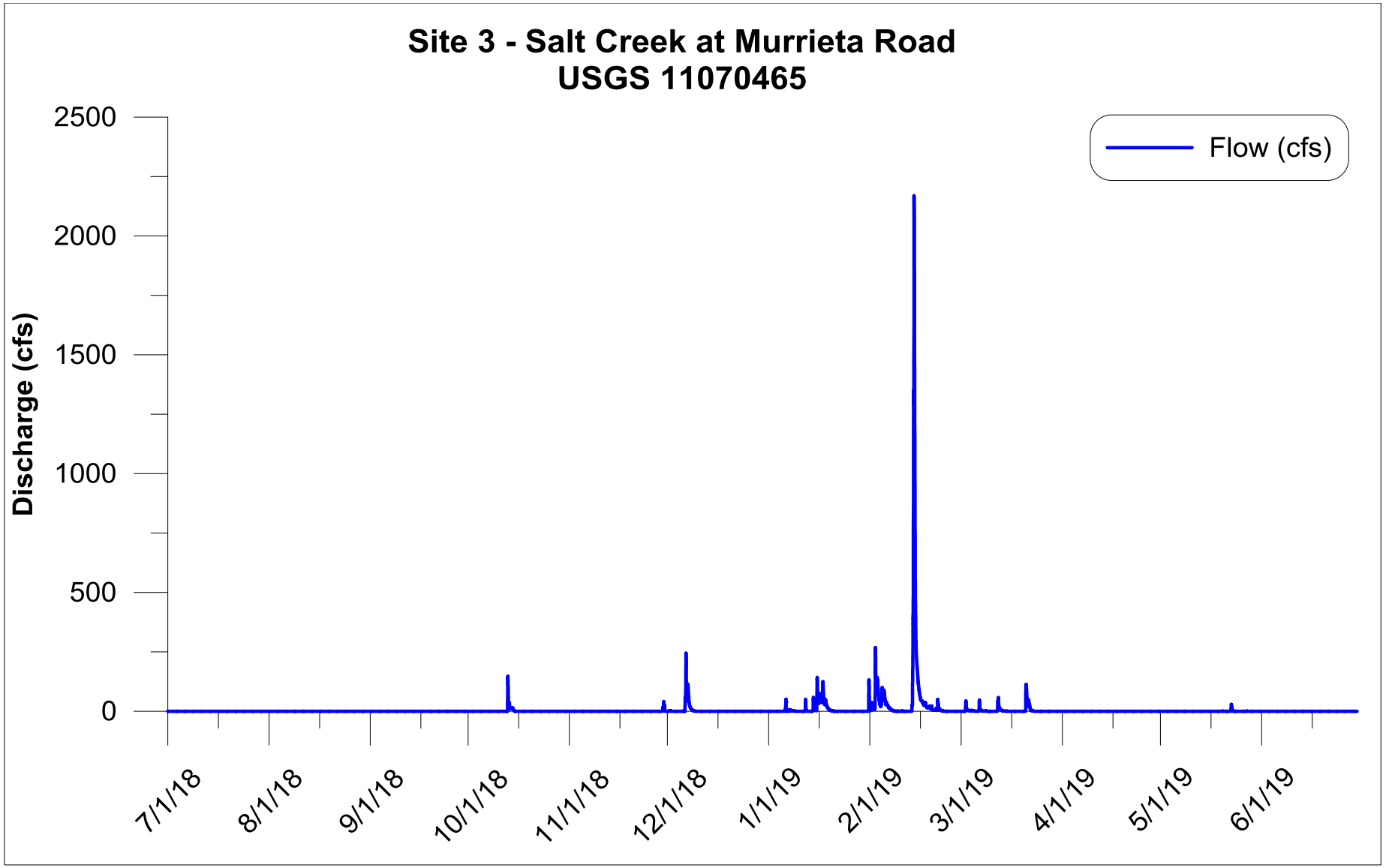


Summary of 2018-2019 Watershed Monitoring and Nutrient Loads

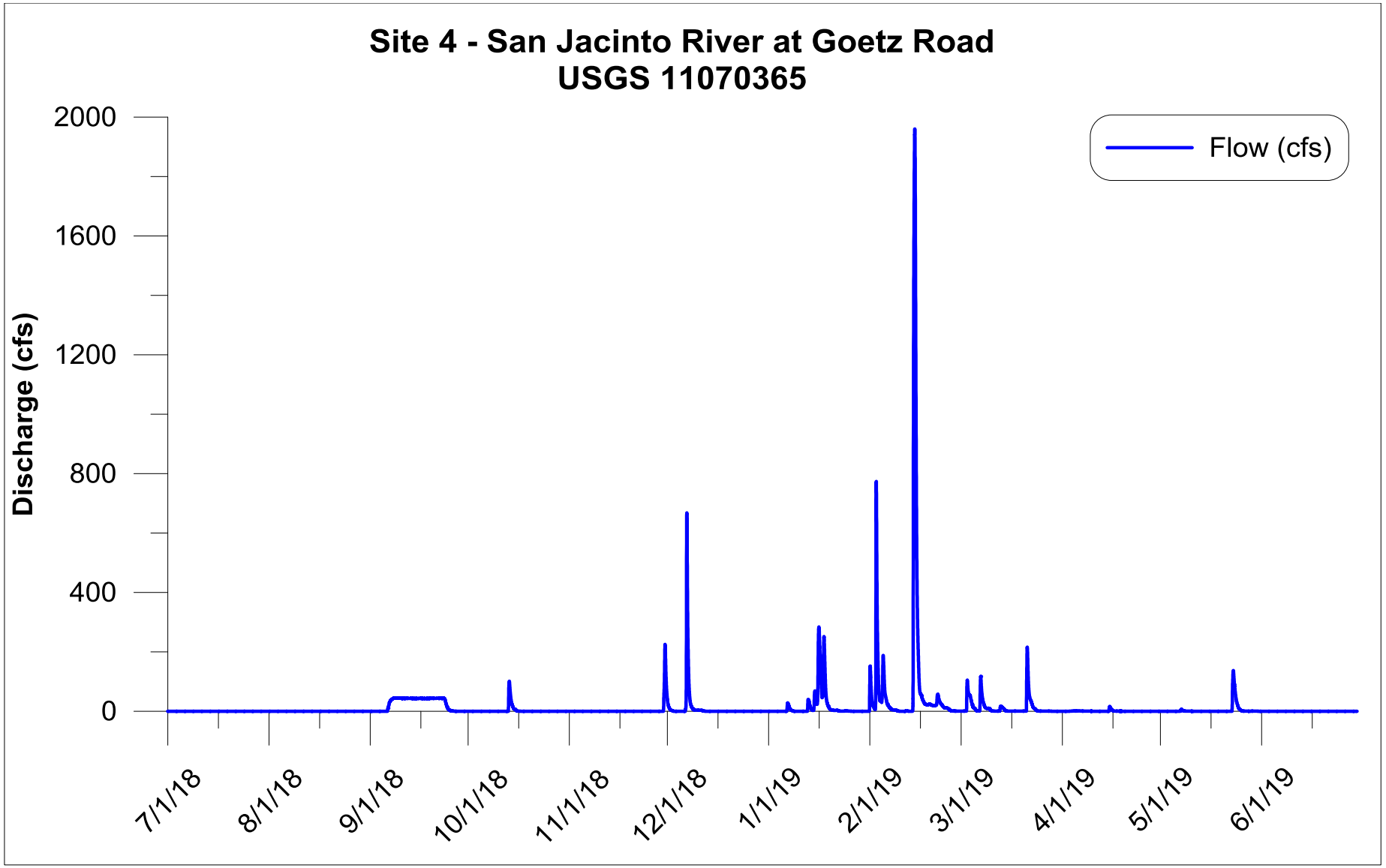
Number and Location Description	Total Annual Flow [a] (Mgal)	Annual Event Mean Storm Concentration (mg/L)		Estimated Annual Load (kg)	
		Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus
Site 3 - Salt Creek at Murrieta Road (USGS 11070465)	1,394	2.37	0.42	12,213	2,266
Site 4 - San Jacinto River at Goetz Road (USGS 11070365)	3,208	1.70	0.61	20,457	7,409
Site 6 - San Jacinto River at Ramona Expressway [b] (USGS 11070210)	12	Not Measured	Not Measured	Not Measured	Not Measured
Site 30 - Canyon Lake Spillway [c] (USGS 11070500)	5,893	1.40	0.19	32,832	5,416

a - Flow data after 10/29/2018 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, only local flows were observed, 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.

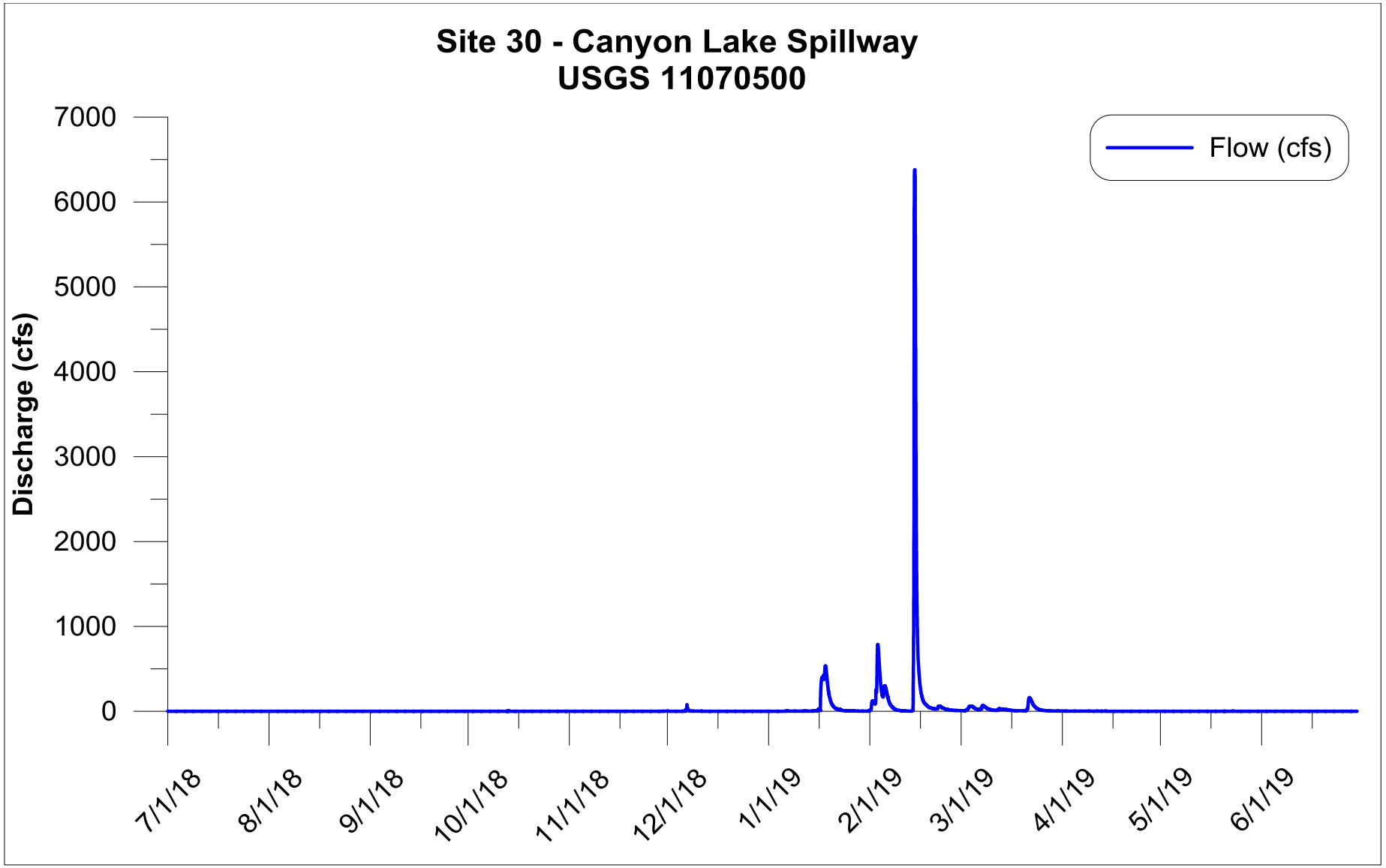
2018-2019 Annual Hydrograph



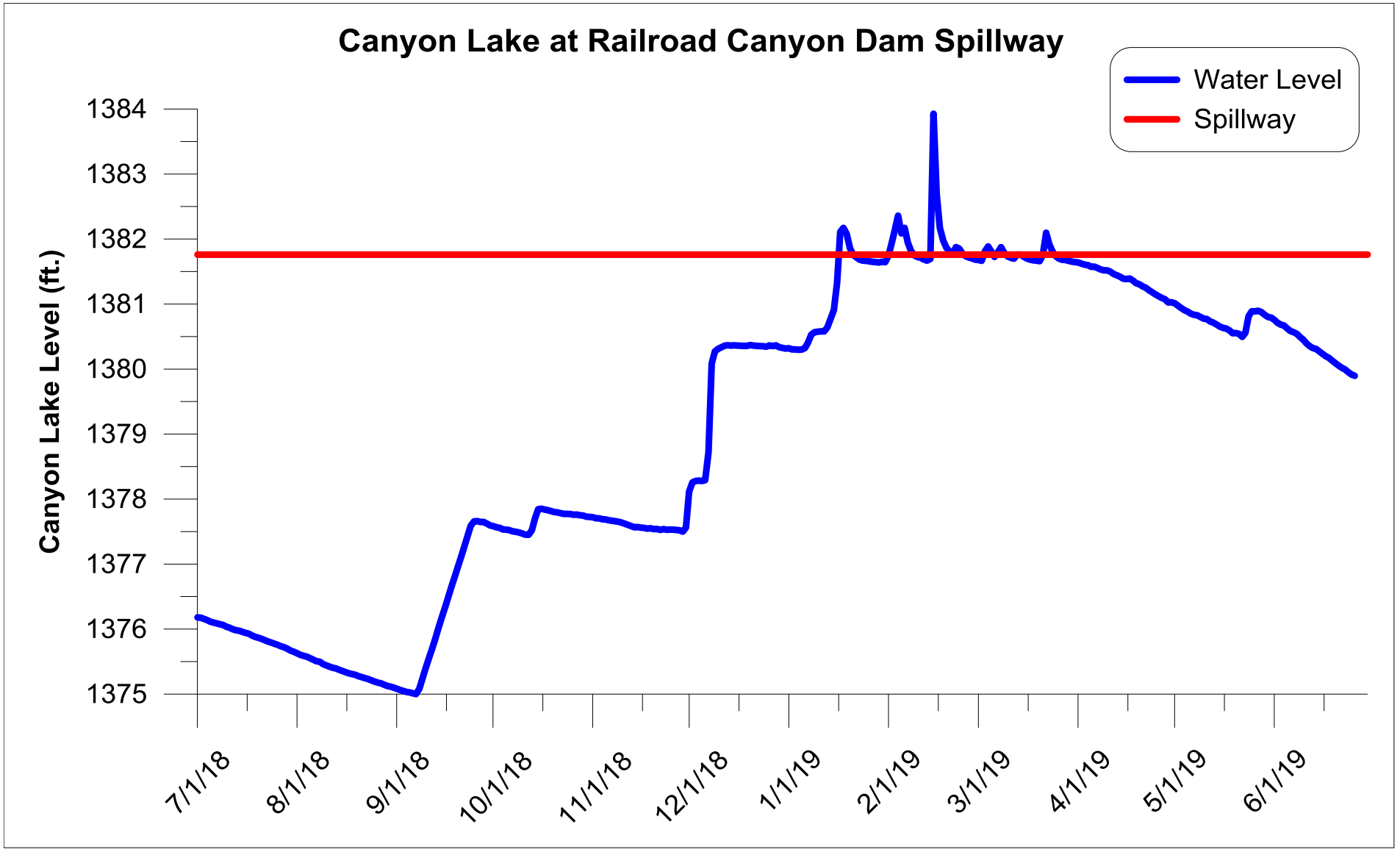
2018-2019 Annual Hydrograph



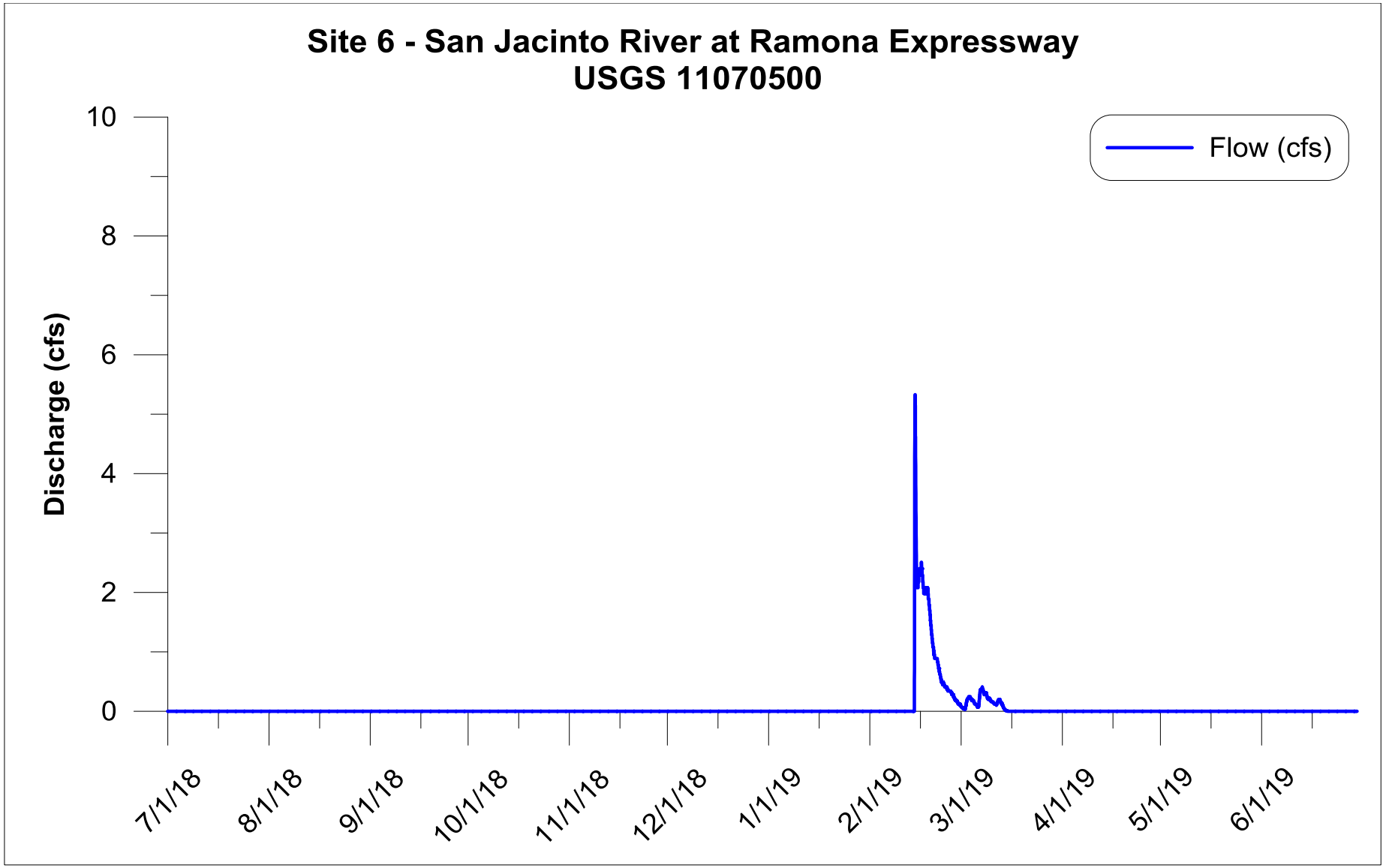
2018-2019 Annual Hydrograph



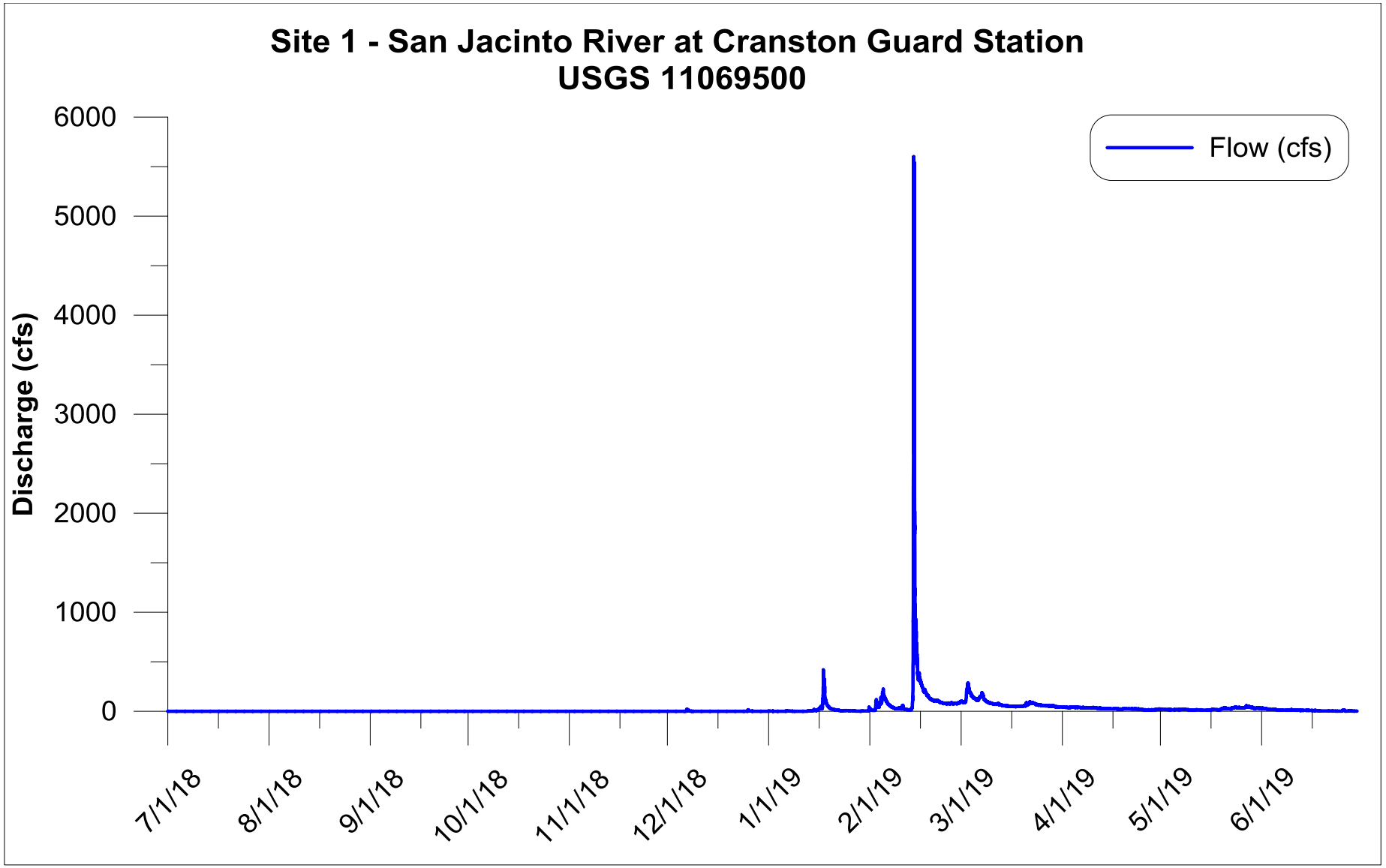
2018-2019 Annual Hydrograph



2018-2019 Annual Hydrograph



2018-2019 Annual Hydrograph

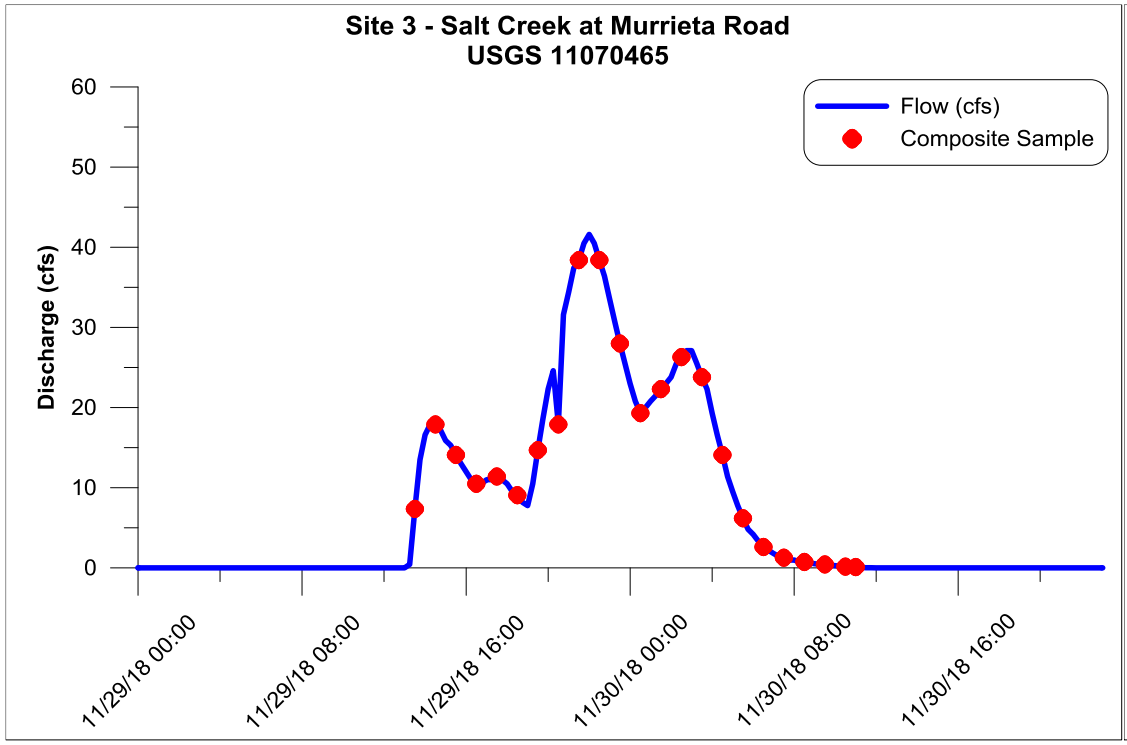


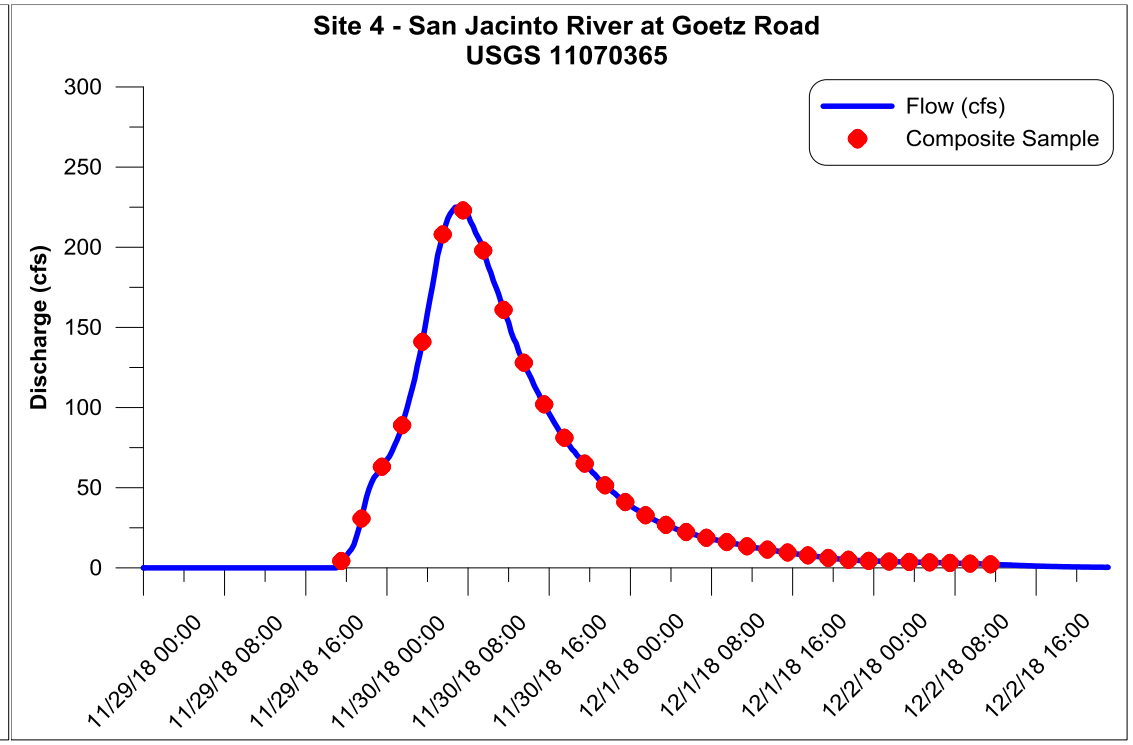
Wet Event #1

November 29-December 2, 2018

Watershed Rainfall: 0.59-1.23 inches

Sites: Salt Creek and San Jacinto



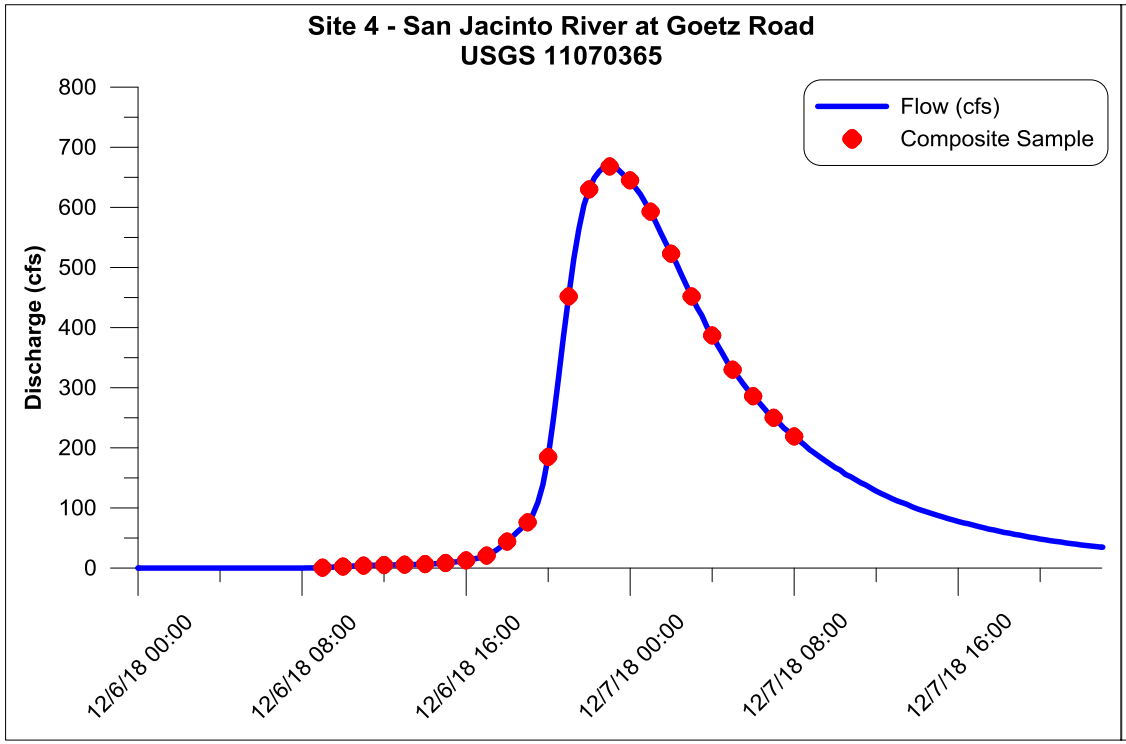


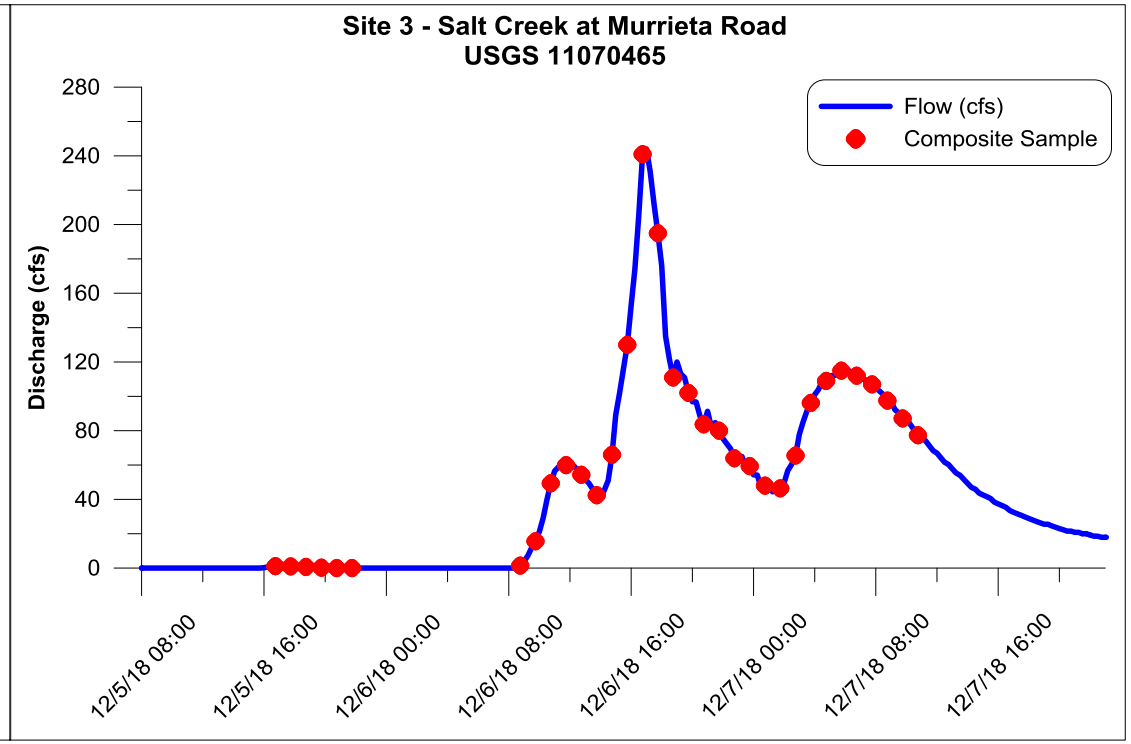
Wet Event #2

December 5-7, 2018

Watershed Rainfall: 1.15-1.46 inches

Sites: Salt Creek and San Jacinto



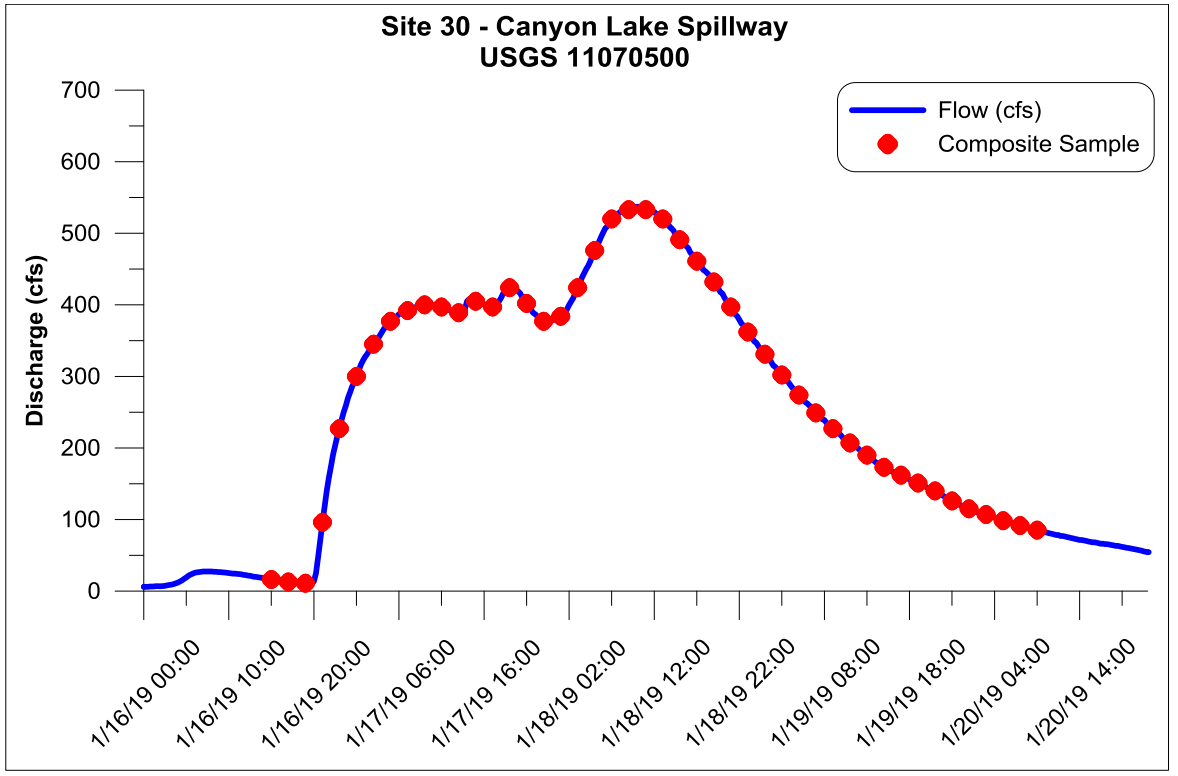


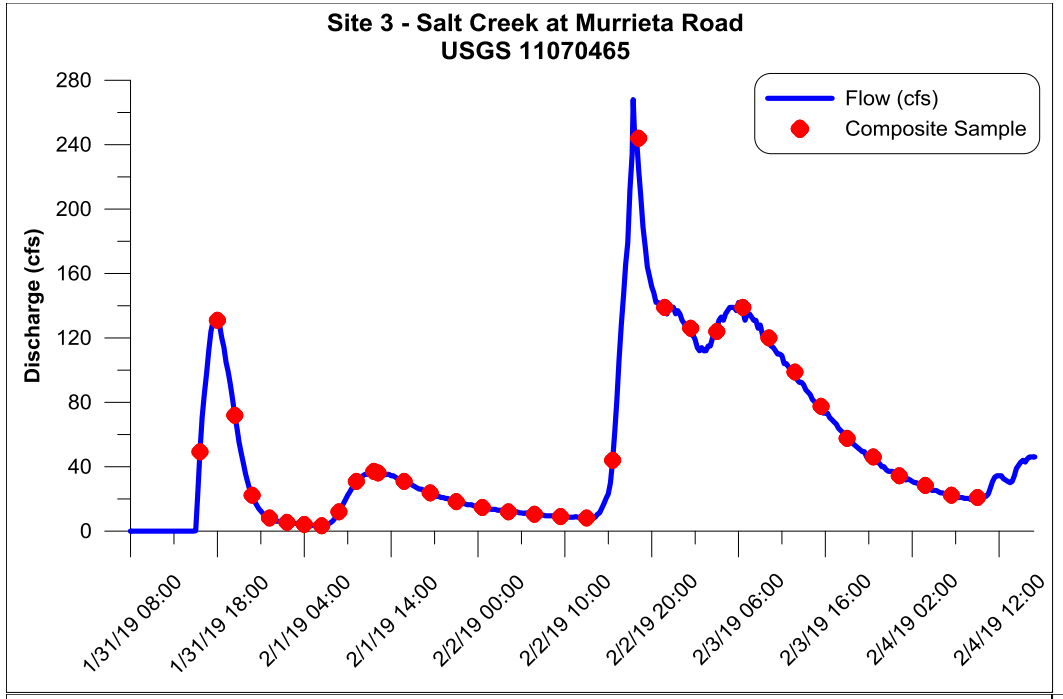
Wet Event #3

January 16-20, 2019

Watershed Rainfall: 1.21-2.62 inches

Sites: Canyon Lake Spillway



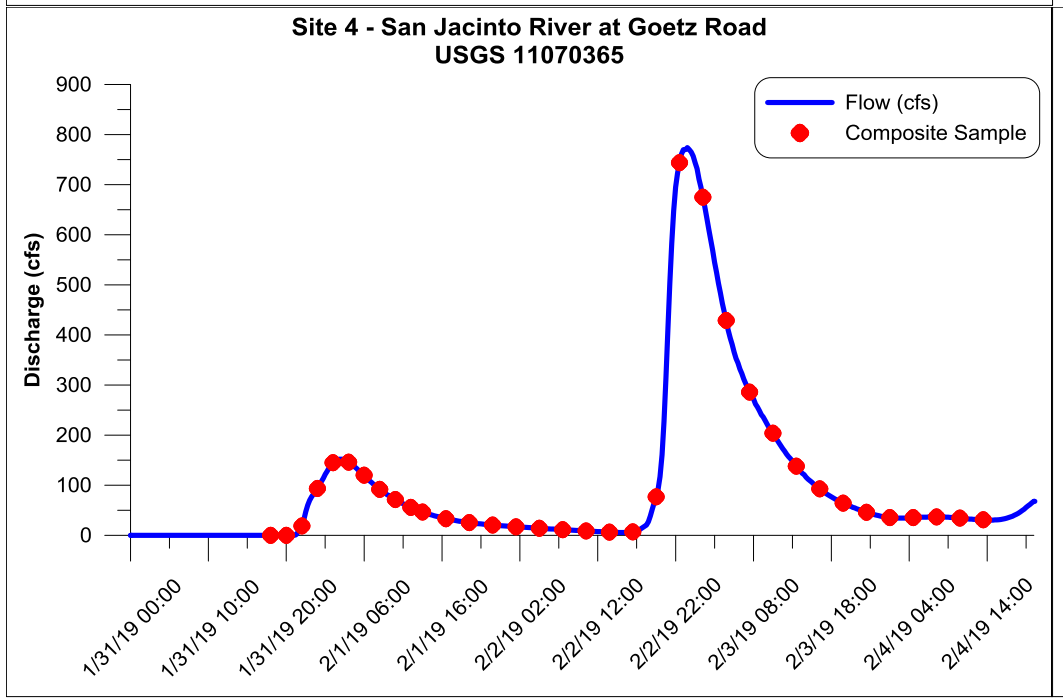


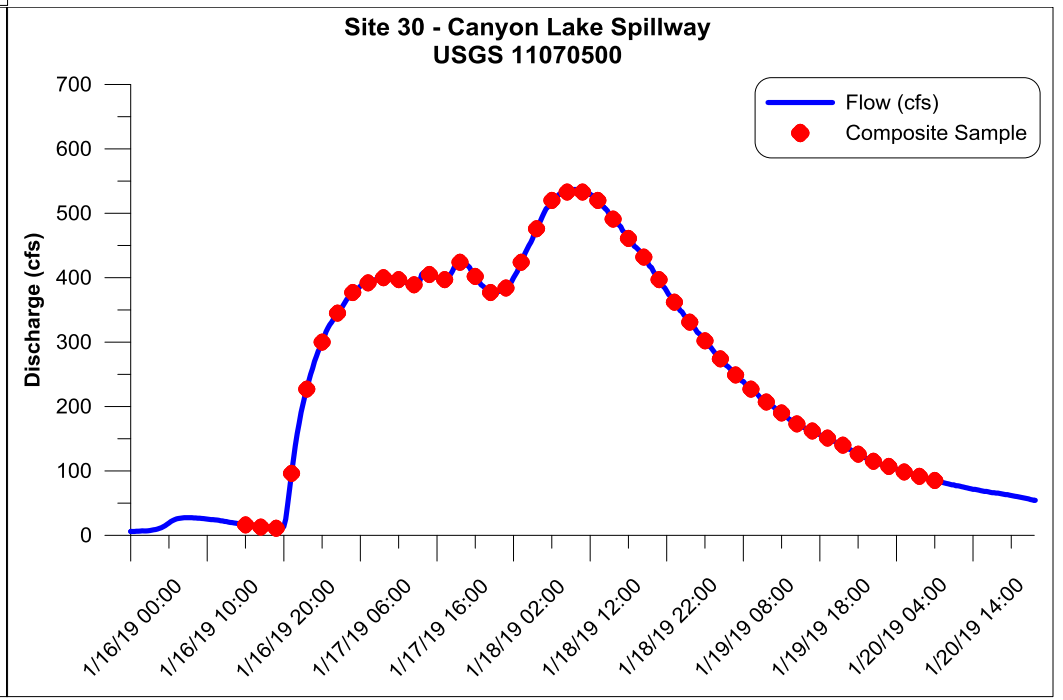
Wet Event #4

January 31-February 6, 2019

Watershed Rainfall: 01.83-2.75 inches

Sites: Salt Creek, San Jacinto, and Canyon Lake



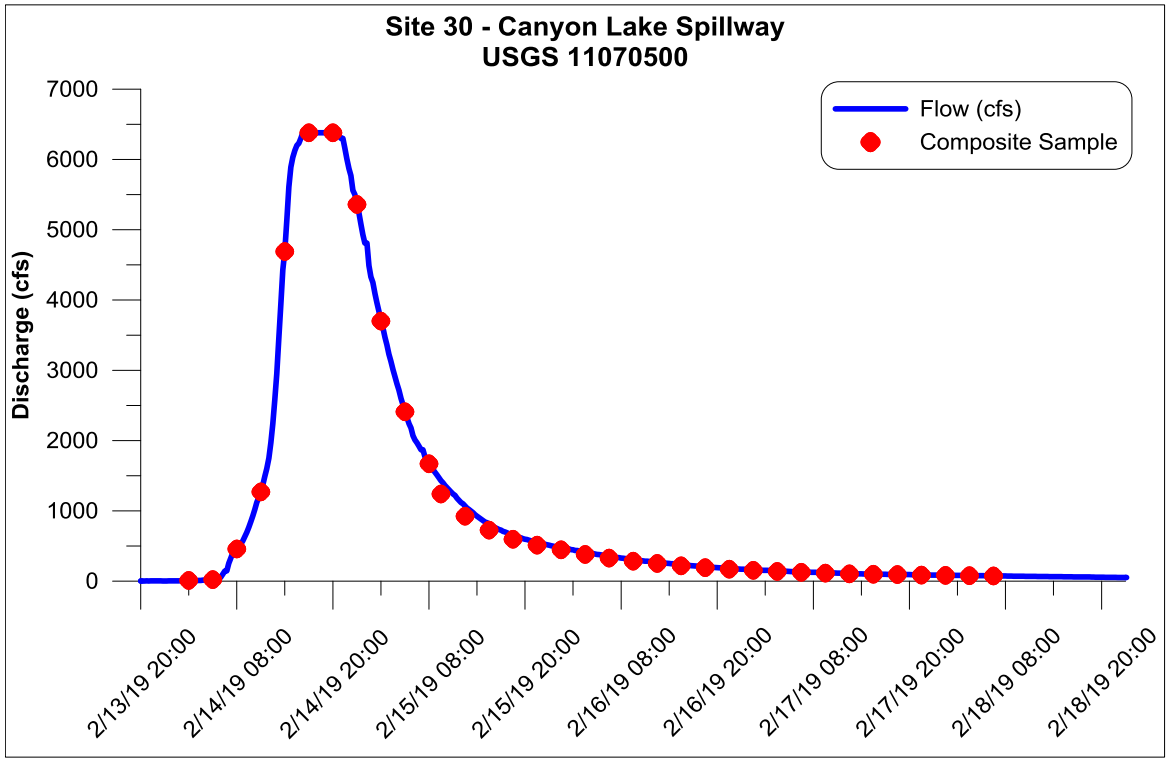


Wet Event #5

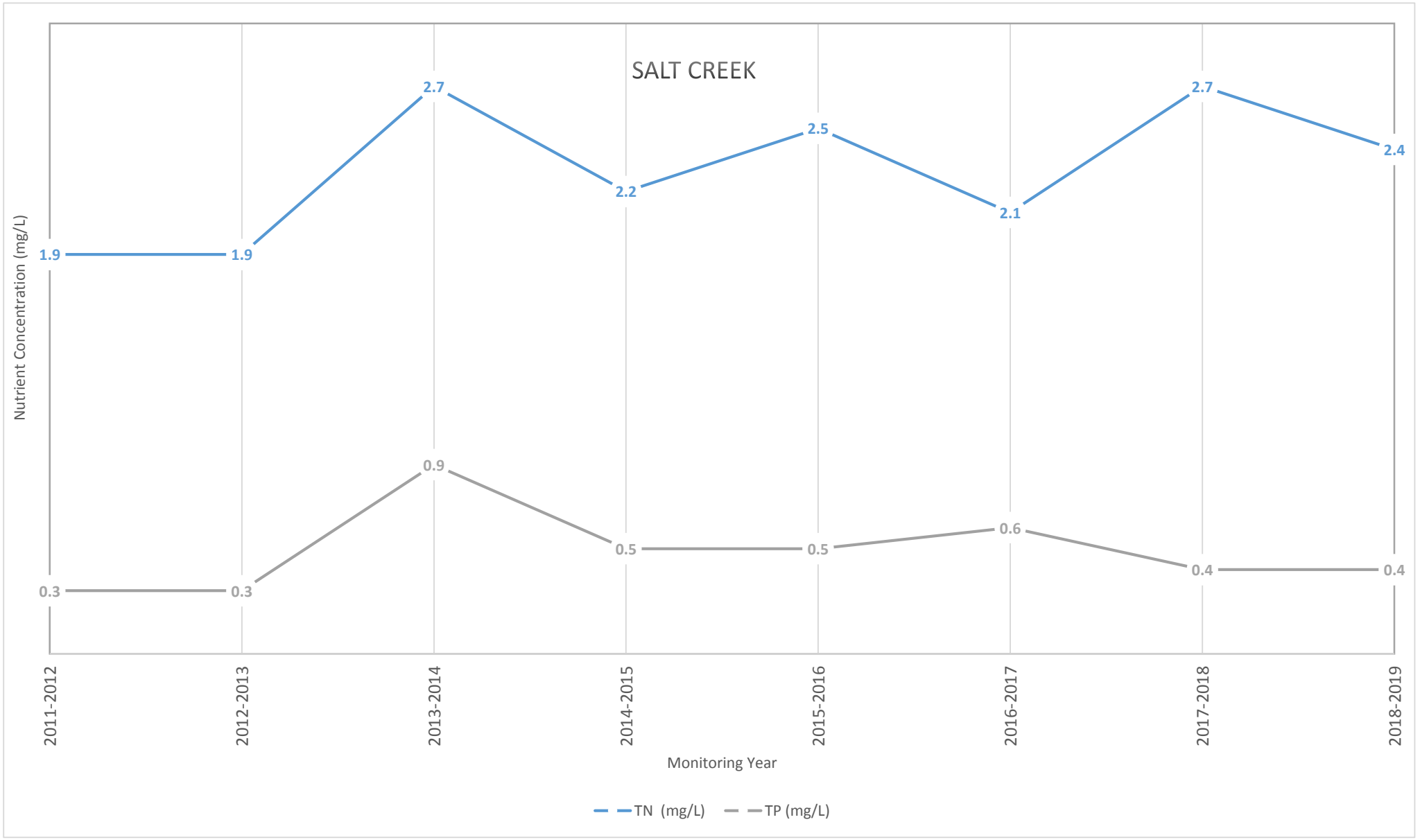
February 14-18, 2019

Watershed Rainfall: 2.79-3.83 inches

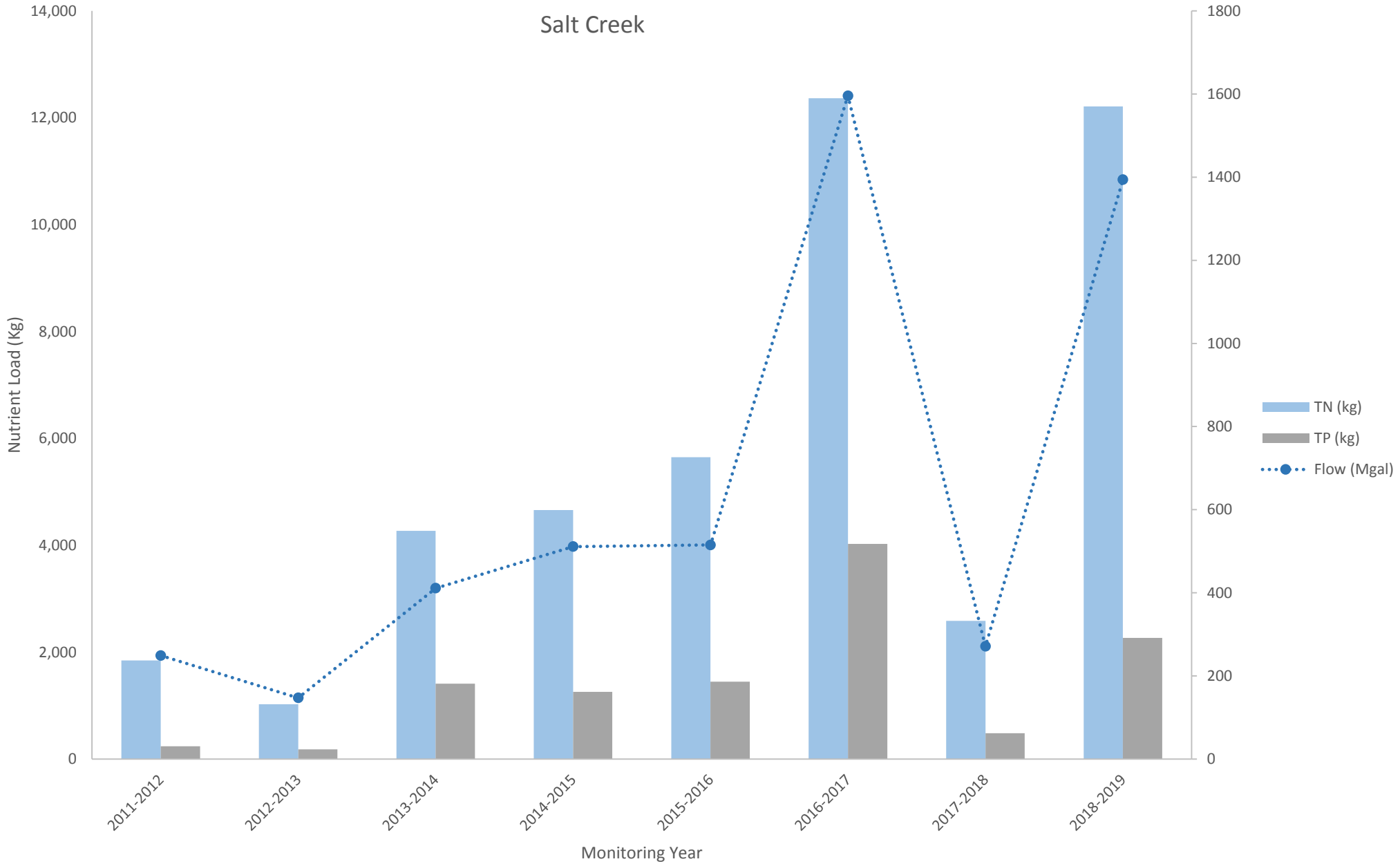
Sites: Canyon Lake Spillway



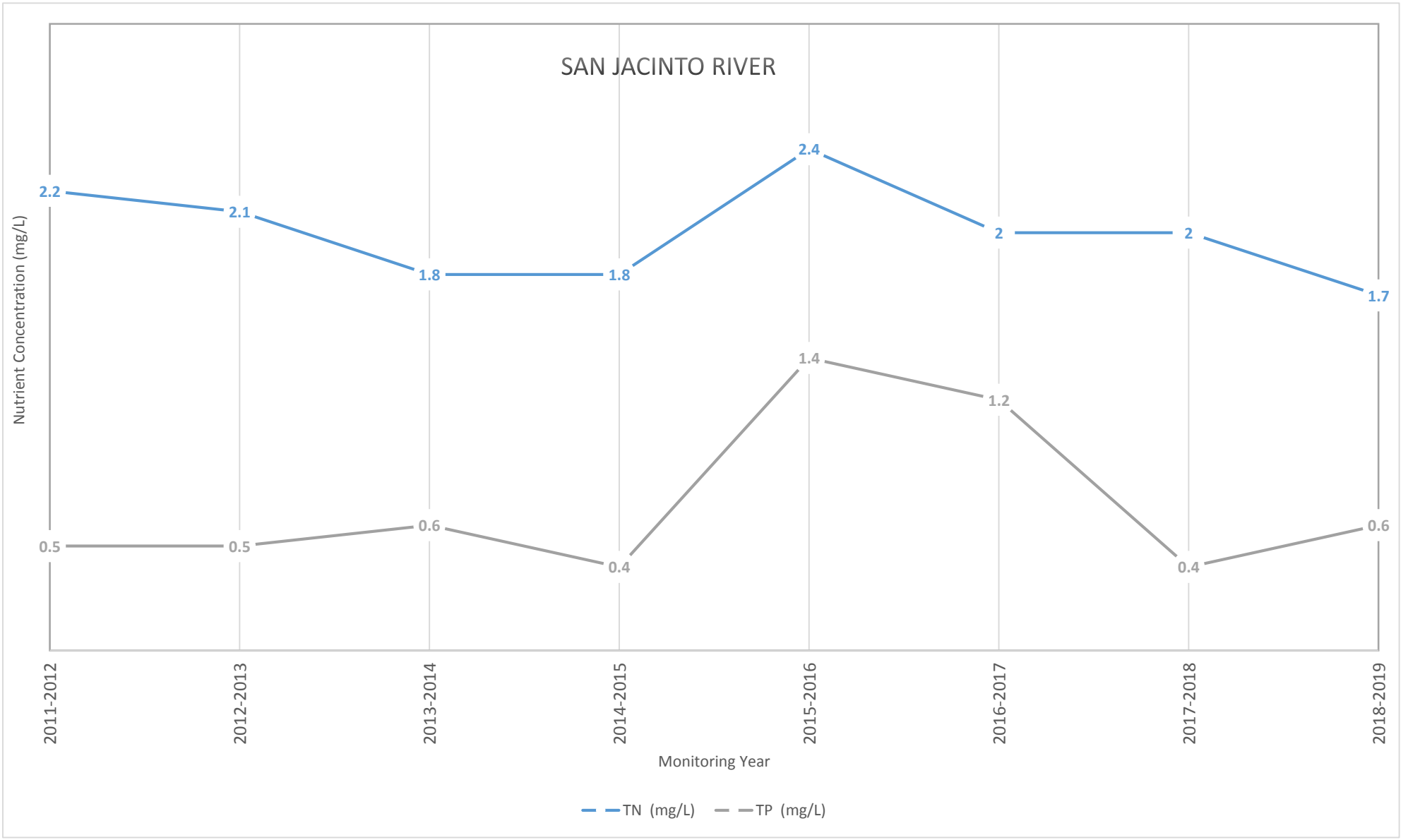
Salt Creek Historic Nutrient Concentrations



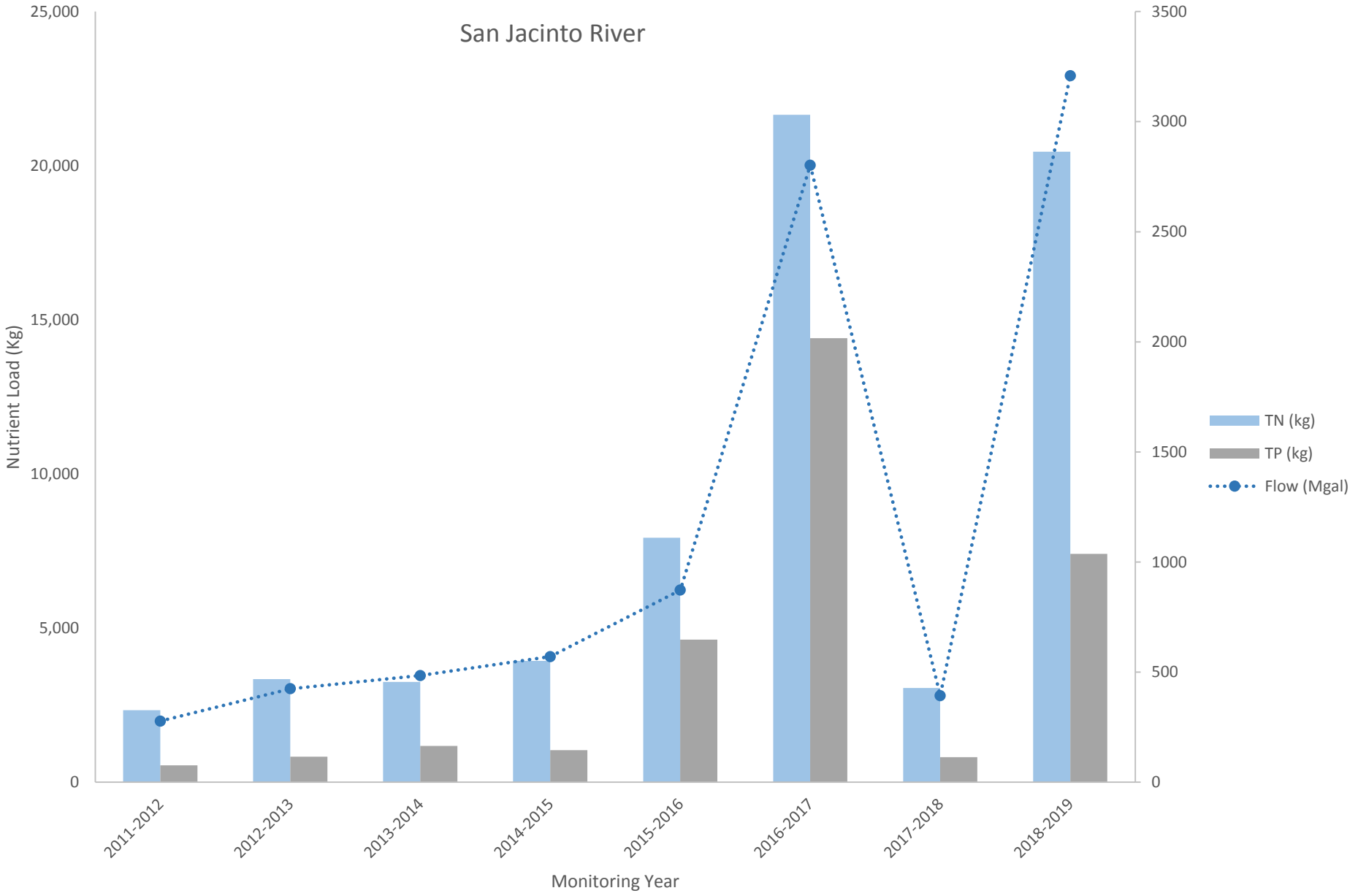
Salt Creek Historic Nutrient Loads



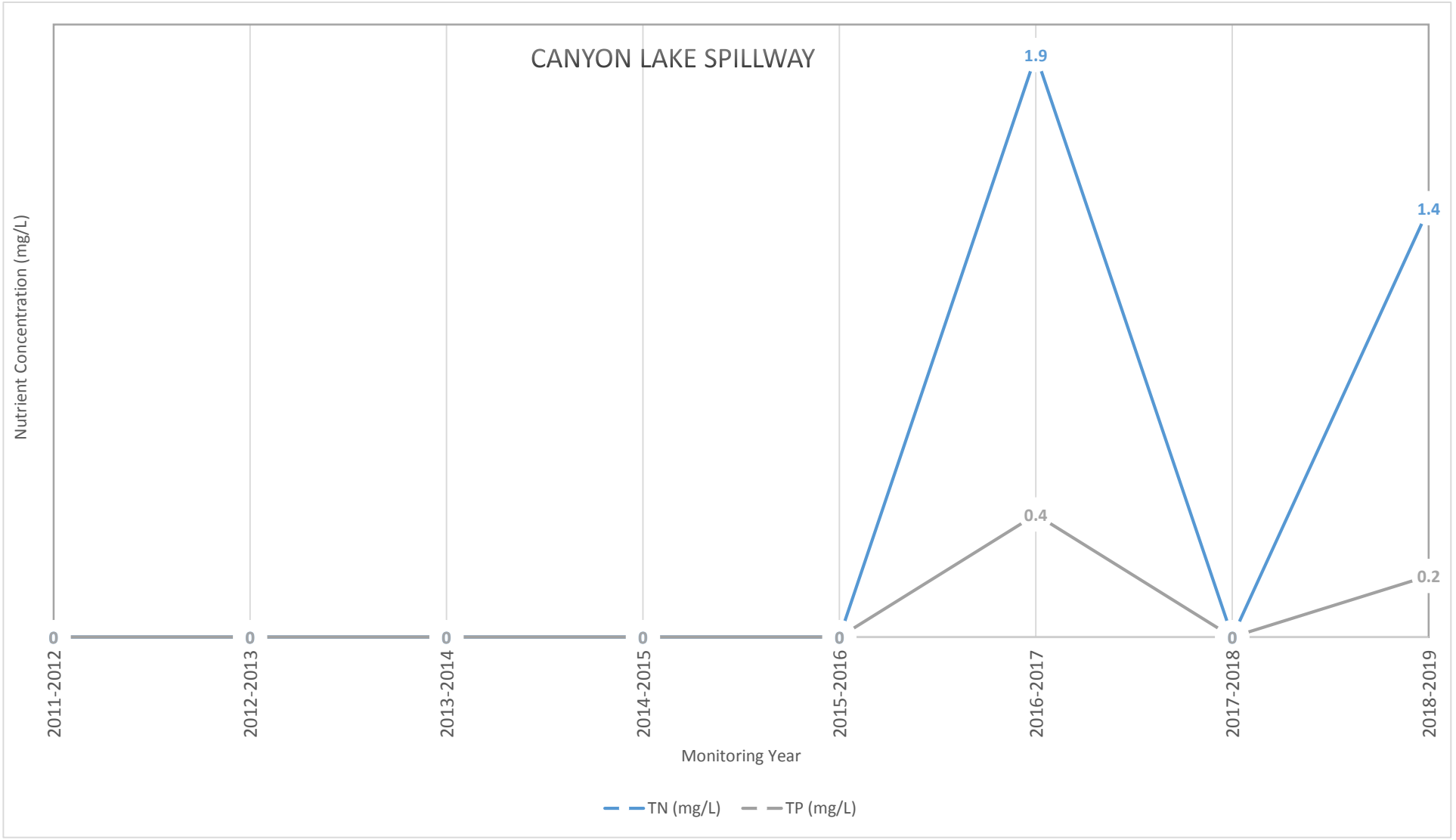
San Jacinto Historic Nutrient Concentrations



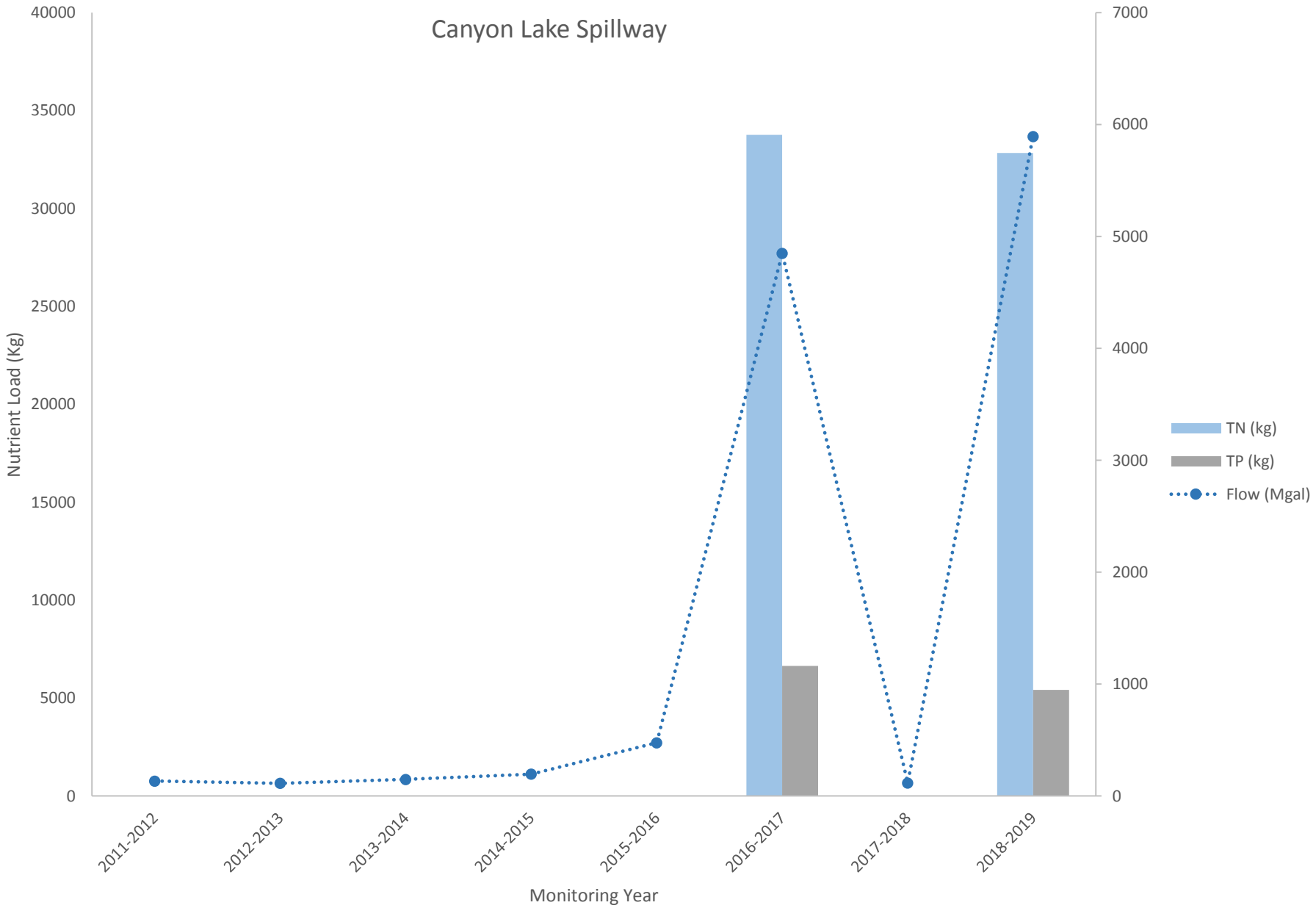
San Jacinto Historic Nutrient Loads



Canyon Lake Spillway Historic Nutrient Concentrations



Canyon Lake Spillway Historic Nutrient Loads

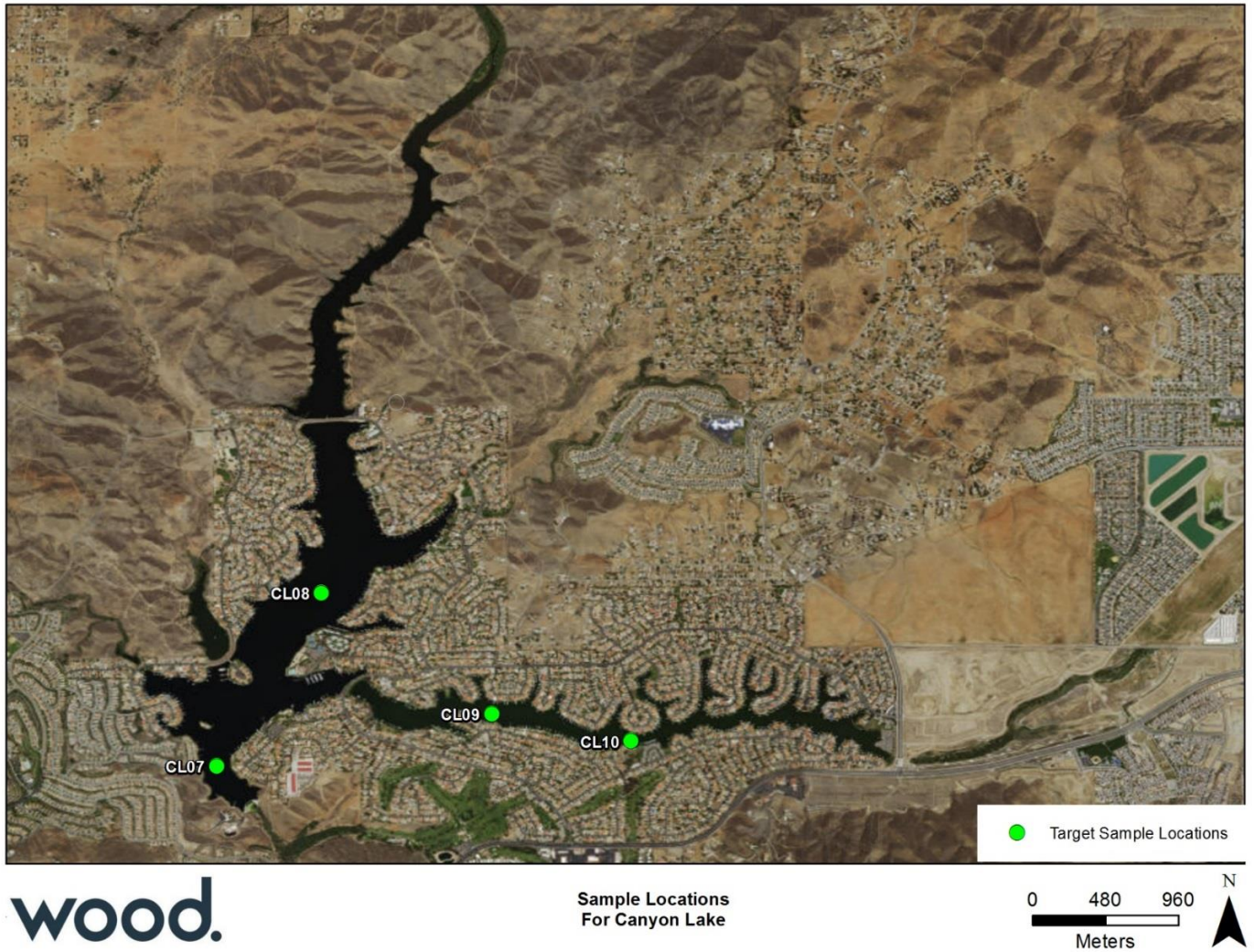


Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2018-19 Summary

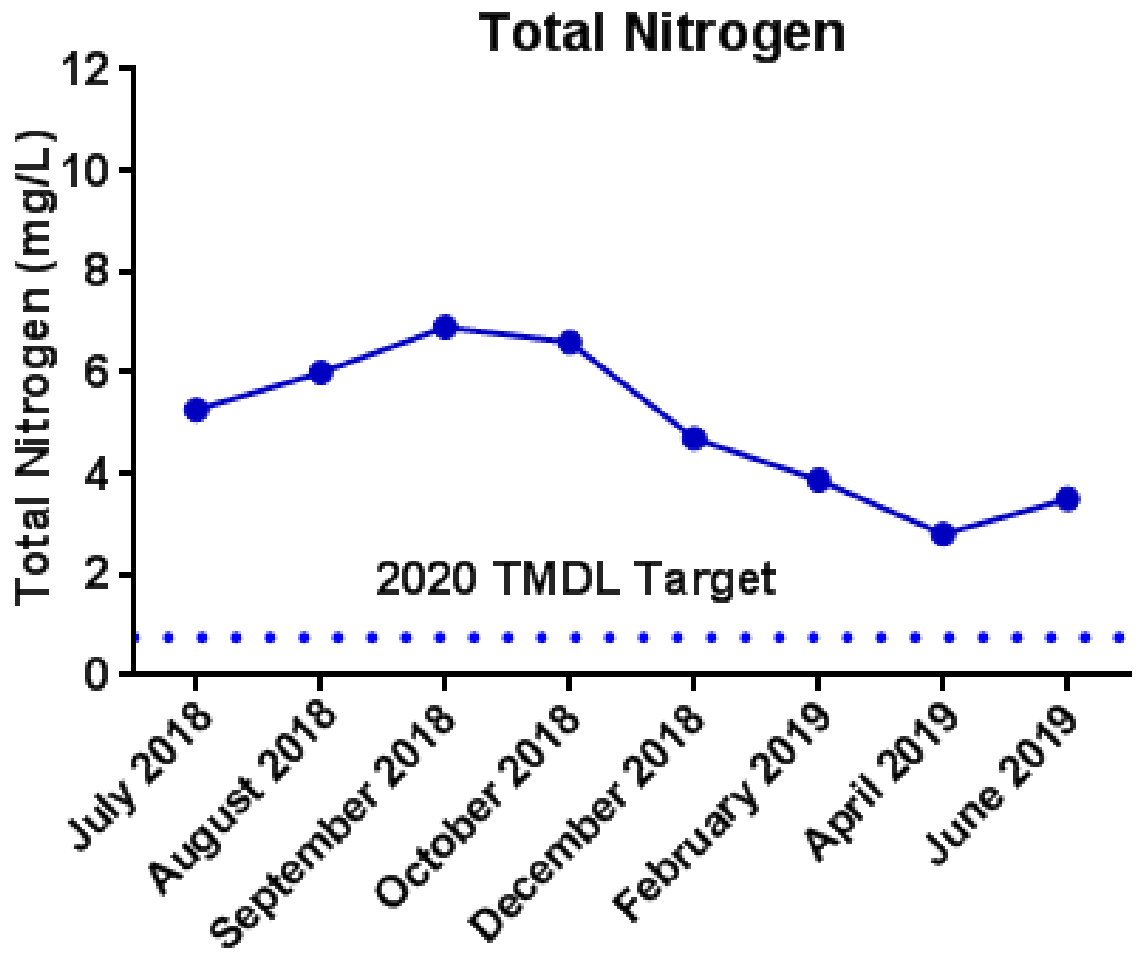
In-Lake Monitoring

Station Locations – Lake Elsinore

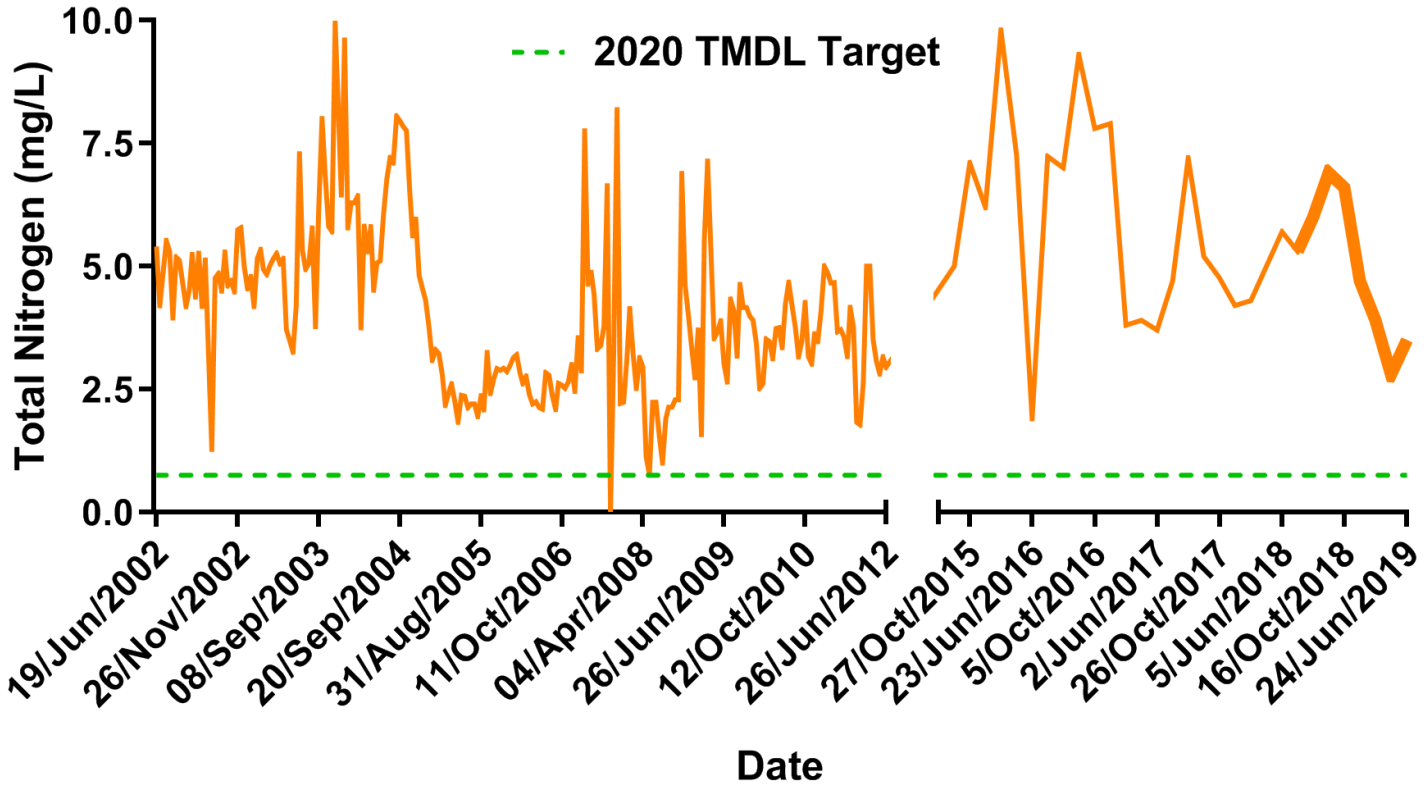
Station Locations – Canyon Lake



Total Nitrogen – Lake Elsinore 2018-2019



Total Nitrogen – Lake Elsinore Historic Data

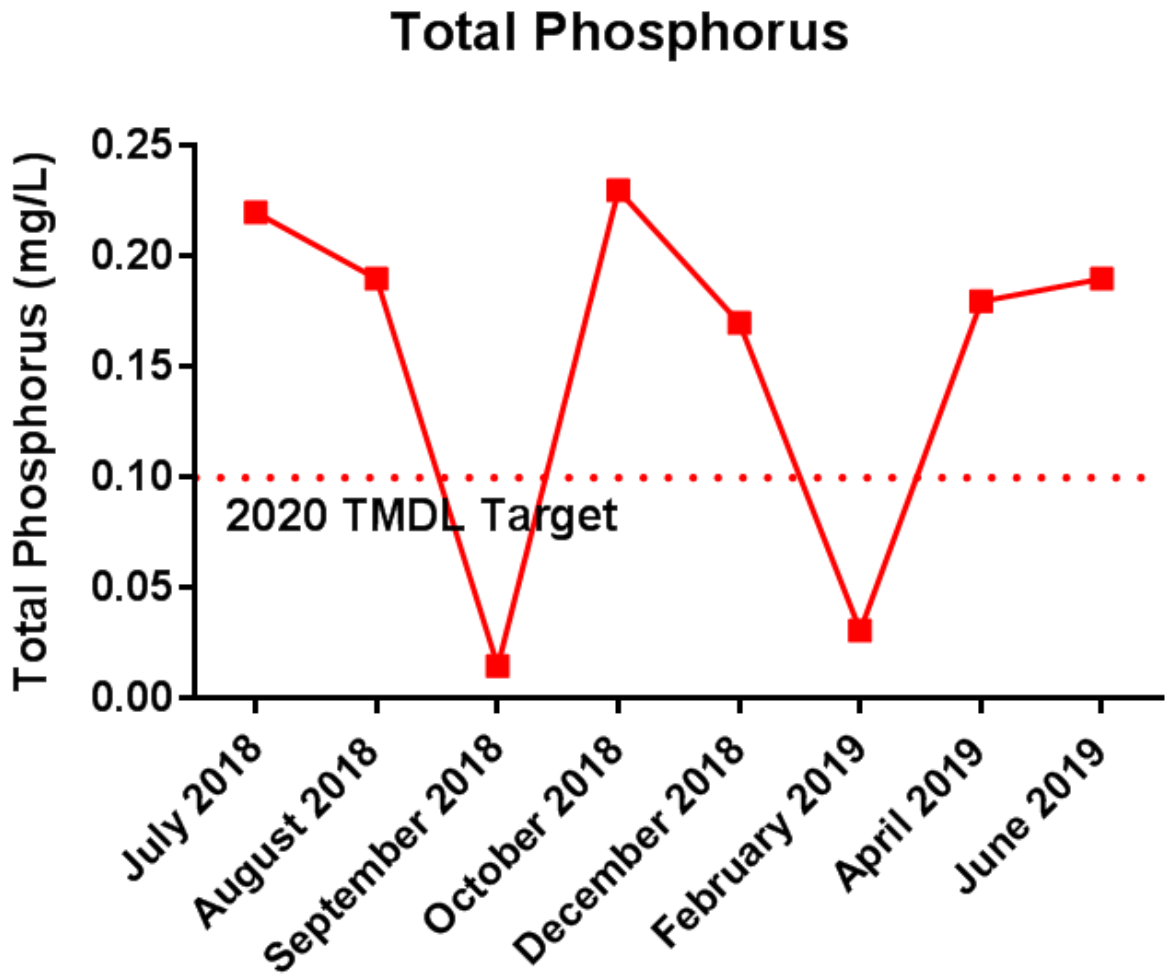


No data available from June 2012-July2015

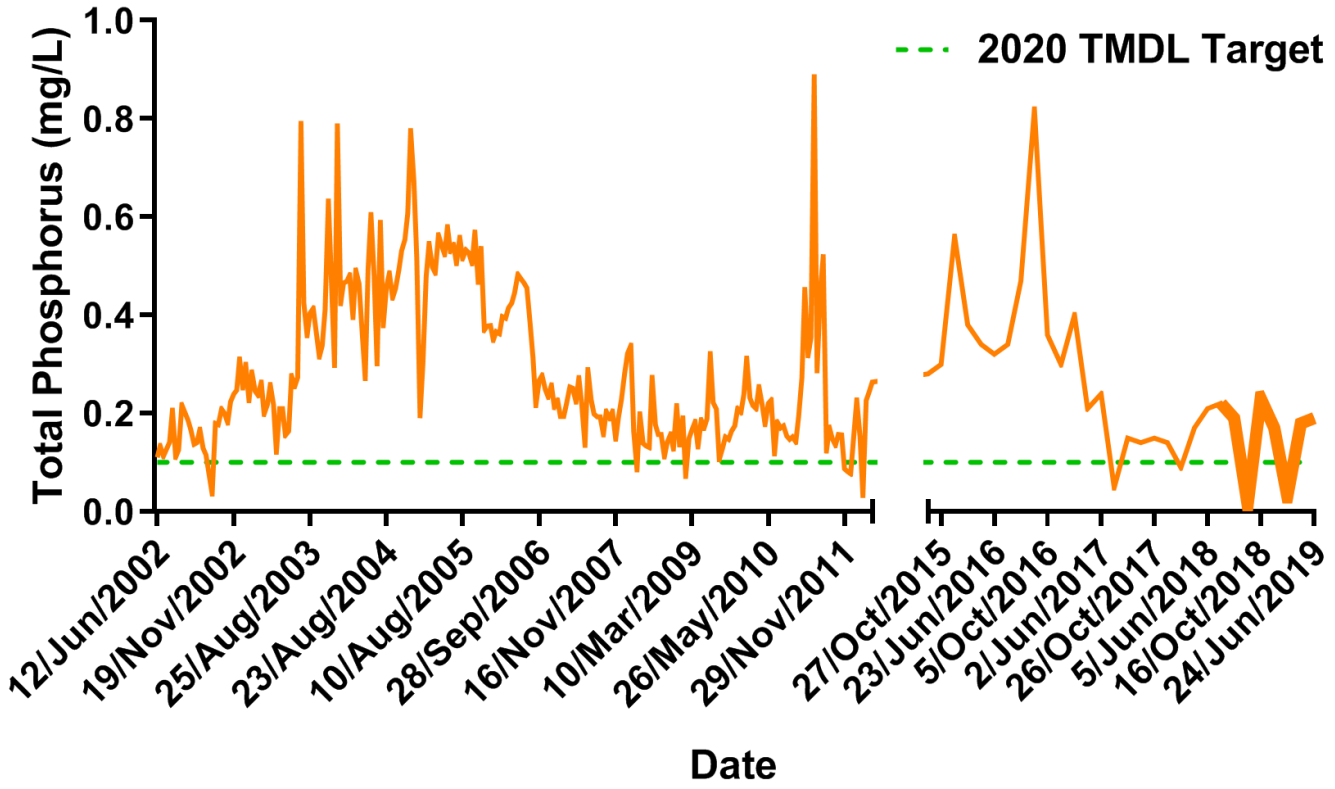
TMDL target of 0.75 mg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2018-June 2019

Total Phosphorus – Lake Elsinore 2018-2019



Total Phosphorus – Lake Elsinore Historic Data

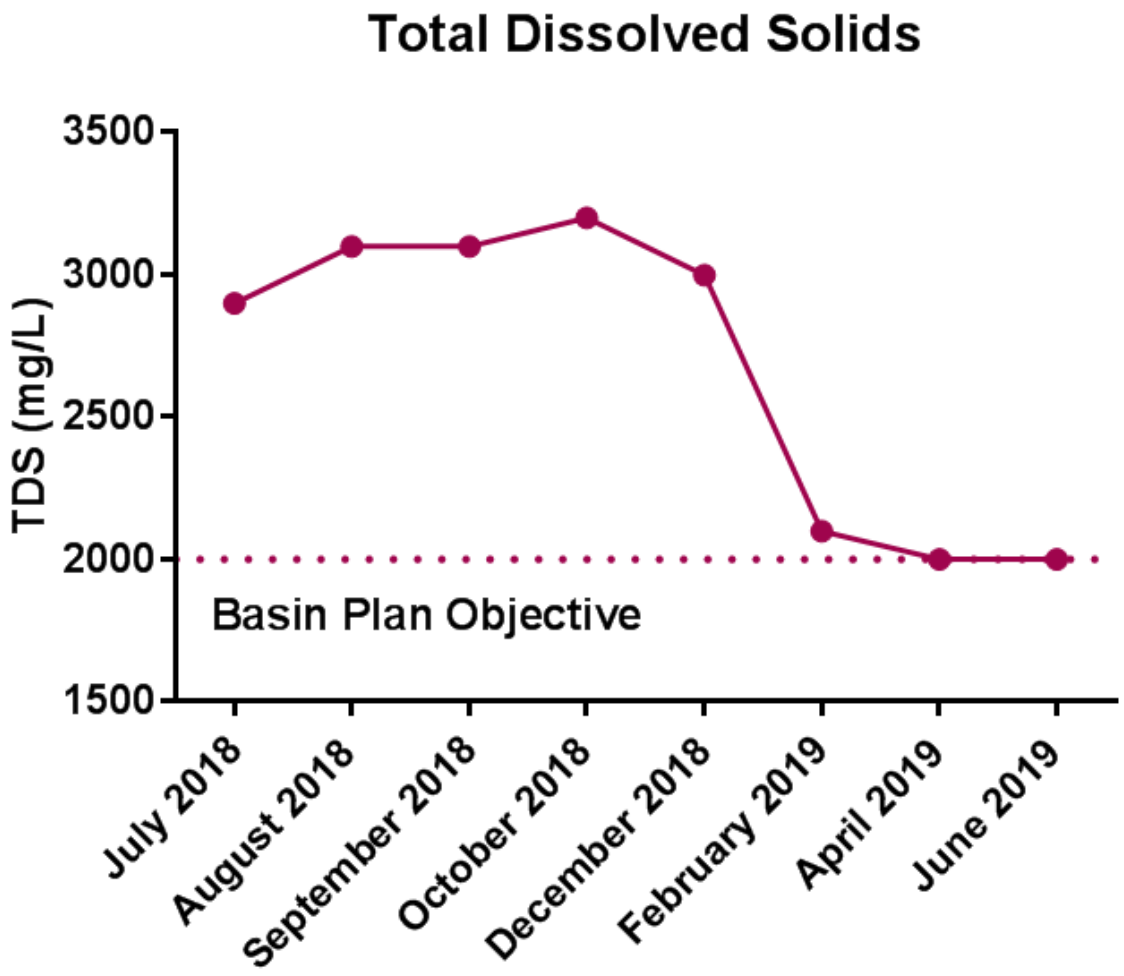


No data available from June 2012-July2015

TMDL target of 0.75 mg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2018-June 2019

Total Dissolved Solids– Lake Elsinore 2018-2019

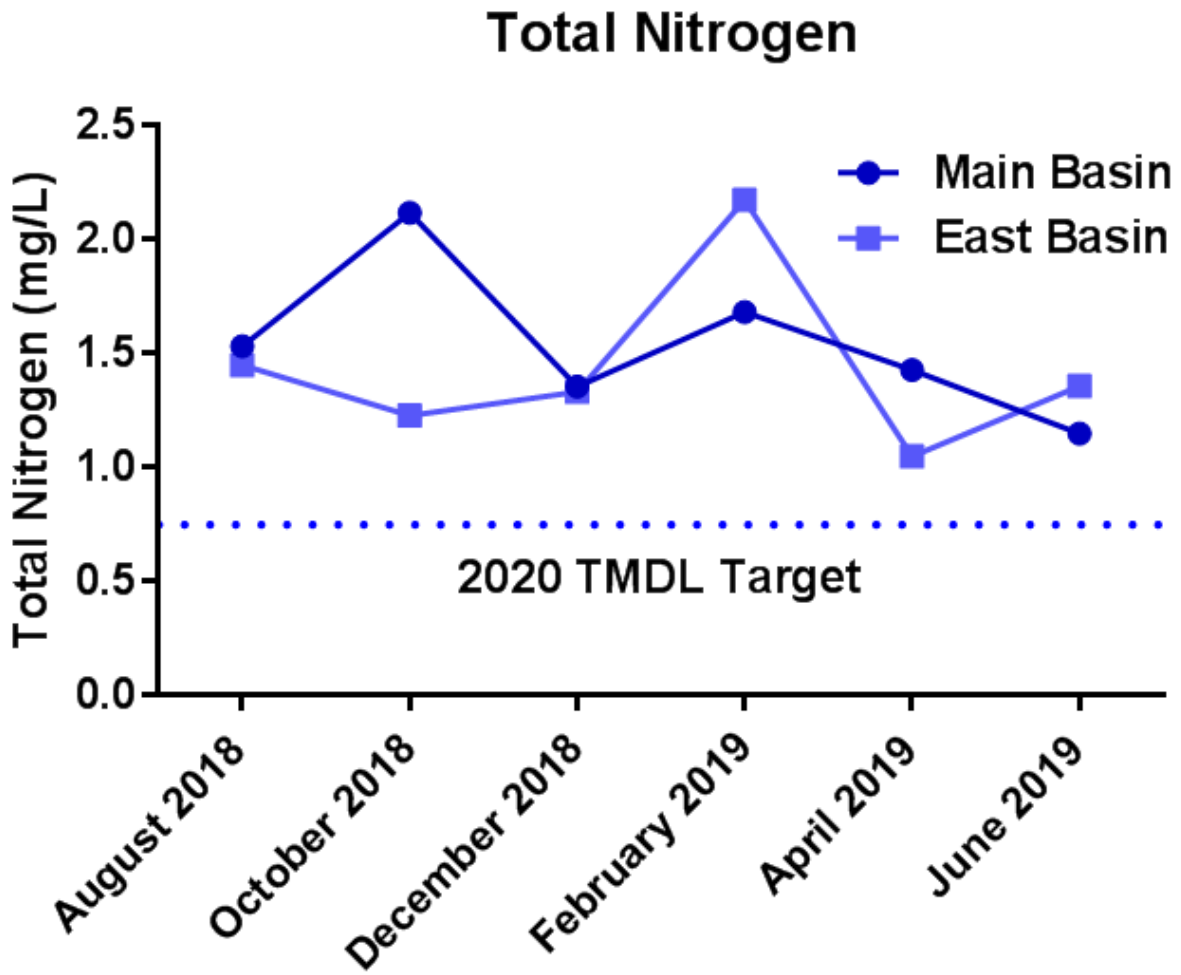


Total Dissolved Solids– Lake Elsinore Historic Data

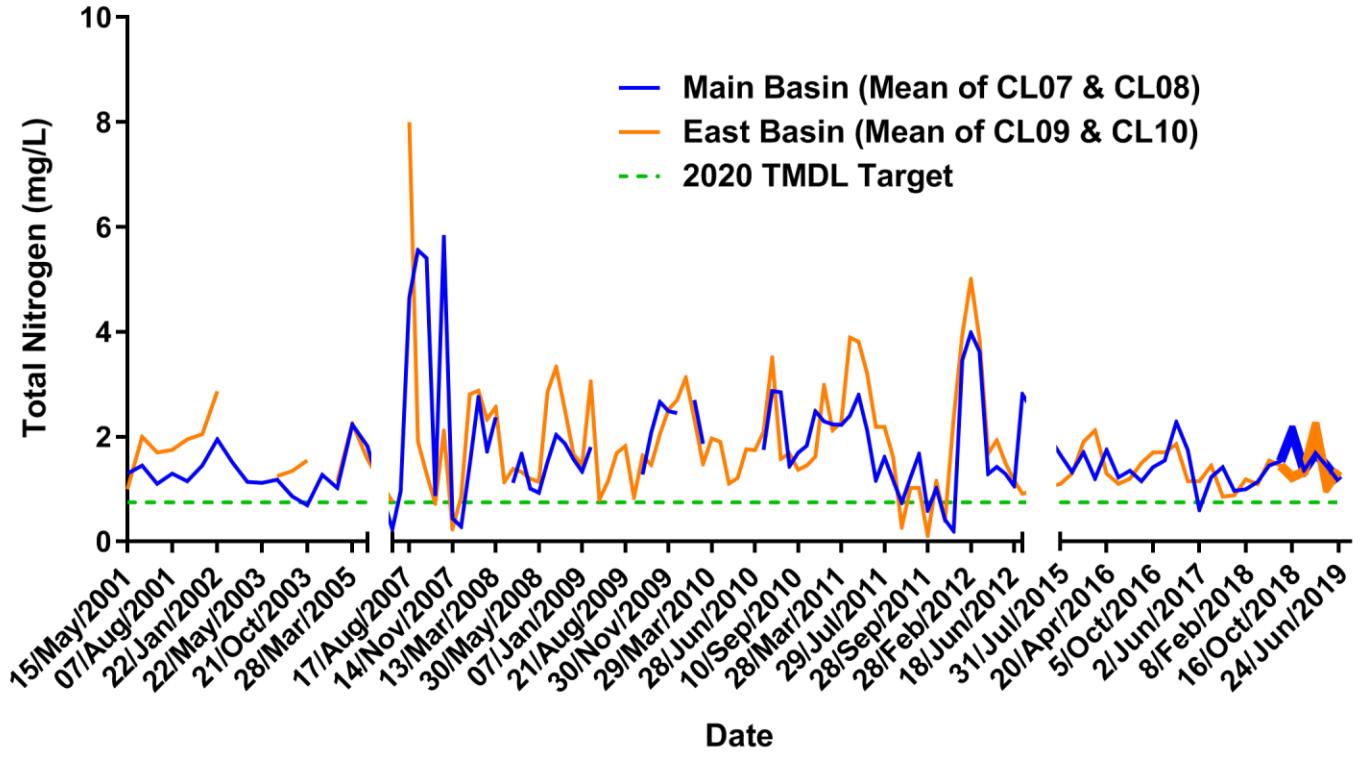
No data available from June 2012-July 2015

Bold represents current monitoring year July 2018-June 2019

Total Nitrogen – Canyon Lake 2018-2019



Total Nitrogen – Canyon Lake Historic Data

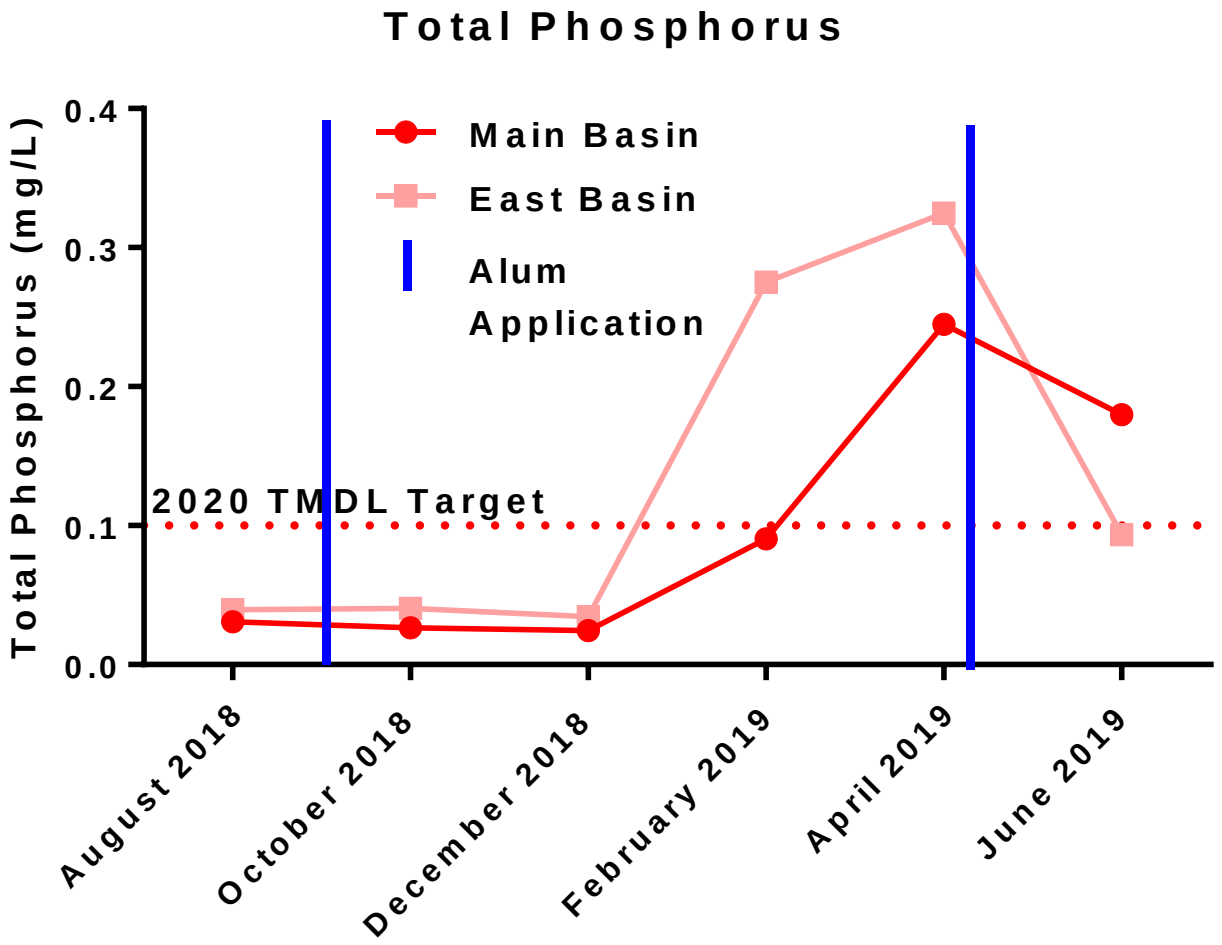


No data available from May 2005-July 2007; June 2012-July2015

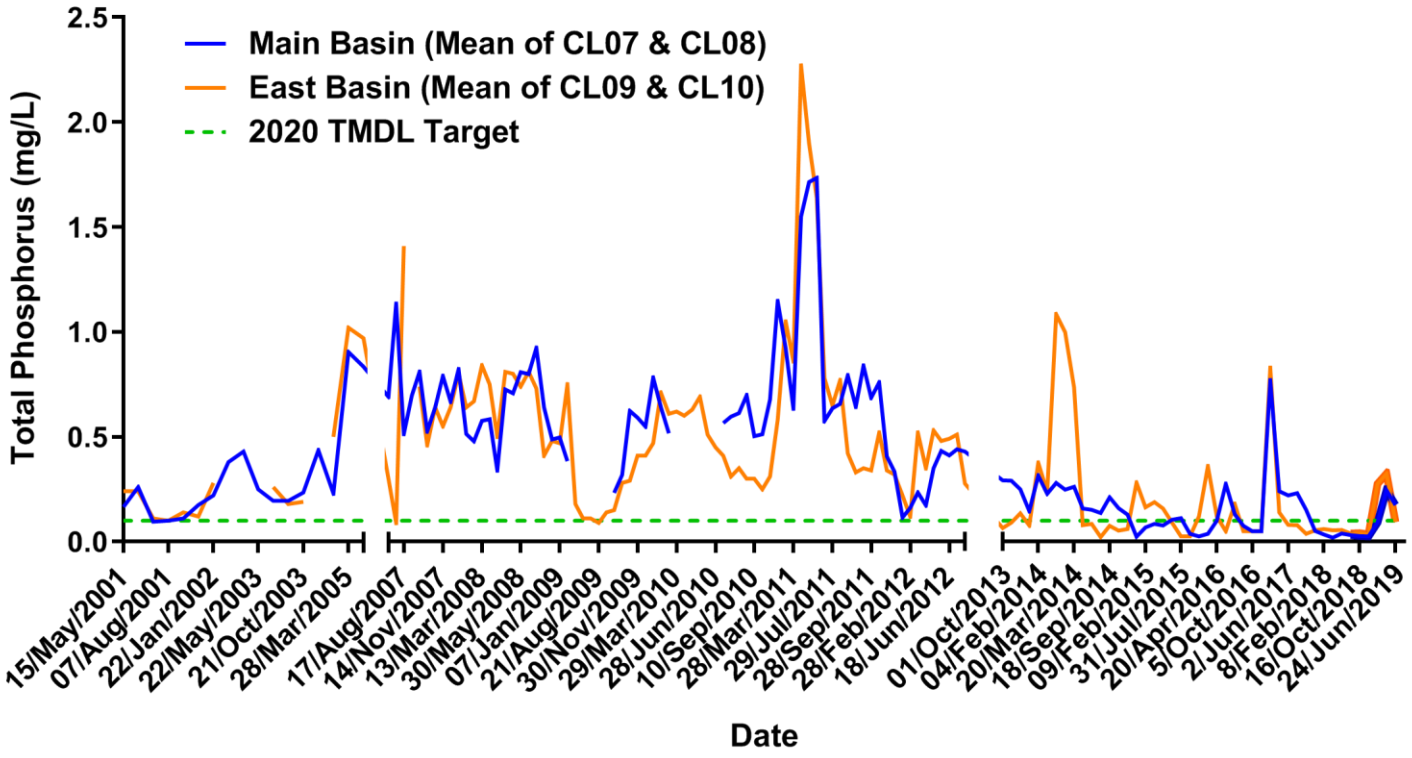
TMDL target of 0.75 mg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2018-June 2019

Total Phosphorus – Canyon Lake 2018-2019



Total Phosphorus – Canyon Lake Historic Data



No data available from May 2005-July 2007; June 2012-Sept 2013

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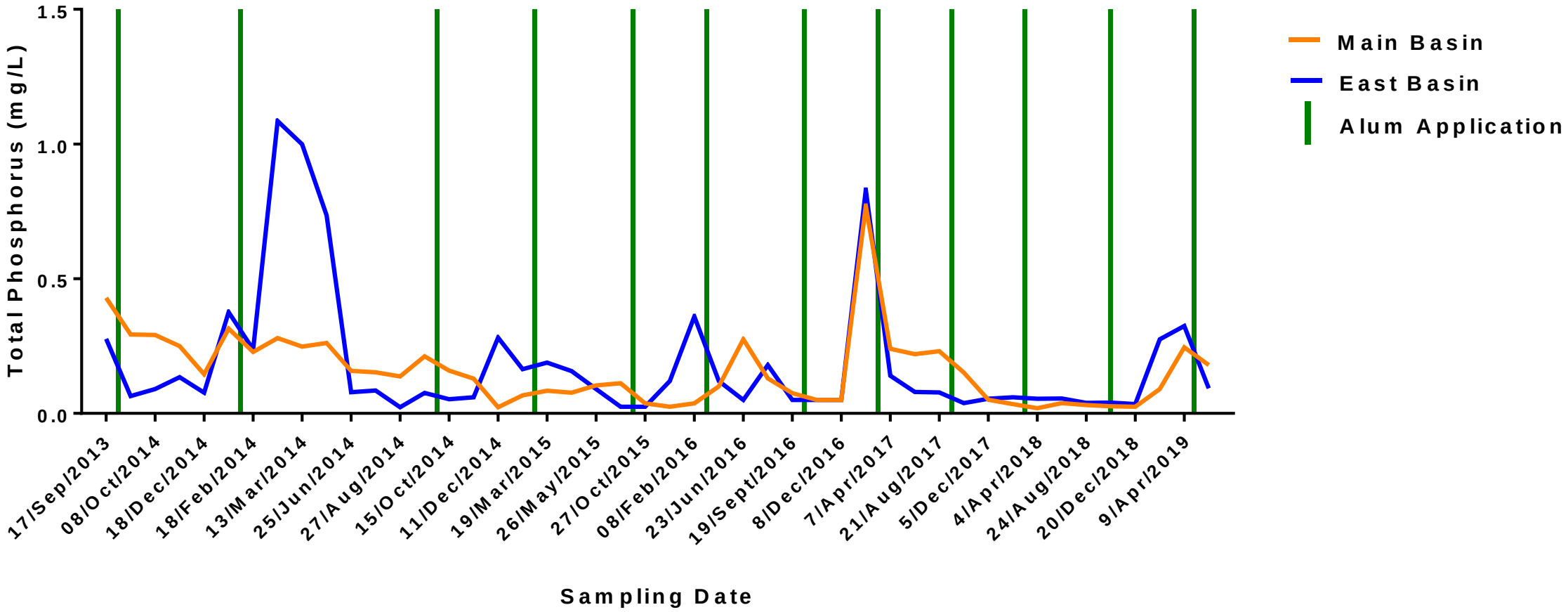
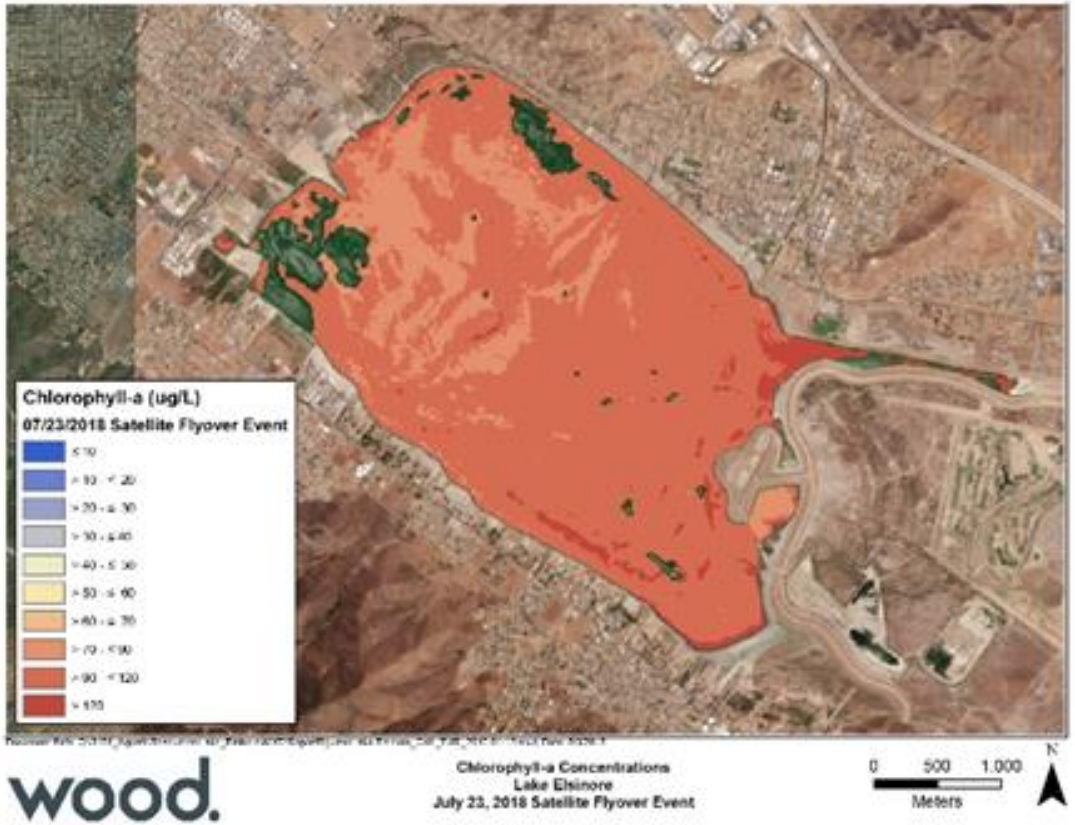
Alum Effectiveness – Canyon Lake Total Phosphorus



* All samples labels not included on x-axis

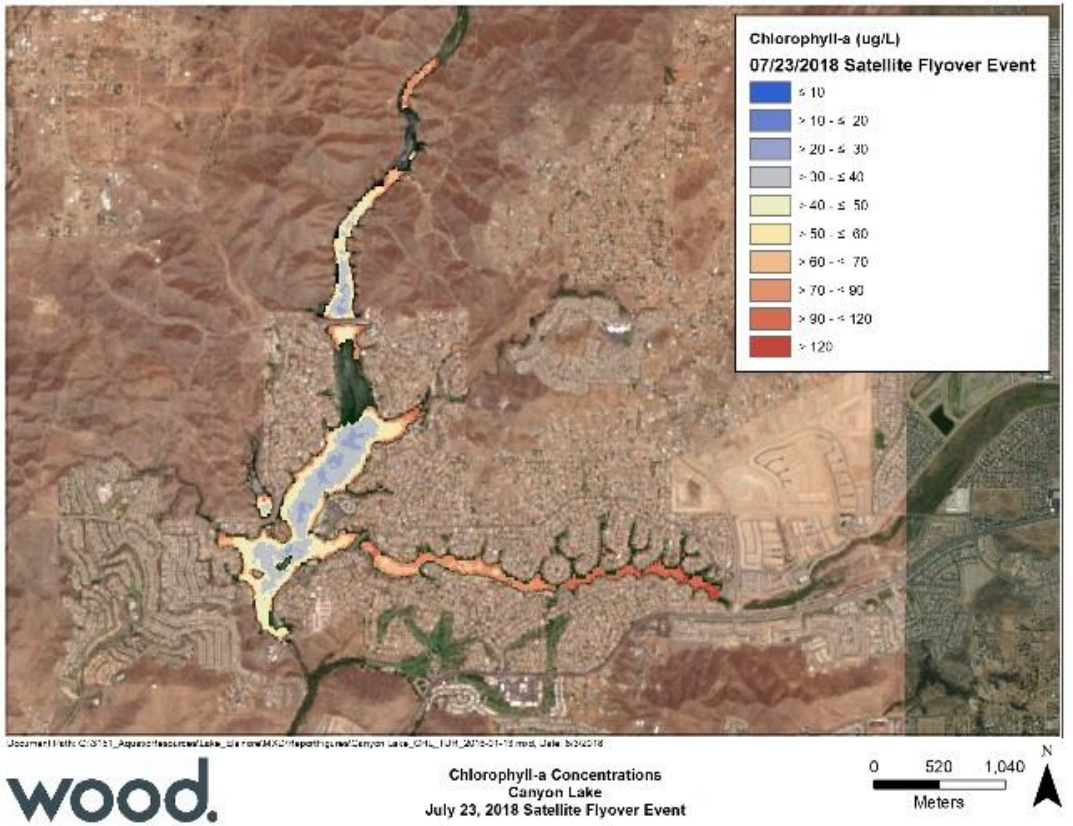
Satellite Imagery – Chlorophyll July 23, 2018

Lake Elsinore



**Data gaps due to surficial cyanobacterial slicks.

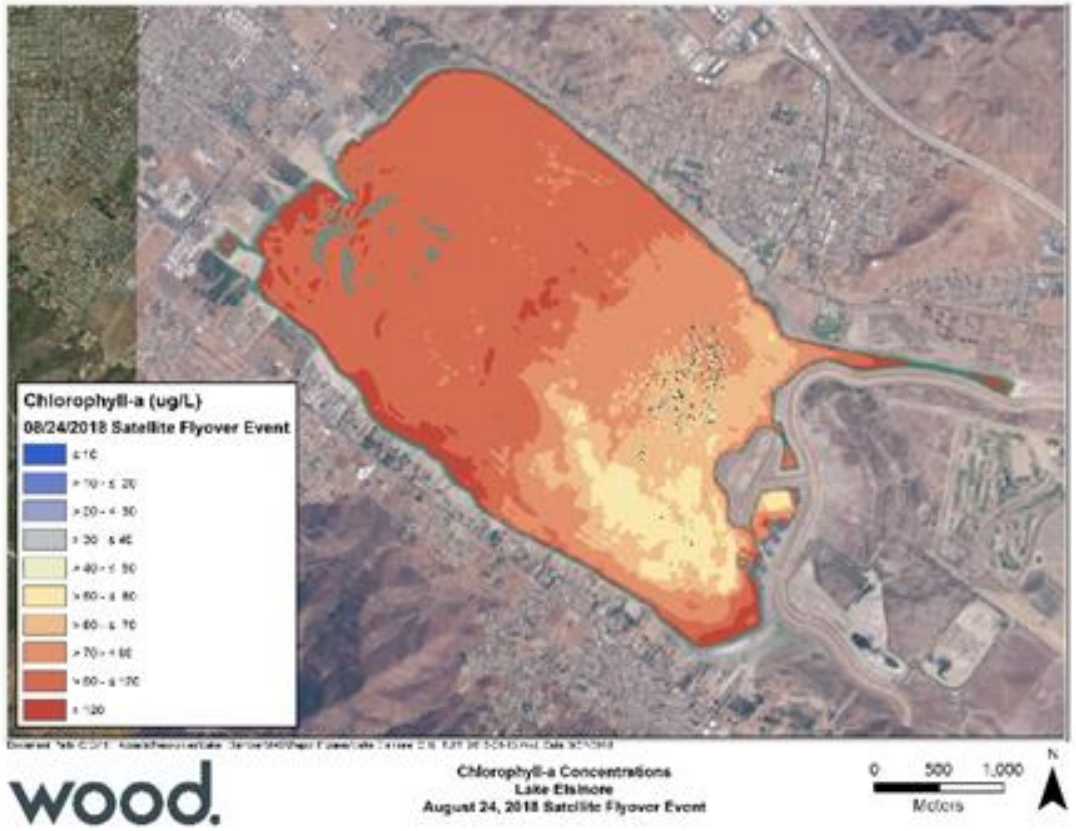
Canyon Lake



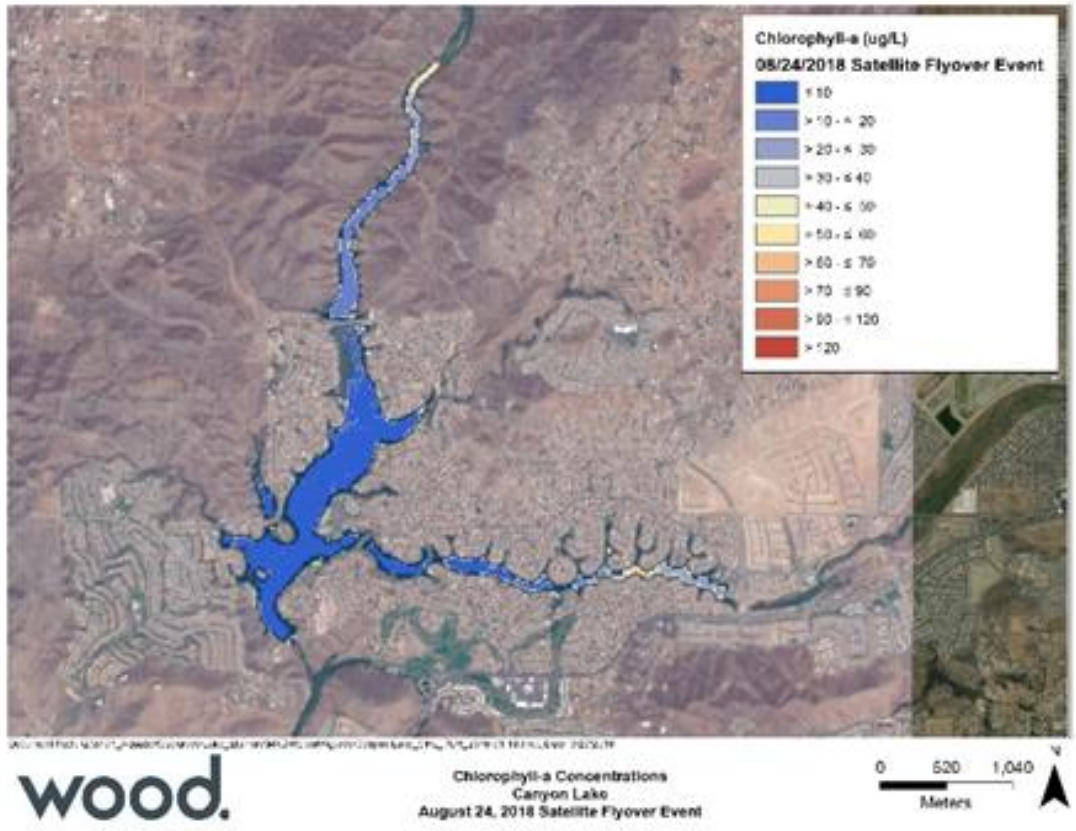
**Data gaps due to high cirrus cloud interference.

Satellite Imagery – Chlorophyll August 24, 2018

Lake Elsinore

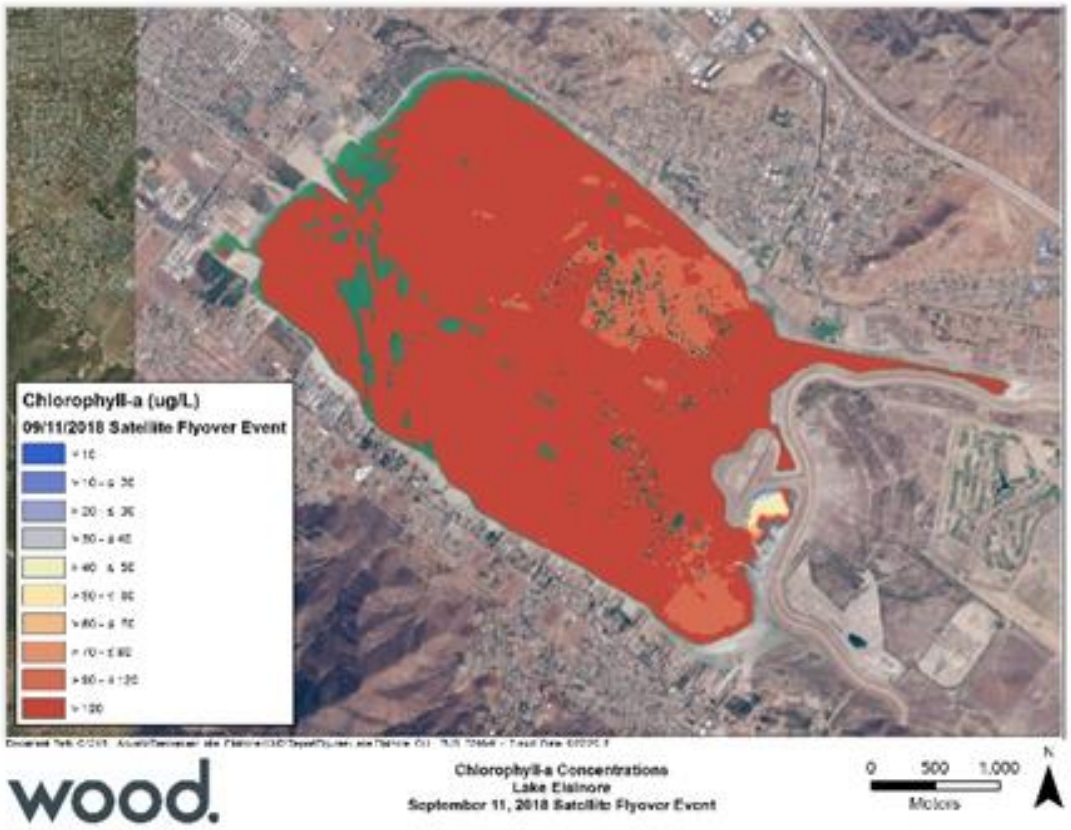


Canyon Lake

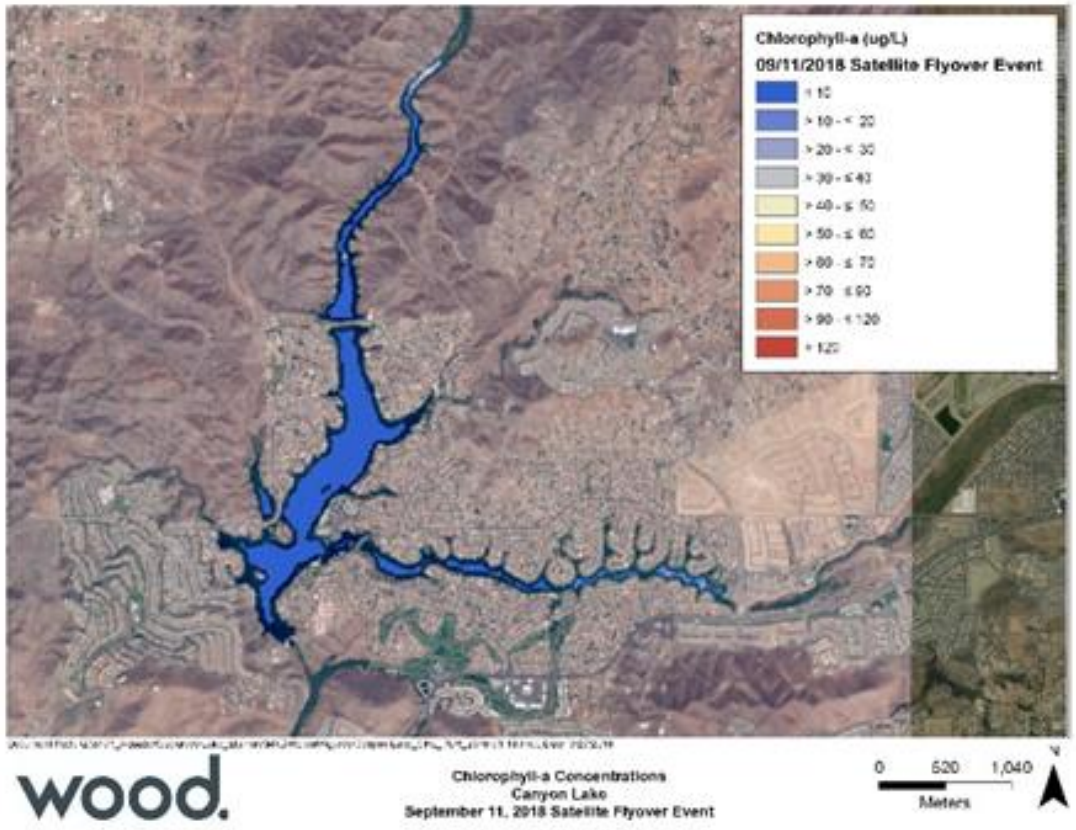


Satellite Imagery – Chlorophyll September 11, 2018

Lake Elsinore



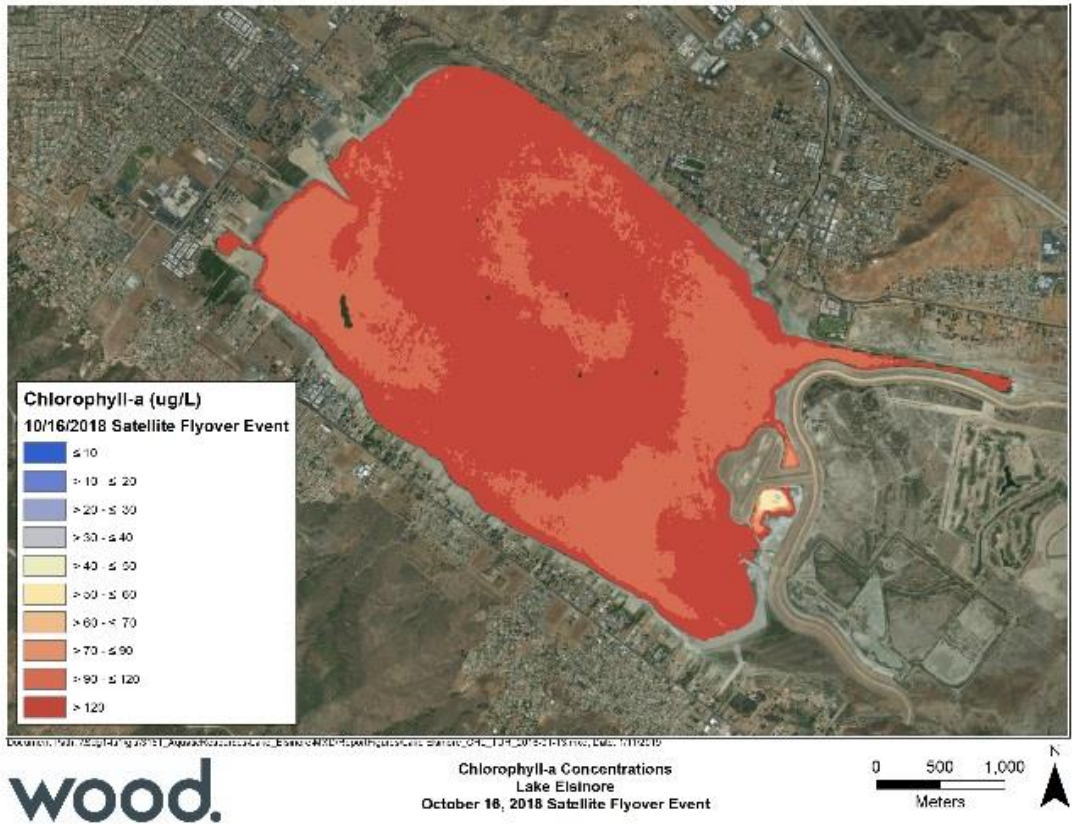
Canyon Lake



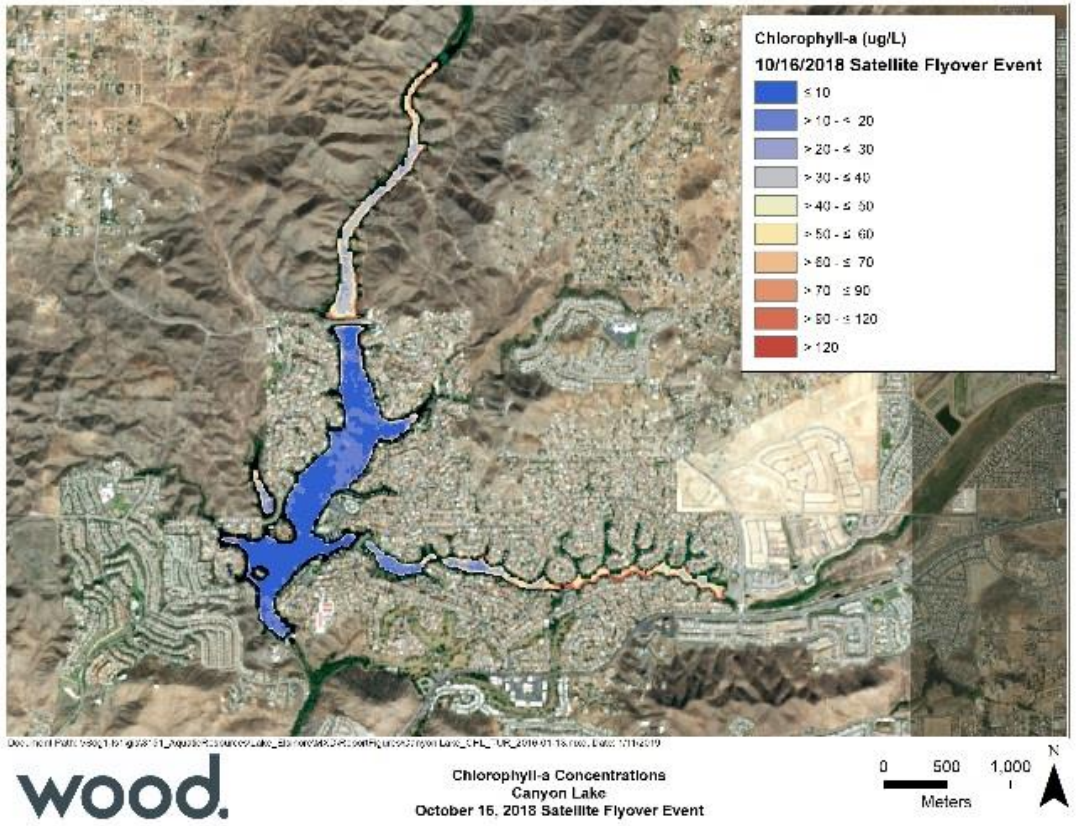
**Data gaps due to surficial cyanobacterial slicks.

Satellite Imagery – Chlorophyll October 16, 2018

Lake Elsinore

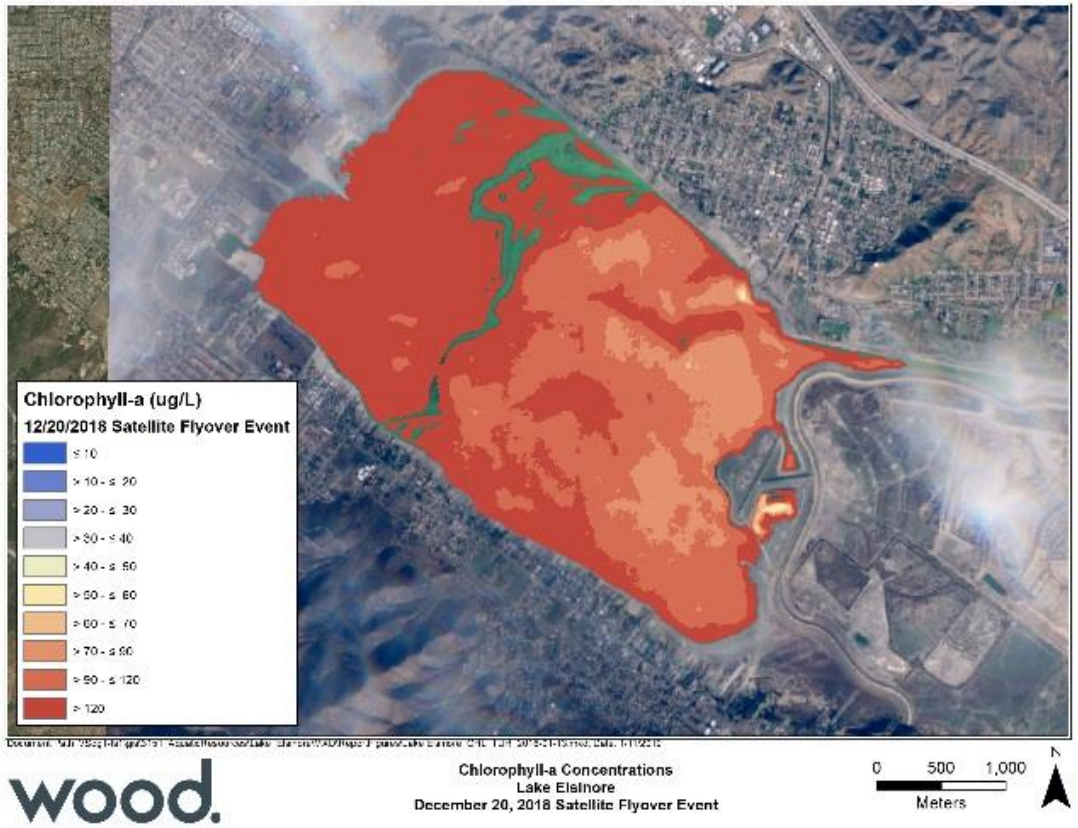


Canyon Lake

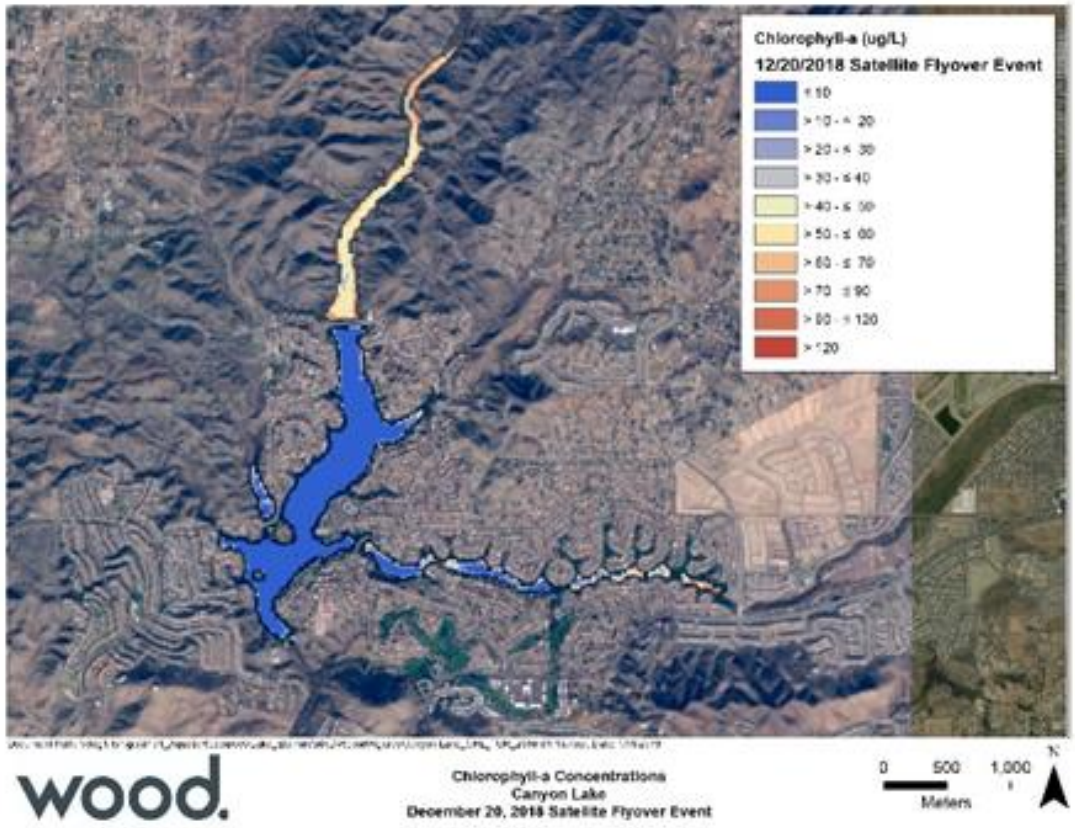


Satellite Imagery – Chlorophyll December 20, 2018

Lake Elsinore



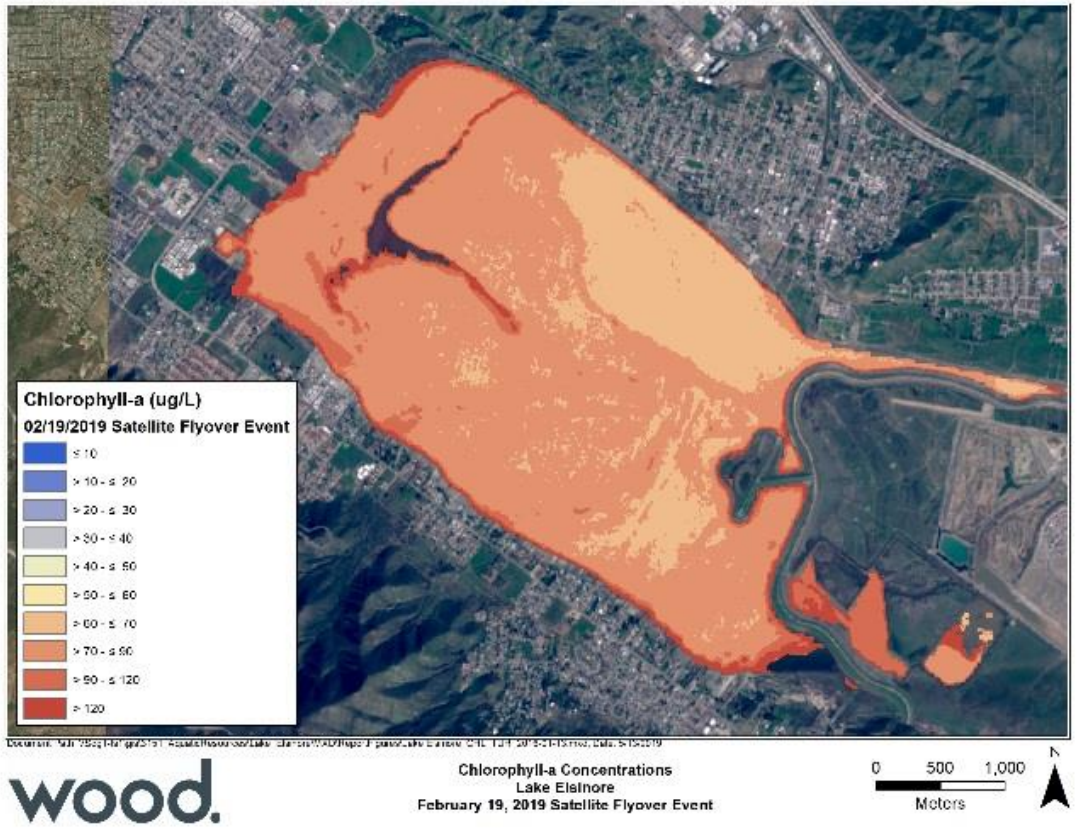
Canyon Lake



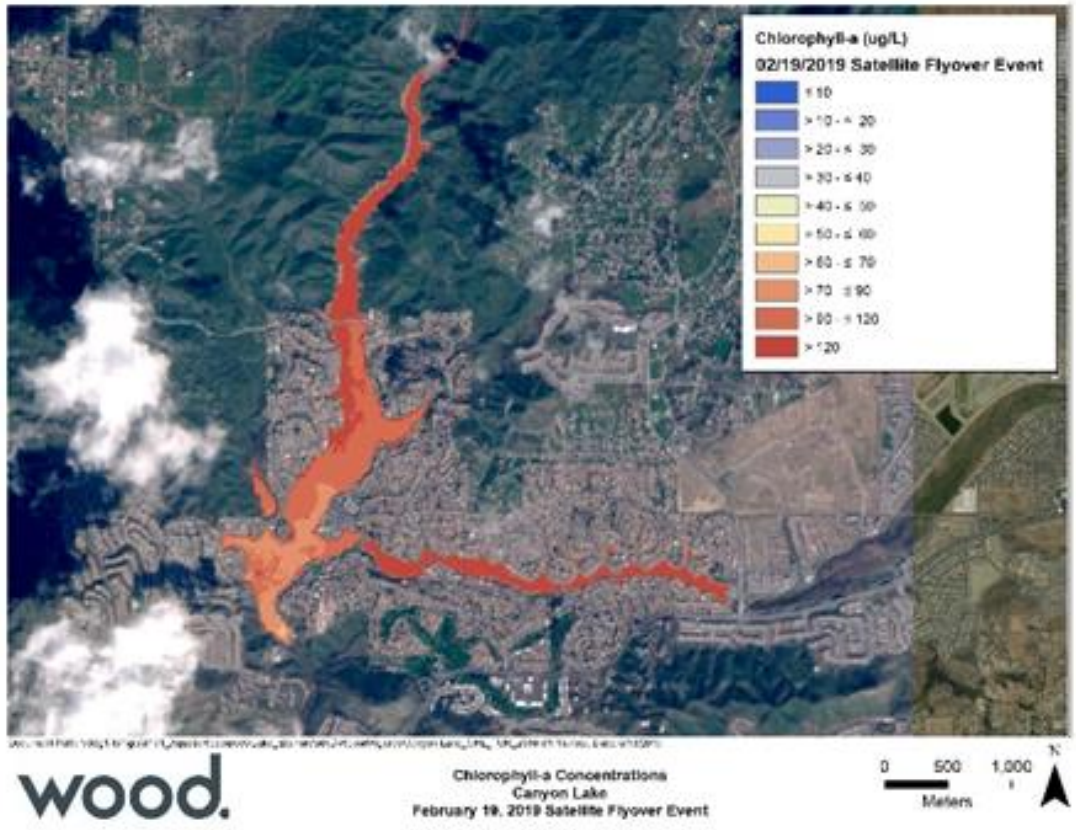
**Data gaps due to surficial cyanobacterial slicks.

Satellite Imagery – Chlorophyll February 19, 2019

Lake Elsinore



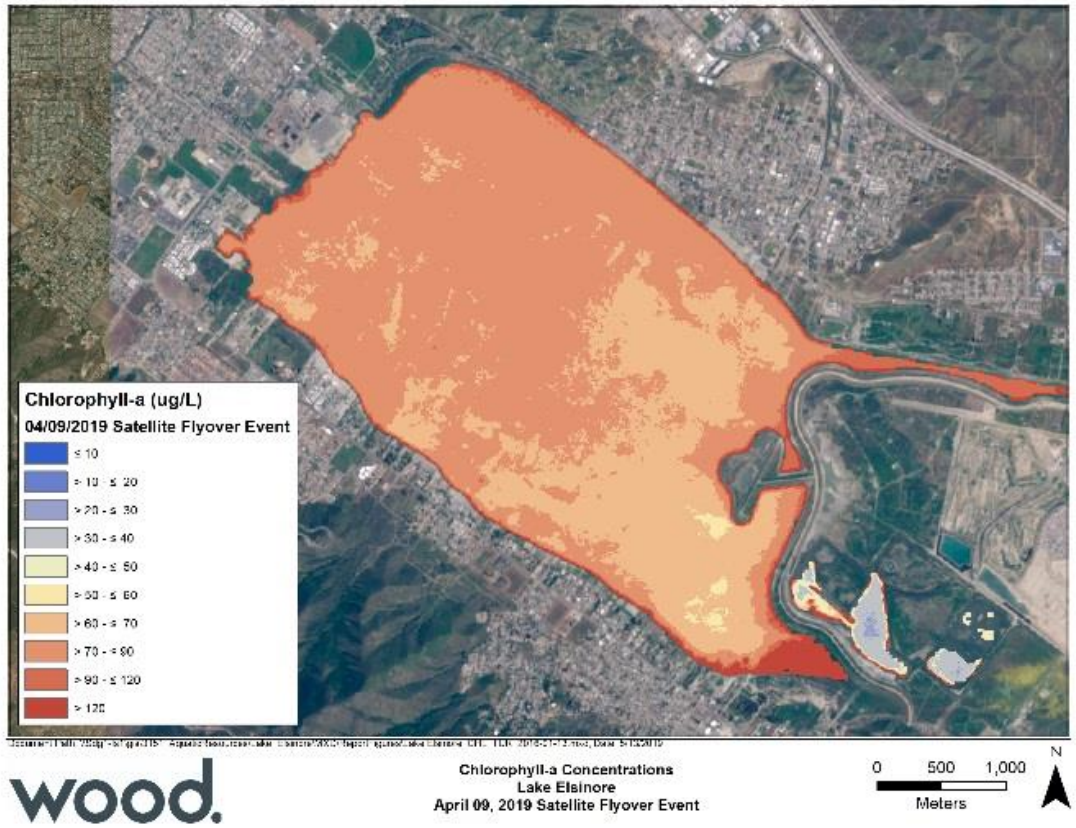
Canyon Lake



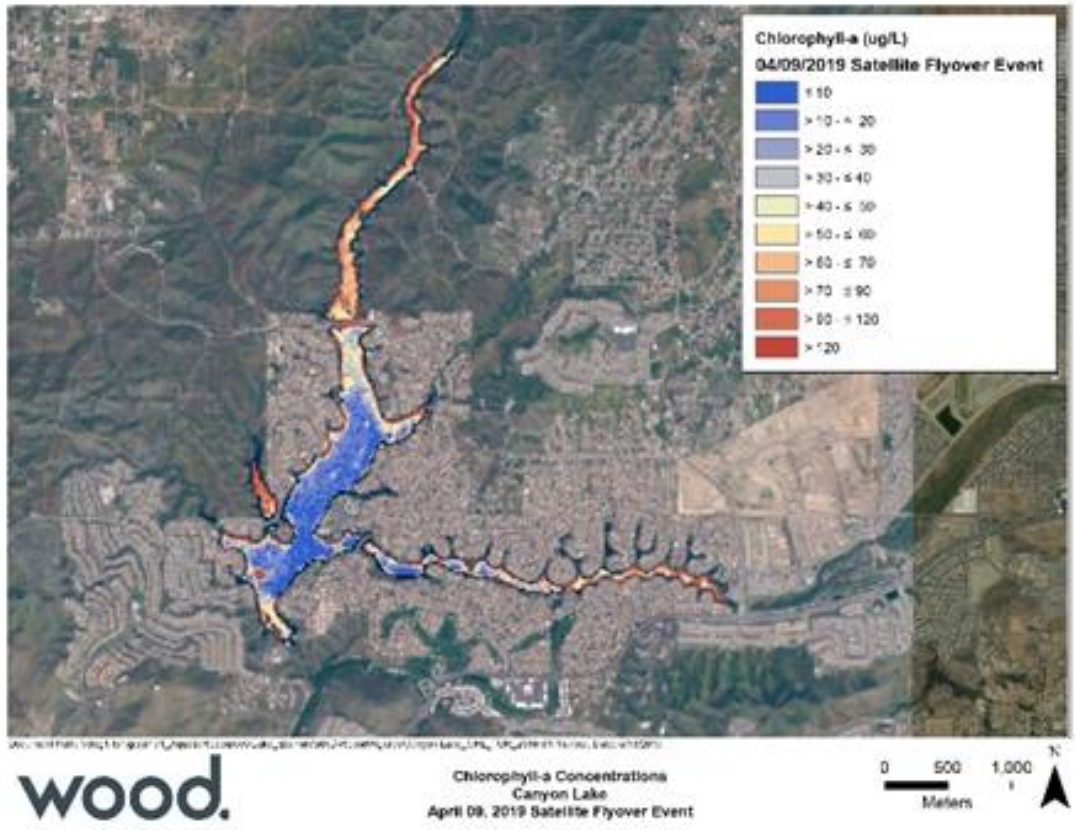
**Data gaps due to surficial cyanobacterial slicks.

Satellite Imagery – Chlorophyll April 9, 2019

Lake Elsinore

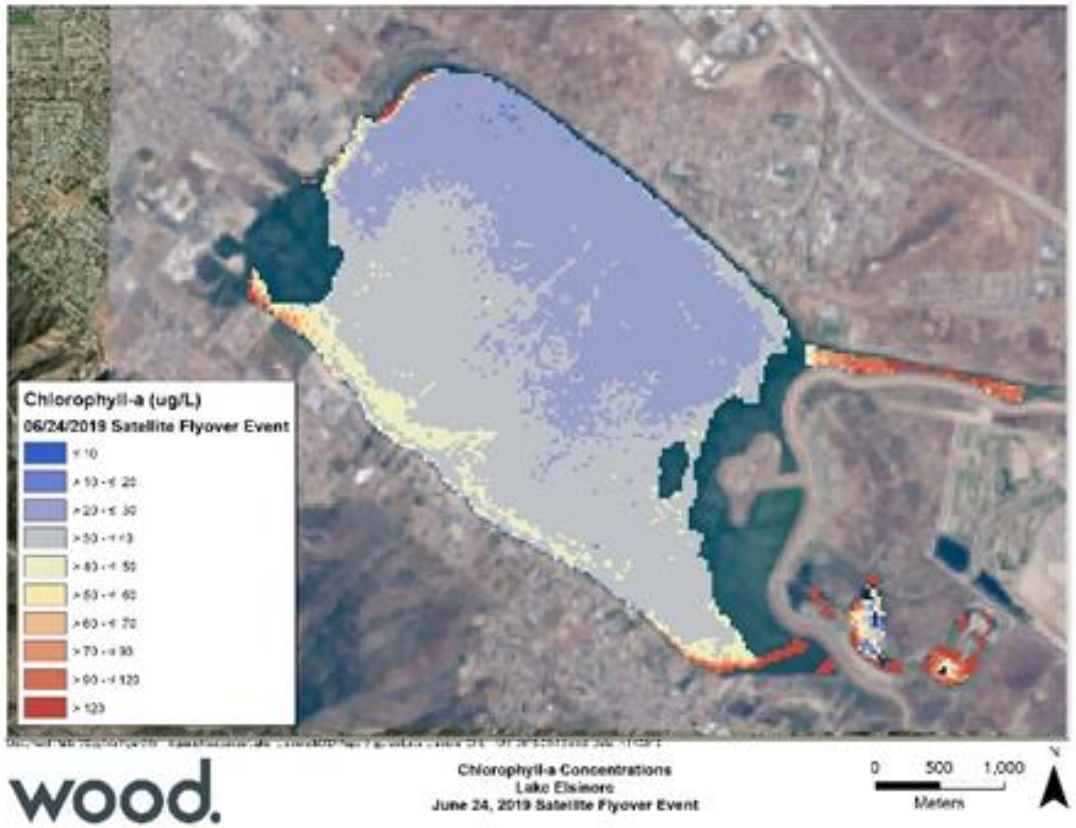


Canyon Lake



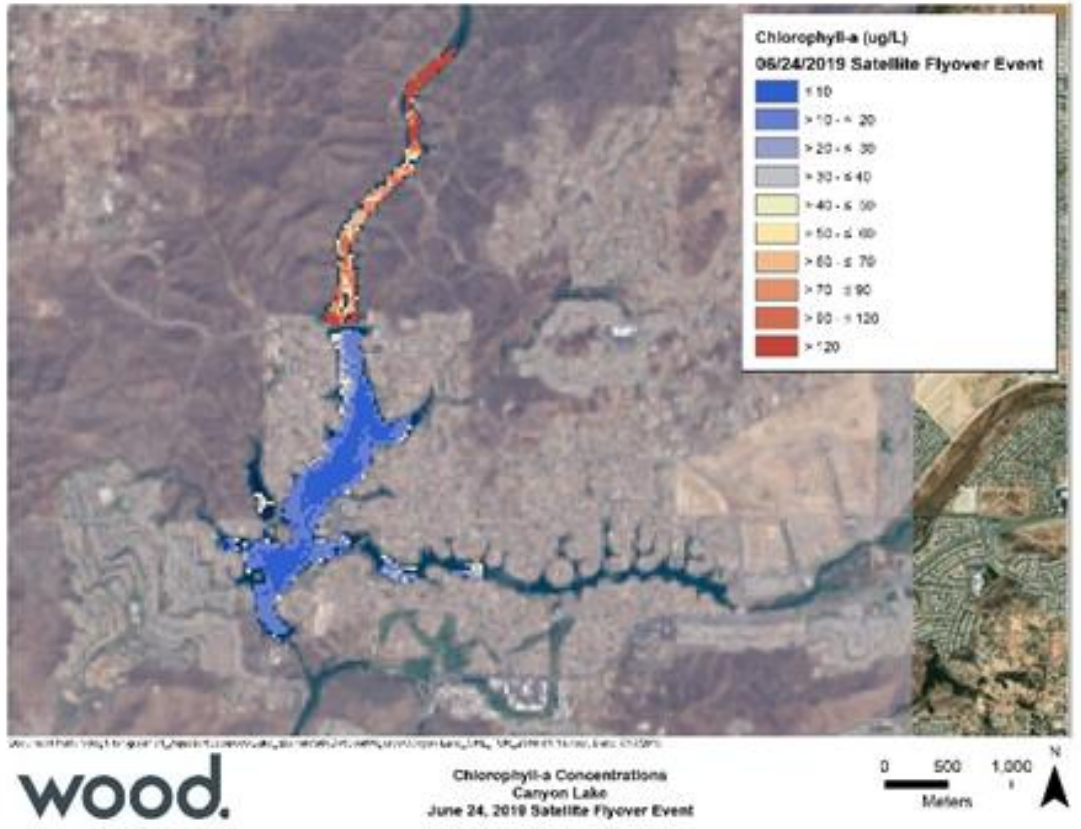
Satellite Imagery – Chlorophyll June 24, 2019

Lake Elsinore



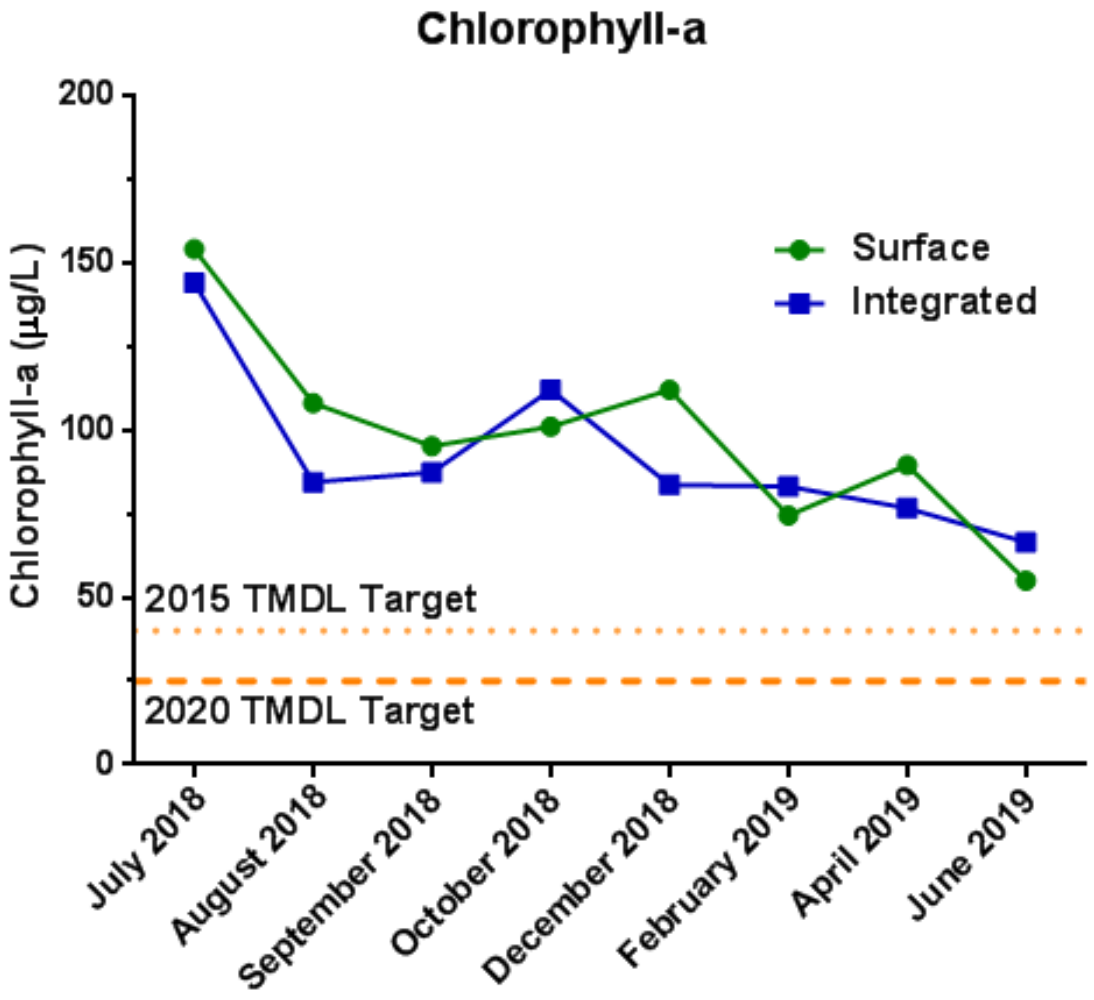
**Data gaps due to high cirrus clouds

Canyon Lake

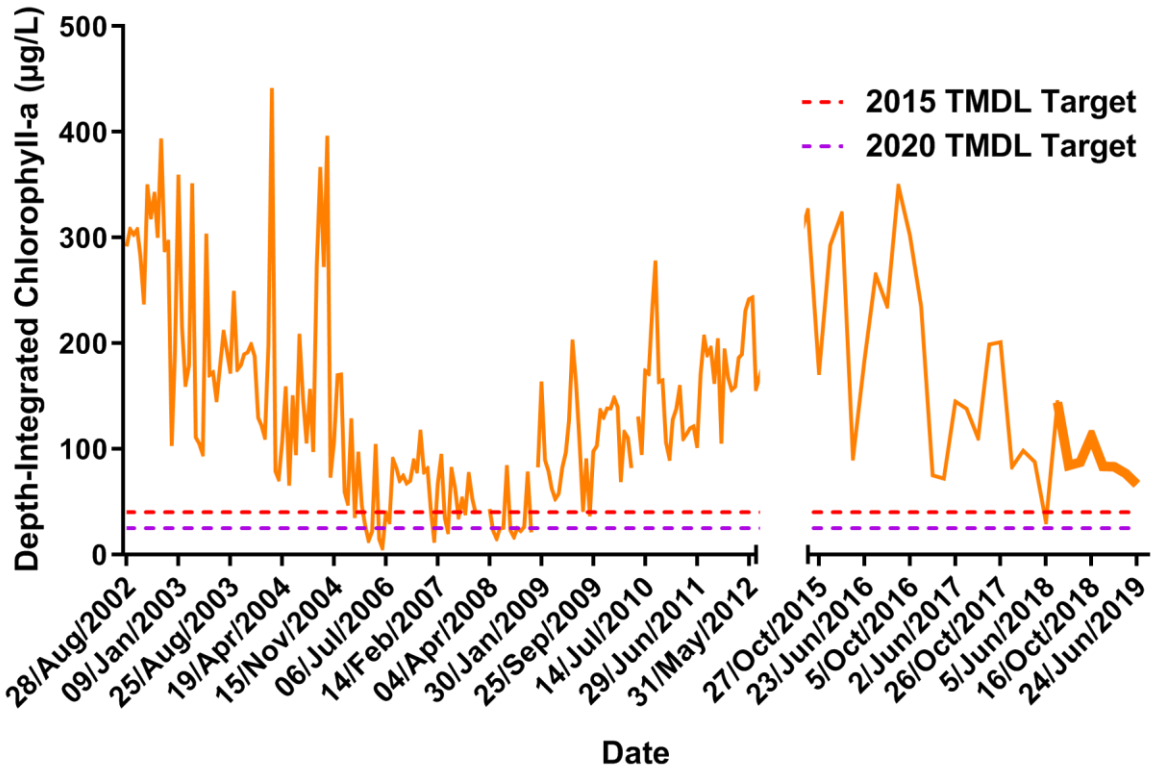


**Data gaps due to high cirrus clouds

Lake Elsinore Chlorophyll – 2018-2019



Lake Elsinore Chlorophyll – Integrated Historic Data



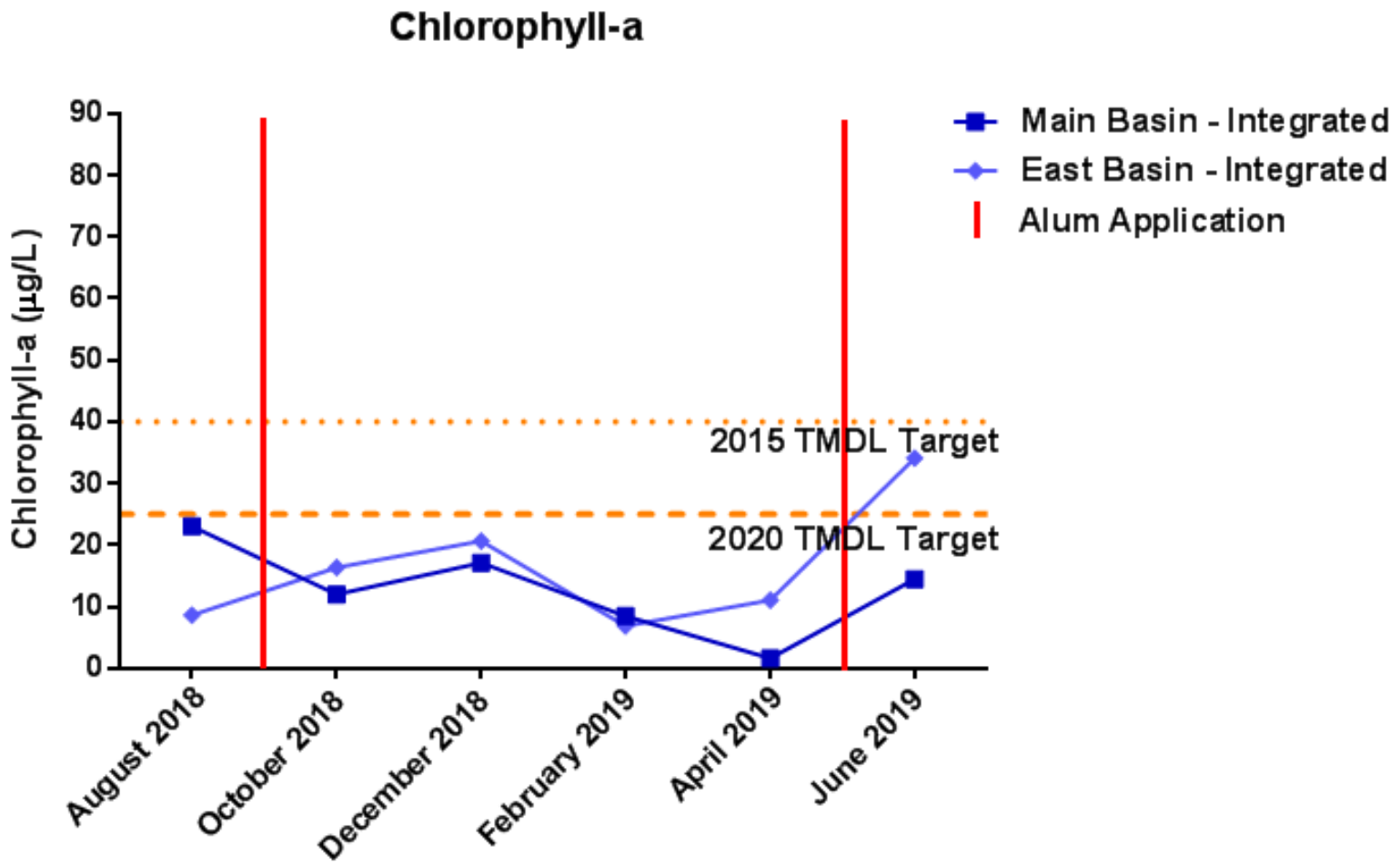
No data available from June 2012-July2015

2015 TMDL target of 40 µg/L is annual average to be attained by 2015

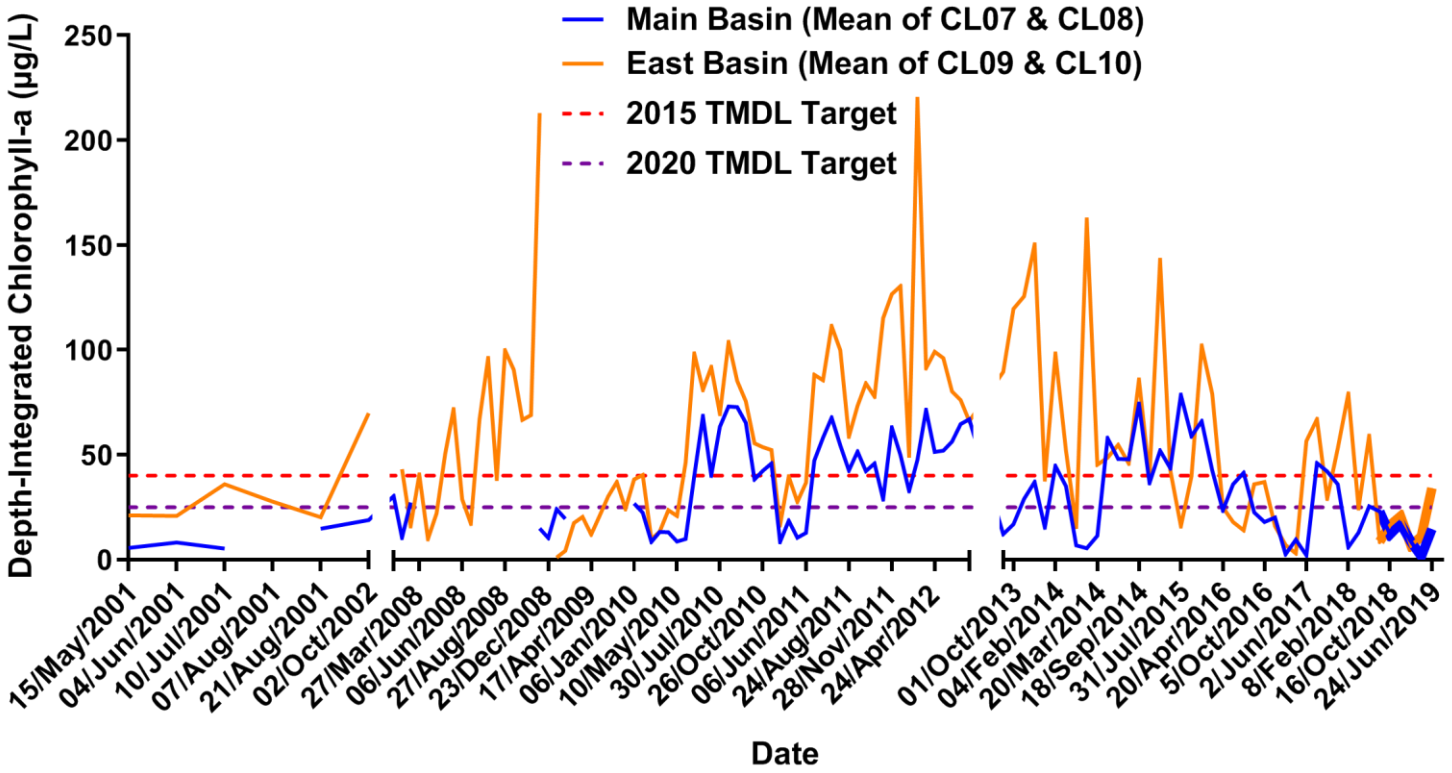
2020 TMDL target of 25 µg/L is annual average to be attained by 2020

Bold represents current monitoring year July 2018-June 2019

Canyon Lake Chlorophyll – 2018-2019



Canyon Lake Chlorophyll – Integrated Historic Data



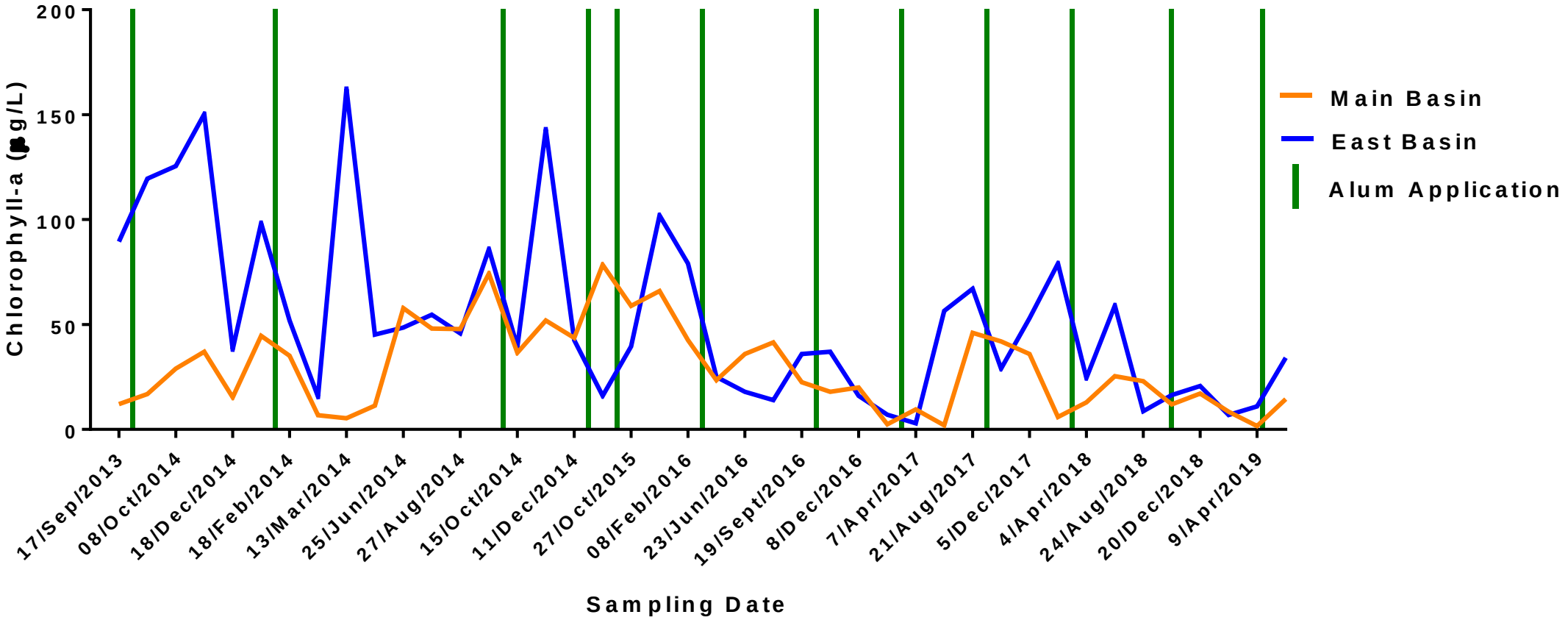
No data available from June 2012-July2015

2015 TMDL target of 40 µg/L is annual average to be attained by 2015

2020 TMDL target of 25 µg/L is annual average to be attained by 2020

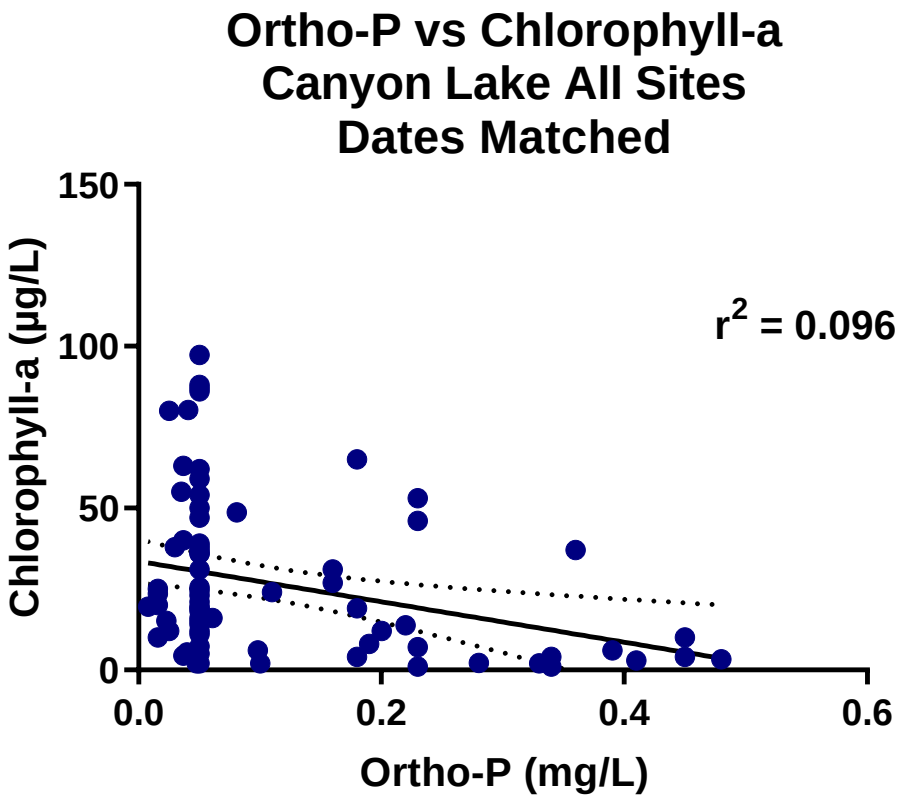
Bold represents current monitoring year July 2018-June 2019

Alum Effectiveness – Canyon Lake Chlorophyll-a

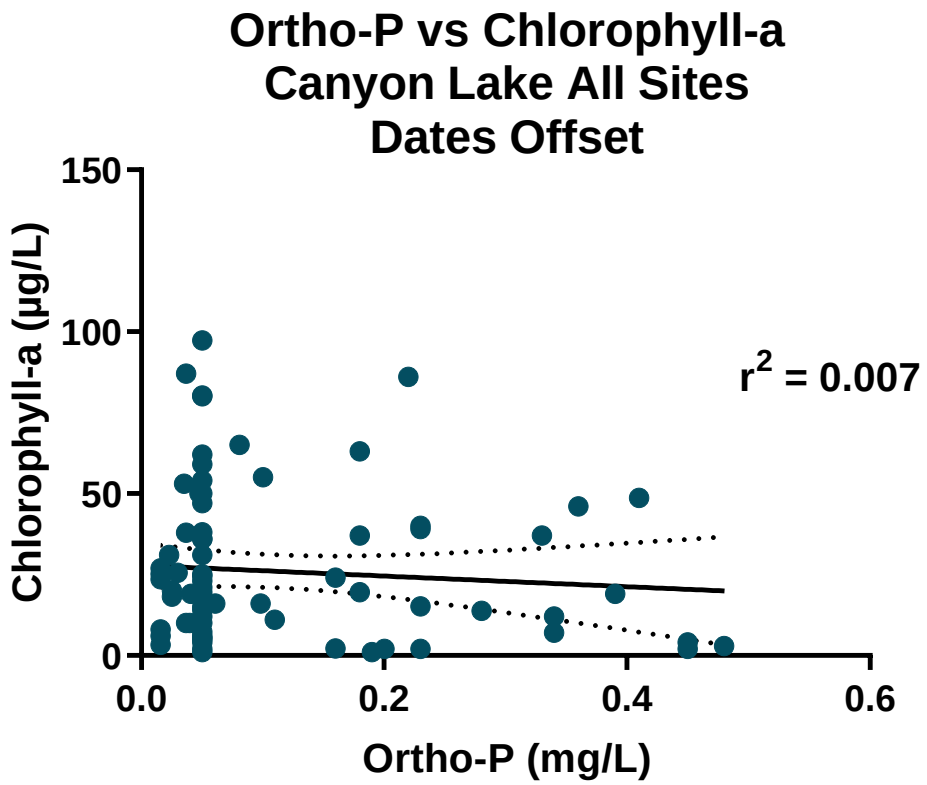


* Note that x-axis does not include dates between sampling (not to scale)
* Alum applied in February 2015, but water not sampled again until October 2015

Influence of Dissolved Phosphorus on Chlorophyll-a



Ortho-P vs. CHL measured during same event

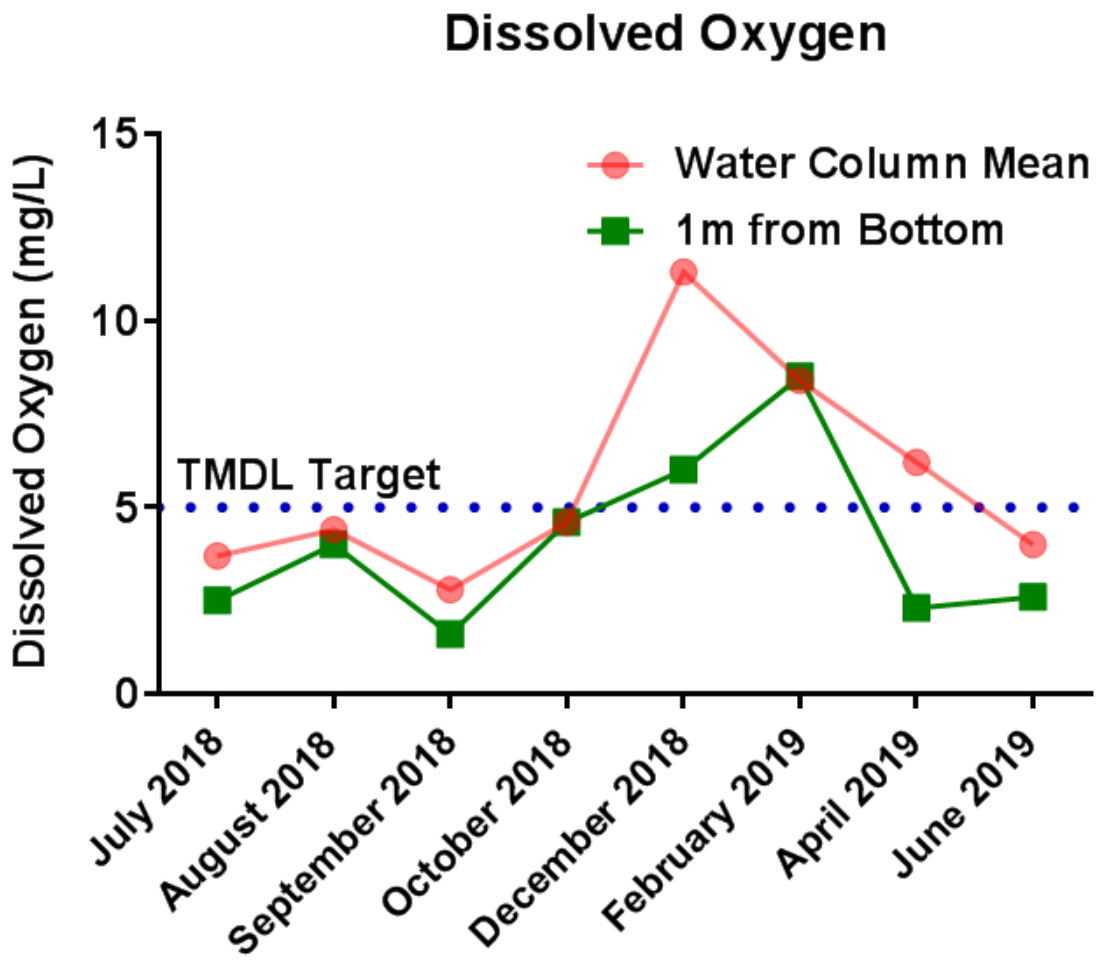


Ortho-P vs. CHL measured in subsequent month

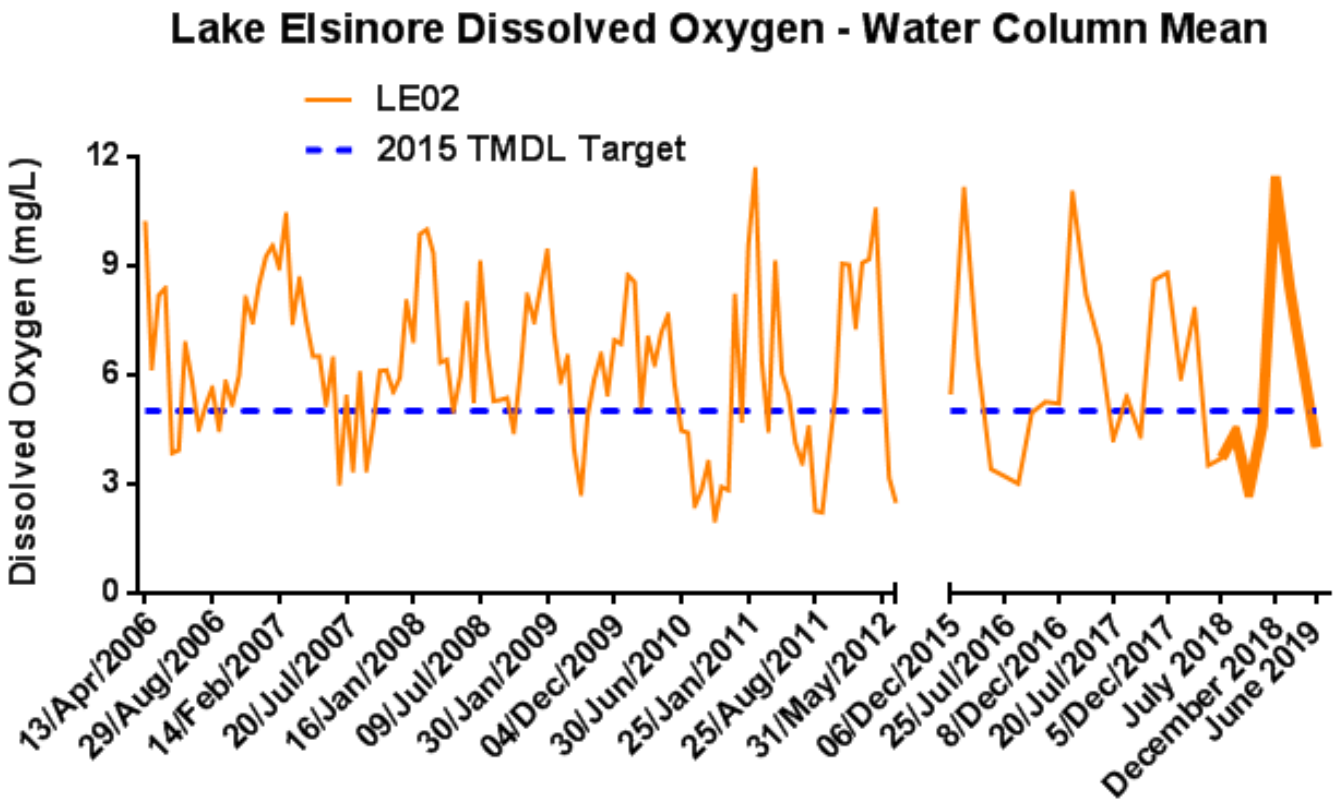
Lake Elsinore and Canyon Lake TMDL Water Quality Monitoring Update – 2018-19 Summary

Dissolved Oxygen Monitoring

Lake Elsinore Dissolved Oxygen – LE02 Water Column Mean vs. 1m from Bottom 2018-2019



Lake Elsinore Dissolved Oxygen – LE02 Water Column Mean Historic Data

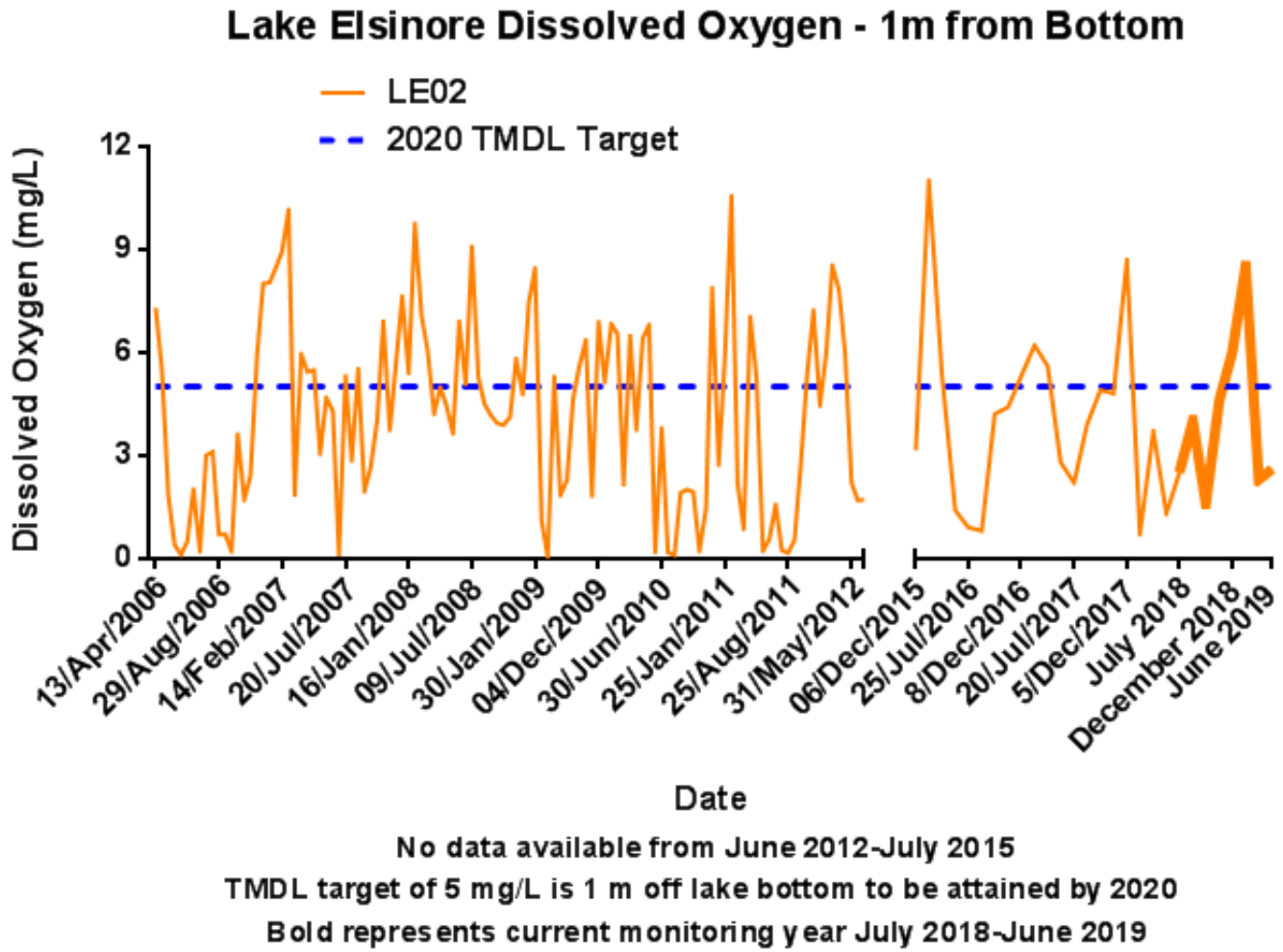


No data available from June 2012-July 2015

TMDL target of 5 mg/L is depth average to be attained by 2015

Bold represents current monitoring year July 2018-June 2019

Lake Elsinore Dissolved Oxygen – LE02 1m from Bottom Historic Data



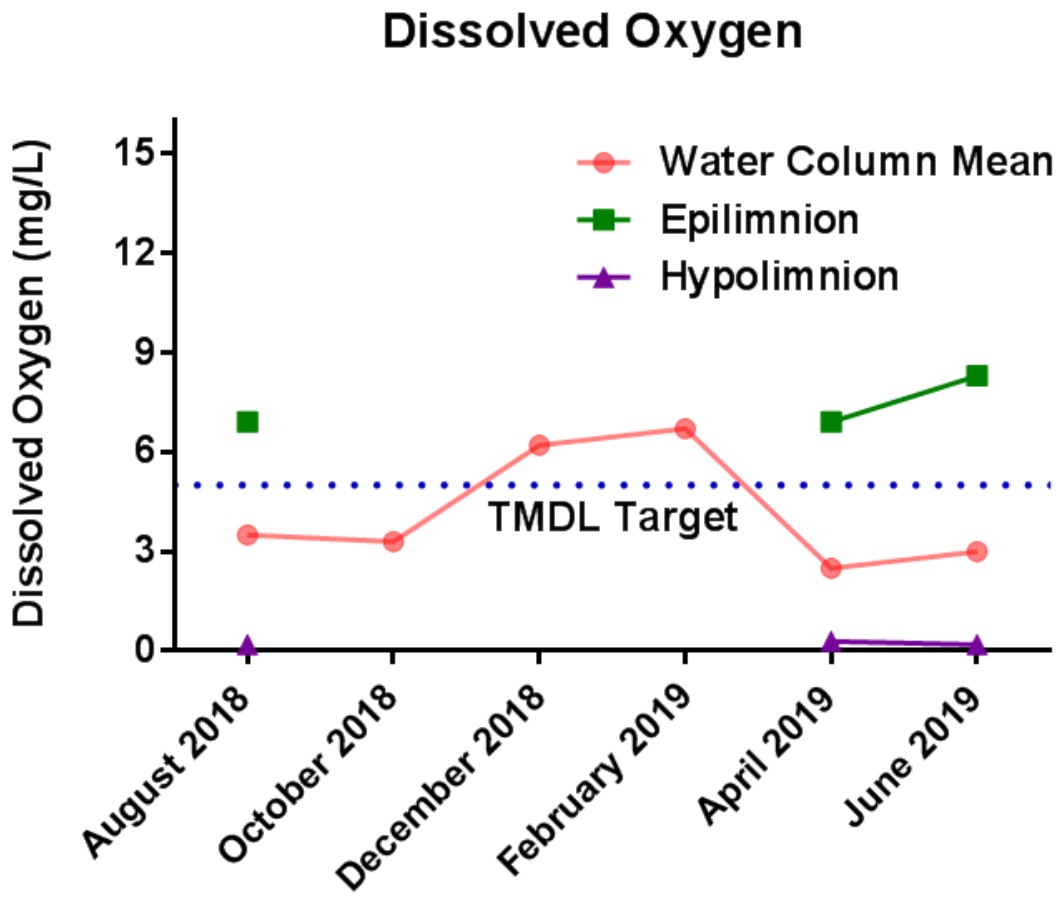
No data available from June 2012-July 2015

TMDL target of 5 mg/L is 1 m off lake bottom to be attained by 2020

Bold represents current monitoring year July 2018-June 2019

Canyon Lake Dissolved Oxygen – Main Basin Epilimnion vs. Hypolimnion 2018-2019

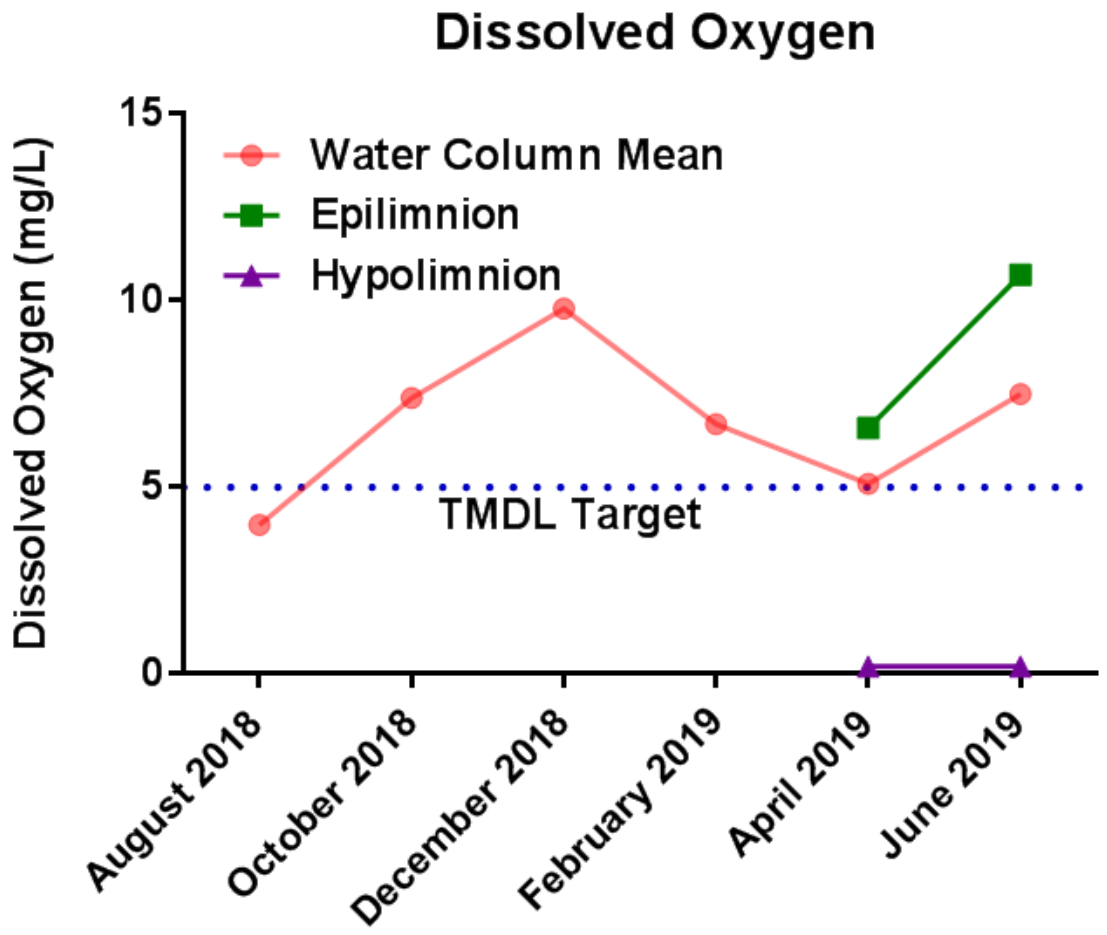
Mean of Sites CL07 & CL08



No stratification in October, December or February
Lake not sampled in July 2018

Canyon Lake Dissolved Oxygen – East Basin Epilimnion vs. Hypolimnion 2018-2019

Mean of Sites CL09 & CL10



No stratification in August, October, December or February
Lake not sampled in July 2018

Questions?

Summary of Lake Elsinore Fisheries Management Efforts

Fisheries Management Monitoring

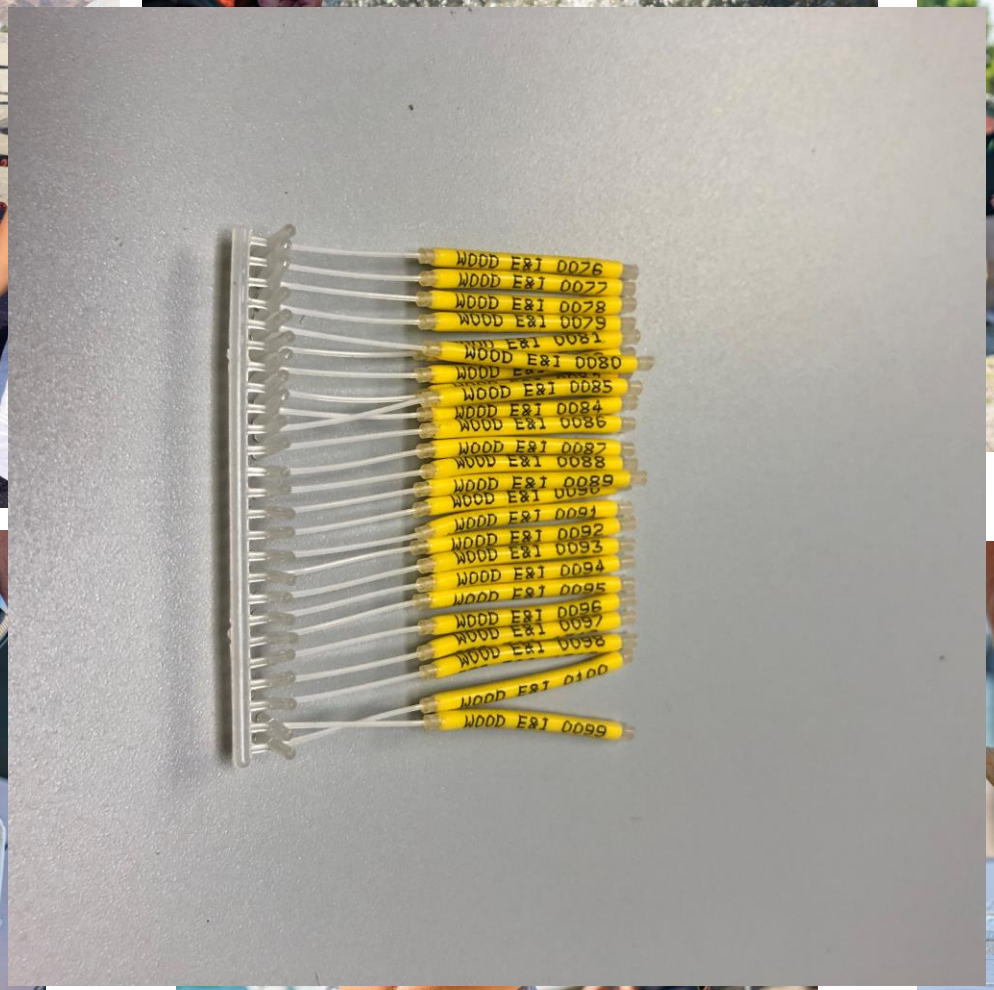
Lake Elsinore Fisheries Management

- Tasks Complete to Date
  - First 2 two beach seine events – 9/4 and 9/24
  - Collection of some fish for tissue analysis (Bluegill, LM Bass)
  - First zooplankton / phytoplankton collection – 8/27
- Future Tasks
  - Otter trawl – October 8
  - Purse seine – October 9
  - Last beach seine – October 15
  - Zooplankton / Phytoplankton collections – November 2019, February 2020
- Data Analysis – January through May 2020
- Report Preparation – April through June 2020

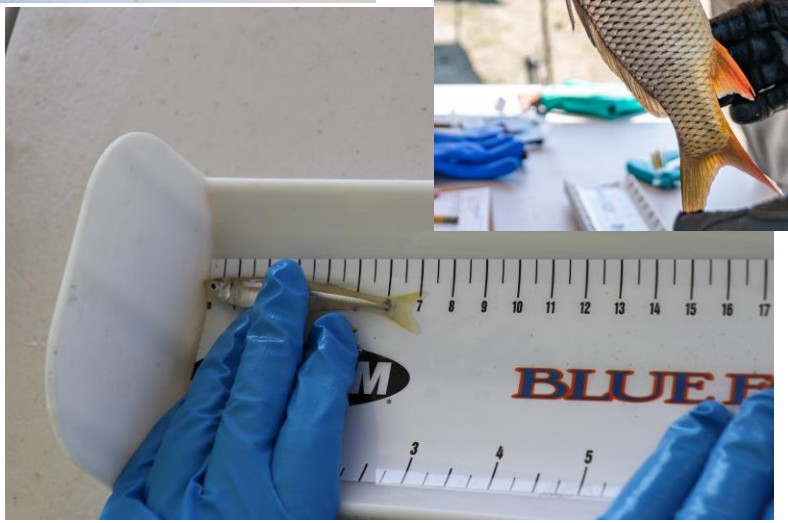
Lake Elsinore Fisheries Management - Fish

Lake Elsinore Fisheries Management - Fish

Lake Elsinore Fisheries Management - Fish



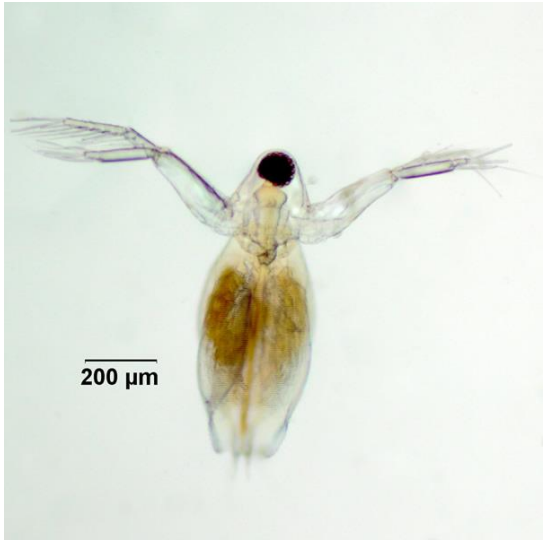
Lake Elsinore Fisheries Management - Fish



Lake Elsinore Fisheries Management - Zooplankton

Acanthocyclops robustus

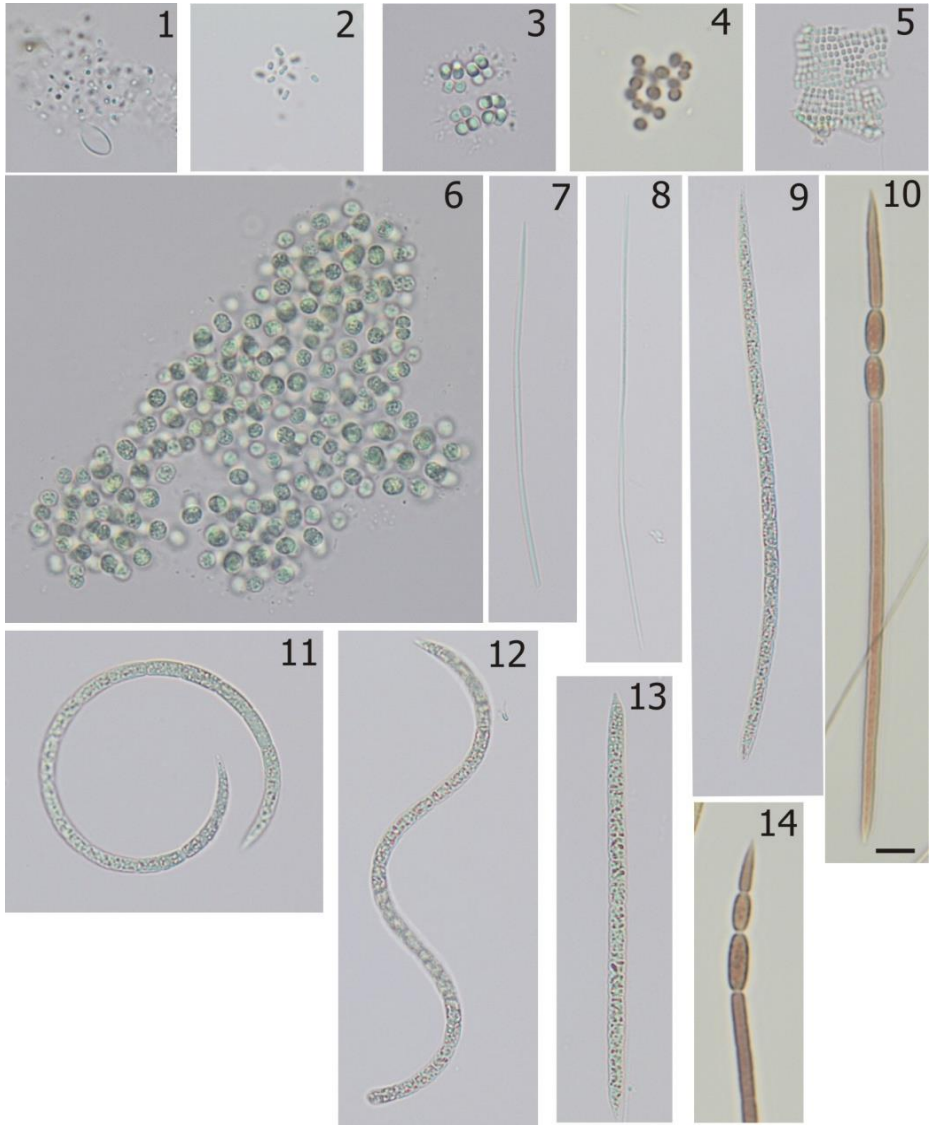
Daphnia sp.



Diaphanosoma sp.

Still awaiting rotifer data

Lake Elsinore Fisheries Management - Phytoplankton

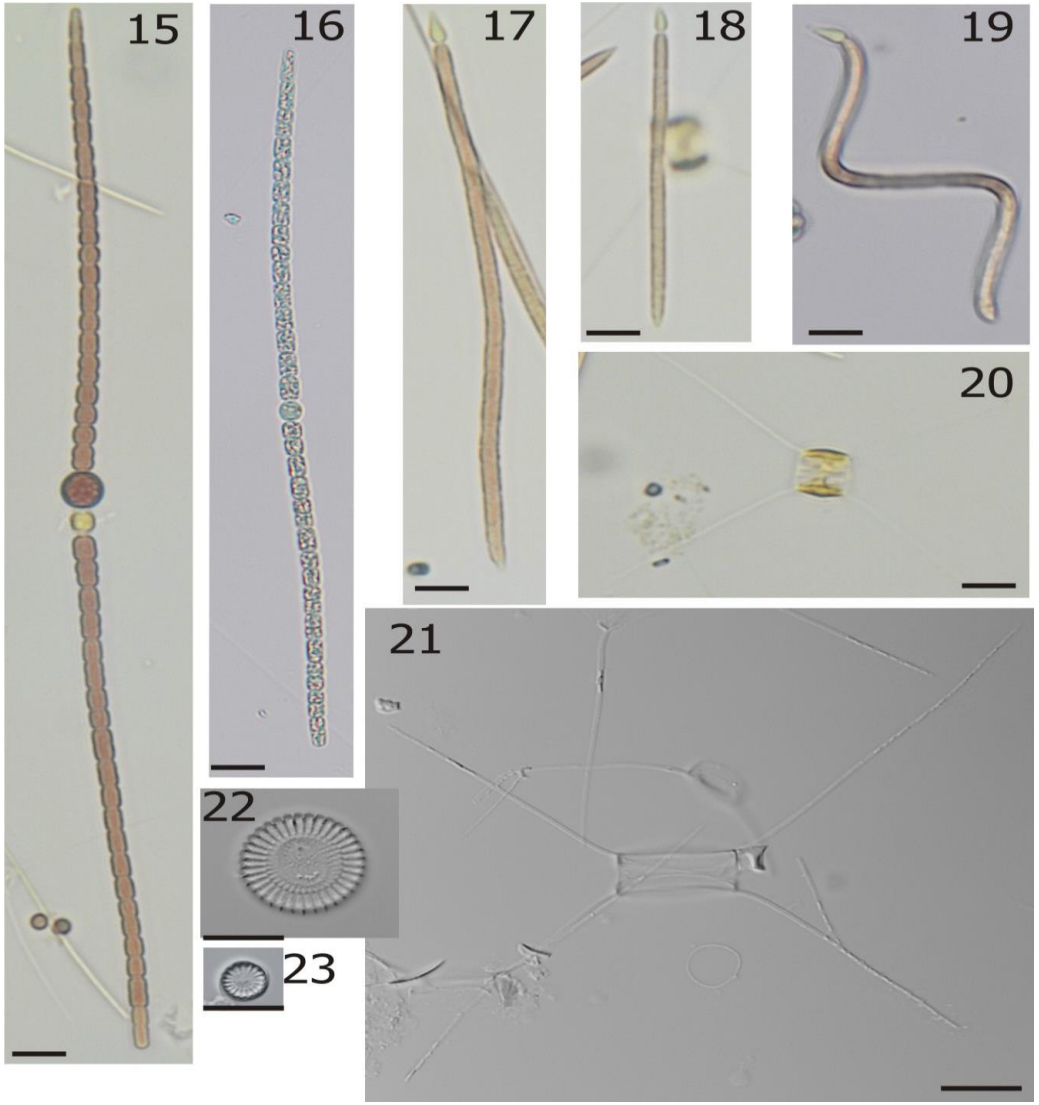


Cyanobacteria

1. *Aphanocapsa delicatissima*
2. *Aphanothece minutissima*
3. *Eucapsis parallelepipedon*
4. *Merismopedia tenuissima*
5. *Chroococcus disperses*
6. *Microcystis* cf. *aeruginosa*
7. *Pseudanabaena* cf. *acicularis*
8. *Planktolyngbya minor*

9 – 13. Raphidiopsis sp.

Lake Elsinore Fisheries Management - Phytoplankton



Diatoms

15-16. Sphaerospermopsis aphanizomenoides

17-19. Cylindrospermopsis raciborskii

20-21. Chaetoceros muelleri

22. Cyclotella meneghiniana

23. Cyclotella atomus

Back Up Slides

Summary of 2008-2019 Nutrient Concentrations

Monitoring Year	Site 3 - Salt Creek		Site 4 - San Jacinto River		Site 30 - Canyon Lake Spillway	
	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)	TP (mg/L)
2008-2009*	3.0/3.1	0.8/1.3	1.4/3.1	0.7/1.5	NS	NS
2009-2010*	1.5/1.9	0.6/1.0	1.6/3.2	0.5/1.2	0.7/1.3	0.6/0.8
2010-2011*	1.5/2.2	0.4/0.5	1.4/2.2	0.7/1.9	0.9/1.5	0.5/0.9
2011-2012	1.9	0.3	2.2	0.5	NS	NS
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

*Values shown for nutrient concentrations are minimum/maximum
NS-Not sampled

Summary of 2008-2019 Nutrient Loads

Monitoring Year	Site 3 - Salt Creek			Site 4 - San Jacinto River			Site 30 - Canyon Lake Spillway		
	Flow (Mgal)	TN (kg)	TP (kg)	Flow (Mgal)	TN (kg)	TP (kg)	Flow (Mgal)	TN (kg)	TP (kg)
2008-2009*	529	6,085/6,125	1,541/2,642	1,042	5,323/12,145	2,682/5,954	NA	NS	NS
2009-2010*	1,282	7,474/9,180	2,960/4,804	2,681	14,716/32,680	4,668/12,382	62	167/294	137/188
2010-2011*	1,946	5,112/7,484	1,370/1,704	3,269	7,690/12,124	4,041/10,664	1,302	2,035/3,556	1,029/2,102
2011-2012	249	1,843	238	277	2,338	542	133	NS	NS
2012-2013	147	1,025	180	424	3,341	822	114	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

*Values shown for nutrient loads are minimum/maximum
NS-Not Sampled
NA-Not Available

Summary of 2018-2019 Monthly Flow

July 2018-June 2019 Mean Monthly Flow (cfs) [a]	Site 3 - Salt Creek at Murrieta Road (11070465)	Site 4 - San Jacinto River at Goetz Road (11070365)	Site 6 - San Jacinto River at Ramona Expressway [b] (11070210)	Site 30 - Canyon Lake Spillway (11070500)	Site 1 - San Jacinto River at Cranston Guard Station (11069500)
July	0.00	0.00	0.00	0.00	0.01
August	0.00	0.00	0.00	0.00	0.00
September	0.00	25.65	0.00	0.00	0.00
October	1.65	2.53	0.00	0.06	0.00
November	0.46	4.37	0.00	0.37	0.00
December	4.05	11.07	0.00	1.77	0.58
January	8.24	16.96	0.00	42.01	14.13
February	56.38	91.53	0.58	246.71	168.92
March	4.07	12.77	0.08	25.39	81.77
April	0.00	0.63	0.00	1.03	27.98
May	0.25	4.47	0.00	0.62	23.38
June	0.00	0.03	0.00	0.21	9.26
Mean Annual Flow (cfs)	**5.91**	**13.60**	**0.05**	**25.09**	**26.17**

a - This value characterizes the average instantaneous flow rate at the USGS station during both dry and wet weather conditions in a given month. Flow data after 10/29/2018 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, only local flows were observed.

Summary of 2018-2019 Rainfall

2018-2019 Monthly Rainfall (inches)	Lake Elsinore	Perris CDF	Pigeon Pass	Hemet / San Jacinto	Winchester
Jul	0.00	0.00	0.07	0.05	0.02
Aug	0.05	0.00	0.06	0.00	0.00
Sep	0.02	0.00	0.00	0.00	0.00
Oct	1.33	0.79	0.93	0.46	0.69
Nov	0.62	1.16	1.26	1.30	1.07
Dec	1.57	1.35	1.27	1.57	1.22
Jan	2.50	2.45	3.20	2.49	2.03
Feb	6.02	5.16	7.19	6.75	5.38
Mar	1.59	1.42	2.74	1.64	2.20
Apr	0.00	0.00	0.06	0.40	0.00
May	0.68	1.05	1.72	1.61	0.76
Jun	0.00	0.00	0.02	0.02	0.00
Annual Rainfall (Inches)	**14.38**	**13.38**	**18.52**	**16.29**	**13.37**