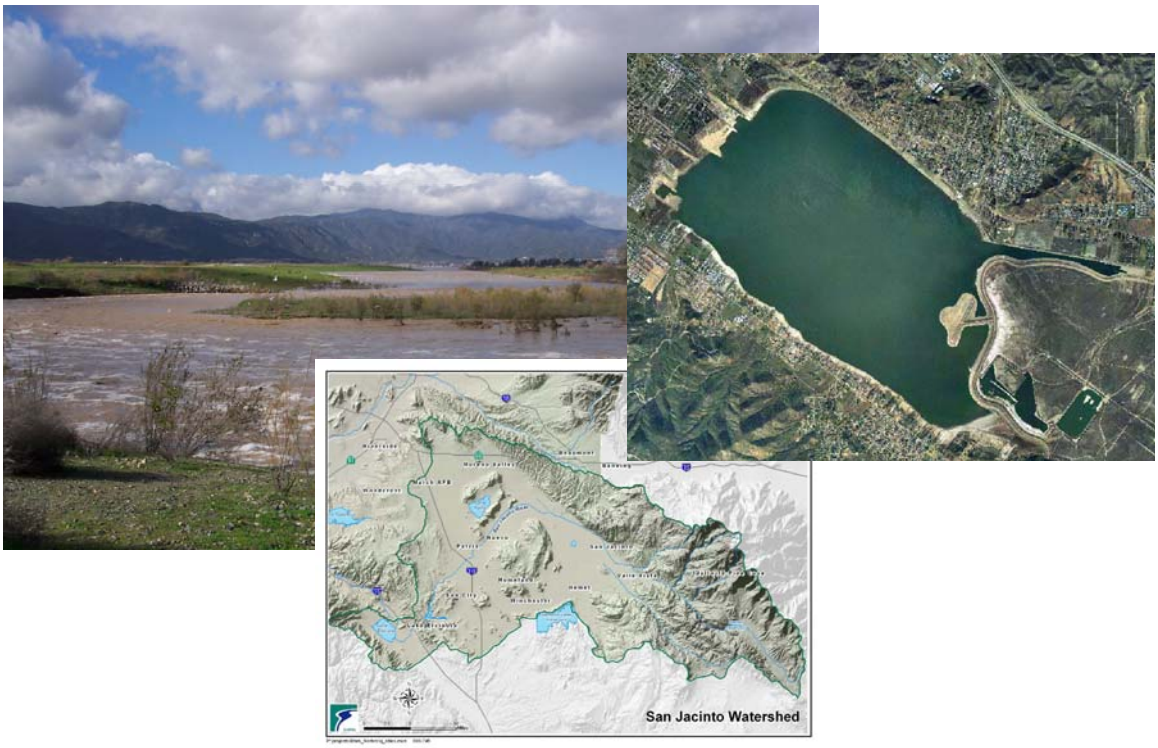
Lake Elsinore & Canyon Lake Nutrient TMDL Annual Water Quality

Report

July 2007 – June 2008

Final Report



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Prepared for:
Santa Ana Regional Water Quality Control Board

Prepared by:
Lake Elsinore & Canyon Lake Nutrient TMDL Task Force

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1.0 Introduction

In 1994, 1998, and again in 2002, Lake Elsinore and Canyon Lake were identified by the California Regional Water Quality Control Board, Santa Ana Region (Regional Board) on its Clean Water Act Section 303(d) list of impaired waterbodies. Impairments identified for these waters included excessive levels of nutrients in both lakes, as well as, organic enrichment/low dissolved oxygen, sedimentation/siltation, and unknown toxicity in Lake Elsinore and high bacterial indicators in Canyon Lake. The Clean Water Act Section 303(d) requires for waters that do not or are not expected to meet water quality standards (beneficial uses, water quality objectives), a Total Daily Maximum Load (TMDL) be implemented. In 2000, the Regional Board initiated the development of TMDLs for nutrients for Lake Elsinore and Canyon Lake.

Since 2000, local stakeholders, in cooperation with the Regional Board, have been working to identify the source of nutrients impairing each lake, and evaluate the impacts to water quality and beneficial uses incurred from nutrient sources. Stakeholders have participated in watershed-wide annual stormwater quality and flow monitoring supported by Riverside County Flood Control and Water Conservation District (RCFC&WCD), as well as, water quality monitoring of Lake Elsinore and Canyon Lake supported by Elsinore Valley Municipal Water District (EVMWD) and the San Jacinto River Watershed Council (SJRWC). Available grant funding has assisted stakeholders in developing models of the lakes to better understand the lake characteristics, as well as a San Jacinto River Watershed model to simulate the wash off and transport of nutrients to the lakes. In addition, the Lake Elsinore & San Jacinto Watersheds Authority (LESJWA) has preformed numerous studies of each lake, and has started to implement projects that are expected to bring about improvements to in-lake water quality.

In 2004, the Regional Board prepared the Lake Elsinore and Canyon Lake Nutrient TMDL Report. This report framed the stakeholders' monitoring and modeling efforts to characterize in-lake water quality, while providing the basis for recommendations to the Regional Board to consider revisions to the Implementation Plan (Chapter 5 of the Water Quality Control Plan, Santa Ana River Basin 1995 by the Regional Board (Basin Plan)) for incorporating the nutrient TMDLs for Canyon Lake and Lake Elsinore. These recommendations outlined in Resolution No. RB8-2004-0037 required stakeholders to develop management plans and to conduct long-term monitoring and implementation programs aimed at reducing nutrient discharges to Lake Elsinore and Canyon Lake.

In December 2004, Resolution No. RB8-2004-0037 amended the Water Quality Control Plan for the Santa Ana River Basin to incorporate Nutrient Total Maximum Daily Loads for Lake Elsinore and Canyon Lake (Lake Elsinore and Canyon Lake TMDL Amendment). The Regional Board adopted the Resolution, and it was subsequently approved by the U.S. Environmental Protection Agency (US EPA) on September 30, 2005. In July 2006, local stakeholders formed a cost sharing partnership, the Lake Elsinore and Canyon Lake Nutrient TMDL Task Force (Task Force)[1].

[1] Lake Elsinore and Canyon Lake TMDL Task Force members 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 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 Game, Eastern Municipal Water District, the U.S. Forest Service in the U.S. Department of Agriculture, March Air Reserve Base – Joint Powers Authority and the U.S. Air Force. Task Force organization and activities are coordinated by the LESJWA.

1.1 TMDL Monitoring and Reporting Requirement

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 allocations; compliance with the nitrogen and phosphorus TMDL, and load allocations (LAs), including waste load allocations (WLAs).

2. A Lake Elsinore nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets. This program will evaluate and determine the relationship between ammonia toxicity and total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Lake Elsinore.

3. Canyon Lake nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets. The monitoring program will evaluate and determine the relationship between ammonia toxicity and the total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Canyon Lake.

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

This report satisfies the obligation of Task Force stakeholders to submit an annual report summarizing the data collected for the year and evaluates compliance with the TMDL for the Canyon Lake and Lake Elsinore nutrient TMDLs.

1.2 Phased Monitoring Approach

LESJWA, in support of the Task Force, provided funding to meet this requirement by developing a single comprehensive nutrient monitoring plan, The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan, included as Appendix A. This plan considered a phased monitoring approach, described in the following paragraphs, to account for significant gaps in information required to understand in-lake and watershed processes. Through this phased approach, the Task Force stakeholders were able to develop a priority schedule for addressing data gaps. This enabled stakeholders to focus on the most prominent data gaps and limitations to the nutrient TMDL calculation, while performing an agreed upon level of monitoring to remain consistent with the Basin Plan requirements to track compliance with TMDLs and associated LAs.

The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan was approved by the Regional Board in March 2006, and was subsequently implemented by the TMDL Task Force. The Task Force is currently implementing Phase 1 of this approach.

Phase 1 – Intensive Lake Study

Phase 1 focuses on data issues regarding in-lake processes and the "linkage analysis" relating external pollutant loading to in-lake response and associated nutrient concentrations compared to numeric water quality targets. The TMDL calculation was not well understood, but was known to have a direct influence on the assessment of the required external load reductions to the lake. Due to the intricacies involved with this process, Phase 1 was scheduled to occur over a two- to three-year period, depending on the completion of in-lake studies and the amount of data collected. Since the implementation schedule of

the Lake Elsinore and Canyon Lake Nutrient TMDL allows for re-evaluation of the TMDL once every three years, it is envisioned that the results of the Phase 1 Monitoring Program will be used to review and revise the Nutrient TMDL. As such, LAs to each lake cannot be adequately assessed until the completion of Phase 1. In accordance with the approved monitoring plan, once LAs are determined for each lake, a more intensive study for the watershed will be conducted as part of Phase 2.

Phase 2 – Intensive Watershed Study

Phase 2 accommodates use of available monetary and staffing resources for conducting an intensive study of the watershed that addresses compliance monitoring, as well as key data gaps needed in understanding external nutrient source contributions from the watershed. The data collection strategy, outlined in Phase 2, includes the incorporation of additional TMDL and flow monitoring stations to assist in addressing watershed data gaps. In allowing the opportunity to allocate resources as they become available, special studies that further address data gaps and advance understanding of hydrology, pollutant sources, and transport processes within the watershed can be pursued more feasibly. Completion of Phase 2 of the approved monitoring program will enable the prediction of more reliable internal and external watershed loading via the update of historical models.

Phase 3 – Compliance Monitoring

Phase 3, or the compliance monitoring phase, is proposed to begin upon completion of the intensive data collection efforts of Phases 1 and 2. It is proposed that this monitoring phase consist of an agreed upon base level of in-lake and watershed compliance monitoring determined after many of the data gaps have been addressed. For more information pertaining to the Phased Program, please refer to the Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan prepared by Tetra Tech, Inc.

2.0 San Jacinto River Watershed Nutrient TMDL Monitoring Program

The RCFC&WCD supports the Task Force effort by coordinating and guiding the Phase 1 San Jacinto Watershed Monitoring Program sampling activities. Under their direction, samples are collected at four designated monitoring stations throughout the San Jacinto River Watershed, including Lake Elsinore and Canyon Lake, during mandated rain events[2].

March Air Reserve Base (March ARB) is currently working on an agreement with RCFC&WCD to monitor water quality at an outfall located on RCFC&WCD property immediately upstream of the base. This monitoring, however, is not scheduled to begin until Phase 2 of the Lake Elsinore and Canyon Lake nutrient TMDL monitoring Program.

In addition to this effort, the San Bernardino National Forest (SBNF), in accordance with their agreement for in-lieu obligations to the Lake Elsinore and Canyon Lake TMDL Task Force, conducts water sampling at the Cranston Guard Station site on the San Jacinto River. This work, contained within this report, is dependant on sufficient funds being allocated by Congress to complete the work.

The objectives of the Phase 1 San Jacinto River Watershed Monitoring Program are as follows:

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

2. Determine the total nutrient load from various sources categorized by land use types, namely, agricultural, urban runoff, and open space sources. The sources drain into the above-mentioned tributaries. These tributaries drain into Canyon Lake and Lake Elsinore.

3. Provide water quality data for watershed model updates.

4. Provide water quality data to evaluate TMDL compliance with WLAs and LAs.

Sampling Stations

To monitor TMDL compliance, five sampling stations were carefully selected to reflect various types of land uses within the watershed. Many of the sampling stations were located at stream gauge stations that were installed by the United States Geological Survey (USGS) or RCFC&WCD. The stations are listed in the **Table 2-1** below and shown in **Figure 2-1**.

Table 2-1. Phase 1 San Jacinto River Watershed Monitoring Stations

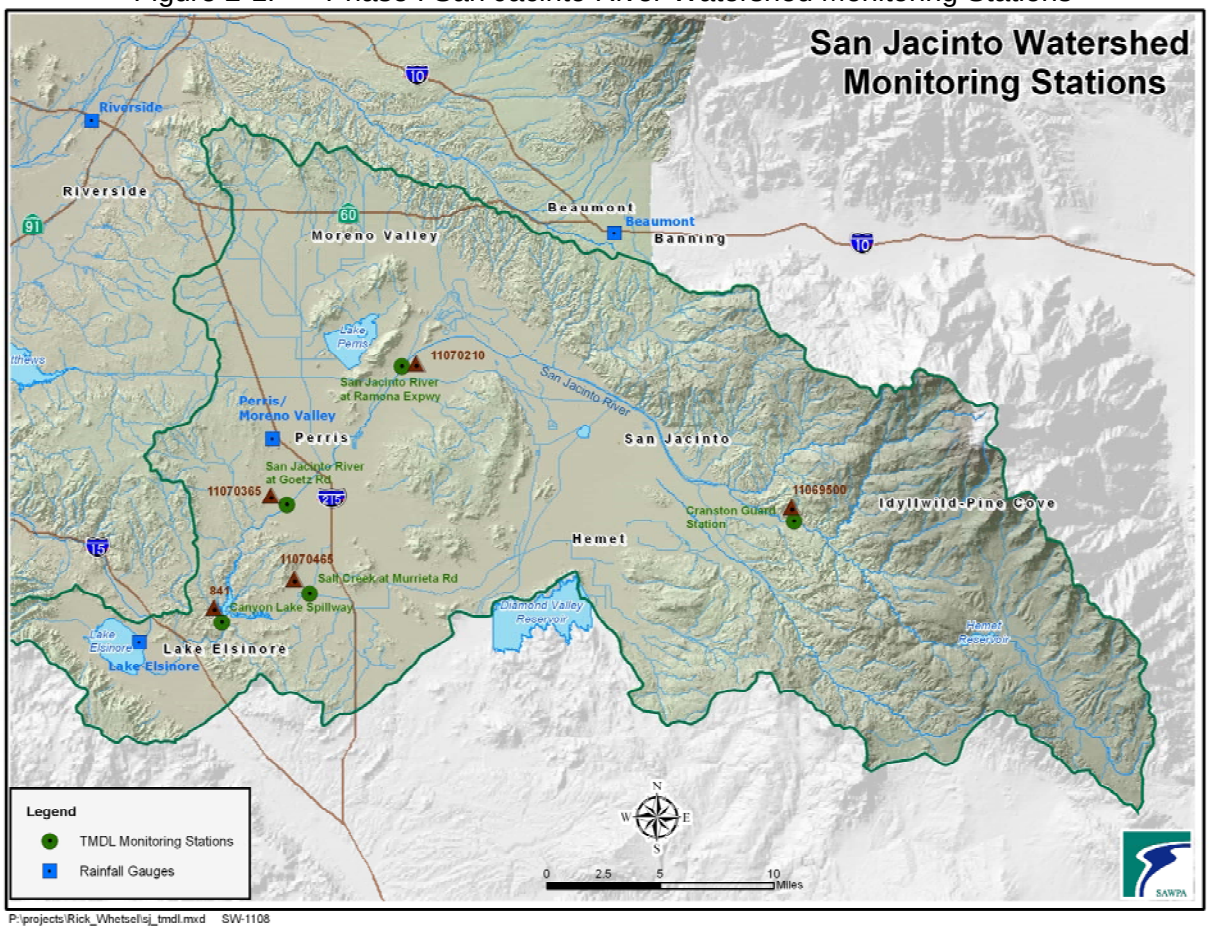
Station ID	Location Number and Description
745	Site 3 - Salt Creek at Murrieta Road
759	Site 4 - San Jacinto River at Goetz Road
741	Site 6 -San Jacinto River at Ramona Expressway
841	Site 30 - Canyon Lake Spillway
792	Site 1 - San Jacinto River at Cranston Guard Station

[2] A mandated rain event is designated as any event sufficient enough to result in runoff during daylight hours.

Revisions to the San Jacinto Watershed Monitoring Program

TMDL compliance monitoring for the San Jacinto Watershed follows the guidelines detailed in the 2007 Lake Elsinore/Canyon Lake TMDL Compliance Program, San Jacinto River Watershed Sampling Plan, Phase 1 Monitoring Plan prepared by RCFC&WCD, included on CD as Appendix B and the SBNF, Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Sampling and Analysis Plan prepared by the U.S. Forest Service (USFS), included on CD as Appendix C. In order to coordinate with other monitoring program requirements and to minimize the number of staff deployed during sampling events RCFC&WCD installed temporary automatic sampling equipment at the TMDL monitoring stations for the reporting period of July 2007 through June 2008, .

Figure 2-1. Phase I San Jacinto River Watershed Monitoring Stations



2.1 San Jacinto Watershed Monitoring Events

The July 2007 through June 2008 reporting period provided only two mandated storm events, which were sampled both by RCFC&WCD and SBNF staff for the TMDL monitoring program. The first occurred January 5th through 7th, and the second January 26th through 29th. Due to varying rainfall patterns in the watershed a third event occurring February 3rd through 4th was only sampled by SBNF staff.

The first monitoring event occurred January 5th through 7th. Rainfall during this event varied between 2.0 inches at the Elsinore gauge to 2.4 inches recorded at the Corona gauge. Peak flows recorded during the event occurred on January 7th and ranged between 162 cubic feet per second (cfs) recorded at "Salt Creek

at Murrieta Road", 532 cfs at "San Jacinto River at Goetz Road**"**, and on January 6th flow peaked at 403 cfs at the "Cranston Guard Station". There were no significant flows recorded at the "San Jacinto River at Ramona Expressway" gauge station. Automatic water quality sampling equipment were temporarily installed at the Salt Creek and Goetz Road stations by RCFC&WCD staff immediately prior to storm onset. Due to instrument failure at the Goetz station, only the Salt Creek station was sampled and analyzed by RCFC&WCD staff. Precipitation forecasts did not warrant deployment of automatic sampling equipment downstream of Canyon Lake; there were no flows exiting Canyon Lake as a result of this storm.

The second monitoring event occurred January 26th through 29th. Rainfall for this event varied between 0.9 inches at the Riverside gauge to 1.7 inches recorded at the Corona gauge. Peak flows measured varied, peaking on January 27th at 343 cfs at "San Jacinto River at Goetz Road", and on January 28th at 258 cfs at "Salt Creek at Murrieta Road" and 305 cfs at the "Cranston Guard Station". Spill elevation (1381.6 ft) at Canyon Lake Dam was reached prior to storm onset and spilling began on January 25th; peak flow exiting the dam was 171 cfs on January 28th. Again, there were no flows measured at the "San Jacinto River at Ramona Expressway" station to warrant sample collection.

A third monitoring event occurring on February 3rd through 4th was only monitored by USFS staff at the "Cranston Guard Station Site". Rainfall for this event varied between 0.24 inches at the Hemet/San Jacinto gauge to 0.6 inches recorded at the Perris/Moreno Valley gauge. Peak flows recorded during the event were not significant at any gauge other than the "Cranston Guard Station". The peak flow measured at the "Cranston Guard Station" was 188 cfs recorded on February 4th, whereas peak flows measured at the other gauges were estimated at only 4 cfs at "Salt Creek at Murrieta Road", and 20 cfs at "San Jacinto River at Goetz Road**"**. Again, there were no significant flows recorded at the "San Jacinto River at Ramona Expressway" gauge station, and no flows exiting Canyon Lake as a result of this storm.

Additional notes on the monitoring:

For the second event, automatic samplers at the Salt Creek and Goetz Road stations were programmed to retrieve flow-weighted samples, while the Canyon Lake Spillway station was time-paced. These programs were "proof-of-concept" in nature and were successful in collecting the prescribed number of samples across the hydrograph, and staff was able to submit all samples to the laboratory within sample holding times. Staff did not encounter problems with power source or keeping samples cold within the sampling bottles onsite. Staff also was successful at changing the volumetric programming of the automatic samplers via cellular technology. The TMDL Monitoring Plan for Phase 1 mandates 12 samples over the course of the hydrograph for three storm events. Mobilization was only initiated for two events, January 5th – 7th and January 26th – 29th. The first storm of the season occurred on November 30th, 2007. The event was predicted to be small; however, a revised forecast the morning of November 30th, upgraded the precipitation predictions based on the amounts that had already fallen. Thus, automatic sampling equipment could not be deployed for this event. Also, rainfall that usually occurs during the late winter/early spring did not produce sufficient rainfall to create adequate runoff for a third TMDL sampling event.

2.2 San Jacinto Watershed Annual Water Quality Summary

As described in the previous section, water quality is sampled for storm events at the five Phase 1 watershed compliance monitoring locations for the San Jacinto River Watershed. A summary of water quality monitoring data for each of the five monitoring locations for the period July 1, 2007 through June 30, 2008, are presented below. The complete set of water quality data for the period July 2007 through June 2008 is included on CD as Appendix D.

Included with this summary, where available flow data exists, is an estimate of annual nutrient loadings (total nitrogen and total phosphorus). For this report, nutrient loadings were estimated based upon the mean storm concentration and an estimate of annual or storm volume passing the respective stream gauge. Flow volumes were estimated by converting daily flow in cfs to a daily volume in gallons and then summing each daily volume for the year.

Summary Storm Water Quality Data – Salt Creek at Murrieta Road

Water quality and flow data was collected for two storm events at the "Salt Creek at Murrieta Road" site. Data for the first storm event is presented in **Table 2-2**, and **Figure 2-2,** and the second storm event in **Table 2-3**, and **Figure 2-3**.

Estimated annual nutrient loading recorded at this site were based upon annual flow recorded at the "Salt Creek at Murrieta Road" USGS stream gauge (ID#11070465). Total annual flow at this gauge was estimated at 1,270.9 cfs (or 821.4 million gallons). Mean storm concentrations for nutrients estimated for the two storm events ranged from 2.5 to 2.6 mg/L for total nitrogen, and 0.62 to 1.08 milligrams per liter (mg/L) for total phosphorus. This resulted in estimated annual nutrient loadings ranging between 17,137 to 17,823 lbs. of nitrogen and 4,250 to 7,403 lbs. of phosphorus.

Figure 2-2. January 5-8 Storm Event - Salt Creek at Murrieta Road

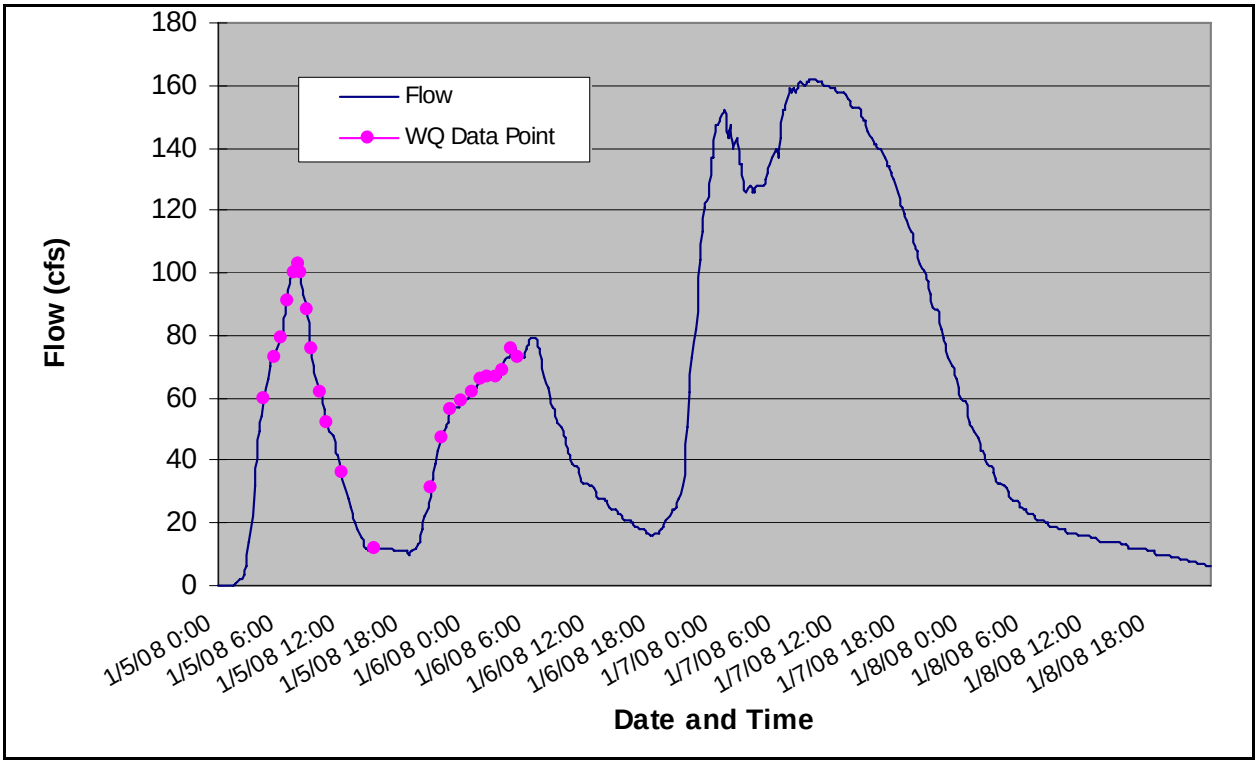


Table 2-2. Salt Creek at Murrieta Road Water Quality Data (01/05/08 thru 01/06/08)

Parameters	units	avg	count	Storm Data (01/05/08 thru 01/06/2008)																						
				1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/6	1/6	1/6	1/6	1/6	1/6	1/6
				4:27	5:32	6:06	6:41	7:14	7:43	8:07	8:30	9:00	9:38	10:35	12:02	14:58	20:24	21:34	22:37	23:36	0:35	1:21	2:04	2:44	3:23	4:18	4:57
ammonia nitrogen (NH4-N)	mg/L	0.26	24	0.42	0.40	0.37	0.35	0.32	0.32	0.30	0.30	0.29	0.29	0.31	0.35	0.49	0.24	0.17	0.14	0.13	0.18	0.13	0.12	0.12	0.12	0.13	0.15
biochemical oxygen demand (BOD)	mg/L	-nd-	24	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	10	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
chemical oxygen demand (COD)	mg/L	40	24	22	37	35	48	46	39	37	39	35	28	35	35	41	54	57	46	41	46	35	33	44	46	39	35
nitrate nitrogen (NO3-N)	mg/L	0.69	24	0.65	0.56	0.59	0.56	0.56	0.56	0.56	0.59	0.63	0.61	0.68	0.74	1.00	1.00	0.84	0.74	0.70	0.70	0.65	0.65	0.68	0.68	0.79	0.84
nitrite nitrogen (NO2-N)	mg/L	0.10	24	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	0.11	0.10	-nd-	-nd-	0.10	-nd-	-nd-	-nd-	-nd-	-nd-	0.10
soluble reactive phosphorus (SRP/ortho-P)	mg/L	0.37	24	0.28	0.28	0.31	0.32	0.34	0.34	0.33	0.36	0.27	0.28	0.32	0.30	0.35	0.54	0.51	0.46	0.44	0.44	0.43	0.44	0.44	0.42	0.39	0.38
total organic nitrogen (Org-N)	mg/L	1.4	24	1.1	1.3	1.3	1.5	1.4	1.0	0.9	0.8	0.8	0.9	0.8	1.0	1.1	2.7	2.2	2.1	1.8	1.7	1.8	1.7	2.1	1.7	1.7	1.7
total phosphorus (TP)	mg/L	0.62	24	0.45	0.45	0.45	0.51	0.55	0.51	0.49	0.49	0.47	0.50	0.52	0.48	0.50	1.00	1.00	0.83	0.80	0.78	0.80	0.69	0.72	0.71	0.67	0.62
total suspended solids (TSS)	mg/L	122	24	150	120	140	170	200	160	120	110	84	96	82	52	37	220	200	160	140	120	72	130	100	98	75	81
total dissolved solids (TDS)	mg/L	241	24	91	92	94	100	88	60	46	110	120	82	110	180	180	340	390	400	410	430	420	420	390	460	400	370
turbidity	NTU	78	24	64	64	76	85	100	78	77	72	75	78	73	55	51	150	140	110	87	76	53	85	60	56	50	55
pH	pH Units	7.6	12	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-
total nitrogen (TN calc)	mg/L	2.4	24	2.2	2.3	2.3	2.4	2.3	1.9	1.8	1.7	1.7	1.8	1.8	2.0	2.6	4.0	3.3	2.9	2.6	2.7	2.6	2.5	2.9	2.5	2.6	2.7

Figure 2-3. January 26-31 Storm Event - Salt Creek at Murrieta Road

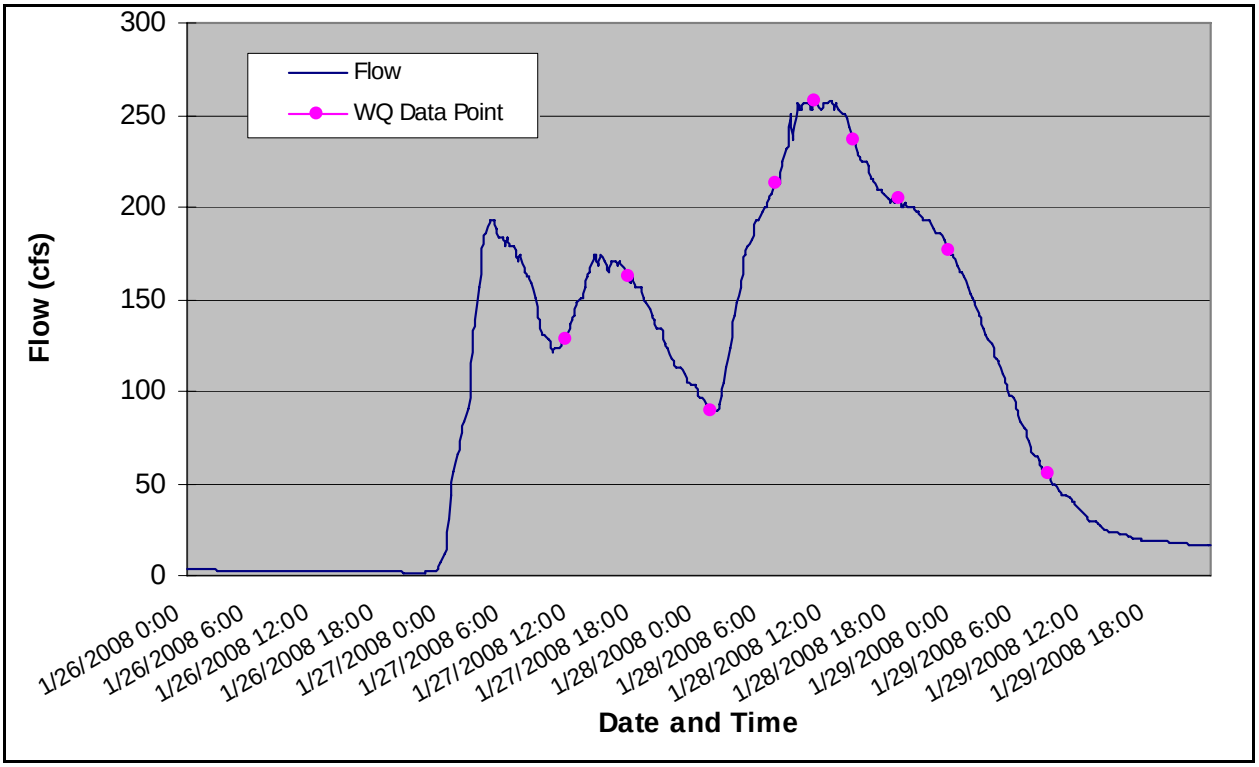


Table 2-3. Salt Creek at Murrieta Road Water Quality Data (1/27/08 thru 1/30/08)

Parameters	units	avg	count	Storm Data (01/27/08 thru 01/30/2008)									
				1/27	1/27	1/28	1/28	1/28	1/28	1/28	1/28	1/29	1/30
				11:24	17:11	1:04	7:04	10:43	14:14	18:24	23:19	8:35	9:47
ammonia nitrogen (NH4-N)	mg/L	0.26	10	0.43	0.30	0.24	0.18	0.31	0.25	0.26	0.10	-nd-	-nd-
biochemical oxygen demand (BOD)	mg/L	-nd-	1	-nd-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-
chemical oxygen demand (COD)	mg/L	61	10	89	65	46	37	59	68	50	85	50	57
nitrate nitrogen (NO3-N)	mg/L	0.50	10	0.68	0.61	0.61	0.50	0.47	0.47	0.43	0.38	0.38	0.43
nitrite nitrogen (NO2-N)	mg/L	-nd-	10	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
soluble reactive phosphorus (SRP/ortho-P)	mg/L	0.50	10	0.82	0.52	0.50	0.37	0.51	0.56	0.48	0.42	0.47	0.37
total organic nitrogen (Org-N)	mg/L	1.9	10	3.9	2.3	1.7	1.4	2.3	1.9	1.3	1.3	1.7	1.5
total phosphorus (TP)	mg/L	1.08	10	1.80	1.00	0.78	0.73	0.98	1.10	1.00	0.98	1.20	1.20
total suspended solids (TSS)	mg/L	236	10	440	180	82	180	210	250	200	210	300	310
turbidity	NTU	331	10	380	140	160	160	200	270	310	380	620	690
pH	pH Units	7.8	10	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.8
total nitrogen (TN calc)	mg/L	2.6	10	5.0	3.2	2.6	2.1	3.1	2.6	2.0	1.8	2.1	1.9

Summary Storm Water Quality Data – San Jacinto River at Goetz Road

Water quality was sampled for only one storm event at the "San Jacinto River at Goetz Road" site. A summary of this data is presented in **Table 2-4,** and **Figure 2-4**.

Estimated annual nutrient loading recorded at this site were based upon annual flow recorded at the "San Jacinto River at Goetz Road" USGS stream gauge (ID#11070365). Total annual flow at this gauge was estimated at 3,211.6 cfs (or 2,075.7 million gallons). Mean storm concentrations for nutrients estimated for the single storm event were 1.8 mg/L for total nitrogen and 0.42 mg/L for total phosphorus. This resulted in estimated annual nutrient loadings of 31,181 lbs. of nitrogen and 7,276 lbs. of phosphorus.

Figure 2-4. January 26-31 Storm Event - Goetz Road

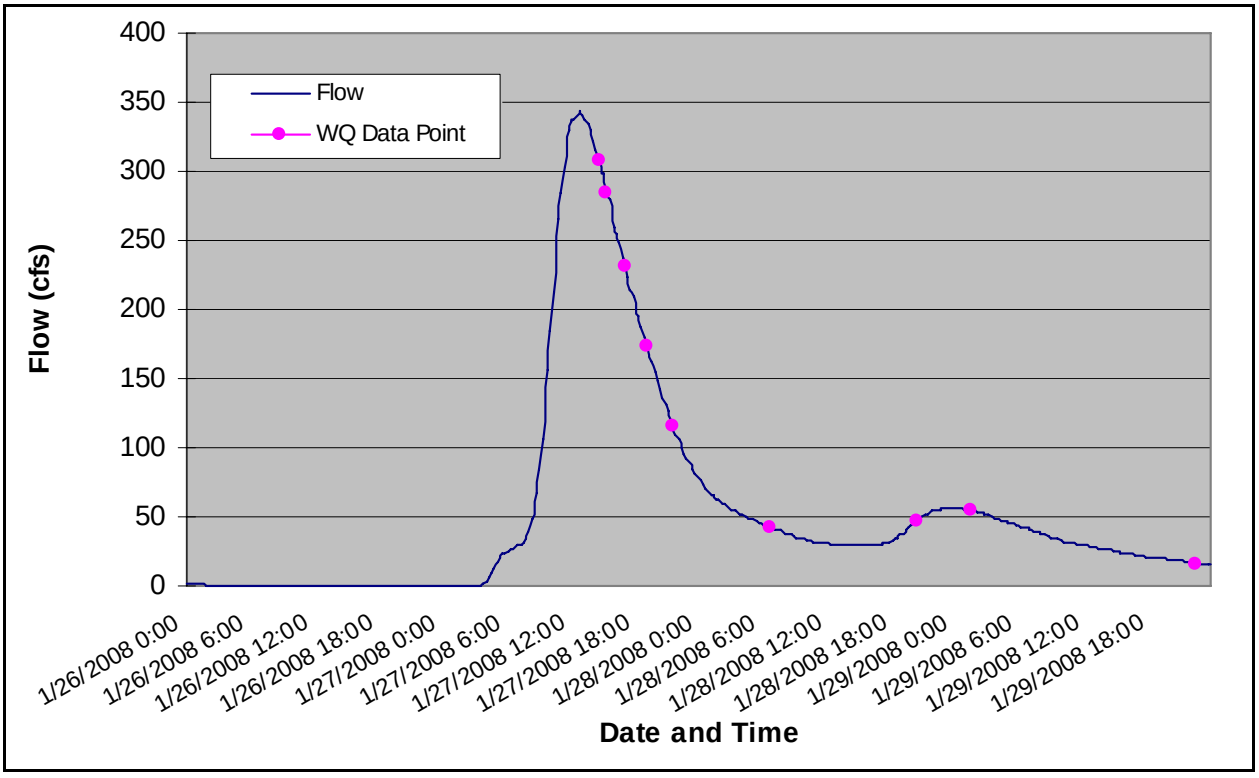


Table 2-4. San Jacinto at Goetz Road Water Quality Data

Parameters	units	avg	count	Storm Data (01/27/08 thru 01/29/2008)								
				1/27	1/27	1/27	1/27	1/27	1/28	1/28	1/29	1/29
				14:28	15:16	16:54	18:53	21:30	6:28	20:16	1:14	22:14
ammonia nitrogen (NH4-N)	mg/L	0.14	9	0.14	0.17	0.11	-nd-	-nd-	-nd-	-nd-	-nd-	0.15
biochemical oxygen demand (BOD)	mg/L	-nd-	1	-nd-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-
chemical oxygen demand (COD)	mg/L	39	9	39	46	46	41	39	35	37	35	33
nitrate nitrogen (NO3-N)	mg/L	0.53	9	0.47	0.45	0.50	0.50	0.61	0.52	0.61	0.54	0.56
nitrite nitrogen (NO2-N)	mg/L	-nd-	9	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
soluble reactive phosphorus (SRP/ortho-P)	mg/L	0.21	9	0.21	0.22	0.21	0.23	0.24	0.23	0.19	0.19	0.19
total organic nitrogen (Org-N)	mg/L	1.2	9	1.6	1.3	1.3	1.2	1.2	1.1	1.3	0.8	1.0
total phosphorus (TP)	mg/L	0.58	9	0.85	0.70	0.64	0.63	0.57	0.55	0.46	0.39	0.41
total suspended solids (TSS)	mg/L	135	9	230	190	170	150	92	130	110	80	62
turbidity	NTU	204	9	340	230	240	230	190	200	160	120	130
pH	pH units	8.0	9	8.1	8.1	8.0	8.0	7.9	8.5	7.8	7.8	7.7
total nitrogen (TN calc)	mg/L	1.8	9	2.2	1.9	1.9	1.7	1.8	1.6	1.9	1.3	1.7

Summary Storm Water Quality Data – San Jacinto River at Ramona Expressway

There were no significant flows at the "San Jacinto River at Ramona Expressway" site; thus, no samples were taken during the 2007-2008 monitoring year.

Summary Storm Water Quality Data – Canyon Lake Spillway

Water quality was sampled for only one storm event at the "Canyon Lake Spillway" site. A summary of this data is presented in **Table 2-5**. However, no time series flow data is available for the "Canyon Lake Spillway"; therefore, it was not possible to estimate nutrient loadings.

Table 2-5. Canyon Lake Spillway Water Quality Data

Parameters	units	avg	count	Storm Data (01/26/08 thru 01/29/2008)											
				1/26	1/27	1/27	1/27	1/27	1/28	1/28	1/28	1/28	1/29	1/29	1/29
				23:35	5:34	11:34	17:34	23:34	5:34	11:34	17:34	23:34	5:34	11:34	17:34
ammonia nitrogen (NH4-N)	mg/L	0.14	12	-nd-	0.13	0.11	0.11	0.13	0.11	0.22	0.11	0.24	-nd-	-nd-	0.13
biochemical oxygen demand (BOD)	mg/L	-nd-	1	-nd-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-
chemical oxygen demand (COD)	mg/L	36	12	44	54	50	33	33	39	33	30	26	28	26	37
nitrate nitrogen (NO3-N)	mg/L	0.35	12	0.36	0.36	0.38	0.34	0.34	0.34	0.34	0.38	0.34	0.34	0.32	0.32
nitrite nitrogen (NO2-N)	mg/L	-nd-	12	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
soluble reactive phosphorus (SRP/ ortho-P)	mg/L	0.31	12	0.35	0.31	0.30	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.30	0.29
total organic nitrogen (Org-N)	mg/L	1.3	12	1.3	1.6	1.5	1.4	1.0	1.0	1.2	1.4	1.3	1.1	1.2	1.2
total phosphorus (TP)	mg/L	0.46	12	0.41	0.63	0.62	0.46	0.51	0.45	0.43	0.43	0.40	0.39	0.41	0.42
total suspended solids (TSS)	mg/L	38	12	18	120	94	55	37	22	15	15	18	15	-nd-	10
turbidity	NTU	21	12	7	110	62	15	13	7	6	7	6	6	6	7
pH	pH units	8.1	12	8.0	8.0	8.1	8.0	8.0	8.1	8.1	8.0	8.0	8.1	8.1	8.1
total nitrogen (TN calc)	mg/L	1.7	12	1.7	2.1	2.0	1.9	1.5	1.5	1.8	1.9	1.9	1.4	1.5	1.7

Summary Storm Water Quality Data – Cranston Guard Station

Water quality and flow data was collected for three storm events at the "Cranston Guard Station" site. Data for the first storm event is presented in **Table 2-6**, and **Figure 2-5,** the second storm event in **Table 2-7**, and **Figure 2-6,** and the third event in **Table 2-8**, and **Figure 2-7**.

Estimated annual nutrient loading recorded at this site were based upon annual flow recorded at the "Cranston Guard Station" USGS stream gauge (ID#11069500). Total annual flow at this gauge was estimated at 4,942.1 cfs (or 3,194.2 million gallons). Mean storm concentrations for nutrients estimated for the three storm events for total nitrogen ranged from 1.1 and 1.2 mg/L for the first and third storm events respectively to 19.1 mg/L for the second storm event. Total phosphorus ranged from 0.39 and 0.43 mg/L for the first and third storm events respectively to 3.7 mg/L for the second storm event. This resulted in estimated annual loadings of total nitrogen ranging between 29,322 and 31,988 lbs. for the first and third storm events respectively and 509,137 lbs for the second storm event. Total phosphorus loads ranged between 10,396 and 11,462 lbs. for the first and third storm events respectively and 98,629 lbs for the second storm event.

Figure 2-5. January 5-7 Storm Event - Cranston Guard Station

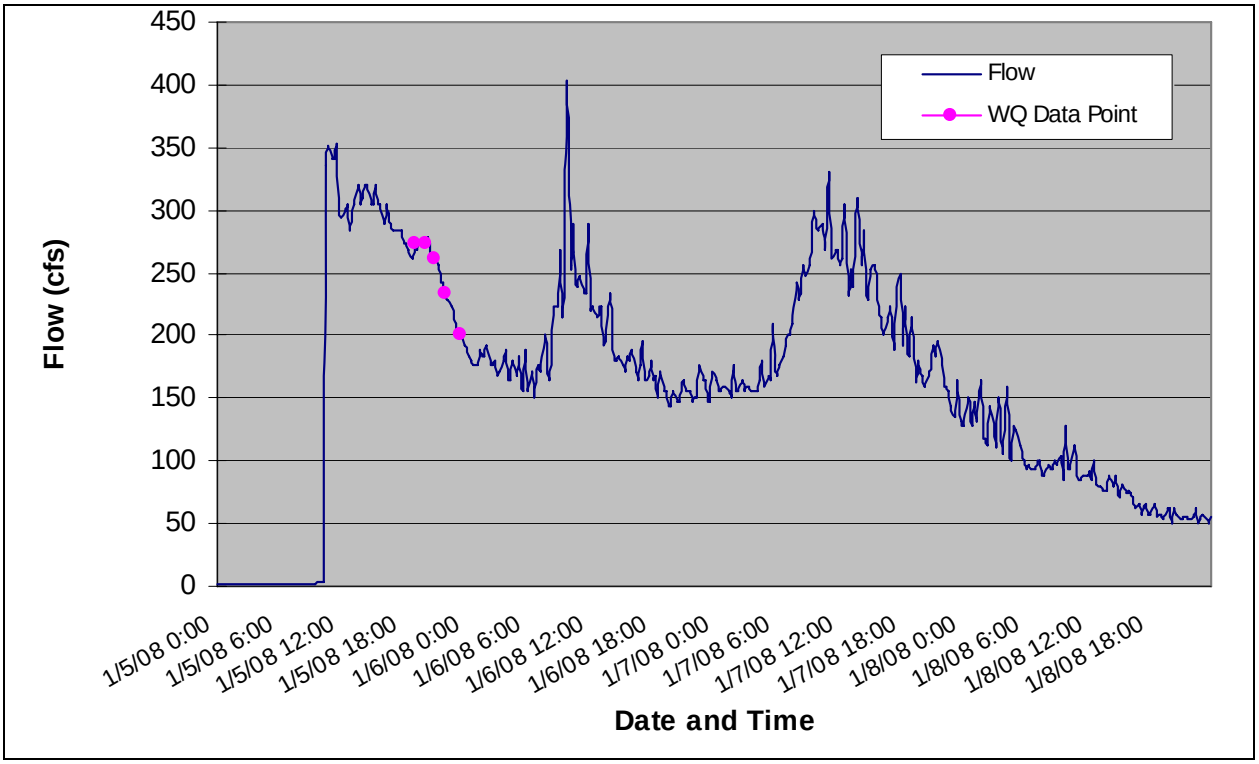


Table 2-6. Cranston Guard Station Water Quality Data (1/5/08)

Parameters	units	avg	count	Storm Data (01/05/08)				
				1/5	1/5	1/5	1/5	1/5
				19:05	20:05	21:02	22:05	23:30
Flow	(cfs)	295	5	320	320	310	278	247
ammonia nitrogen (NH4-N)	mg/L	-nd-	5	-nd-	-nd-	-nd-	-nd-	-nd-
biochemical oxygen demand (BOD)	mg/L	-nd-	5	-nd-	-nd-	-nd-	-nd-	-nd-
chemical oxygen demand (COD)	mg/L	103	5	110	130	96	100	79
nitrate nitrogen (NO3-N)	mg/L	-nd-	5	-nd-	-nd-	-nd-	-nd-	-nd-
nitrite nitrogen (NO2-N)	mg/L	-nd-	5	-nd-	-nd-	-nd-	-nd-	-nd-
soluble reactive phosphorus (SRP/ortho-P)	mg/L	0.069	5	0.075	0.072	0.069	0.066	0.065
total organic nitrogen (Org-N)	mg/L	1.1	5	1.5	1.1	1.2	0.9	1
total phosphorus (TP)	mg/L	0.39	5	0.46	0.4	0.41	0.36	0.32
total suspended solids (TSS)	mg/L	228	5	200	240	240	230	230
turbidity	NTU	69	5	81	73	56	69	64
pH	pH units	-na-	-na-	-na-	-na-	-na-	-na-	-na-
total nitrogen (TN calc)	mg/L	1.1	5	1.5	1.1	1.2	0.9	1

Figure 2-6. January 26-29 Storm Event - Cranston Guard Station

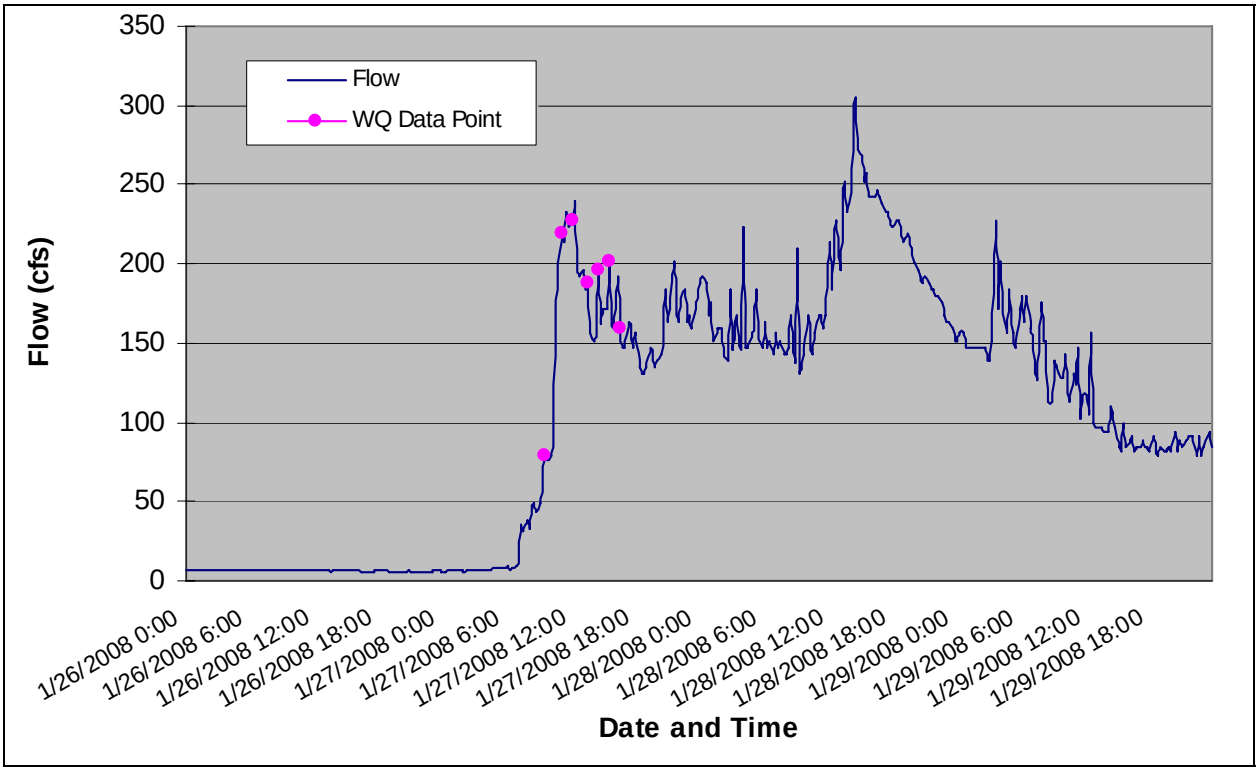


Table 2-7. Cranston Guard Station Water Quality Data (1/27/08)

Parameters	units	avg	count	Storm Data (01/27/08)						
				1/27	1/27	1/27	1/27	1/27	1/27	1/27
				9:30	11:00*	12:00	13:30	14:30	15:30	16:30
Flow	(cfs)	220	7	110	257	268	228	238	242	196
ammonia nitrogen (NH4-N)	mg/L	-nd-	7	0.13	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
biochemical oxygen demand (BOD)	mg/L	-nd-	7	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	10
chemical oxygen demand (COD)	mg/L	102	7	270	100	89	59	65	76	54
nitrate nitrogen (NO3-N)	mg/L	-nd-	7	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
nitrite nitrogen (NO2-N)	mg/L	-nd-	7	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
soluble reactive phosphorus (SRP/ortho-P)	mg/L	0.062	7	-nd-	0.066	-nd-	-nd-	0.061	0.061	0.058
total organic nitrogen (Org-N)	mg/L	3.6	7	19	1.4	1.2	1.3	0.9	0.8	0.8
total phosphorus (TP)	mg/L	1.16	7	3.7	0.8	1.1	0.74	0.7	0.61	0.45
total suspended solids (TSS)	mg/L	4313	7	27000	370	900	540	520	450	410
turbidity	NTU	191	7	>4,000	200	340	210	160	140	96
pH	pH units	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-
total nitrogen (TN calc)	mg/L	3.6	7	19.1	1.4	1.2	1.3	0.9	0.8	0.8

Notes:
* sample collected at: N.F. & Hwy 74

Figure 2-7. February 2-5 Storm Event - Cranston Guard Station

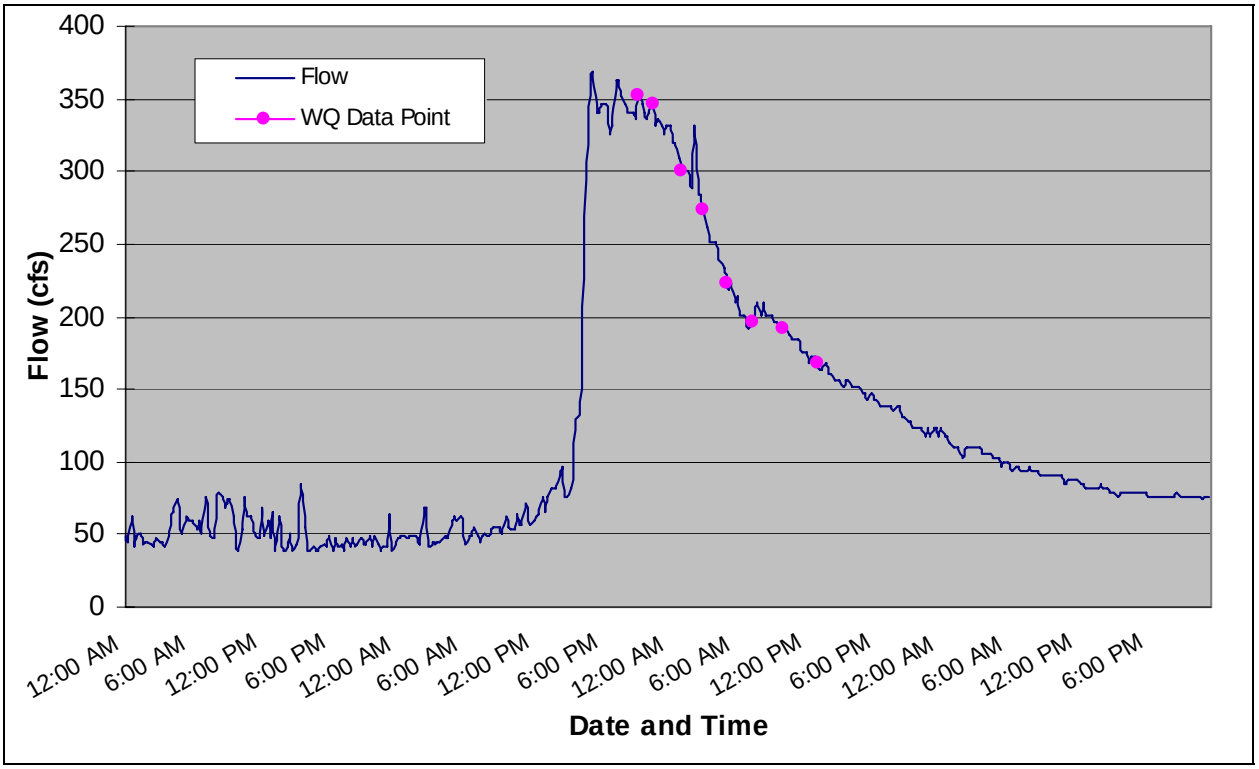


Table 2-8. Cranston Guard Station Water Quality Data (2/3/08 thru 2/4/08)

Parameters	units	avg	count	Storm Data (02/03/08 thru 2/4/08)							
				2/3 21:15	2/3 23:00	2/4 1:00	2/4 3:00	2/4 5:00	2/4 7:15	2/4 10:00	2/4 13:00
Flow	(cfs)	254	8	347	331	300	273	223	201	192	168
ammonia nitrogen (NH4-N)	mg/L	-nd-	8	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
biochemical oxygen demand (BOD)	mg/L	-nd-	8	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
chemical oxygen demand (COD)	mg/L	58	8	46	110	61	52	44	52	48	50
nitrate nitrogen (NO3-N)	mg/L	0.30	8	0.27	0.25	0.29	0.32	0.32	0.32	0.32	0.32
nitrite nitrogen (NO2-N)	mg/L	-nd-	8	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-	-nd-
soluble reactive phosphorus (SRP/ortho-P)	mg/L	0.079	8	0.09	0.081	0.087	0.084	0.086	0.066	0.07	0.07
total organic nitrogen (Org-N)	mg/L	0.9	8	1.6	0.8	0.8	0.8	0.6	0.8	0.7	0.7
total phosphorus (TP)	mg/L	0.43	8	0.69	0.93	0.51	0.33	0.28	0.22	0.23	0.22
total suspended solids (TSS)	mg/L	194	8	380	260	330	160	140	130	83	71
turbidity	NTU	64	8	150	79	120	46	41	29	23	20
pH	pH units	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-	-na-
total nitrogen (TN calc)	mg/L	1.2	8	1.9	1.1	1.1	1.1	0.9	1.1	1.0	1.0

2.3 San Jacinto Watershed Rainfall Records

The RCFC&WCD maintains rainfall records for rain gauges located within or near the San Jacinto Watershed as shown in **Figure 2-1** and identified in **Table 2-9**.

Table 2-9. San Jacinto River Watershed Rainfall Gauges

Station ID	Station Description
178	Riverside
35	Corona
67	Lake Elsinore
186	Hemet/SJ
155	Perris / Moreno Valley

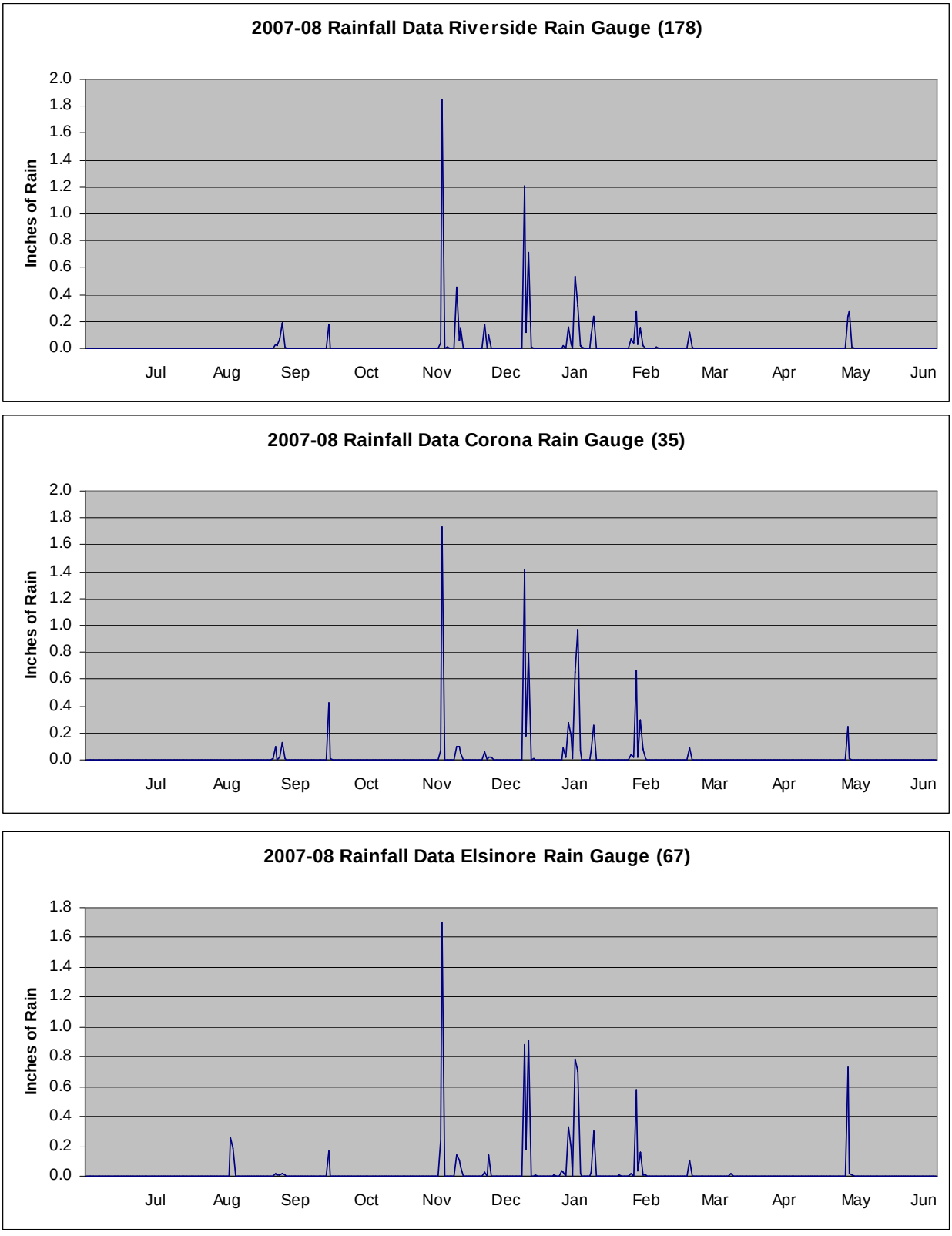
Rainfall data recorded at these five stations for the period July 1, 2007, through June 30, 2008, are summarized in **Table 2-10**. The complete set of rainfall gauge data for the period July 2007 through June 2008 is included on CD as Appendix D.

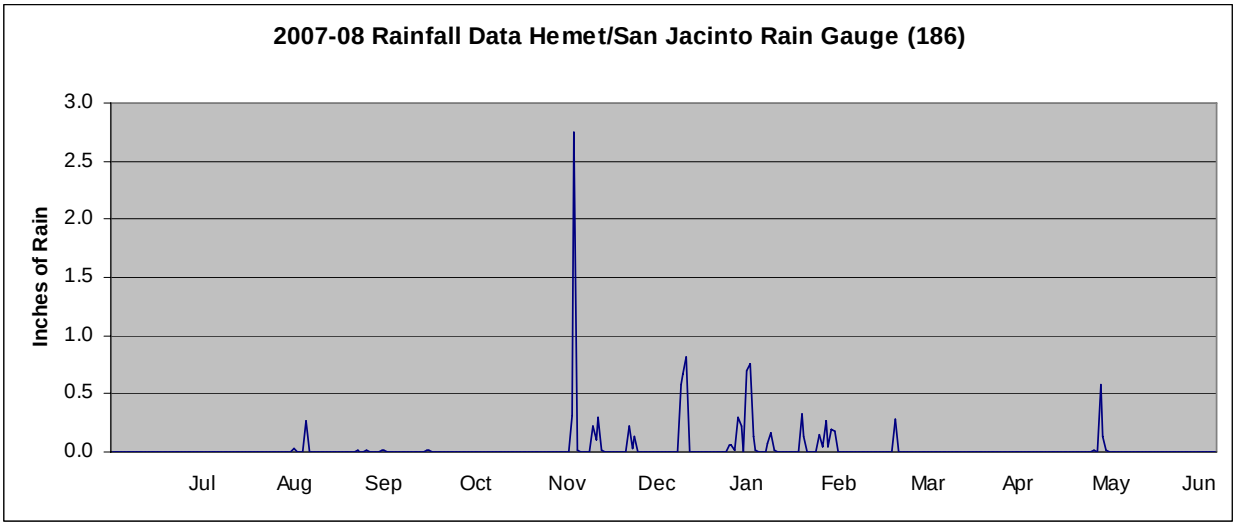
Table 2-10. Summary Rainfall Data (July 2007 to June 2008)

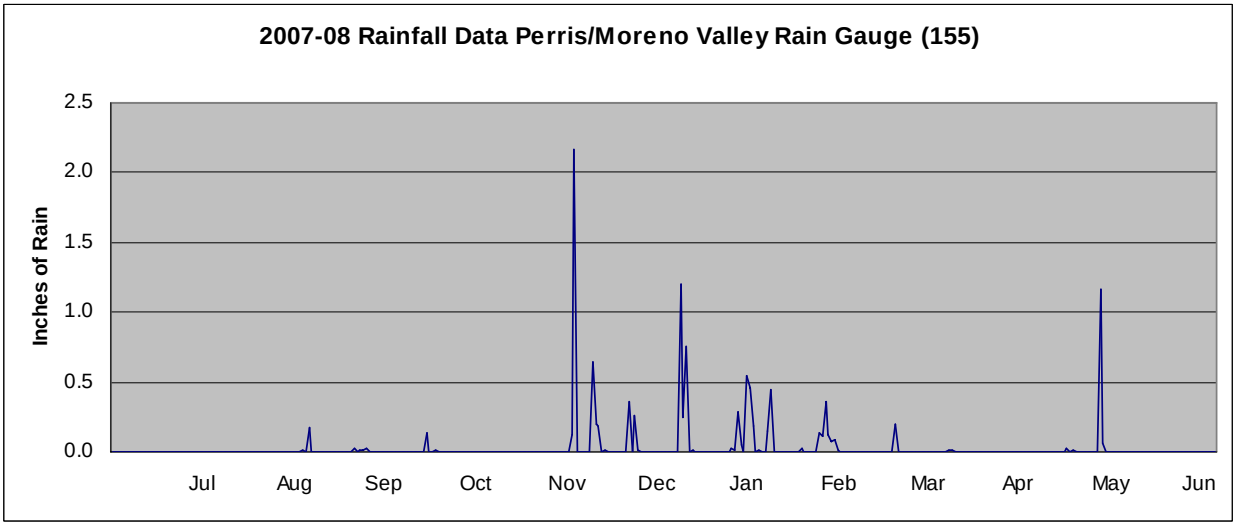
Monthly Rainfall (inches)	Riverside	Corona	Elsinore	Hemet/SJ	Perris/MV
Jul	0.00	0.00	0.00	0.00	0.00
Aug	0.00	0.00	0.00	0.03	0.00
Sep	0.32	0.27	0.52	0.33	0.24
Oct	0.18	0.44	0.17	0.04	0.15
Nov	0.04	0.07	0.24	0.31	0.12
Dec	2.81	2.08	2.18	3.78	3.83
Jan	3.14	4.67	4.08	4.34	3.78
Feb	0.93	1.46	1.16	1.59	1.51
Mar	0.14	0.09	0.11	0.28	0.20
Apr	0.00	0.00	0.02	0.00	0.02
May	0.53	0.26	0.76	0.74	1.26
Jun	0.00	0.00	0.00	0.00	0.00
Annual Rainfall (Inches)	**8.09**	**9.34**	**9.24**	**11.44**	**11.11**
% of Normal	**72%**	**63%**	**84%**	**90%**	**92%**

Figure 2-8 presents the daily rainfall records each monitoring station for the period of July 2007 – June 2008.

Figure 2-8. Daily Rainfall Gauge Records for July 2007 to June 2008




2007-08 Rainfall Data Hemet/San Jacinto Rain Gauge (186)
Inches of Rain
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun


2007-08 Rainfall Data Perris/Moreno Valley Rain Gauge (155)
Inches of Rain
2.5
2.0
1.5
1.0
0.5
0.0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun

2.4 Stream Gauge Records

The USGS and RCFC&WCD monitor stream flow from a number of gauging stations in the San Jacinto River Watershed. Stream gauging stations maintained and operated for Phase 1 of the San Jacinto Watershed Monitoring Program are shown in **Figure 2-1** and identified in **Table 2-11**.

Table 2-11. Phase 1 Stream Gauge Stations

Station ID	Agency	Location Description
11070465	USGS	Salt Creek at Murrieta Road
11070365	USGS	San Jacinto River at Goetz Road
11070210	USGS	San Jacinto River at Ramona Expressway
841	RCFC&WCD	Canyon Lake Spillway
11069500	USGS	Cranston Guard Station

Stream gauge data recorded at these four stations for the period July 1, 2007, through June 30, 2008, is summarized in **Table 2-12**. The complete set of stream gauge data for the period July 2007 through June 2008 is included on CD as Appendix D.

Please note that data was available for RCFC&WCD station ID 841 Canyon Lake Spillway for only a limited period in January and February 2008 only. Flow exited Canyon Lake Dam for 9 days in January and 5 days in February.

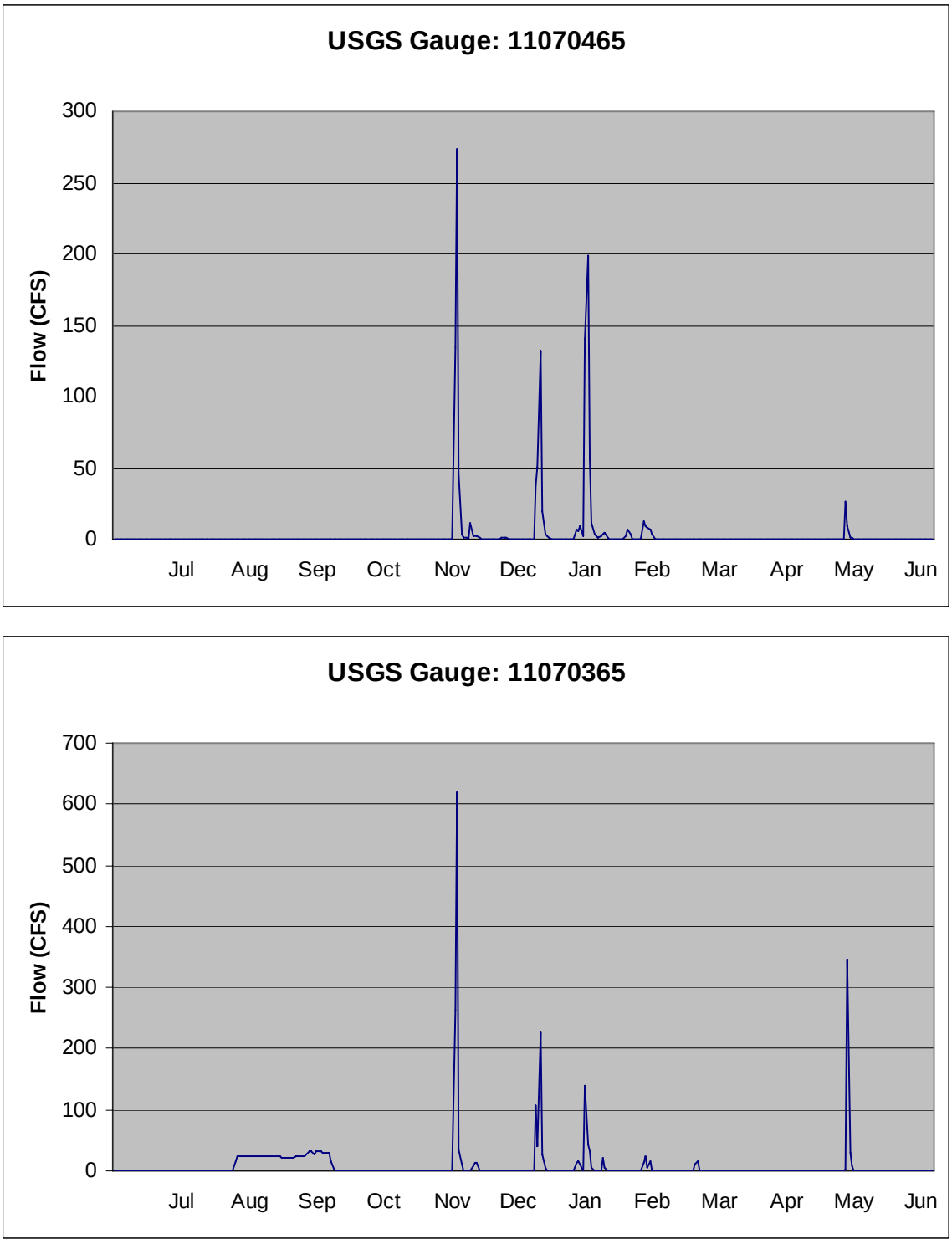
Table 2-12. Summary – Stream Gauge Data (July 2007 to June 2008)

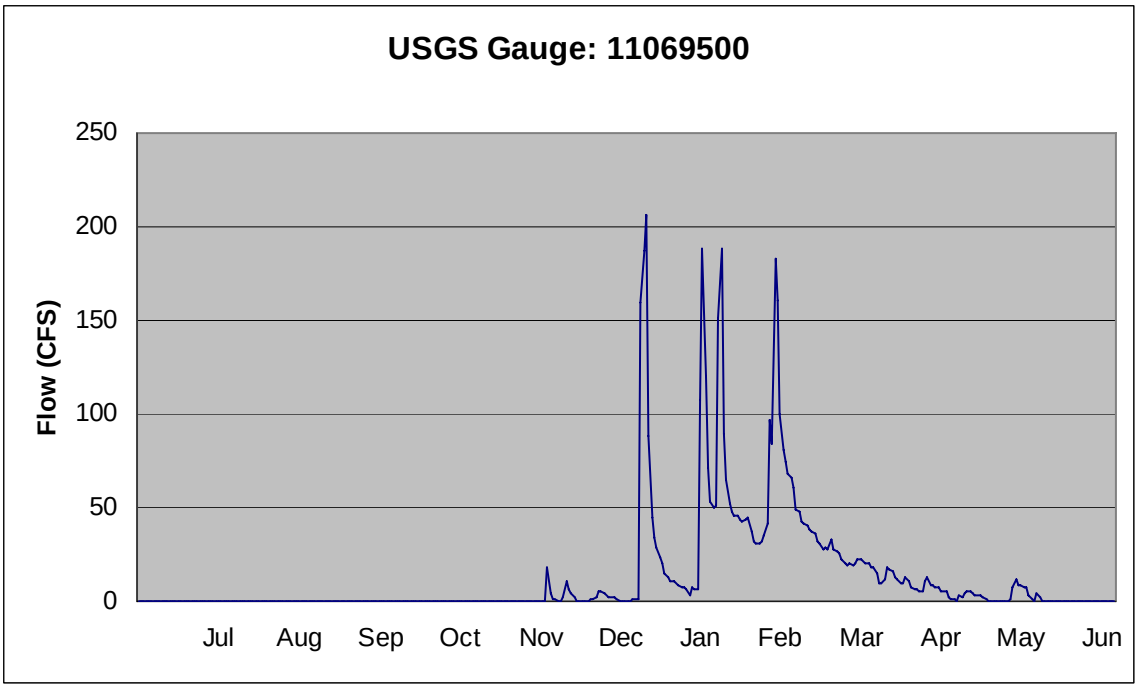
Mean Monthly Flow (cfs)	11070465	11070365	11070210	841	11069500
Jul	0.01	0.00	0.00	-na-	0.00
Aug	0.00	5.87	0.00	-na-	0.00
Sep	0.00	24.83	0.00	-na-	0.00
Oct	0.00	5.50	0.00	-na-	0.00*
Nov	4.47	8.73	0.00	-na-	0.00*
Dec	11.30	22.47	0..00	-na-	2.71*
Jan	21.94	21.05	0.00	108.4	46.7*
Feb	2.35	2.95	0.00	6.0	70.7*
Mar	0.00	0.89	0.00	-na-	31.1*
Apr	0.00	0.01	0.00	-na-	9.7*
May	1.23	12.57	0.00	-na-	3.1*
Jun	0.00	0.00	0.00	-na-	0.3*
Mean Annual Flow (cfs)	**3.44**	**8.74**	**0.00**	-na-	**13.69***

* Data reported as provisional.

Figure 2-9 presents the available daily stream flow records from each monitoring station for the period of July 2007-June 2008.

Figure 2-9. Daily Stream Gauge Records for July 2007 to June 2008




USGS Gauge: 11069500
Flow (CFS)
250
200
150
100
50
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun

3.0 Lake Elsinore Nutrient TMDL Monitoring Program

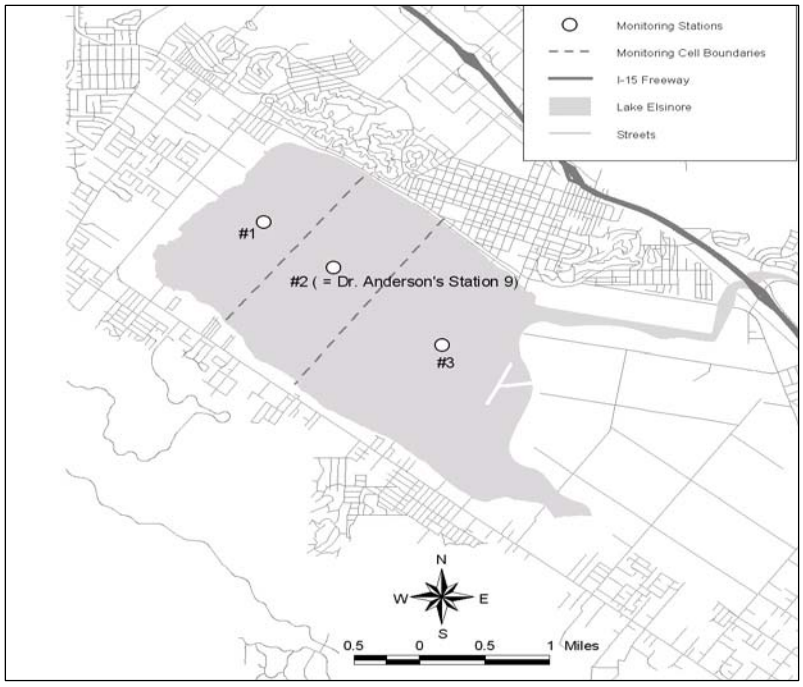
Elsinore Valley Municipal Water District (EVMWD) supports the Task Force effort by conducting the Phase 1 Lake Elsinore Monitoring Program sampling and analysis. This work is preformed in coordination with EVMWD's NPDES compliance program (Order No. R8-2005-0003 for NPDES No. CA8000027 for the Regional Water Reclamation Plant, Lake Elsinore, and Riverside County approved March 4, 2005).

EVMWD's NPDES compliance monitoring program for Lake Elsinore was initiated in April 2006. For the July 2007 to June 2008 period, Lake Elsinore TMDL compliance monitoring was conducted by a team led by Dr. James Noblet, California State University, San Bernardino (CSUSB). During this period, the Lake Elsinore Marine Search and Rescue group provided watercraft and pilots for the sampling team.

Sampling Station Locations

To characterize water quality conditions in Lake Elsinore, three polygons/cells were defined, with a sampling site in the approximate center of each cell (**Figure 3-1**). All sampling sites were located and referenced using global positioning system (GPS) units with surface buoys. The middle of the three open water sampling stations (Site 2 in this program) overlaps with Site 9 of the pilot discharge sampling program (2002 – 2004).

Figure 3-1. Lake Elsinore Monitoring Cell Locations



Sampling Schedule

The TMDL monitoring plan calls for monthly sampling October to May and biweekly sampling June to September (16 sampling events). The CSUSB team collected samples on a total of 21 dates. The exact dates of sampling were dependent upon student class schedule, local weather conditions, and other factors.

Revisions to the Monitoring Plan

Aside from the additional sampling dates, there were no revisions made to the Lake Elsinore Nutrient TMDL Monitoring Plan. TMDL compliance monitoring for Lake Elsinore follows the April 2007 – March 2008 Lake Elsinore Water Quality Monitoring Plan to Evaluate the Efficacy of the In-Lake Nutrient Reduction Facilities (Aeration and Mixing) for Lake Elsinore prepared by EVMWD, included on CD as Appendix E. Since April 2007, water quality sampling and analysis has been conducted by CSUSB.

Fish Kills and Algae Blooms

There were not reported fish kills of algae blooms in Lake Elsinore for the July 2007 – June 2008 monitoring period.

Recycled Water Input to Lake Elsinore

Recycled water addition to Lake Elsinore from the EVMWD Regional Plant began on June 26, 2007. Inputs through June 2008 are summarized in **Table 3-1.**

Table 3-1. Summary of EVMWD Regional Plant Recycled Water Input to Lake Elsinore

Month	Recycled Water Input to Lake Elsinore (millions of gallons)	Nitrogen Input in Recycled Water (pounds)	Phosphorus Input in Recycled Water (pounds)
July 2007	99	1,739	364
August 2007	112	1,962	449
September 2007	146	3,778	488
October 2007	131	2,952	886
November 2007	100	4,190	453
December 2007	161	6,163	589
January 2008	130	2,502	479
February 2008	185	4,175	371
March 2008	176	5,135	704
April 2008	156	3,245	454
May 2008	148	3,096	344
June 2008	133	2,775	532
Annual Totals	**1,678**	**41,711**	**6,114**

3.1 Lake Elsinore Annual Water Quality Summary

Lake Elsinore monitoring results for the period July 1, 2007 through June 30, 2008 are summarized in **Table 3-2**.

Table 3-2. Summary – Lake Elsinore Water Quality Data (July 2007 to June 2008)

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2007 – 2008 Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Dissolved Oxygen (mg/L) (Station 2, depth profile)	Not less than 5 mg/L as a depth average	2015	21	3.01 – 9.99 (readings below TMDL objective observed on 4 sample dates) (4 dates out of 21, or 19%)	6.21	1.96
	Not less than 5 mg/L 1 meter above lake bottom	2020	21	0.12 – 9.71 (readings below TMDL objective observed on 14 sample dates) (14 dates out of 21, or 67%)	4.23	2.27
pH (3 stations, depth profile)	6.5 - 8.5	---	21	8.61 – 9.70	9.00	0.31
Ammonia N (NH_4-N) (mg/L) (3 stations, integrated samples)	Toxicity stds	2020	24	0.025 – 0.308	0.115	0.084
Toxicity (comparison to ammonia data; 3 stations; surface, integrated, and bottom samples)	Acute: 1-hr avg not to exceed CMC more than once every 3 yrs on avg	2020	No observed exceedences of the Criteria Maximum Concentration (CMC) or acute criterion at the range of pH conditions measured.			
	Chronic: 30-day avg not to exceed CCC more than once every 3 yrs on avg		Exceedences of the Criteria Continuous Concentration (CCC) or chronic criterion under some of the observed pH and temperature conditions on: ➢ 10/12/07 E1 Integrated sample ➢ 11/28/07 E2 Integrated sample ➢ 1/16/08 E2 Bottom sample ➢ 5/16/08 E3 Surface sample ➢ 6/27/08 E1 Surface sample Exceedence of CCC observed 2.3% of the time (5 out of 216 ammonia readings).			
Total Nitrogen (TN) (mg/L) (3 stations, integrated samples)	Annual average 0.75 mg/L	2020	24	0.50 – 8.56	3.60	2.25
Total Phosphorus (TP) (mg/L) (3 stations, integrated samples)	Annual average 0.1 mg/L	2020	24	0.09 – 0.38	0.20	0.07

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2007 – 2008 Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Chlorophyll *a* (µg/L) (3 stations, surface samples 0-2 m, April to Sept)	Summer average no greater than 40 µg/L	2015	13	16.0 – 95.6	44.0	21.0
Chlorophyll *a* (µg/L) (3 stations, integrated samples, April to Sept)	Summer average no greater than 25 µg/L	2020	10	17.0 – 74.4	40.7	17.5
Secchi Depth (cm) (3 stations)	---	---	20	36 - 102	70	23
Total Dissolved Solids (mg/L) (3 stations, integrated samples)	2000 mg/L	---	24	1113 - 1814	1440	131

Notes:

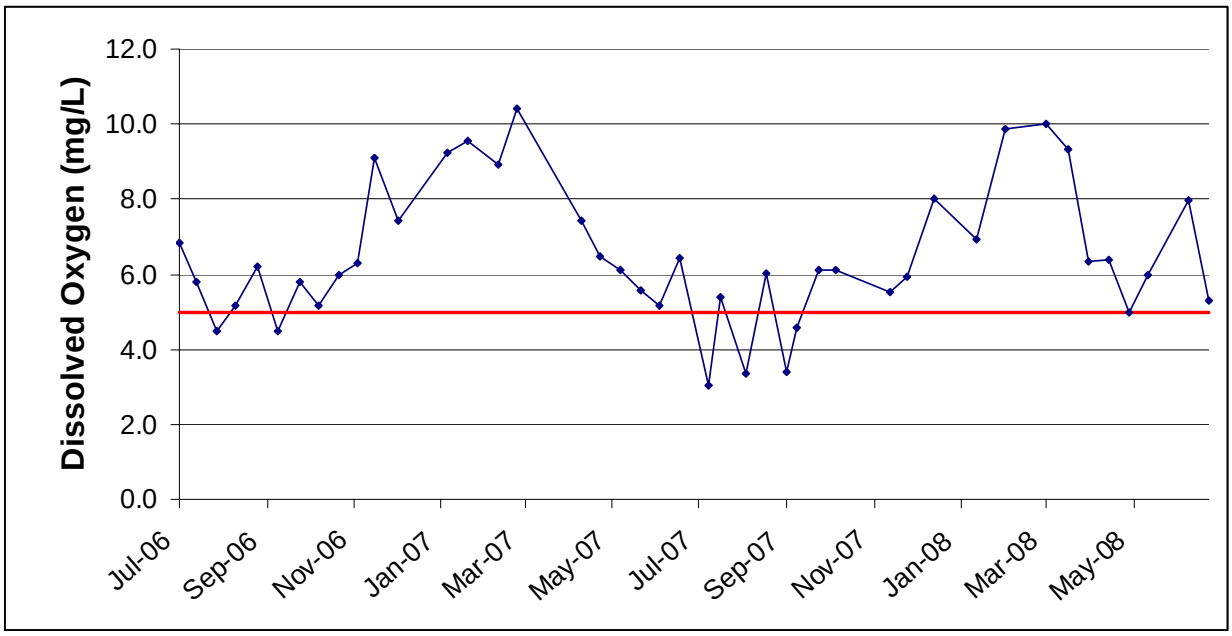
CMC = Criteria Maximum Concentration or acute criterion

CCC = Criteria Continuous Concentration or chronic criterion

Number of sampling events includes triplicates where applicable.

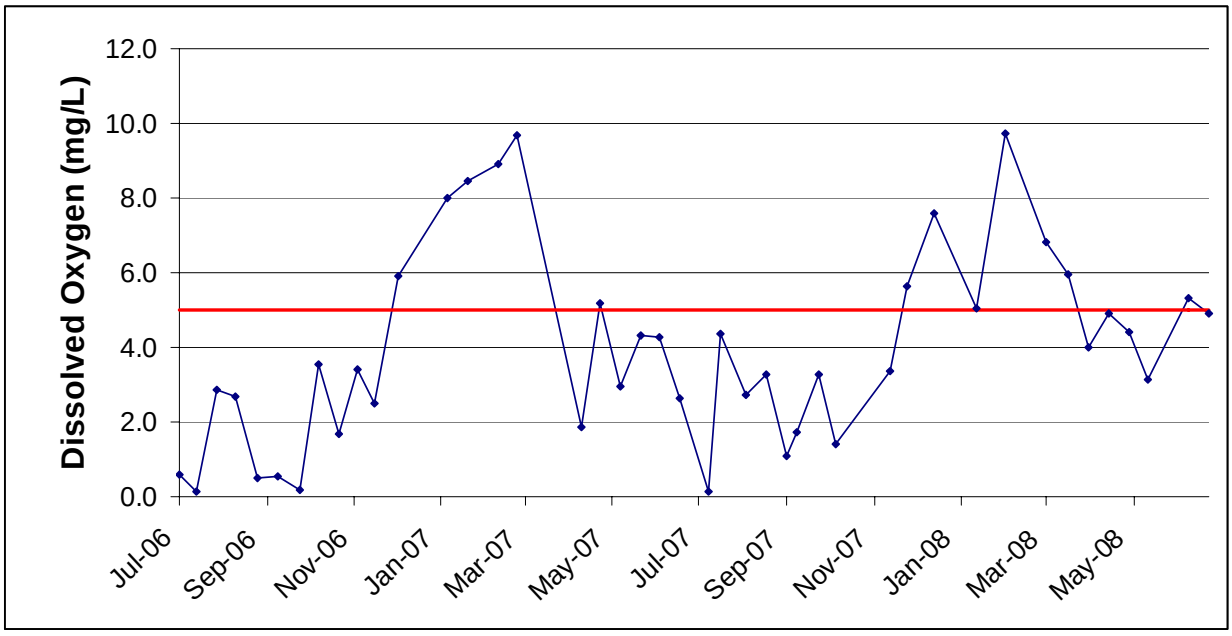
Annual trends for dissolved oxygen, total nitrogen, total phosphorus and chlorophyll *a* are presented in the figures below.

Figure 3-2. Lake Elsinore Dissolved Oxygen (mg/L)
Station E2 Depth Average – July 2006 to June 2008



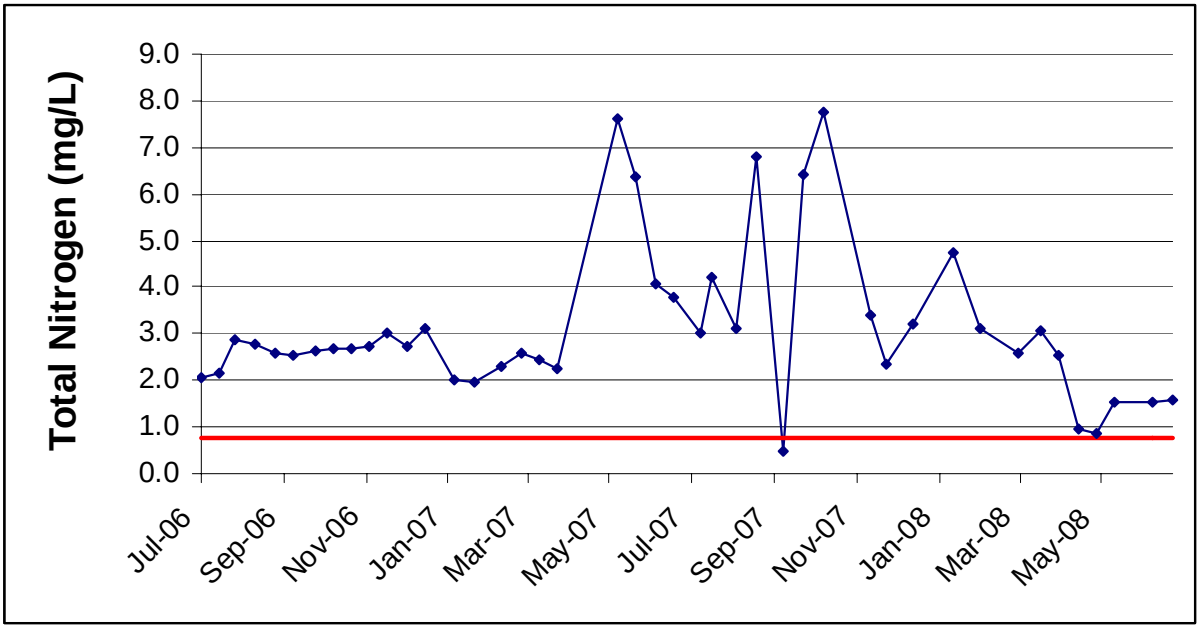
Note: Red line indicates TMDL 2015 Objective of 5 mg/L.

Figure 3-3. Lake Elsinore Dissolved Oxygen (mg/L)
Station E2 1 meter from the Lake Bottom – July 2006 to June 2008



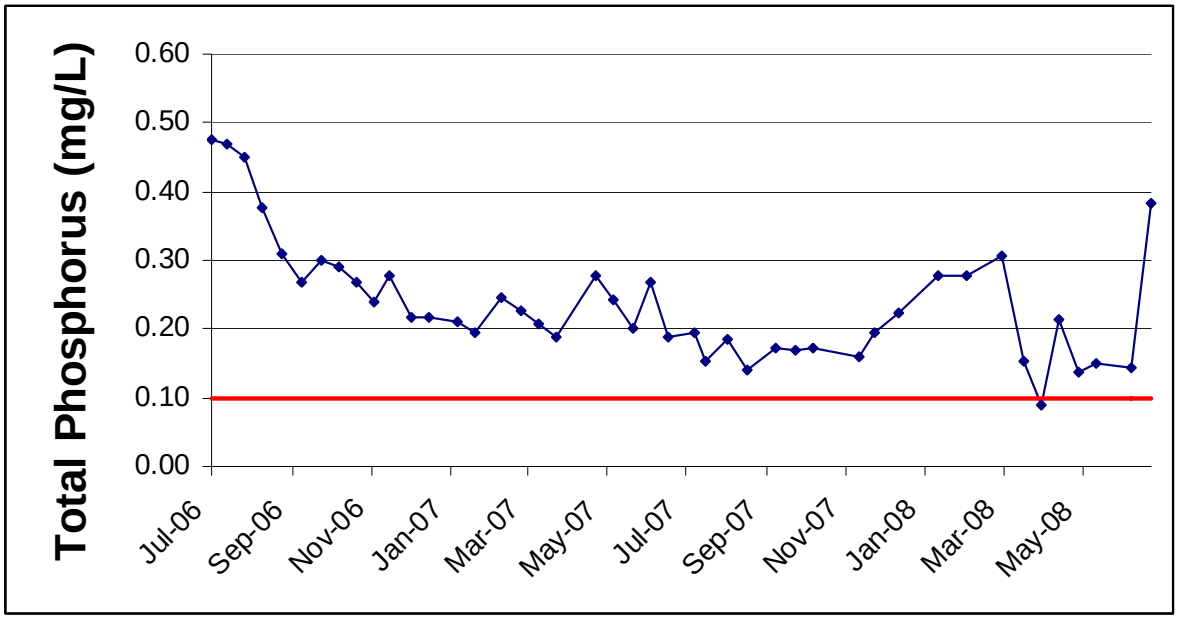
Note: Red line indicates TMDL 2020 Objective of 5 mg/L.

Figure 3-4. Lake Elsinore Total Nitrogen (mg/L)
Three Stations Integrated Samples – July 2006 to June 2008



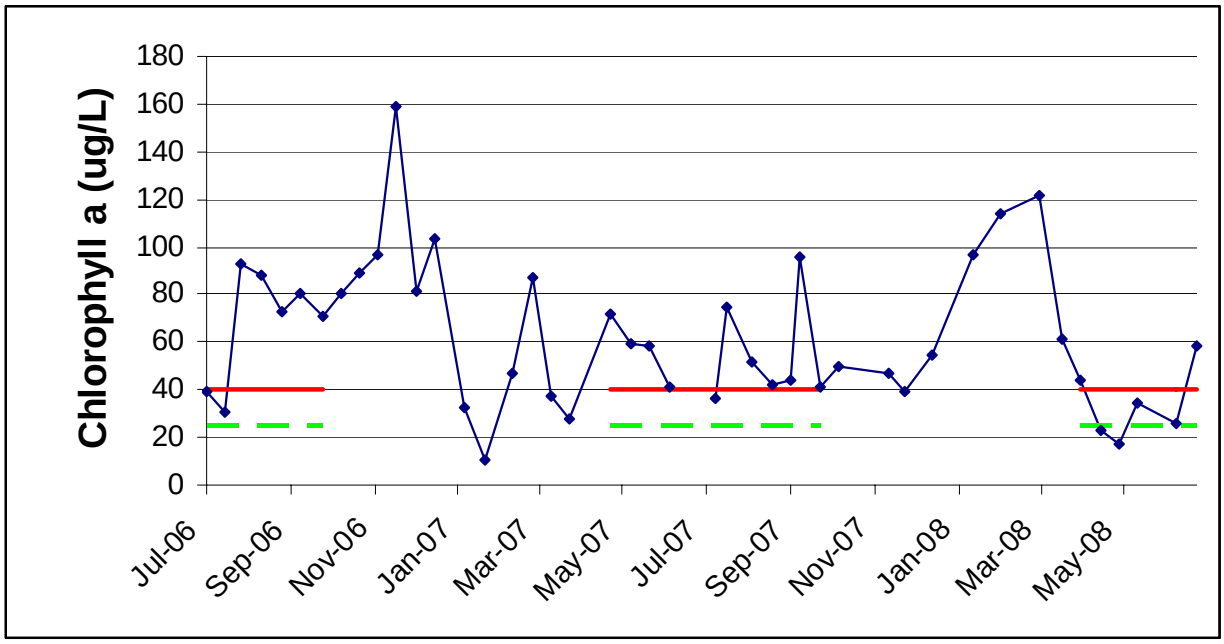
Note: Red line indicates TMDL 2020 Objective of 0.75 mg/L.

Figure 3-5. Lake Elsinore Total Phosphorus (mg/L)
Three Stations Integrated Samples – July 2006 to June 2008



Note: Red Line indicates TMDL 2020 Objective of 0.1 mg/L.

Figure 3-6. Lake Elsinore Chlorophyll *a* (ug/L)
Three Stations Integrated Samples – July 2006 to June 2008



Notes: Integrated samples not available on all dates; surface samples used for daily average on those dates. Red line indicates TMDL 2015 summer objective of 40 ug/L. Green line indicates TMDL 2020 summer objective of 25 ug/L.

A complete description of Lake Elsinore water quality analyses and results from July 2007 through June 2008 is available through the quarterly reports of the Lake Elsinore Monitoring and Evaluation Program included on CD as Appendix F. The complete set of Lake Elsinore Water Quality Data is included on CD as Appendix D.

4.0 Canyon Lake Nutrient TMDL Monitoring Program

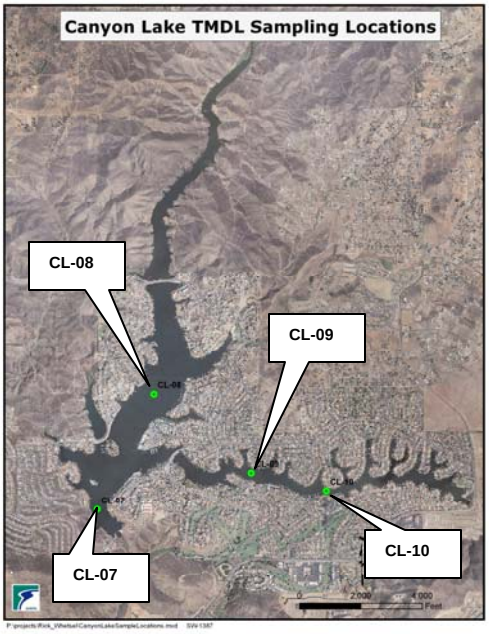
EVMWD supports the Task Force effort by conducting the Phase 1 Canyon Lake Nutrient TMDL Monitoring Program sampling and analysis. For the July 2007 to June 2008 period, Canyon Lake monitoring was conducted by a team led by Dr. James Noblet, CSUSB. During this period, the Canyon Lake Marine Patrol provided watercraft and pilots for the sampling team.

Sampling Station Locations

Field measurements consisted of Hydrolab casts and water column sampling at four sites on Canyon Lake (**Figure 4-1**). The sites in the main basin (C7 and C8) were deeper than those in East Bay (C9 and C10).

- **Station (C7)** - at the deepest part of the lake near the dam. The site is generally strongly stratified during the summer. The nutrient content of the lake in this area is important because any dam overflows would first discharge into the San Jacinto River and flow down to Lake Elsinore.
- **Station (C8)** - Centrally located, this station is most reflective of conditions in the Lake.
- **Stations (C9 and C10)** - shallow sites within East Bay that receive some local nuisance runoff and also receive discharges from Salt Creek during periods of rainfall and runoff.

Figure 4-1. Canyon Lake Monitoring Locations



Sampling Schedule

The TMDL monitoring plan calls for monthly sampling October to May and biweekly sampling June to September (16 sampling events). The CSUSB team collected samples on a total of 20 dates. The exact dates of sampling were dependent upon student class schedule, local weather conditions, and other factors.

Revisions to the Monitoring Plan

Aside from the additional sampling dates, there were no revisions made to the Canyon Lake Nutrient TMDL Monitoring Plan. TMDL compliance monitoring for Canyon Lake follows the July 2007 – June 2008 Canyon Lake Water Quality Monitoring Plan prepared by EVMWD, and included on CD as Appendix G. Since July 2007, water quality sampling and analysis has been conducted by CSUSB..

Fish Kills and Algae Blooms

There were no reported fish kills in Canyon Lake for the July 2007 – June 2008 monitoring period. There was a single algae bloom reported in May of 2008.

4.1 Canyon Lake Annual Water Quality Summary

Canyon Lake monitoring results for the period July 1, 2007 through June 30, 2008 are summarized in **Table 4-1**.

Table 4-1. Summary – Canyon Lake Water Quality Data (July 2007 to June 2008)

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2007 – 2008 Results							
			Main Basin Results				East Bay Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation	Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Dissolved Oxygen* (mg/L) Station 7 for Main Basin (deepest station) Stations 9 and 10 for East Bay	Not less than 5 mg/L above the thermocline	2015	20	2.12 – 13.75 (readings below TMDL objective observed on 6 sample dates) (6 dates out of 20, or 30%)	7.08	2.97	20	2.71 – 7.89 (readings below 5 mg/L observed on 6 sample dates) (6 dates out of 20, or 30%)	5.56	1.25
	Not less than 5 mg/L daily average in hypolimnion	2020	20	0.16 – 5.51 (readings below TMDL objective observed on 18 sample dates) (18 dates out of 20, or 90%)	1.11	1.74				
pH (Stations 7 and 8 for Main Basin; 9 and 10 for East Bay)	6.5 - 8.5	---	20	7.66 – 8.73	8.11	0.29	20	7.61 – 9.31	8.39	0.41
Ammonia N (NH_4-N) (mg/L) (Stations 7 and 8 for Main Basin; 9 and 10 for East Bay)	See Toxicity stds, below	2020	24	0.041 – 0.792	0.302	0.202	24	ND – 0.902	0.265	0.234

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2007 – 2008 Results							
			Main Basin Results				East Bay Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation	Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Toxicity (calculated CMC and CCC to ammonia data)	Acute: 1-hr avg not to exceed CMC more than once every 3 yrs on avg	2020	Exceedences of the Criteria Maximum Concentration (CMC) or acute criterion on: ➢ C8 5/30/08 at 4m and at 5 m ➢ Exceedence observed 0.7% of the time (1 out of 140 ammonia readings)				Exceedences of the Criteria Maximum Concentration (CMC) or acute criterion on: ➢ C9 5/30/08 at 4 m ➢ Exceedence observed 0.8% of the time (1 out of 121 ammonia readings)			
	Chronic: 30-day avg not to exceed CCC more than once every 3 yrs on avg	2020	Exceedences of the Criteria Continuous Concentration (CCC) or chronic criterion under some of the observed pH and temperature conditions on: ➢ Exceedences observed 5.7% of the time (8 out of 140 samples) (most exceedences observed 6/18/08)				Exceedences of the Criteria Continuous Concentration (CCC) or chronic criterion under some of the observed pH and temperature conditions on: ➢ Exceedences observed 13.2% of the time (16 out of 121 ammonia readings) (most exceedences observed 5/30/08, 6/6/08, and 6/18/08)			
Total Nitrogen (TN) (mg/L)	Annual average 0.75 mg/L	2020	23	0.33 – 4.37	2.00	1.39	24	0.35 – 5.49	1.90	1.14
Total Phosphorus (TP) (mg/L)	Annual average 0.1 mg/L	2020	24	0.33 – 0.89	0.62	0.14	24	0.17 – 1.33	0.65	0.21

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2007 – 2008 Results							
			Main Basin Results				East Bay Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation	Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
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	22	8.7 – 125.4	38.9	31.6	22	10.6 – 266.1	74.6	59.3
Chlorophyll *a* (µg/L) (integrated samples)		2020	22	3.4 – 125.4	33.4	28.9	22	9.2 – 266.1	69.9	58.0
Secchi Depth (cm)	---	---	20	62 - 160	103	30	20	47 - 107	70	18
Total Dissolved Solids (mg/L) (integrated samples)	700 mg/L	---	19	577 - 985	811	128	18	551 - 1206	901	248

Notes:

Dissolved Oxygen: Main Body count, range, mean and standard deviation calculated from the daily averages for 20 sampling days. For station C7, data for upper waters reflect results from above the thermocline when lake was stratified, readings from all depths when the lake was mixed. Average values for the hypolimnion were calculated from all readings below the thermocline for dates when the lake was stratified and from the four deepest readings when the lake was mixed. East Bay (stations C9 and C10) count, range, mean and standard deviation calculated from the daily averages for 20 sampling days; all readings, all depths.

pH: Count, range, mean and standard deviation calculated from daily averages for 20 sampling days.

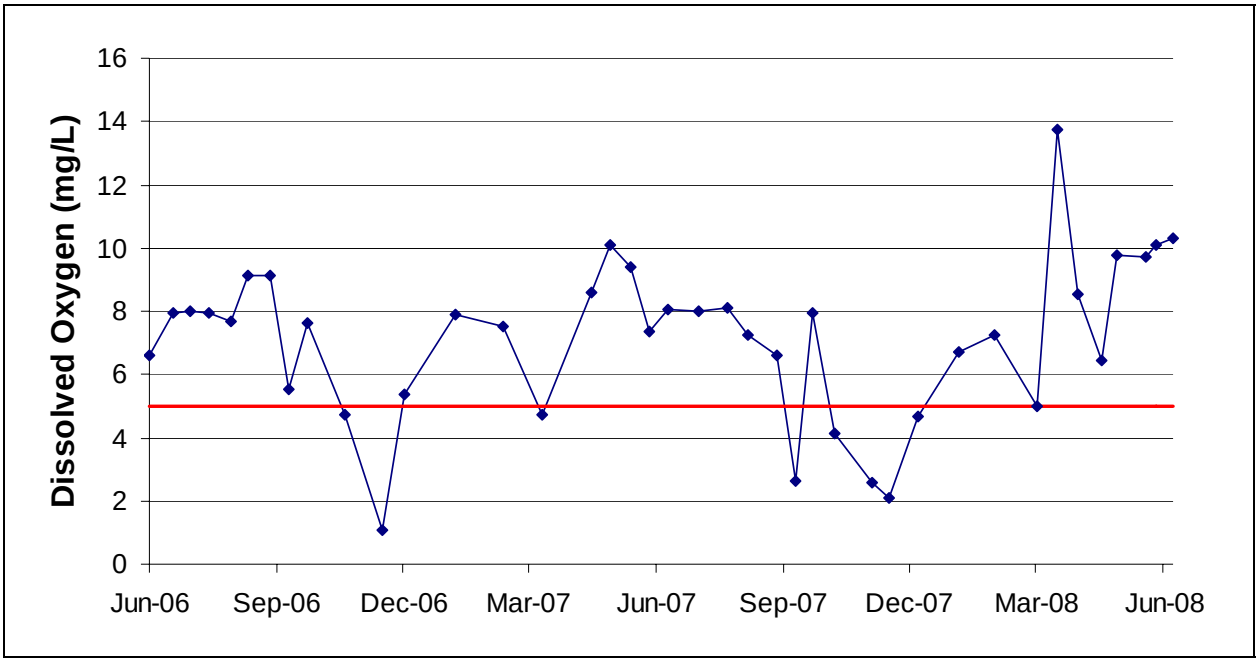
Ammonia, Total Nitrogen: Mean calculated using integrated water column sample for dates when the lake was mixed and from an average of available epilimnion, thermocline, and hypolimnion samples from dates when the lake was stratified.

Chlorophyll *a*: Main Body - integrated samples not taken on all dates – results from surface samples used for averaging on those dates. East Bay – integrated samples not taken on all dates – daily average integrated results calculated from all available depths.

Toxicity – For each ammonia reading, there is a range of measured pH and temperature conditions; CMC and CCC exceedences were observed for some depths (and therefore some combinations of pH and temperature) only.

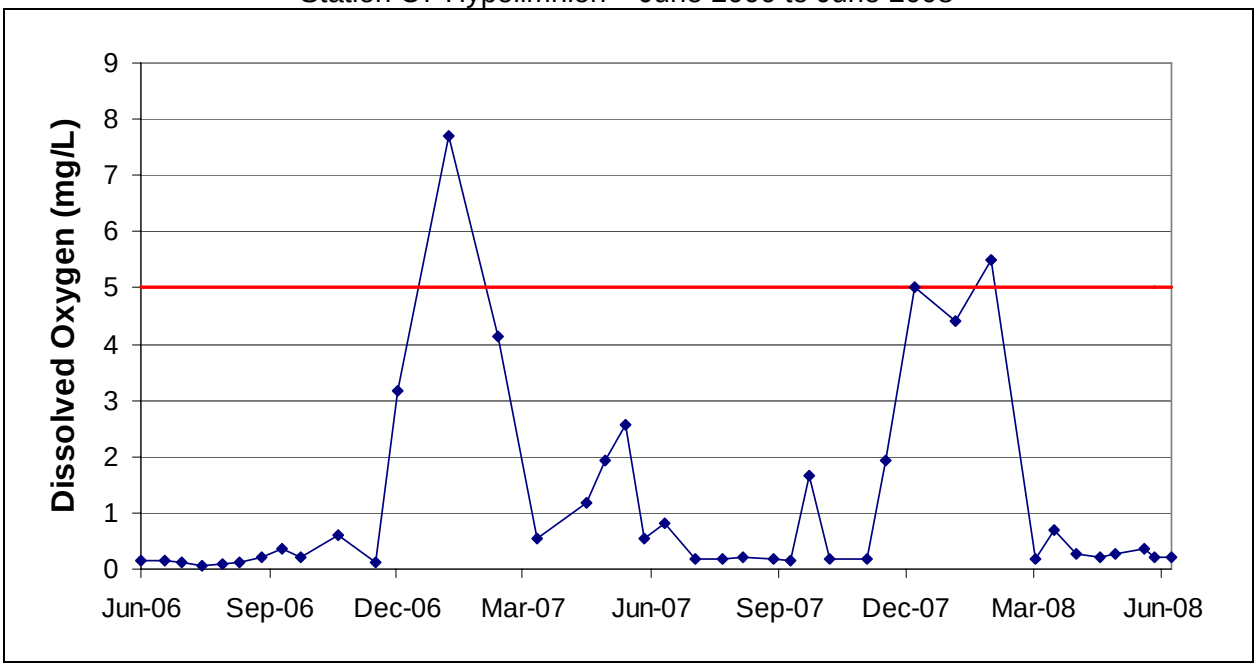
Annual trends for dissolved oxygen, total nitrogen, total phosphorus and chlorophyll *a* are presented in the figures below.

Figure 4-2. Canyon Lake Dissolved Oxygen (mg/L)
Station C7 Above the Thermocline – June 2006 to June 2008



Note: On dates lake was mixed, DO readings from all depths were used for averaging.

Figure 4-3. Canyon Lake Dissolved Oxygen (mg/L)
Station C7 Hypolimnion – June 2006 to June 2008



Note: On dates lake was mixed, four deepest DO readings used for averaging.

Figure 4-4. Canyon Lake Total Nitrogen (mg/L)
Stations C7 and C8 (Main Body) - June 2006 to June 2008

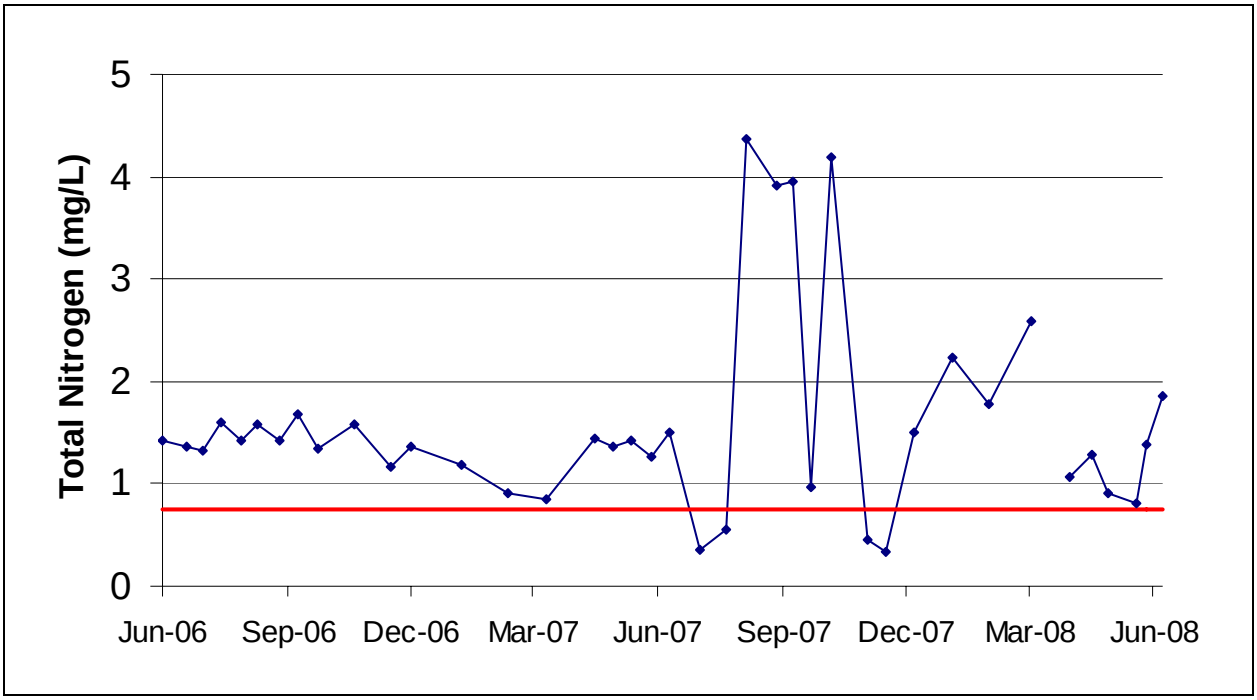


Figure 4-5. Canyon Lake Total Phosphorus (mg/L)
Stations C7 and C8 (Main Body) – June 2006 to June 2008

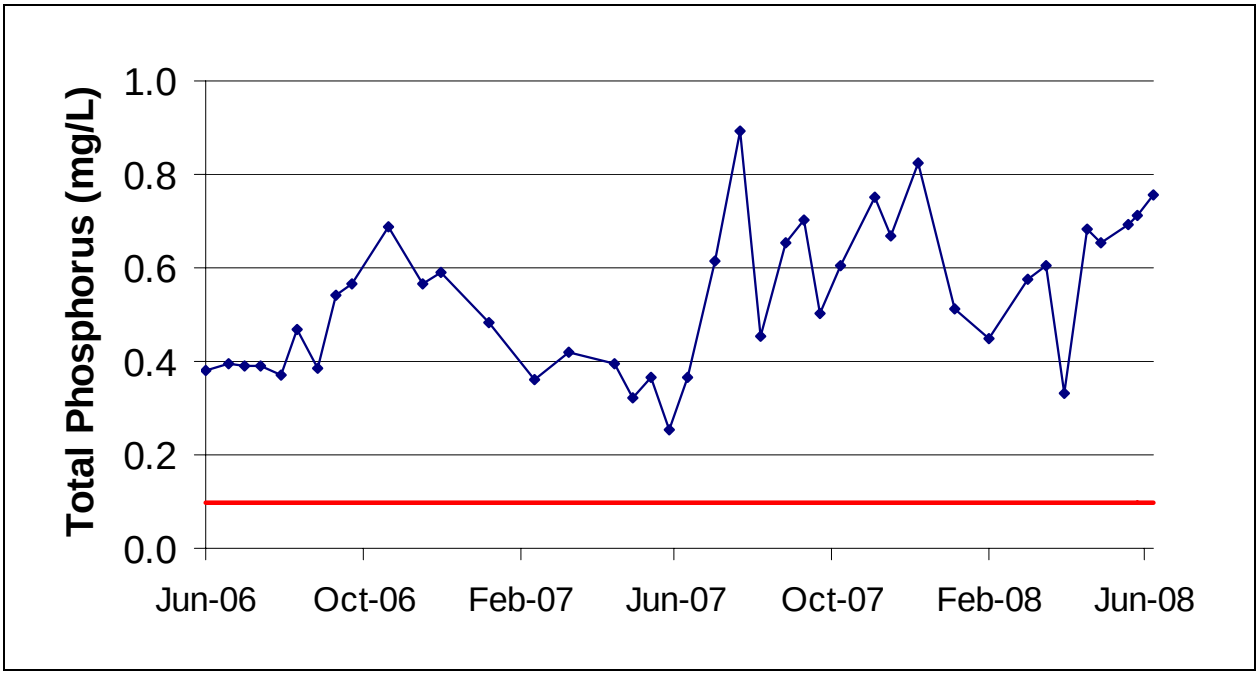
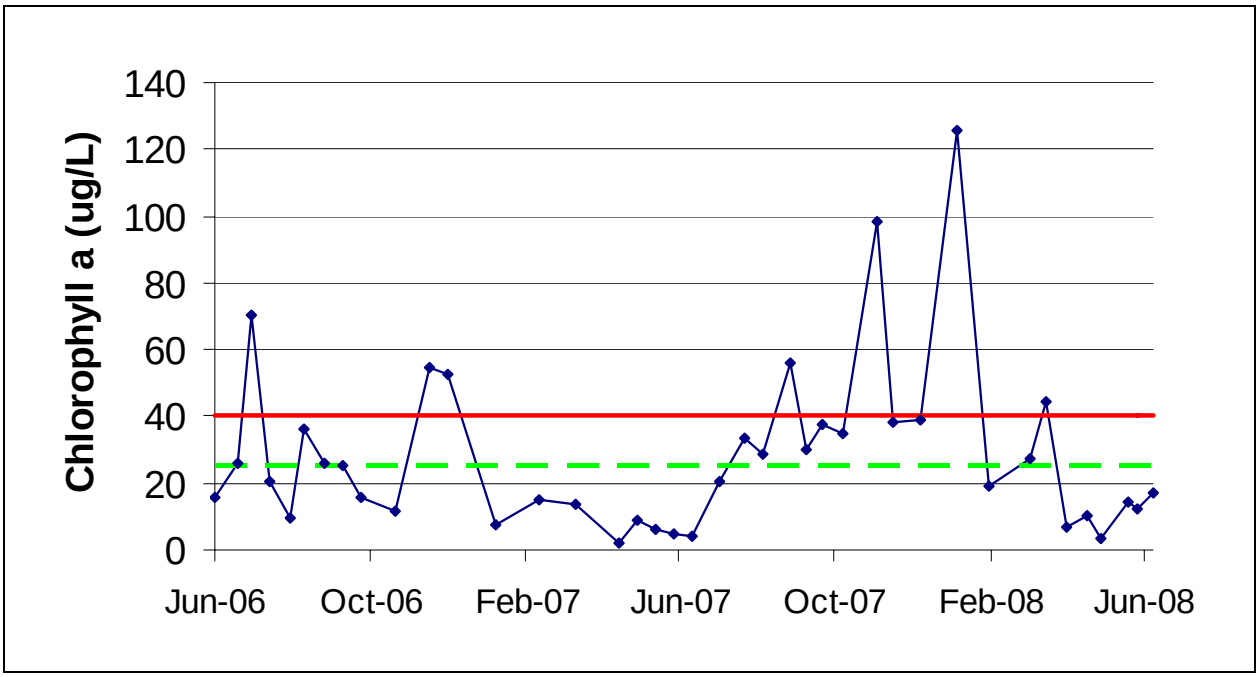


Figure 4-6. Canyon Lake Chlorophyll *a* (ug/L)
Stations C7 and C8 (Main Body) Integrated Samples – June 2006 to June 2008



Note: Red line indicates TMDL 2015 objective of 40 ug/L and green line indicates TMDL 2020 objective of 25 ug/L,

A complete description of Canyon Lake water quality analyses and results from July 2007 through June 2008 is available in the annual report prepared by MWH (included on CD as Appendix H). The complete set of Canyon Lake Water Quality Data is included on CD as Appendix D.

5.0 Data Management

LESJWA, on behalf of Task Force, oversees the management and storage of water quality samples and field analyses data for projects associated with the Lake Elsinore and Canyon Lake Nutrient TMDLs following the guidelines established in the Lake Elsinore, Canyon Lake and San Jacinto Watershed Monitoring Quality Assurance Protection Plan, which is included on CD as Appendix I.

5.1 Management of TMDL Data

Persons responsible for maintaining records for the individual components of the "The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan" are as follows.

The San Jacinto Watershed Quality Assurance Manager, (Steve Clark/RCFC&WCD) maintains all San Jacinto Watershed Nutrient Monitoring Program sample collection records, sample transport records, chain of custody and field analyses forms, and all records submitted by contract laboratories associated with the San Jacinto Watershed nutrient monitoring program.

The Lake Elsinore Quality Assurance Manager, (Sarah Garber/MWH) maintains all Lake Elsinore Nutrient Monitoring Program sample collection records, sample transport records, chain of custody and field analyses forms, and all records submitted by contract laboratories associated with the Lake Elsinore nutrient monitoring program.

The Canyon Lake Quality Assurance Manager, (Dr. James Noblet, CSUSB CSUSB) maintains all Canyon Lake Nutrient Monitoring Program sample collection records, sample transport records, chain of custody and field analyses forms, and all records submitted by contract laboratories associated with the Canyon Lake nutrient monitoring program collected from July 2007 – June 2008.

Each laboratory contracted by the Task Force has appointed a Quality Assurance Manager to maintain the laboratory's records.

LESJWA oversees the actions of these persons and will maintain the Lake Elsinore and Canyon Lake nutrient TMDL database, which includes all sample analyses results that have passed all QA processes as defined in the QAPP. LESJWA will also arbitrate any issues relative to records retention and any decisions to discard records.

All records are passed to the Regional Board as required by in the Lake Elsinore, Canyon Lake and San Jacinto Watershed Monitoring Quality Assurance Protection Plan. Copies of the chemical monitoring records are maintained by the appropriate Program Quality Assurance Manager and each laboratory contracted by the Task Force for five years after project completion then discarded, except for the database, which are maintained by LESJWA without discarding. Copies of other monitoring records are being maintained by the appropriate Program Quality Assurance Manager for five years after project completion then discarded.

5.2 Storage of TMDL Data

LESJWA has an existing database of laboratory and field measurement data from previous studies. This database, along with all future data, is maintained by LESJWA under the direction of LESJWA. Beginning in June 2007, all laboratory and field measurement data submitted to LESJWA for inclusion in the Santa Ana Watershed Data Management System (SAWDMS) database follow the guidelines and formats established by SWAMP (http://www.waterboards.ca.gov/swamp/qapp.html).

Data are transmitted to LESJWA in a standard electronic format and uploaded to the database through batch set electronic means. All contract laboratories maintain a record of transferred records and will periodically assess their record of transferred records against those actually held by the Task Force. Prior to upload, QA/QC tools check new data against existing data in the database for completeness, validity of analytical methods, validity of sample locations, validity of sample dates, and data outliers. Data not passing QA/QC tests are returned to the originating laboratory or generator for clarification and/or correction. When all data within a batch set have passed QA/QC, the data are uploaded to the database. A unique batch number, date loaded, originating laboratory and the person who loaded the data are recorded in the database so that data can be identified and removed in the future if necessary.

The Task Force's database is backed up using built-in software backup procedures. In addition, all data files are backed up on tape on a weekly basis as part of LESJWA's SOP for disaster recovery. Back up tapes are kept for a minimum of four weeks before they are written over. Tapes are rotated off-site for separate storage on a monthly (or more frequent) basis, in accordance with SAWPA Information Systems SOPs. Each back up session validates whether the files on tape are accurate copies of the original. The Task Force also maintains an access log showing who accessed the database, when, and what was done during the session. All changes to the database are stored in a transaction database with the possibility of rollback, if necessary.

Data are stored on a Windows 2003 Server with a 2Ghz + CPU and 2Gb RAM with a fail safe RAID 5 configuration. The server checks for operating system updates daily and downloads and installs patches and service packs as necessary. The current server is two years old, and as per LESJWA's policy, will be replaced after a maximum of 4 years of service. The server is also protected with Norton Anti-Virus software which is updated daily. The database software is Microsoft SQL Server 2000 standard edition with Service Pack 4. The database administrator checks the Microsoft Website for new patches and service packs on a monthly basis and installs updates as necessary. The general policy for updating operating system and database software is to evaluate the software on a test machine after a new version has been out for approximately 1 year. The new version is then installed at the discretion of the network or database administrator.

The database is operated with a transaction log recording all changes with ability to roll back if necessary. Full database backups occur on a weekly basis and immediately before batch upload. It is expected that TMDL data are loaded quarterly to twice per year.

Data is exported from SAW DMS into the SWAMP format using a pre-made query that will map data fields from SAW DMS to the SWAMP template. The exported data are sent to the SWRCB IM Coordinator for processing into the SWAMP database. The data are retrieved for analysis and report writing by exporting from SAW DMS using pre-made queries.