Lake Elsinore and San Jacinto Watersheds Authority

WATER QUALITY REPORT

for the Canyon Lake Alum Treatment Project

Monitoring Period: Fall 2013 to Spring 2014

July 2014

MWH®

BUILDING A BETTER WORLD

Canyon Lake Alum Treatment Project

Water Quality Report

Monitoring Period: Fall 2013 to Spring 2014

July 2014

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

Number **Page**

Canyon Lake Water Quality Monitoring Report Monitoring Period: Fall 2013 to Spring 2014

EXECUTIVE SUMMARY

To evaluate the effectiveness of alum to control nutrients and resultant algae blooms in Canyon Lake, participants in the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Load (TMDL) Task Force[1] (Task Force) are implementing an alum application project. This project will include up to five alum applications to the lake, in the Main body of the lake and the East Bay. Water quality monitoring at four stations will be used to establish the effectiveness of the project for phosphorus removal, and the resultant effect on algal concentrations and water quality.

This report, summarizing the results of Canyon Lake water quality monitoring for the period from September 2013 to March 2014, has been prepared for the Lake Elsinore and San Jacinto Watersheds Authority (LESJWA) in compliance with the Water Quality Monitoring Plan for the Canyon Lake Alum Application Project (MWH, August 2013). The monitoring program is conducted by a team led by Dr. James Noblet, California State University San Bernardino (CSUSB), under the coordination of MWH Americas, Inc., Pasadena, California.

The first alum application to Canyon Lake was conducted from September 23 to 27, 2013; the second application was conducted from February 10 to 13, 2014. Water quality trend analysis will be conducted as the dataset expands after each monitoring event. Based on averages of samples integrated throughout the water column, post alum application results, as compared with the September 17, 2013 sample results, indicate 71 percent (main body) and 59 percent (East Bay) reduction in Soluble Reactive Phosphorus, and 40 percent reduction (main body) and 50 percent increase (East Bay) in Total Phosphorus. These trends reflect initial data only, and will be revisited based on the results of future sampling.

1 INTRODUCTION

Canyon Lake was formed in 1928 when the Canyon Lake Dam was constructed; the lake has three main sections – the relatively shallow East Bay (depths generally less than 10 ft), the deeper central body of the lake (depths in excess of 40 ft), and the area north of the causeway that connects with the San Jacinto River. EVMWD has used the reservoir as a potable water source since 1957 when the Canyon Lake water treatment plant began operation. Allowable recreational activities on Canyon Lake are defined in the lease agreement between EVMWD

[1] Lake Elsinore / Canyon Lake TMDL Task Force members participating in the Alum Treatment Project include: the County of Riverside, the City of Beaumont, the City of Canyon Lake, the City of Hemet, the City of Lake Elsinore, the City of Moreno Valley, the City of Menifee, the City of Murrieta, the City of Perris, the City of Riverside, the City of San Jacinto, Riverside County Flood Control and Water Conservation District, Elsinore Valley Municipal Water District, Western Riverside County Agricultural Coalition acting on behalf of the Agricultural Operators and Dairy Operators in the San Jacinto River Basin, the California Department of Transportation (CalTrans), the California Department of Fish and Wildlife, March Air Reserve Base Joint Powers Authority, the U.S. Air Force and the Lake Elsinore and San Jacinto Watersheds Authority.

(lessor) and the Canyon Lake POA (lessee) and include swimming, boating, fishing and water sports. Recreation occurs pursuant to an agreement to ensure that drinking water is not affected by these recreational activities. The POA is also allowed to construct and maintain boat docks, sea walls, bulkheads, launching ramps, bathing beaches, and other improvements necessary or desirable for complete utilization of the lake. The number of people using the lake for recreation is limited since Canyon Lake is a gated community of approximately 4,800 homes.

Canyon Lake is listed on the Clean Water Act Section 303(d) list as impaired for excessive nutrients and high bacteria concentrations. Consequently, the Santa Ana Regional Water Quality Control Board (Regional Board) adopted Resolution No. R8-2004-0037 in December 2004 to amend the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) to incorporate TMDLs for Lake Elsinore and Canyon Lake. The TMDLs address beneficial use impairment due to excessive nutrients (phosphorus and nitrogen) discharged to the lakes from various sources. Per the Basin Plan, designated beneficial uses for Canyon Lake are municipal and domestic supply, agricultural supply, groundwater recharge, contact and non-contact recreation, warm freshwater habitat, and wildlife habitat. Draft TMDLs to address beneficial use impairment were released for public review in March 2004 and revised in September 2004. On December 20, 2004, the Regional Board adopted Resolution No. R8-2004-0037, amending the Basin Plan to incorporate nutrient TMDLs for Lake Elsinore and Canyon Lake. The TMDLs were subsequently approved by the State Water Resources Control Board, the State Office of Administrative Law and the U.S. Environmental Protection Agency (USEPA).

2 OBJECTIVE

The objective of the monitoring program is to collect water quality data from Canyon Lake before and after application of alum. Results will be used to describe trends in Canyon Lake water quality conditions from 2013 to 2015.

3 MATERIALS AND METHODS

From September 17, 2013 to December 18, 2013, and again from February 4, 2014 to March 20, 2014, lake water samples were collected by a team led by Dr. James Noblet and sample analysis was conducted at Dr. Noblet's laboratory at CSUSB. The Canyon Lake Marine Patrol provided watercraft and pilots for the sampling team.

3.1 Sampling Stations and Sampling Frequency

Pre-alum treatment monitoring for the first application was conducted on Canyon Lake on September 17, 2013. Alum application was conducted from September 23 to 27, 2013 and then again on February 10 to 13, 2014. The first round of post-alum treatment water quality sampling occurred on October 1, October 8, October 15 and after lake turnover on December 18, 2013. The second round of monitoring occurred on February 4, February 18, March 6, March 13 and March 20, 2014. Four sampling stations were selected to reflect different lake conditions **Figure 1**, **Table 1**:

- C7 – deepest part of the lake near the dam - generally strongly stratified during the summer
- C8 – mid-lake, main body of Canyon Lake - most reflective of mid-lake conditions

- C9 (Roadrunner Beach) and C10 (Indian Beach) – shallow sites within East Bay that receive some local nuisance runoff as well as discharges from Salt Creek during periods of rainfall and runoff

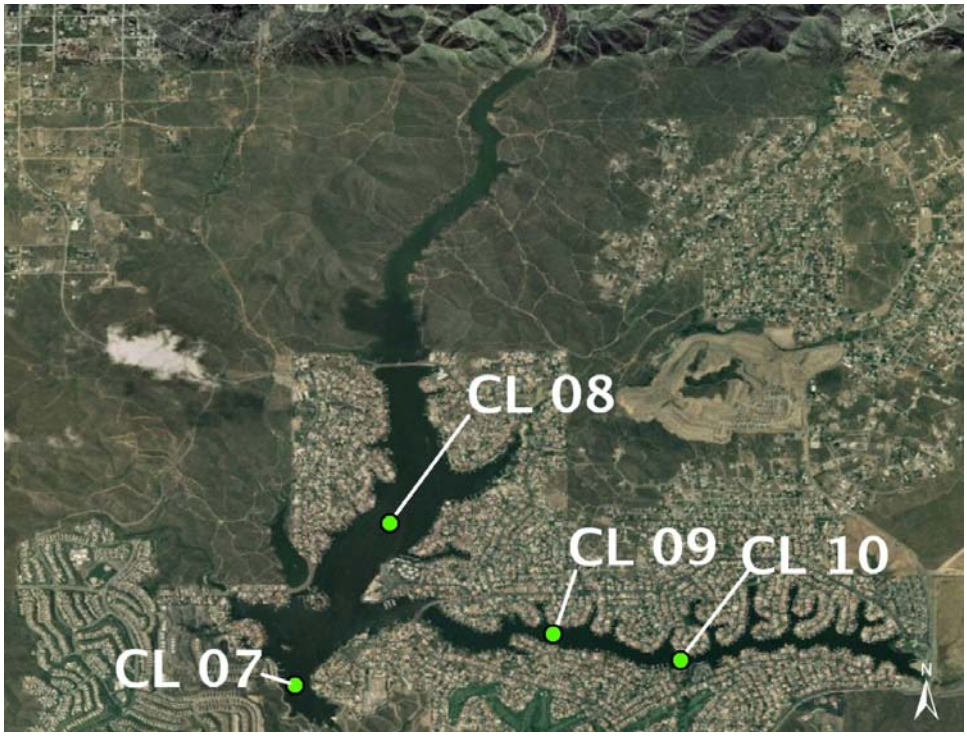
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline. Samples were collected in the morning hours (approximately 0800 to 1200).

Table 1
Location of Water Quality Sampling Stations

Station ID	Station Location (latitude / longitude)
7 - Dam	33 deg 40.675 N / -117 deg 16.517 W
8 – Mid-Lake	33 deg 41.296 N / -117 deg 16.155 W
9 – Roadrunner Beach	33 deg 40.874 N / -117 deg 15.528 W
10 – Indian Beach	33 deg 40.779 N / -117 deg 15.046 W

Station locations were identified using a handheld GPS unit.

Figure 1
Canyon Lake Water Quality Monitoring Locations



3.2 Sampling

The sampling program includes monitoring of 18 water quality parameters – 7 field parameters, 11 laboratory parameters. Secchi depth (in cm) was measured with a standard secchi disk. Other field parameters were measured using a Hydrolab DataSonde 5 Multiprobe (DS-5) and Surveyor Data Display. Temperature, conductivity, dissolved oxygen, pH, turbidity, and oxidation-reduction potential were measured from surface to bottom at 1-meter intervals. For other parameters, samples were collected for subsequent laboratory analysis from the surface/epilimnion (0.5 – 1.0 m), hypolimnion (below the thermocline), and near bottom (within approximately 50 cm of the sediments). Depth integrated (0 – bottom) samples were obtained by mixing 1 liter samples collected at 1 meter intervals; samples were collected with a van Dorn sampler. Collection of the floc ("protosediment") on the lake bottom was avoided.

Water samples were stored in opaque brown plastic bottles on ice and returned to CSUSB. For analysis of the dissolved fraction, samples were filtered through 0.7-micron pure glass fiber filter and acidified as appropriate. All samples were refrigerated at 4 degrees Celsius until analysis.

Table 2 summarizes sample collection and analysis methods for each parameter of interest.

4 RESULTS

4.1 Canyon Lake Conditions September 2013 to March 2014

4.1.1 Meteorological Conditions

Meteorological conditions on the sample dates and during the sampling period (September through March 2014) are summarized in **Table 3** and **Table 4**. A major rain event (approximately 2.8 inches) occurred from February 27 to March 1, 2014.

Table 2
Water Quality Sample Collection and Analysis

Parameter	Sample Collection	Sample Analysis	QA/QC Notes
FIELD MEASUREMENTS			
Temperature	Vertical profile at each station (4 stations) (1 m intervals)	Hydrolab DataSonde 5 and Surveyor	• Hydrolab is calibrated against solutions of known pH, DO and turbidity each morning. Calibration check values are recorded on a Hydrolab calibration sheet. • Concentration of DO standard is calculated from known temperature-dependence of O_2 solubility in water corrected for local atmospheric pressure/elevation; over a lab temperature (T) range of 20-25 °C and elevation of 1600 ft above MSL. • Turbidity is calibrated against a 40 NTU Hach StablCal Primary turbidity standard.
Dissolved Oxygen (DO)			
pH			
Turbidity			
Conductivity			
Oxidation Reduction Potential			
Secchi Depth (transparency)	1 reading per station (4 stations)	Visual observation in field	• Measured to nearest 0.01 m
LABORATORY PARAMETERS			
Total Phosphorus (TP)	Three samples per station (3 stations): Epilimnion Hypolimnion Depth Integrated (when lake is stratified) and One single depth-integrated sample at East Bay station CL10	SM 4500-P F (total); Lachat 10-115-01-4-B SM 4500-P C (SRP)	• Laboratory duplicates at a frequency of no less than one per 10 samples. Duplicate analyses of field splits will be used to assess the precision of analytical methods. Duplicate analysis of a sample on the same instrument will provide instrumental precision data. • Reference materials to be run with each batch of laboratory samples. • Spike samples to be run at a frequency of no less than one per 20 samples or one per batch (whichever is more frequent). • Matrix spike replicates to be run at a frequency of no less than one duplicate per 20 samples or one per batch (whichever is more frequent). • Laboratory and field blanks. • Samples for analysis of dissolved constituents will be filtered and acidified as appropriate.
Total Dissolved Phosphorus (TDP)			
Soluble Reactive Phosphorus (SRP)			
Total Nitrogen (TN)		SM 4500-N C; Lachat 10-107-04-4-B SM 4500-NH3 D	
Total Dissolved Nitrogen (TDN)			
Ammonia (NH_3)			
Aluminum – dissolved (Al_{diss}) Aluminum – total (Al_{total})		EPA 200.9	
Total Dissolved Solids (TDS)		SM 2540 C	
Total Suspended Solids (TSS)		SM 2450D	
Chlorophyll *a*		SM 10200 H	

Source for laboratory methods: American Public Health Association, American Waterworks Association, and Water Environment Federation. 1992 and 2005. Standard Methods for the Examination of Water and Wastewater, 18th and 21st Editions.

Table 3
Canyon Lake Meteorological Conditions
for Sample Dates from September 2013 to March 2014

Sample Date	Precipitation during day of sampling	Wind Conditions during sampling	Air Temperature at 9:00 a.m. (degrees F)
9/17/2013	0	Calm	74.0
10/1/2013	0	Calm – 1 mph SE	68.6
10/8/2013	0	Calm – 3 mph S	64.7
10/15/2013	0	Calm – 2 mph SE	69.8
12/18/2013	0	Calm	57.2
2/4/2014	0	Calm – 3 mph SE	49.4
2/18/2014	0	Calm – 3 mph E/SE	51.4
3/6/2014	0	Calm – 4 mph E/S	63.1
3/13/2014	0	Calm – 3 mph S/SE	54.2
3/20/2013	0	Calm – 2 mph E/SE	60.5

Source: http://weathercurrents.com/lakeelsinore

Table 4
Monthly Precipitation for September 2013 to March 2014

Month	Precipitation (inches)
September 2013	0
October 2013	0.35
November 2013	0.36
December 2013	0.52
January 2014	0.01
February 2014	2.41
March 2014	0.52

Source: http://weathercurrents.com/lakeelsinore

4.2 Water Quality

Results of water quality field analyses and laboratory analyses conducted by CSUSB are summarized in **Tables 6** through **21** and **Figures 2** through **17**. **Table 5** provides an overall summary of water quality conditions. Average data for the July 2011 to June 2012 sampling period are provided for reference in **Table 5**. Average data are also graphed for most parameters; for the period of October 2009 to June 2012.

Table 5
Summary of Canyon Lake Water Quality

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Target to be Attained	September 2013 – March 2014 Results					
			Main Basin – Stations 7 and 8			East Bay – Stations 9 and 10		
			Pre-Alum Application Mean (Sept 17, 2013)	Post-Alum Application Mean (October 1, 2013 thru March 20, 2014)	Annual Mean July 2011 – June 2012	Pre-Alum Application Mean (Sept 17, 2013)	Post-Alum Application Mean (October 1, 2013 thru March 20, 2014)	Annual Mean July 2011 – June 2012
Dissolved Oxygen (mg/L)	Not less than 5 mg/L above the thermocline	2015	8.22	9.57	5.93 (station 7 only)	6.72	10.35	7.96
	Not less than 5 mg/L daily average in hypolimnion	2020	0.04	1.79	1.46 (station 7 only)			
pH	6.5 - 8.5	---	7.97	7.79	8.10	8.30	8.35	8.65
Ammonia N (NH_4-N) (mg/L) (integrated samples)	See Toxicity stds	2020	1.22	0.52	0.39	0.96	0.14	0.34
Total Nitrogen (TN) (mg/L) (integrated samples)	Annual average 0.75 mg/L	2020	2.04	3.01	1.60	2.31	2.77	1.79

Table 5 (continued)
Summary of Canyon Lake Water Quality

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Target to be Attained	September 2013 – March 2014 Results					
			Main Basin - Stations 7 and 8			East Bay – Stations 9 and 10		
			Pre-Alum Application Mean (Sept 17, 2013)	Post-Alum Application Mean (October 1, 2013 thru March 20, 2014)	Annual Mean July 2011 – June 2012	Pre-Alum Application Mean (Sept 17, 2013)	Post-Alum Application Mean (October 1, 2013 thru March 20, 2014)	Annual Mean July 2011 – June 2012
Total Phosphorus (TP) (mg/L) (integrated samples)	Annual average 0.1 mg/L	2020	0.43	0.26	0.49	0.28	0.42	0.43
Chlorophyll *a* (µg/L) (surface samples 0-2 m)	Annual average no greater than 40 µg/L Annual average no greater than 25 µg/L	2015	15.8	40.2	50.4	90.4	114.2	81.5
Chlorophyll *a* (µg/L) (integrated samples)		2020	12.1	21.6	52.6	89.6	91.9	96.7
Secchi Depth (cm)	---	---	108	107	129	34	54	86
Total Dissolved Solids (mg/L) (integrated samples)	700 mg/L	---	611	721	565	643	756	733

Table 6
Temperature (degrees Celsius)

Station	Depth Class (m)	Canyon Lake Temperature (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C7	0.5		23.03	21.15	20.58	12.60	12.12	15.40	17.46	17.08	18.36
	1	26.86	23.03	21.16	20.62	12.61	12.12	15.30	17.42	17.11	18.37
	2	26.84	23.04	21.16	20.60	12.34	12.10	14.82	16.37	17.10	18.34
	3	26.86	23.04	21.16	20.28	12.03	12.10	14.75	15.18	17.08	18.29
	4	26.85	23.04	21.15	19.97	11.98	12.08	13.65	15.01	16.75	17.29
	5	26.84	23.01	21.15	19.87	11.95	12.08	12.78	14.83	15.84	16.25
	6	26.81	22.90	21.15	19.84	11.94	12.06	12.33	14.60	14.96	15.05
	7	22.36	21.42	21.13	19.65	11.93	12.06	12.26	14.43	14.51	14.42
	8	17.46	17.91	19.14	19.06	11.91	12.05	12.23	14.08	14.16	13.79
	9	16.72	15.54	15.55	16.81	11.88	12.03	12.19	13.44	13.66	13.22
	10	15.34	14.82	14.92	15.33	11.87	11.90	12.16	12.84	13.18	13.04
	11	14.69	14.46	14.45	14.77	11.85	11.78	12.16	12.66	13.03	12.95
	12	14.37	14.27	14.33	14.47	11.81	11.75	12.16	12.55	12.87	12.87
	13	14.05	14.16	14.18	14.26	11.81	11.74	12.15	12.48	12.69	12.86
	14	13.90							12.43	12.65	12.83
	15								12.42	12.59	
C8	0.5		23.24	21.61	20.28	12.82	12.93	15.28	17.65	16.88	19.06
	1	27.51	23.27	21.61	20.28	12.79	12.83	15.27	17.52	16.90	18.96
	2	27.50	23.17	21.56	20.21	12.34	12.59	15.13	15.62	16.90	18.74
	3	27.33	23.13	21.54	20.04	12.01	12.42	14.86	15.05	16.90	18.44
	4	27.30	23.09	21.52	19.97	11.94	12.46	13.00	14.97	16.29	17.42
	5	27.13	23.04	21.49	19.91	11.91	12.38	12.60	14.82	15.51	15.60
	6	26.11	22.88	21.32	19.76	11.90	12.12	12.40	14.20	14.81	15.34
	7	22.59	21.90	20.87	19.64	11.87	11.99	12.30	14.56	14.31	14.62
	8	19.61							13.81	13.95	14.11
	9								13.07		

Station	Depth Class (m)	Canyon Lake Temperature (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C9	0.5		22.28	21.07	19.63	11.83	12.83	16.30	16.53	17.18	18.87
	1	27.58	22.31	21.03	19.59	11.70	12.73	15.80	16.58	17.18	18.53
	2	26.76	22.18	20.68	19.32	11.06	12.60	15.50	15.77	17.06	18.17
	3	26.46	22.17	20.67	19.17	11.07	12.56	14.20	14.14	16.42	18.01
	4	26.43	22.14	20.62	19.15	11.04	12.28	12.70	14.03	14.74	16.04
	4.5					10.90					
	5	25.79	22.15						14.02		14.72
	6	21.87							13.85		13.79
	7	17.88									
C10	0.5		22.63	21.18	19.74	11.95	13.30	16.00	16.96	17.21	19.47
	1	27.34	22.47	21.16	19.64	11.86	12.95	15.60	16.56	17.18	18.79
	2	26.86	22.06	20.73	19.31	11.57	12.92	15.20	14.52	16.87	18.47
	3	26.56							13.94	16.20	17.78
	4									15.02	16.32

Table 7
Dissolved Oxygen (DO) (mg/L)

Station	Depth Class (m)	Canyon Lake Dissolved Oxygen (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C7	0.5		5.81	3.06	10.02	6.26	9.48	19.12	16.81	8.85	13.60
	1	8.10	5.72	2.49	10.23	6.24	9.46	19.78	16.87	8.68	13.54
	2	8.12	5.75	2.47	10.25	4.43	9.43	20.65	12.14	8.66	13.57
	3	8.17	5.84	2.76	6.13	3.02	9.11	19.35	6.08	8.65	13.54
	4	8.25	5.70	2.75	4.33	2.71	9.06	8.40	5.61	7.35	3.69
	5	8.04	5.07	2.99	4.11	2.58	9.02	3.45	5.25	3.56	0.00
	6	7.92	2.82	3.36	3.80	2.53	9.15	1.62	3.73	0.00	0.00
	7	0.05	0.12	3.53	0.75	2.35	9.23	1.10	3.00	0.00	0.00
	8	0.04	0.04	0.12	0.12	2.28	9.27	0.82	0.12	0.00	0.00
	9	0.04	0.06	0.05	0.04	2.87	8.60	0.59	0.00	0.00	0.00
	10	0.04	0.05	0.05	0.05	2.96	8.15	0.16	0.00	0.00	0.00
	11	0.04	0.05	0.05	0.05	2.91	0.33	0.12	0.00	0.00	0.00
	12	0.04	0.05	0.05	0.05	3.18	0.26	0.11	0.00	0.00	0.00
	13	0.04	0.05	0.05	0.05	3.23	0.20	0.11	0.00	0.00	0.00
	14	0.05							0.00	0.00	0.00
	15								0.00	0.00	
C8	0.5		6.96	6.34	9.17	7.90	14.76	18.80	12.62	7.69	14.52
	1	8.91	6.97	6.34	9.22	7.69	14.73	20.35	15.00	7.56	14.35
	2	9.12	6.67	6.14	9.04	5.26	12.35	20.15	10.78	7.52	13.93
	3	8.72	6.43	5.85	5.02	3.70	10.70	17.29	6.14	7.42	11.83
	4	8.39	6.40	5.71	3.12	3.40	10.03	3.74	5.80	5.48	3.90
	5	6.73	5.18	5.07	2.60	3.36	9.76	1.42	3.38	2.23	0.00
	6	0.15	1.61	0.52	0.52	3.45	5.09	0.47	1.31	0.00	0.00
	7	0.03	0.14	0.10	0.04	3.34	3.18	0.23	2.16	0.00	0.00
	8	0.05							0.00	0.00	0.00
	9								0.00		

Station	Depth Class (m)	Canyon Lake Dissolved Oxygen (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C9	0.5		9.41	8.85	10.55	10.86	14.17	20.23	11.96	14.73	14.43
	1	9.74	10.76	8.83	10.51	10.79	14.09	20.61	13.41	16.07	14.78
	2	9.62	9.72	8.34	10.11	8.10	13.95	17.43	10.07	15.08	14.29
	3	8.51	9.14	8.31	8.24	6.07	14.28	1.37	4.25	9.19	12.46
	4	8.09	7.49	8.99	6.44	5.53	9.04	0.29	2.55	0.00	1.84
	4.5					2.68					
	5	0.65	5.71						1.17		0.00
	6	0.52							0.00		0.00
	7	0.25									
C10	0.5		12.60	11.73	13.66	11.26	15.60	15.36	11.25	15.13	12.54
	1	11.78	13.03	12.25	13.51	10.72	15.44	15.69	12.62	15.57	13.58
	2	10.47	16.80	11.28	12.57	8.60	12.45	14.62	4.81	14.81	12.80
	3	7.56							2.48	8.49	9.61
	4									2.25	2.83

Table 8
pH (standard pH units)

Station	Depth Class (m)	Canyon Lake pH (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C7	0.5		7.68	7.47	8.36	7.43	8.22	8.94	9.03	8.32	8.88
	1	8.73	7.68	7.45	8.40	7.47	8.22	9.02	9.19	8.42	8.89
	2	8.73	7.69	7.46	8.37	7.36	8.21	8.96	8.71	8.46	8.90
	3	8.73	7.70	7.46	7.78	7.24	8.20	8.96	8.14	8.47	8.90
	4	8.73	7.68	7.47	7.62	7.22	8.19	8.28	7.90	8.30	8.16
	5	8.72	7.61	7.48	7.59	7.21	8.17	7.94	7.81	7.89	7.78
	6	8.70	7.45	7.51	7.57	7.24	8.19	7.64	7.90	7.60	7.60
	7	7.11	7.23	7.53	7.38	7.21	8.20	7.51	7.63	7.47	7.46
	8	7.11	7.30	7.18	7.30	7.20	8.23	7.46	7.50	7.39	7.34
	9	7.11	7.18	7.19	7.17	7.21	8.18	7.42	7.41	7.33	7.26
	10	7.10	7.11	7.17	7.18	7.20	7.80	7.39	7.37	7.27	7.23
	11	7.07	7.10	7.11	7.15	7.21	7.55	7.37	7.32	7.23	7.24
	12	7.01	7.08	7.09	7.09	7.21	7.42	7.36	7.30	7.20	7.18
	13	7.00	7.05	7.07	7.05	7.20	7.36	7.35	7.29	7.17	7.16
	14	6.96							7.26	7.16	7.14
	15								7.18	7.15	
C8	0.5		7.71	7.73	8.24	7.60	8.64	9.01	8.82	8.18	8.89
	1	8.76	7.71	7.73	8.23	7.55	8.66	9.04	8.99	8.21	8.89
	2	8.78	7.67	7.69	8.20	7.34	8.50	9.03	8.58	8.23	8.87
	3	8.75	7.65	7.67	7.62	7.22	8.37	8.82	7.99	8.24	8.74
	4	8.72	7.64	7.65	7.50	7.18	8.30		7.87	8.00	8.04
	5	8.51	7.55	7.62	7.46	7.18	8.25		7.66	7.71	7.73
	6	7.66	7.34	7.35	7.36	7.18	8.00		7.50	7.51	7.59
	7	7.12	7.19	7.31	7.34	7.17	7.64		7.46	7.41	7.46
	8	7.11							7.39	7.33	7.35
	9								7.33		

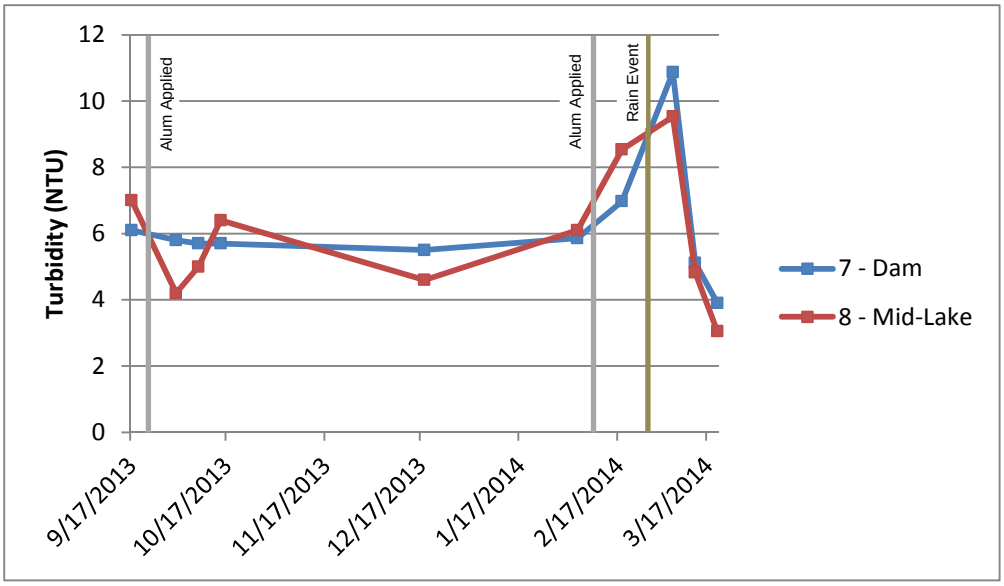
Station	Depth Class (m)	Canyon Lake pH (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C9	0.5		8.14	8.25	8.54	7.99	8.55	no data	8.67	9.00	9.25
	1	8.70	8.02	8.22	8.54	7.91	8.54		8.67	9.16	9.26
	2	8.71	7.83	8.17	8.42	7.62	8.57		8.26	9.16	9.21
	3	8.57	7.74	8.19	8.22	7.54	8.58		7.74	8.51	8.95
	4.5					7.52					
	4	8.50	7.49	8.27	7.95		7.83		7.47	7.76	8.03
	5	7.33	7.38						7.30		7.63
	6	6.98							7.23		7.34
	7	6.94									
C10	0.5		8.33	8.65	8.85	8.08	8.72	no data	8.49	9.10	9.10
	1	8.78	8.32	8.64	8.83	8.02	8.62		8.60	9.15	9.17
	2	8.66	8.20	8.57	8.69	7.81	8.51		7.65	9.09	9.10
	3	8.49							7.48	8.35	8.82
	4									7.92	8.21

Table 9
Turbidity (NTU)

Station	Depth Class (m)	Canyon Lake Turbidity (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C7	0.5		4.4	4.8	4.3	4.0	4.5	5.7	9.2	2.1	2.1
	1	3.3	4.4	5.4	4.2	3.5	4.5	6.0	9.2	2.3	2.2
	2	3.4	5.1	4.9	4.3	3.5	4.5	7.3	13.4	2.3	2.4
	3	3.5	4.0	5.2	3.6	4.3	4.7	6.3	9.5	2.2	2.1
	4	3.8	4.1	5.6	4.3	5.2	4.7	5.7	8.0	2.1	2.9
	5	4.3	5.0	5.5	4.0	5.2	5.1	6.2	7.3	2.6	3.9
	6	4.9	5.4	5.5	4.2	5.2	5.1	6.4	7.5	3.3	1.9
	7	13.6	7.2	5.1	9.9	5.5	5.3	7.4	6.9	3.3	3.2
	8	7.5	7.3	5.9	7.3	6.2	5.2	8.0	9.0	5.0	4.3
	9	6.8	6.5	5.6	6.7	5.9	5.6	7.5	16.7	7.5	4.6
	10	6.0	6.7	5.6	5.9	6.6	5.7	7.1	15.8	7.9	5.1
	11	5.7	6.9	6.3	5.8	6.6	7.3	7.0	13.1	7.9	6.1
	12	8.2	6.9	7.1	7.3	6.9	7.9	7.5	12.7	7.9	6.0
	13	6.5	7.6	7.0	7.6	8.6	11.9	9.5	11.0	8.0	5.8
	14	7.3							11.0	8.3	5.9
	15								13.6	9.1	
C8	0.5		3.3	4.0	5.9	4.9	7.2	6.7	7.8	4.5	2.0
	1	3.1	3.5	4.0	5.9	4.6	6.9	8.7	8.6	3.5	2.6
	2	3.5	3.7	4.3	5.6	3.9	5.9	10.2	8.5	3.0	2.8
	3	3.3	3.6	4.3	5.0	3.7	5.5		8.0	3.2	2.7
	4	3.6	3.9	4.6	4.8	4.6	5.5		7.8	3.1	2.2
	5	4.2	4.0	4.4	5.0	4.7	5.5		7.3	3.7	2.5
	6	14.9	4.8	7.9	9.6	4.7	5.4		7.6	5.0	2.5
	7	12.5	6.5	6.6	9.2	5.8	6.9		7.5	8.0	4.5
	8	10.5							9.3	9.4	5.6
	9								22.9		

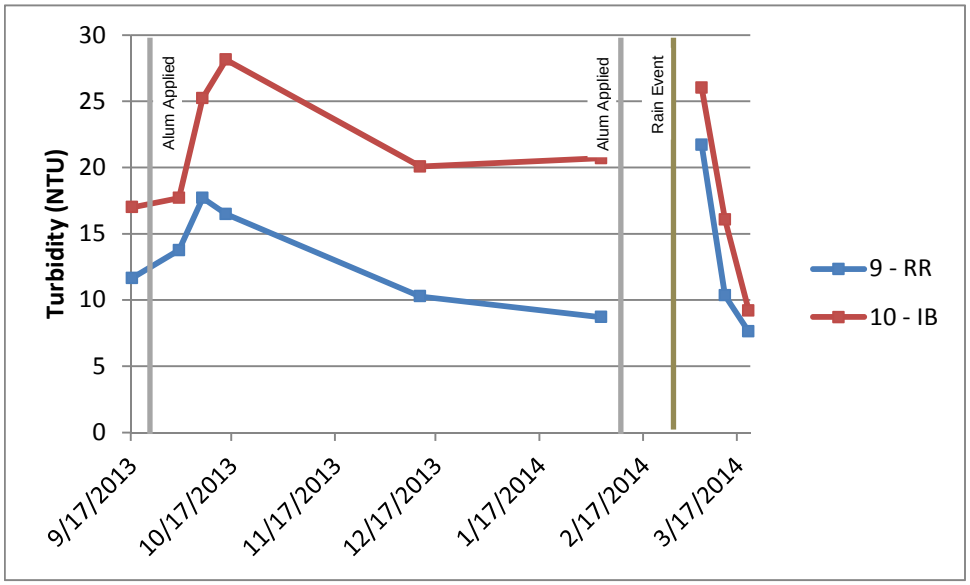
Station	Depth Class (m)	Canyon Lake Turbidity (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
C9	0.5		13.7	17.4	16.4	5.8	8.5	no data	17.5	15.5	7.1
	1	11.5	14.0	17.5	18.2	6.5	9.1		17.5	13.8	7.2
	2	13.1	12.6	17.5	15.8	7.4	8.9		16.0	7.6	7.0
	3	11.6	12.9	19.3	15.9	11.3	9.2		24.7	5.9	4.7
	4	11.9	13.1	16.8	16.1	14.2	7.8		22.8	8.9	7.4
	4.5					16.4					
	5	9.6	16.3						23.8		9.5
	6	12.2	13.7						29.7		10.4
	7	11.7									
C10	0.5		18.3	25.9	29.9	10.5	23.6	no data	21.3	13.0	8.9
	1	17.4	17.8	25.3	28.0	10.8	19.6		21.7	13.2	9.6
	2	16.8	17.0	24.5	26.5	38.9	18.9		26.4	9.0	8.4
	3	16.8							34.7	9.2	7.7
										35.9	11.4

Figure 2
Canyon Lake Main Body Turbidity (NTU)
September 2013 to March 2014



Station 7 is near the Canyon Lake Dam; Station 8 is Mid-lake in the Main Body of the lake.
Turbidity values are averages of data from throughout the water column.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Figure 3
Canyon Lake East Bay Turbidity (NTU)
September 2013 to March 2014



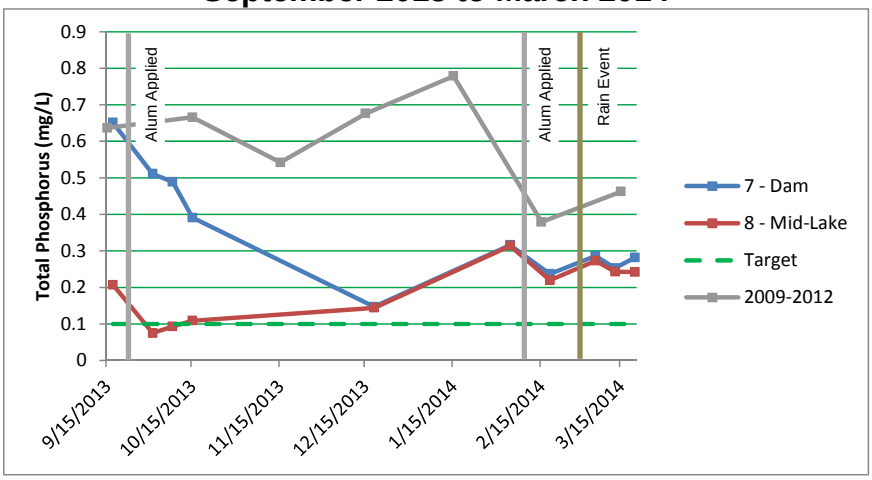
Station 9 is at Roadrunner Beach in the East Bay; and Station 10 is at Indian Beach in the East Bay.
Turbidity values are averages of data from throughout the water column.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Table 10
Total Phosphorus (mg/L)

Station	Depth Class (m)	Canyon Lake TP (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	0.061	0.073	0.093	0.106	0.288	0.288	0.239	0.522	0.300	0.183
	I	0.651	0.511	0.489	0.391	0.316	0.316	0.237	0.286	0.253	0.282
	H	1.350	1.270	1.210	0.654			0.292	0.286	0.260	0.297
	H2									0.270	0.308
	H3									0.300	0.407
8	E	0.074	0.070	0.091	0.102	0.391	0.391	0.225	0.392	0.211	0.169
	I	0.207	0.075	0.093	0.109	0.314	0.314	0.220	0.273	0.243	0.242
	H	1.010	0.121	0.129	0.169			0.221	0.268	0.249	0.288
9	E	0.092	0.108	0.126	0.141	0.271	0.271	0.225	1.070	1.150	0.667
	I	0.426	0.066	0.101	0.127	0.303	0.303	0.237	1.020	1.000	0.740
	H									0.986	0.939
10	E					0.540	0.540		1.120	1.200	0.791
	I	0.128	0.063	0.081	0.142	0.449	0.449	0.237	1.150	0.998	0.730

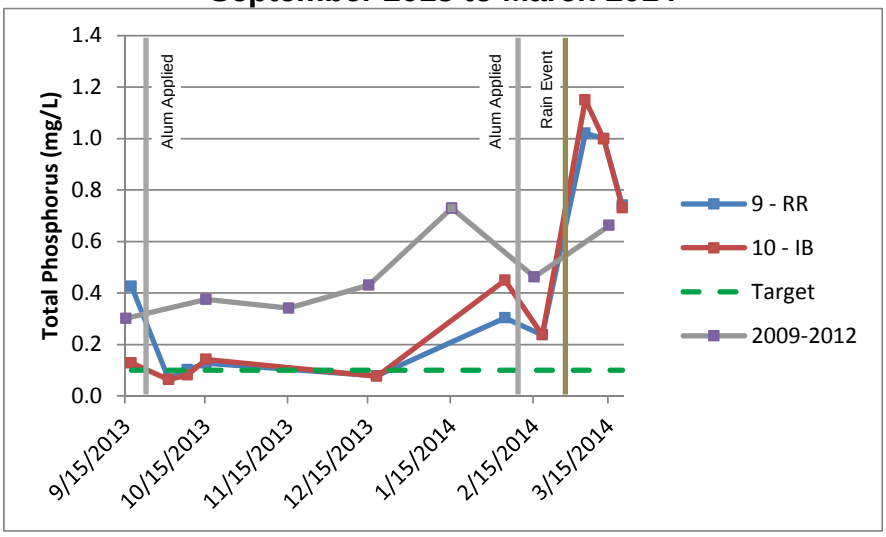
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Figure 4
Canyon Lake Main Body Total Phosphorus (mg/L)
September 2013 to March 2014



Station 7 is near the Canyon Lake Dam; Station 8 is in the Main Body of the lake.
Total Phosphorus values reflect results from integrated samples taken from throughout the water column.
The TMDL target value for Total Phosphorus is 0.1 mg/L annual average by 2020.
Average data (integrated samples) by month for the Main Body for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Figure 5
Canyon Lake East Bay Total Phosphorus (mg/L)
September 2013 to March 2014



Station 9 is at Roadrunner Beach; Station 10 is at Indian Beach.
Total Phosphorus values reflect results from integrated samples taken from throughout the water column.
The TMDL target value for Total Phosphorus is 0.1 mg/L annual average by 2020.
Average data (integrated samples) by month for the East Bay for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Table 11
Total Dissolved Phosphorus (mg/L)

Station	Depth Class (m)	Canyon Lake TDP (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	0.035	0.039	0.060	0.048	0.111	0.122	0.061	0.180	0.141	0.083
	I	0.644	0.474	0.472	0.358	0.122	0.167	0.109	0.217	0.214	0.234
	H	1.340	1.230	1.190	0.602			0.198	0.243	0.197	0.100
										0.253	0.244
										0.291	0.357
8	E	0.047	0.039	0.053	0.047	0.107	0.115	0.107	0.150	0.158	0.085
	I	0.190	0.043	0.057	0.072	0.115	0.110	0.109	0.154	0.205	0.199
	H	1.010	0.085	0.082	0.153			0.130	0.185	0.196	0.235
9	E	0.045	0.027	0.027	0.029	0.031	0.058	0.126	0.790	0.427	0.470
	I	0.410	0.029	0.025	0.027	0.033	0.087	0.136	0.834	0.597	0.573
	H									0.837	0.821
10	E						0.122		0.926	0.533	0.539
	I	0.049	0.025	0.024	0.024	0.017	0.113	0.122	0.950	0.569	0.524

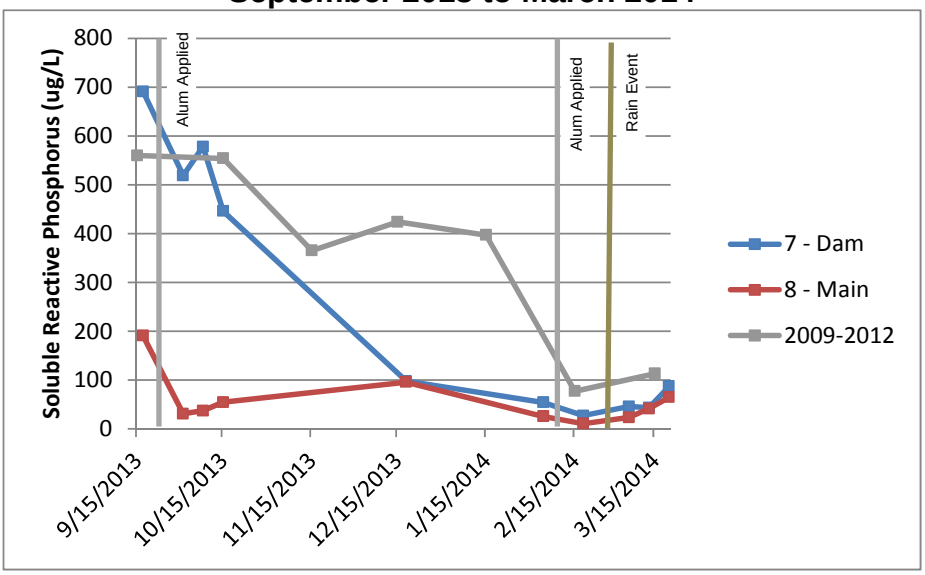
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Table 12
Soluble Reactive Phosphorus (SRP) (ug/L)

Station	Depth Class (m)	Canyon Lake SRP (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	13	27	44	27	84	30	4	18	19	<10
	I	691	519	578	446	98	54	28	46	44	87
	H	1640	1580	1580	808			69	63	48	62
	H2									78	92
	H3									100	151
8	E	23	22	35	29	86	17	<10	9	27	<10
	I	191	31	37	55	96	26	11	24	42	65
	H	1230	75	67	171			11	40	59	90
9	E	20	14	7	10	49	<10	<10	308	165	156
	I	487	15	8	8	55	14	<10	348	257	235
10	E						23		377	212	188
	I	27	14	8	7	46	19	<10	400	242	214

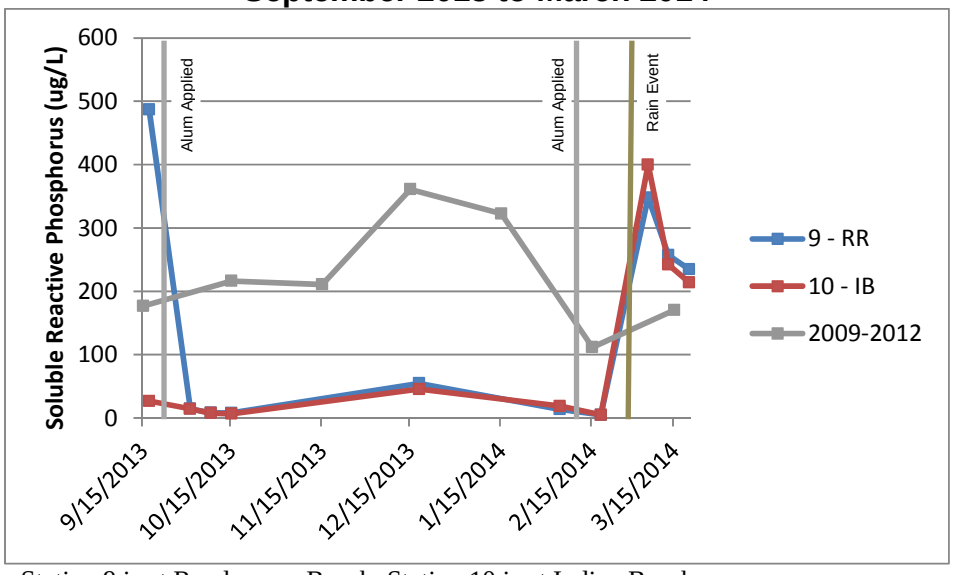
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Figure 6
Canyon Lake Main Body Soluble Reactive Phosphorus (ug/L)
September 2013 to March 2014



Station 7 is near the Canyon Lake Dam; Station 8 is in the Main Body of the lake.
SRP values reflect results from integrated samples taken from throughout the water column.
Average data (integrated samples) by month for the Main Body for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Figure 7
Canyon Lake East Bay Soluble Reactive Phosphorus (ug/L)
September 2013 to March 2014



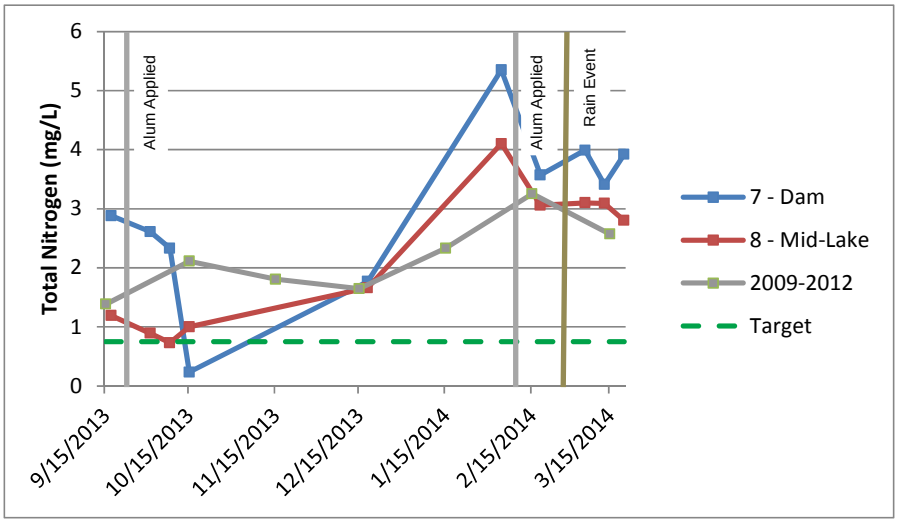
Station 9 is at Roadrunner Beach; Station 10 is at Indian Beach.
SRP values reflect results from integrated samples taken from throughout the water column.
Average data (integrated samples) by month for the East Bay for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Table 13
Total Nitrogen (TN) (mg/L)

Station	Depth Class (m)	Canyon Lake TN (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	0.80	0.84	0.79	0.98	1.70	3.20	3.45	4.64	2.93	2.35
	I	2.88	2.61	2.33	0.23	1.77	5.35	3.57	3.99	3.41	3.92
	H	5.12	5.81	5.07	3.44			3.96	3.35	2.63	2.66
	H2									3.61	3.48
	H3									3.70	4.95
8	E	0.78	0.85	0.82	0.93	1.85	4.46	3.38	3.34	2.96	2.43
	I	1.19	0.89	0.73	1.00	1.66	4.10	3.06	3.10	3.09	2.80
	H	3.52	0.94	0.91	1.40			2.56	3.11	2.75	2.81
9	E	1.60	1.18	1.49	1.68	1.92	3.42	3.51	4.31	4.76	2.87
	I	2.99	0.85	1.31	1.79	1.80	5.14	3.37	4.26	3.96	2.86
	H									3.66	3.07
10	E						5.43		3.92	4.83	3.15
	I	1.63	0.98	1.08	2.17	1.78	4.95	3.10	3.98	3.80	2.73

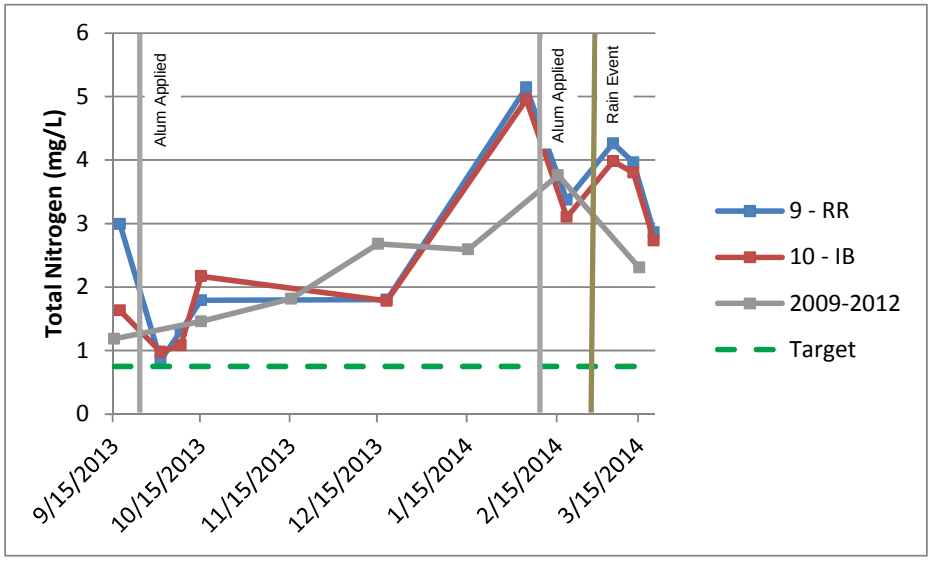
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Figure 8
Canyon Lake Main Body Total Nitrogen (mg/L)
September 2013 to March 2014



Station 7 is near the Canyon Lake Dam; Station 8 is in the Main Body of the lake.
Total Nitrogen values reflect results from integrated samples taken from throughout the water column.
The TMDL target value for Total Nitrogen is 0.75 mg/L annual average by 2020.
Average data (integrated samples) by month for the Main Body for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Figure 9
Canyon Lake East Bay Total Nitrogen (mg/L)
September 2013 to March 2014



Station 9 is at Roadrunner Beach; Station 10 is at Indian Beach.
Total Nitrogen values reflect results from integrated samples taken from throughout the water column.
The TMDL target value for Total Nitrogen is 0.75 mg/L annual average by 2020.
Average data (integrated samples) by month for the East Bay for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Table 14
Total Dissolved Nitrogen (TDN) (mg/L)

Station	Depth Class (m)	Canyon Lake TDN (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	0.60	0.56	0.49	0.59	1.36	3.01	1.90	2.00	1.76	1.58
	I	2.83	1.79	2.06	2.09	1.49	3.95	2.60	2.87	3.35	3.10
	H	5.31	4.35	5.04	3.21			2.82	3.37	2.88	2.00
										3.50	3.29
										3.68	4.26
8	E	0.68	0.54	0.51	0.54	1.28	2.40	1.99	1.77	2.79	1.64
	I	1.11	0.42	0.54	0.65	1.35	2.58	1.86	2.50	2.66	2.45
	H	3.42	0.55	0.61	1.18			1.67	2.54	2.28	2.53
9	E	1.00	0.43	0.49	0.56	1.12	1.96	1.90	2.93	1.58	1.65
	I	2.59	0.39	0.48	0.55	1.32	3.39	1.88	3.94	2.71	2.26
										3.27	2.69
10							1.85		3.59	1.76	1.68
	I	0.99	0.40	0.52	0.59	1.17	2.38	1.60	3.69	1.96	1.76

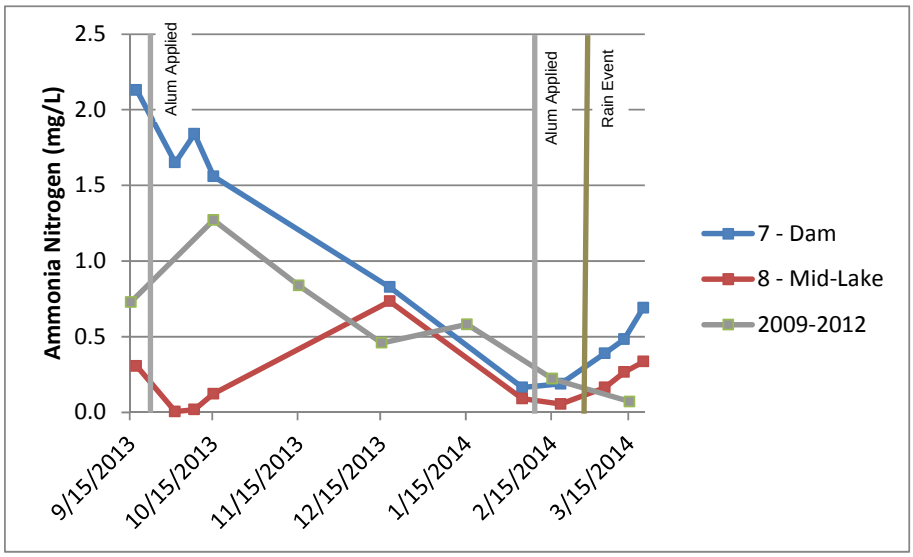
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Table 15
Ammonia-Nitrogen (NH4-N) (mg/L)

Station	Depth Class (m)	Canyon Lake NH-4-N (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	0.011	0.016	0.042	0.035	0.732	0.097	0.036	0.048	0.088	<0.010
	I	2.130	1.650	1.840	1.560	0.827	0.164	0.188	0.389	0.482	0.690
	H	5.540	4.690	5.130	2.880			0.492	0.582	0.188	0.553
	H2									0.895	1.88
	H3									1.450	2.65
8	E	0.017	0.014	0.020	0.040	0.627	0.019	<0.010	0.015	0.149	0.063
	I	0.306	<0.010	0.018	0.122	0.733	0.090	0.054	0.163	0.265	0.334
	H	2.880	0.118	0.152	0.679			0.018	0.423	0.374	0.533
9	E	0.070	0.013	<0.010	0.011	0.459	0.039	<0.010	0.024	<0.010	0.048
	I	1.890	<0.010	<0.010	<0.010	0.560	0.183	0.044	0.295	0.142	0.237
	H						0.029		0.078	0.034	0.077
10	E						0.045	<0.010	0.196	0.085	0.120
	I	0.036	<0.010	<0.010	0.014	0.506	0.019	<0.010	0.015	0.149	0.063

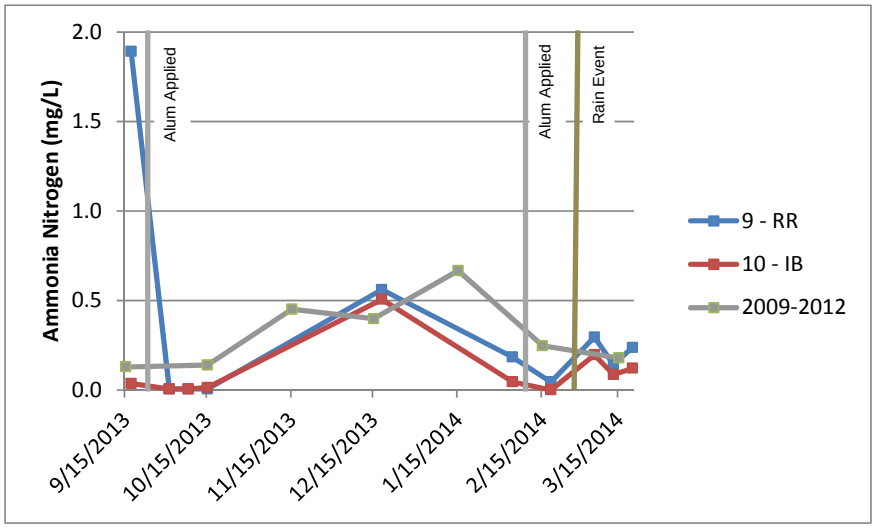
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
mdl = 0.010 mg/L
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Figure 10
Canyon Lake Main Body Ammonia Nitrogen (mg/L)
September 2013 to March 2014



Station 7 is near the Canyon Lake Dam; Station 8 is in the Main Body of the lake.
Ammonia values reflect results from integrated samples taken from throughout the water column.
Average data (integrated samples) by month for the Main Body for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Figure 11
Canyon Lake East Bay Ammonia Nitrogen (mg/L)
September 2013 to March 2014



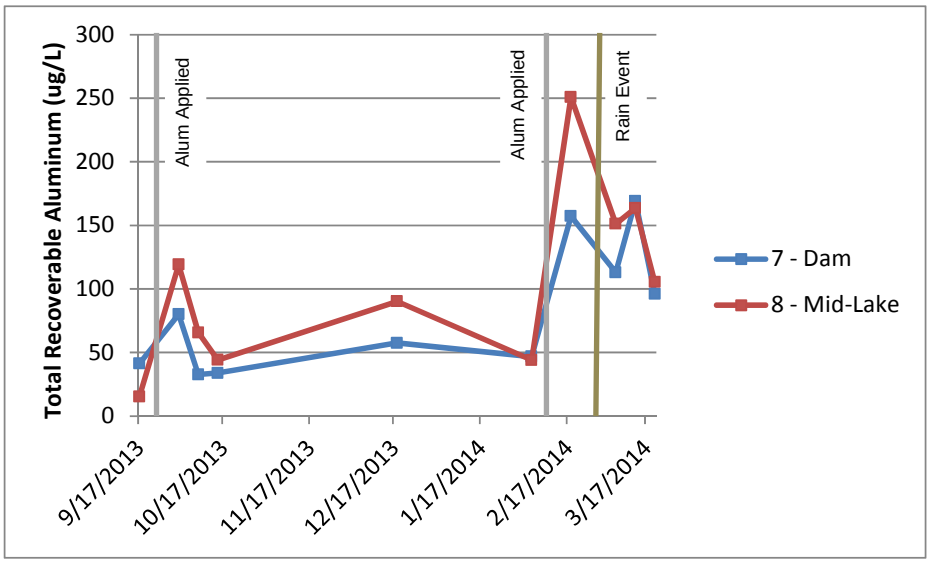
Station 9 is at Roadrunner Beach; Station 10 is at Indian Beach.
Ammonia values reflect results from integrated samples taken from throughout the water column.
Average data (integrated samples) by month for the East Bay for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Table 16
Total Recoverable Aluminum (Al) (ug/L)

Station	Depth Class (m)	Canyon Lake Al_{total} (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	32	116	52	34	59	91	298	108	156	113
	I	41	80	33	34	57	47	157	113	169	96
	H	26	18	17	24			25	53	37	77
	H2									23	104
	H3									100	75
8	E	29	104	52	33	67	31	118	96	127	70
	I	15	119	66	44	90	44	251	151	164	105
	H	24	106	51	30			269	78	73	135
9	E	64	295	227	134	70	114	102	116	139	148
	I	20	95	210	133	70	156	75	306	313	157
10	I	260	191	264	338	328				325	106

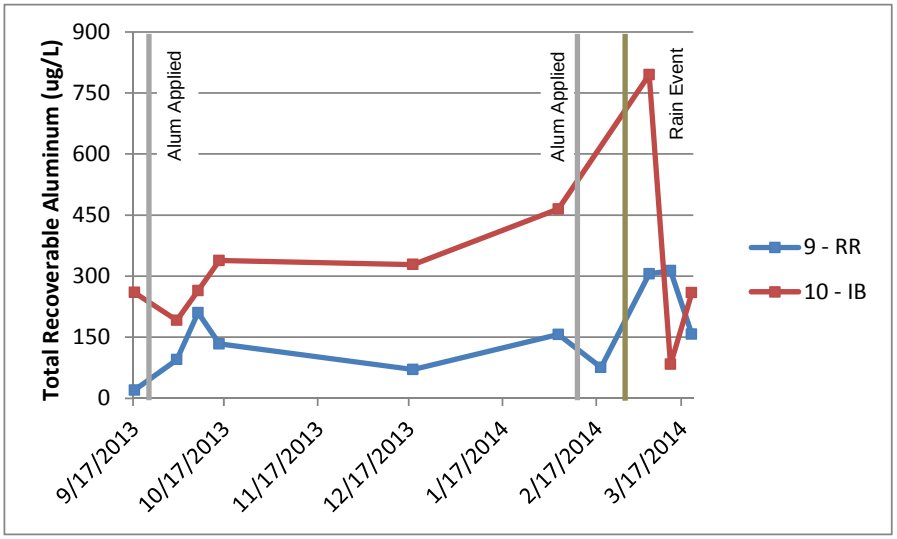
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, monthly samples of the hypolimnion at Station 7 were collected: near the bottom (0.5-1.0 m from bottom, avoiding any floc), just beneath the thermocline, and mid-thermocline.

Figure 12
Canyon Lake Main Body Total Recoverable Aluminum (ug/L)
September 2013 to December 2013



Station 7 is near the Canyon Lake Dam; Station 8 is in the Main Body of the lake.
Total Recoverable Aluminum values reflect results from integrated samples taken from throughout the water column.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Figure 13
Canyon Lake East Bay Total Recoverable Aluminum (ug/L)
September 2013 to December 2013



Station 9 is at Roadrunner Beach; Station 10 is at Indian Beach.
Total Recoverable Aluminum values reflect results from integrated samples taken from throughout the water column.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches)

Table 17
Dissolved Aluminum ($Al_{dissolved}$) (ug/L)

Station	Depth Class (m)	Canyon Lake $Al_{dissolved}$ (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	<1	24	3	4	<1	10	99	15	43	25
	I	<1	6	5	5	<1	34	36	15	34	21
	H	2	1	<1	1			7	9	30	20
	H2									26	16
	H3									29	11
8	E	<1	14	5	2	<1	7	82	13	57	25
	I	<1	13	5	3	<1	8	77	9	45	20
	H	<1	11	<1	5			23	10	29	13
9	E	<1	18	10	7	<1	10	50	12	24	14
	I	4	18	13	4	<1	10	37	13	25	25
	H									24	15
10	I	<1	12	10	8	6	10	26	23	14	13
	B						10		21	13	10

E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
mdl = 1 ug/L

Table 18
Total Suspended Solids (TSS) (mg/L)

Station	Depth Class (m)	Canyon Lake TSS (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	3.8	5.6	4.2	16.2	4.8	7.8	13.6	10.0	5.0	4.8
	I	4.8	4.4	4.0	2.6	3.2	8.6	9.7	7.2	5.6	7.0
	H1	7.2	3.0	3.4	3.6			6.6	5.0	6.2	4.8
	H2									6.5	5.0
	H3									5.0	4.8
8	E	4.6	2.4	4.4	5.4	4.0	15.6	9.7	12.1	3.6	5.2
	I	8.6	no data	5.4	no data	3.2	10.8	14.8	8.1	5.0	5.2
	H	5.4	2.8	5.6	3.0			11.2	6.3	4.2	3.6
9	E	16.9	31.9	19.2	54.2	9.8	13.2	16.1	13.3	29.0	12.5
	I	10.4	14.3	18.7	15.6	10.2	13.2	13.2	14.1	15.6	9.1
	H									10.0	5.2
10	S						28.0		13.6	25.7	14.6
	I	23.0	25.3	19.0	40.0	19.3	24.0	17.6	19.6	16.8	9.7

E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, three hypolimnion samples were collected at Station 7 – spaced from the thermocline to near bottom of the lake.

Table 19
Total Dissolved Solids (TDS) (mg/L)

Station	Depth Class (m)	Canyon Lake TDS (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	660	740	712	530	770	738	794	628	762	568
	I	606	694	652	542	744	774	800	744	792	658
	H1	530	624	588	500			810	722	838	648
	H2									716	674
	H3									716	642
8	E	586	770	694	598	782	726	788	672	668	626
	I	616	728	702	592	788	756	796	736	790	682
	H	496	744	688	598			768	668	662	736
9	E	722	844	828	732	850	858	874	540	652	494
	I	652	882	794	724	856	828	872	548	536	
10	I	634	812	832	774	906				486	662

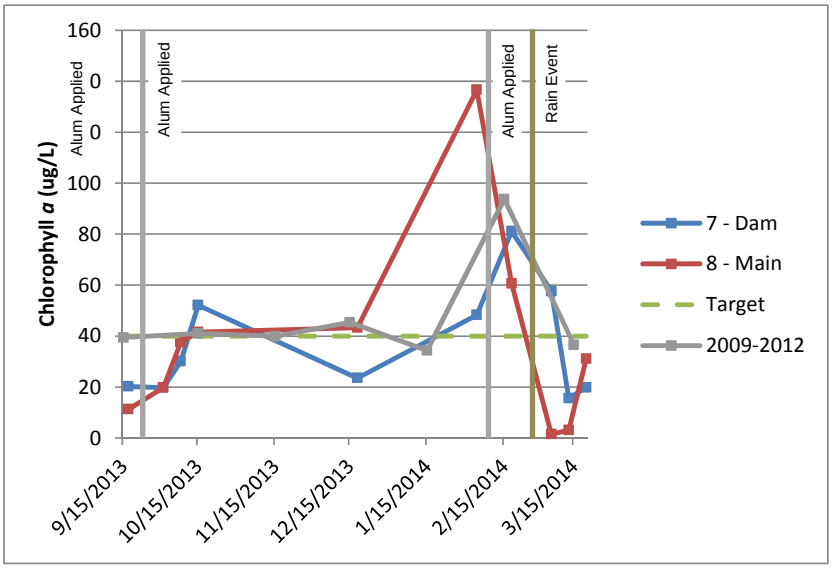
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
Starting on March 13, 2014, three hypolimnion samples were collected at Station 7 – spaced from the thermocline to near bottom of the lake.

Table 20
Chlorophyll *a* (ug/L)

Station	Depth Class (m)	Canyon Lake Chlorophyll *a* (September 2013 – March 2014)									
		17-Sept	1-Oct	8-Oct	15-Oct	18-Dec	4-Feb	18-Feb	6-March	13-March	20-March
7	E	20.2	19.8	30.1	52.1	23.5	48.3	81.1	57.6	15.6	19.8
	I	17.9	19.1	25.7	35.3	10.3	39.1	35.1	2.0	7.2	11.4
	H	9.2	13.4	16.0	32.4			<1	<1	3.0	9.2
8	E	11.3	19.8	37.6	41.6	43.3	136.6	60.6	1.5	3.1	31.1
	I	6.3	14.7	32.2	38.7	20.4	50.2	no data	11.6	3.6	11.4
	H	41.0	24.0	20.6	27.3			22.5	2.1	4.0	2.5
9	E	90.4	115.0	129.3	154.1	75.9	61.4	53.0	48.6	305.0	85.4
	I	74.6	128.9	113.3	153.9	40.8	51.9	51.9	17.4	136.2	34.1
10	E						181.9	37.6	20.6	346.0	132.5
	I	104.5	110.2	137.7	146.7	35.7	144.6	no data	13.9	188.2	56.3

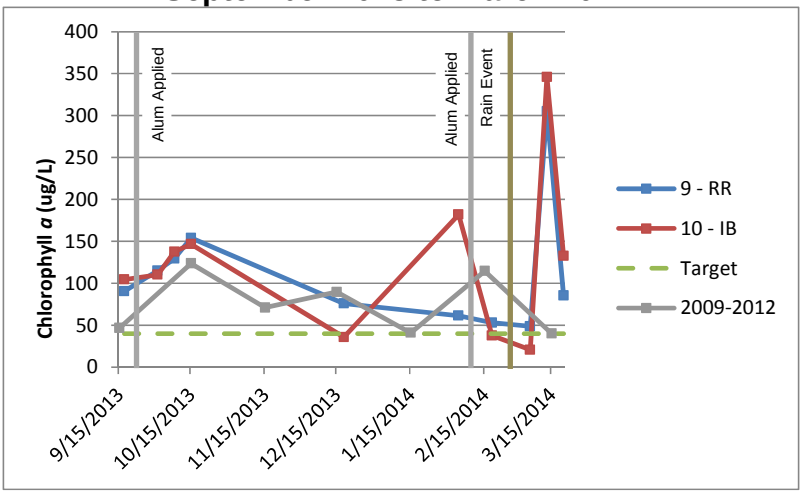
E= Epilimnion/Surface (0.5 - 1.0 m); I = Integrated; H= Hypolimnion (approximately 0.5 m from bottom)
mdl = 1 ug/L

Figure 14
Canyon Lake Main Body Chlorophyll a (ug/L)
September 2013 to March 2014



Station 7 is near the Canyon Lake Dam; Station 8 is in the Main Body of the lake.
Chlorophyll *a* values reflect results from surface samples.
The TMDL target value for chlorophyll *a* is 40 ug/L annual average by 2015.
Average data (surface samples) by month for the Main Body for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

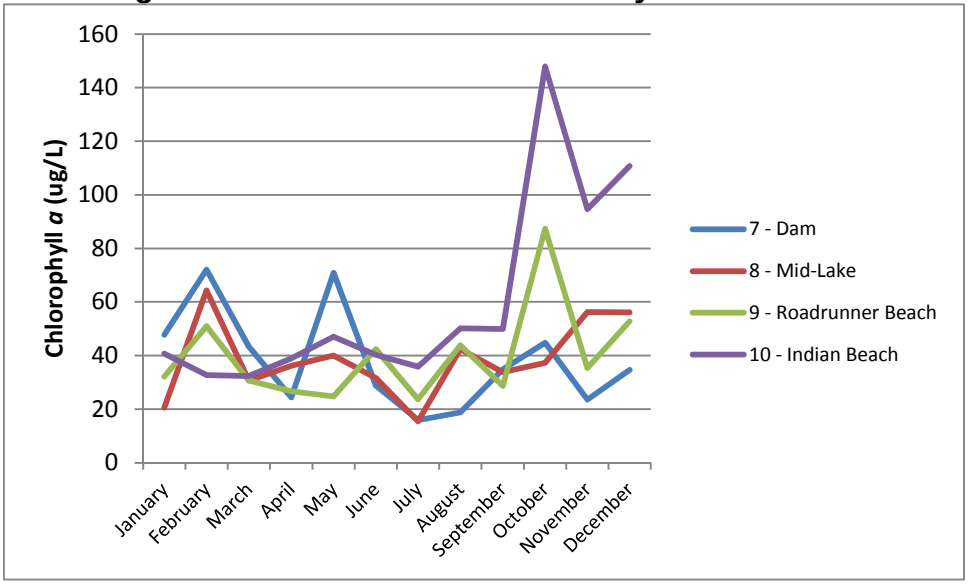
Figure 15
Canyon Lake East Bay Chlorophyll a (ug/L)
September 2013 to March 2014



Station 9 is at Roadrunner Beach; Station 10 is at Indian Beach.
Chlorophyll *a* values reflect results from surface samples.
The TMDL target value for chlorophyll *a* is 40 ug/L annual average by 2015.
Average data (surface samples) by month for the East Bay for 2009 to 2012 are shown for comparison.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

For additional reference, average chlorophyll *a* data by month are graphed below for each station individually for the period of January 2009 through June 2012.

Figure 16
Canyon Lake Chlorophyll *a* (ug/L)
Average Surface Water Results January 2009 – June 2012

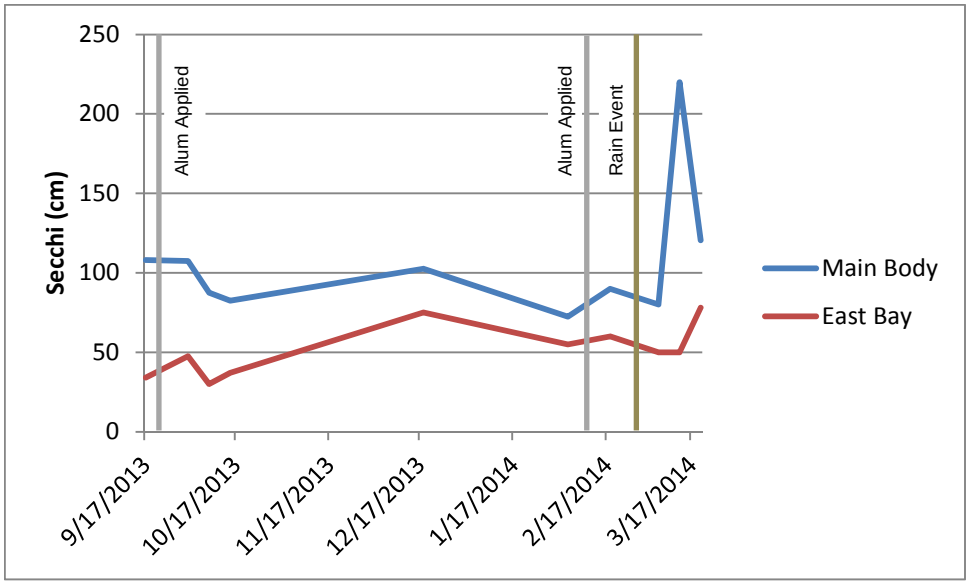


Station 7 is near the Canyon Lake Dam; Station 8 is Mid-lake in the Main Body of the lake; Station 9 is at Roadrunner Beach in the East Bay; and Station 10 is at Indian Beach in the East Bay.
Chlorophyll *a* values reflect results from surface samples.
Data are averages by month by station for the period January 2009 through June 2012. Not all stations were sampled on every sample date; the number of samples per month varies from 0 to 3.
The TMDL target value for chlorophyll *a* is 40 ug/L annual average by 2015.

Table 21
Secchi Depth (cm)

Station	Canyon Lake Secchi Depth (September 2013 - March 2014)									
	15-Jul	29-Jul	10-Aug	24-Aug	12-Sept	4-Feb	18-Feb	6-March	13-March	20-March
C7	110	100	85	85	135	75	90	80	190	120
C8	106	115	90	80	70	70	90	80	250	121
C9	38	55	35	39	80	75	70	50	60	78
C10	30	40	25	35	70	35	50	50	40	78

Figure 17
Canyon Lake Secchi Depth (cm)
September 2013 to March 2014



Stations 7 and 8 are in the main body of the lake; stations 9 and 10 are in the East Bay.
Alum application periods were September 23 through 27, 2013; and February 10 to 13, 2014.
The major rain event noted occurred from February 27 to March 1, 2014 (approximately 2.8 inches).

Glossary

Ammonia (NH_3) – A gaseous alkaline compound of nitrogen and hydrogen that is highly soluble in water. Un-ionized ammonia (NH_3) is toxic to aquatic organisms. The proportions of NH_3 and ammonium (NH_4^+) and hydroxide (OH^-) ions depend on water temperature, pH, and salinity.

Chlorophyll *a* – A measure of algal biomass used to characterize the degree of eutrophication.

Electrical conductivity (EC) – Measure of the ability of water to conduct an electric charge. Values increase as salinity increases.

Oxidation-Reduction Potential (ORP) – tendency of a molecule to acquire electrons and thereby be reduced. Oxygen levels strongly affect redox potential. Strongly aerobic microorganisms can only be active at positive ORP values.

pH – The hydrogen ion activity of water (pH) is measured on a logarithmic scale, ranging from 0 to 14. The pH of "pure" water at 25°C is 7.0 (neutral). Low pH (0-<7) is acidic; high pH (>7-14) is basic or alkaline.

Phosphorus – In natural waters, phosphorus occurs almost solely as orthophosphates, condensed phosphates, and organically bound phosphate.

Secchi disk – A white disk 12" or more in diameter that is lowered into the water to estimate transparency of the water. The depths at which it first disappears when lowered and reappears when raised determine the Secchi depth reading.

Solids – Total solids includes "total suspended solids", the portion of material retained by a filter during sample analysis, and "total dissolved solids", the portion that passes through a filter.

Soluble Reactive Phosphorus (SRP) – Largely a measure of orthophosphate, one of the biologically available forms of phosphorus in water.

Total Maximum Daily Load (TMDL) – Water quality standards that define how much of a pollutant can be in a surface and/or ground water while still allowing it to meet its designated uses, such as for drinking water, fishing, swimming, irrigation or industrial purposes.

Turbidity – Attributable to the suspended and colloidal matter in water, including clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms. The reduction of clearness in turbid waters diminishes the penetration of light and therefore can adversely affect photosynthesis.