2017 ANNUAL REPORT

OF SANTA ANA RIVER WATER QUALITY

Final Report

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Prepared by:

SANTA ANA WATERSHED PROJECT AUTHORITY

September 2018

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Acronym and Abbreviations List

AFY	acre-feet per year
COD	chemical oxygen demand
EC	electrical conductivity
HCMP	Hydraulic Control Monitoring Program
mg/L	milligrams per liter
umho/cm	micromhos per centimeter
MWD	Metropolitan Water District of Southern California
NTU	nephelometric turbidity units
OCWD	Orange County Water District
RIX	Regional Tertiary Treatment Rapid Infiltration and Extraction Facility
RWQCB	Regional Water Quality Control Board, Santa Ana Region
SAR	Santa Ana River
SAWPA	Santa Ana Watershed Project Authority
TDS	total dissolved solids
TIN	total inorganic nitrogen
TN	total nitrogen
USGS	United States Geological Survey

1 Introduction

In 1996, the Nitrogen and Total Dissolved Solids (N/TDS) Task Force was formed to conduct scientific investigations regarding the then existing nitrogen and TDS water quality objectives of the 1995 Water Quality Control Plan for the Santa Ana River (SAR) Basin (Region 8). This Task Force, administered by the Santa Ana Watershed Project Authority (SAWPA) was comprised of 22 water supply and wastewater agencies. The work performed by the Task Force was broken out into a number of phases. In 2003, the Final Technical Memorandum was completed, which reported the results of this scientific investigation, *The TIN/TDS Study – Phase 2B of the Santa Ana Watershed Wasteload Allocation Investigation*.

As a result of this work, the Regional Water Quality Control Board (Regional Board) staff amended the Santa Ana River Watershed Water Quality Control Plan (Basin Plan). The Basin Plan Amendment (hereafter the 2004 Basin Plan Amendment) was adopted by the Regional Board in January 2004, approved by the State Water Resources Control Board in September 2004, and approved by the Office of Administrative Law in December 2004.

Pursuant to the 2004 Basin Plan Amendment, certain participants in the N/TDS Task Force are required to conduct the following investigations:

- Re-computation of the triennial Ambient Water Quality over a 20 year period; and
- Preparation of an Annual Report of Santa Ana River Water Quality.

This report fulfills the second requirement listed above – *Preparation of an Annual Report of Santa Ana River Water Quality*[1]. Contained within this report are water quality data required to implement the surface water monitoring program necessary to determine compliance with the nitrogen and TDS objectives of the SAR and, thereby, the effectiveness of the wasteload allocations.

In Chapter 4 of the Basin Plan, the baseflow TDS and total nitrogen objectives for Reach 3 of the River are specified. For Reach 2, a TDS objective based on a five-year, volume-weighted, moving average of the annual TDS concentration is also defined. The use of this moving average allows the effects of wet and dry years to be integrated over the five-year period and reflects the long-term quality of water recharged by Orange County Water District (OCWD) downstream of Prado Dam.

The Basin Plan specifies a monitoring program to determine compliance with the Reach 3 baseflow objectives at Prado Dam (see Chapter 4 of the Basin Plan), whereas baseflow is defined by the Basin Plan as composed of wastewater discharges, rising groundwater, and nonpoint source discharges. Regional Board staff conducts this program on an annual basis. The measurement of baseflow quality, rather than the quality of flows in Reach 2, has long been used to indicate the effects of recharge of SAR flows on Orange County groundwater. The efficacy of this approach was evaluated as part of the 2004 Basin Plan Amendment for the TDS/nitrogen management plan in the Basin Plan. As discussed in the 2004 Basin Plan Amendment, Reach 3 baseflow objectives are considered protective of the Orange County Groundwater Basin and the existing monitoring program designed to measure compliance is sufficient.

In addition to the baseflow sampling program and the surface water monitoring commitments associated with certain agencies' "maximum benefit" programs, the comprehensive monitoring program implemented by the Task Force members must include an evaluation of compliance with the TDS and nitrogen objectives for Reaches 2, 4, and 5 of the SAR. Compliance with the Reach 2 TDS objective can be determined by the

[1] The 2017 Annual Report was prepared in accordance with the Santa Ana River Water Quality Work Plan approved by the Regional Board in Res. No. R8-2005-0063."

evaluation of data collected by OCWD, the United States Geological Survey (USGS), and others. Compliance with Basin Plan objectives for Reach 4 and 5 of the SAR can be determined in the same manner.

A description of the data collected for this report is discussed in Section 2. Section 3 presents the analysis of the monitoring data collected. Results are presented by Reach of the SAR. Section 4 provides Conclusions and Recommendations of the report. Section 5 presents the Response to Comments. The complete set of 2017 surface water quality data is included as Appendix B on the enclosed CD.

2 Data Collection

Water quality and discharge data used to prepare the 2017 Annual Report of Santa Ana River Water Quality, were collected from a number of regional efforts to monitor surface water quality along the SAR and its tributaries, including in-stream gauges employed by USGS, shown in Figure 2-1.

A detailed description of each of these monitoring efforts, representing the 2017 calendar year follows:

Regional Board staff typically conducts annual water quality monitoring of baseflow in the SAR exiting Reach 3, below Prado Dam. Monitoring typically extends over a five-week period during the months of August and September and is used to determine compliance with Reach 3 baseflow objectives. In 2017 baseflow monitoring consisted of three sampling events from September 7 through September 21, as shown in Table 3-3. The complete set of 2017 baseflow water quality data collected exiting Reach 3 below Prado Dam by the Regional Board is included in Appendix B on the enclosed CD.

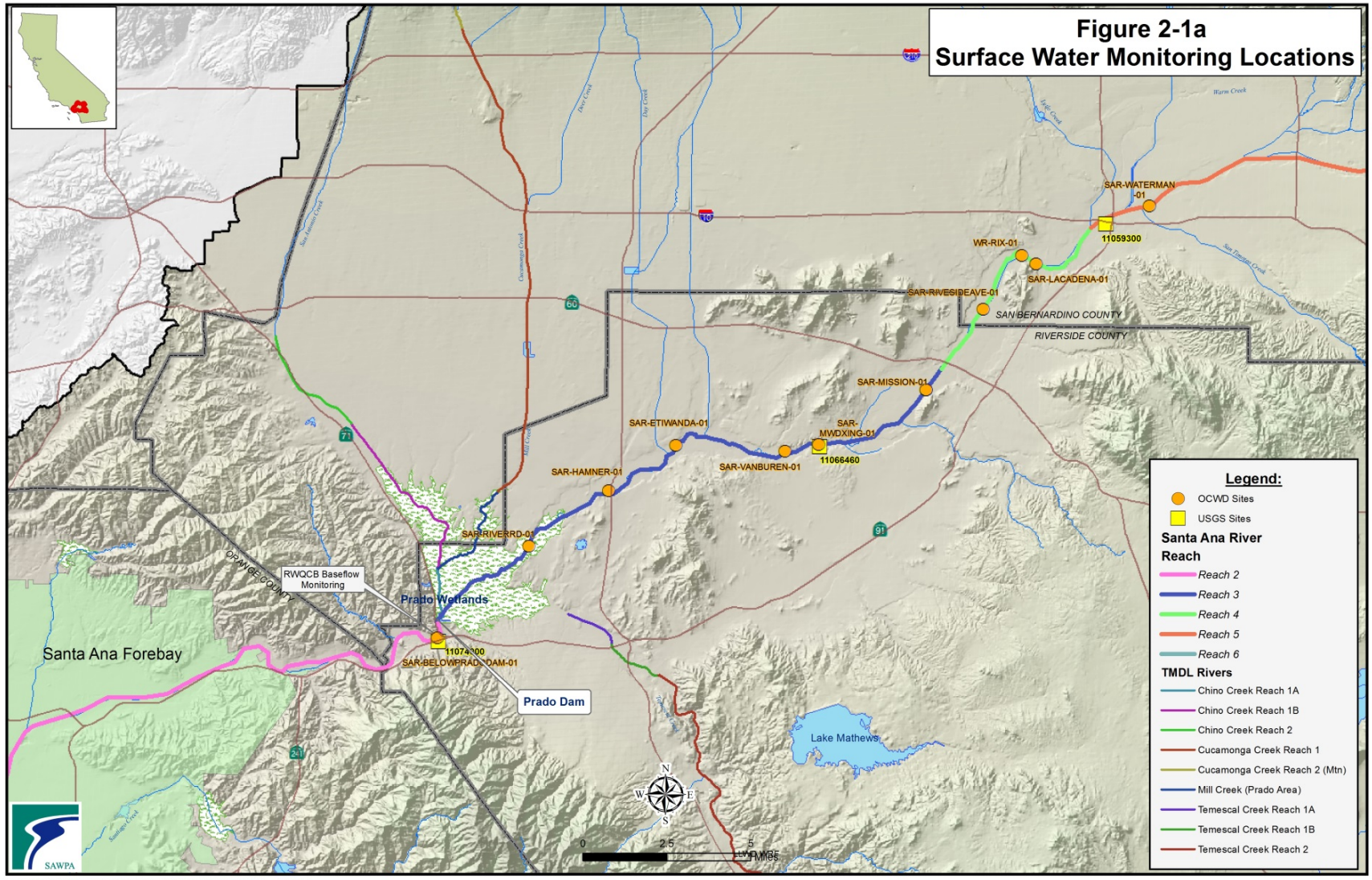
OCWD conducts a monitoring program for the SAR to assess the quality of the SAR water recharged into the Orange County Groundwater Basin. OCWD collects monthly and quarterly samples from the SAR at Imperial Highway in Anaheim and other locations along the SAR below Prado Dam and its tributaries. During the month of August, monitoring is performed with a greater sampling frequency to capture base flow conditions within the Watershed. At sites Above Prado Dam, OCWD collects samples from a single monitoring event in August (event took place on 08/15/2017). These data are used in this report to evaluate water quality for Reaches 2, 3, 4, and 5 of the SAR during low flow conditions. OCWD monitoring locations used in this report are presented in Table 2-1. In later tables and figures, OCWD stations are referred to by their map location. The complete set of 2017 SAR water quality data collected by OCWD and used in this report is included in Appendix B on the enclosed CD.

Table 2-1. OCWD's Santa Ana River Water Quality Monitoring Locations

Station ID	Station Name	Tributary	X Coordinate	Y Coordinate
8105	SAR-BELOWDAM-01	Santa Ana River Reach 2	- 117.644996	33.883665
8096	SAR-RIVERRD-01	Santa Ana River Reach 3	- 117.666485	33.948989
8111	SAR-HAMNER-01	Santa Ana River Reach 3	- 117.556597	33.947337
9672	SAR-ETIWANDA-01	Santa Ana River Reach 3	- 117.52223	33.967365
8112	SAR-VANBUREN-01	Santa Ana River Reach 3	- 117.465465	33.965049
8113	SAR-MWDXING-01	Santa Ana River Reach 3	- 117.448032	33.968027
8114	SAR-MISSION-01	Santa Ana River Reach 4	- 117.392523	33.991576
8115	SAR-RIVERSIDEAVE-01	Santa Ana River Reach 4	- 117.362809	34.02648
14655	WR-RIX-01	Santa Ana River Reach 4	- 117.342839	34.049706
8116	SAR-LACADENA-01 *	Santa Ana River Reach 4	- 117.33571	34.046335
8117	SAR-WATERMAN-01 *	Santa Ana River Reach 5	- 117.276721	34.071365

**No flow at these sites in 2017.*

Figure 2-1. Surface Water Monitoring Locations



The USGS maintains three active gauging stations to monitor flow and water quality along the SAR. Long-term stream flow and water quality data are available for gauging stations 11074000, *located at Below Prado Dam*, and 11066460, *located at MWD Crossing*. Additionally, stream flow data is available for gauging station11059300, located at SAR at E St near San Bernardino. The list of USGS gauging stations used in this report is presented in Table 2-2. The complete set of 2017 flow and water quality data available from these USGS gauging stations is included in Appendix B on the enclosed CD.

Table 2-2. USGS Stream Gauge Stations

USGS ID	Station Name	2017 Flow (AFY)	Tributary	X Coordinate	Y Coordinate
11074000	SAR Below Prado Dam	178,126	SAR Reach 2	- 117.644446	33.881583
11066460	SAR at MWD Crossing	68,475	SAR Reach 3	- 117.447501	33.966858
11059300	SAR at E St near San Bernardino	21,334	SAR Reach 5	- 117.729724	34.016857

3 Analysis of Monitoring Data

3.1 Santa Ana River Reach 2

Water quality objectives specified for Reach 2 of the SAR by the Basin Plan include only a TDS objective of 650 mg/L. No other water quality objectives are specified for Reach 2. The determination of compliance with the TDS objective for Reach 2 is made by using flow-weighted average for the five most recent water years as reported by the SAR Watermaster in their annual report based upon their estimation of total flow quality, shown in Table 3-1. In years of normal rainfall, most of the total flow of the river is percolated in the Santa Ana Forebay (see Figure 2-1), and directly affects the quality of the groundwater. For that reason, compliance with the TDS water quality objective for Reach 2 is based on the five-year moving average, which is estimated by computing the arithmetic average of the five most recent annual estimates of flow-weighted TDS for total flow at Below Prado (from Appendix F of the 2016-17 Annual SAR Watermaster Report[2]). Use of this moving average allows the effects of wet and dry years to be smoothed out over the five-year period.

Table 3-1. Yearly Volume-Weighted Moving Average TDS at Below Prado Dam (SAR Watermaster Report)

Water Year Ending *	Yearly Flow-weighted TDS (mg/L)
2013	621
2014	582
2015	522
2016	560**
2017	408
5 Year Average	539

Note: * Santa Ana River Watermaster data reported for FY 2016-17 water year
** FY 2015-16 water year data adjusted from 541 mg/L to remove the influence of non-tributary water transfer flow from OC59.

Alternative Method to Determine Compliance with TDS Objective for Reach 2

Additionally, an alternative methodology was employed using the data collected from OCWD and USGS. These data were plotted and a five-year, volume-weighted moving average[3] was calculated to provide an alternative measure to estimate compliance with this objective.

During the 2017 calendar year, 63 samples were collected for TDS at *Below Prado Dam*. These included grab samples collected by the USGS, OCWD and the Regional Board. From the results of these samples,

[2] Determination of flow-weighted TDS for total flow at Below Prado for Water Year 2016-17 is based on records from a continuous monitoring device operated by the USGS for EC of the river flow below Prado Dam. This record is supplemented by grab samples for EC collected by the USGS and analyzed for TDS. Using the daily EC data, flow-weighted average daily concentrations for TDS are calculated using the following best fit correlation equation:

TDS = EC x 0.6068 (where the units of TDS and EC are mg/L and □s/cm, respectively)

[3]

$$5-Year\ Moving\ Average\ TDS\ (mg/L) = \frac{\left(\sum_{n=first\ month\ of\ 1st\ year}^{last\ month\ of\ 5th\ year} Monthly\ Flow\right) x \left(\sum_{n=first\ month\ of\ 1st\ year}^{last\ month\ of\ 5th\ year} Volume\ Weighted\ Monthy\ Average\ TDS\right)}{\left(\sum_{n=first\ month\ of\ 1st\ year}^{last\ month\ of\ 5th\ year} Monthly\ Flow\right)}$$

electrical conductivity (EC) and TDS were graphically plotted. A linear regression of TDS versus EC yielded the following equation:

$$TDS = (EC \times 0.6293) - 22.695$$

The coefficient of determination (R^2) of the linear regression was 0.97, which indicates a strong correlation between TDS and EC; that is, about 97 percent of the variability in TDS is explained by this equation. Using the above equation and daily EC data from a continuous monitoring device operated by USGS, daily TDS values were calculated for 2017 data. Daily stream flow values at *Below Prado Dam* were multiplied by the computed TDS values and summed for each month. This total was divided by the total monthly flow in order to yield a volume-weighted average for each month. These results are shown in Table 3-2. The 5-year volume-weighted TDS average for the period January 2013 through December 2017 was 519 mg/L. This represents a decrease of 50.0 mg/L from last year's 5-year volume-weighted TDS average of 569 mg/L.

A five-year, volume-weighted, moving average was calculated using these values in addition to historic flow-weighted TDS averages calculated by the SAR Watermaster. Figure 3-1 shows the time history for TDS observations for 1996 to the present at *Below Prado Dam* as depicted as the five-year moving average TDS concentration, and the five-year, volume-weighted, moving average[4] TDS concentration.

Through either method, the five-year, volume-weighted, moving average for TDS is the compliance metric for Reach 2. This statistic has never exceeded the Basin Plan objective of 650 mg/L for the period shown. The five-year, volume weighted moving average TDS concentration has decreased over time from the mid-1980s until about 2000 when TDS concentrations were observed to slightly increase. This upward trend continued until about 2004 when TDS concentrations dropped. Since 2008 there has been an increase in TDS concentrations.

During wet periods, not all of the water flowing from Prado Dam is captured for recharge in Orange County. Therefore, a volume-weighted average may not be representative of the quality of water actually recharged. For comparison, the five-year moving average TDS, based on discrete samples collected by OCWD, Regional Board, USGS, and by CBWM/IEUA for the HCMP through 2012, is plotted on Figure 3-1.

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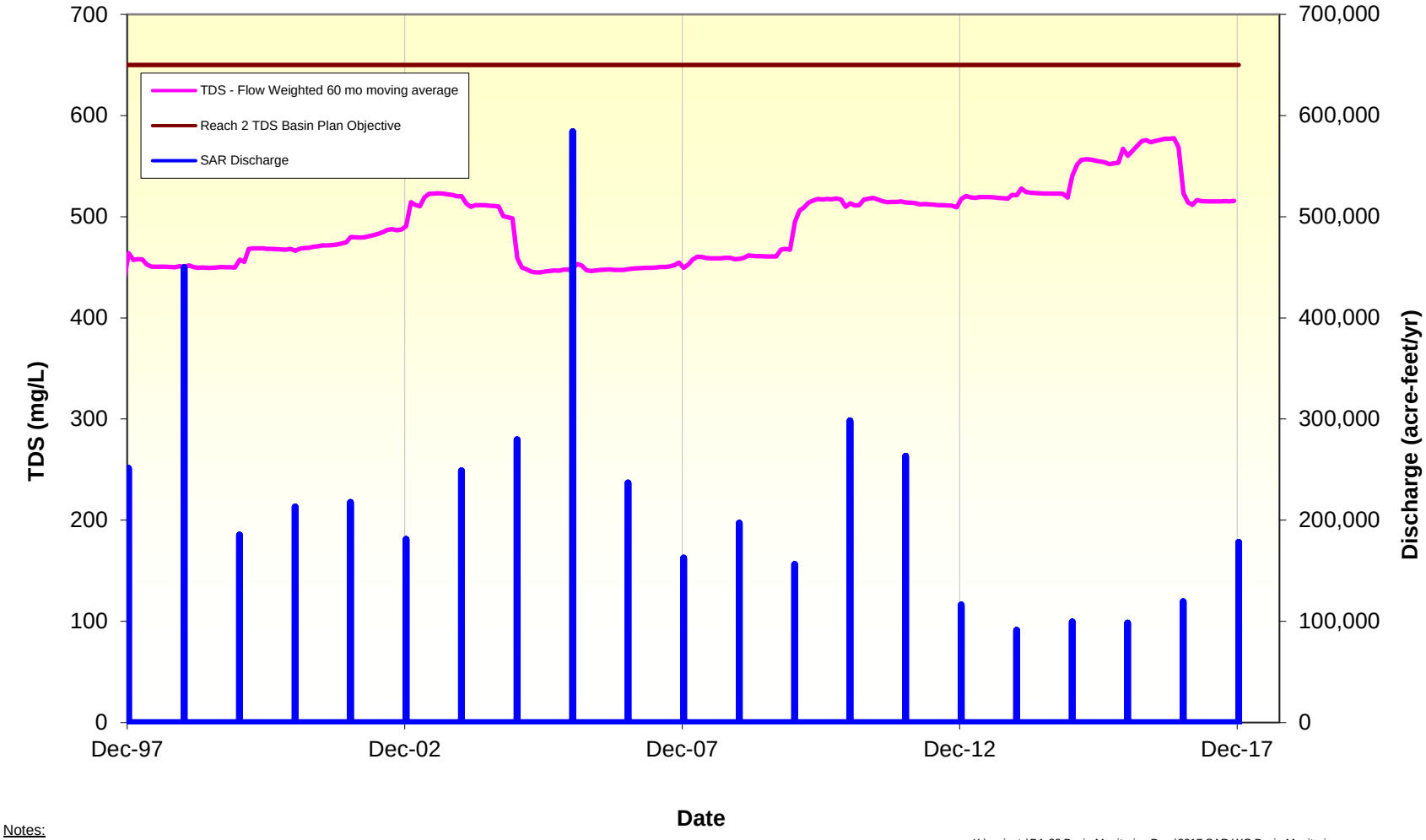
$$Volume\ Weighted\ Monthy\ Average\ TDS\ (mg/L) = \sum_{n=first\ day\ of\ month}^{last\ day\ of\ month} \frac{Daily\ TDS\ Sample\ \left(\frac{mg}{L}\right) x\ Daily\ Flow\ (cfs)}{\sum_{n=first\ day\ of\ month}^{last\ day\ of\ month} Daily\ Flow\ (cfs)}$$

Table 3-2. Monthly Volume-Weighted Moving Average TDS at Below Prado Dam (2017 OCWD, USGS and Regional Board at Below Prado Dam)

Month	Monthly Flow (cfs-days)	Monthly Volume Weighted TDS (mg/L)	Monthly Flow X TDS
Jan-13*	1,023	543	555,871
Feb-13	6,276	598	3,754,901
Mar-13	5,297	607	3,217,293
Apr-13	3,468	677	2,346,238
May-13	3,484	655	2,280,414
Jun-13	2,333	693	1,616,724
Jul-13	2,183	671	1,465,135
Aug-13	2,000	661	1,322,963
Sep-13	1,970	637	1,254,888
Oct-13	2,721	658	1,791,512
Nov-13	4,207	578	2,433,502
Dec-13	4,446	653	2,903,676
Jan-14	3,312	681	2,255,040
Feb-14	3,627	659	2,390,989
Mar-14	10,811	429	4,635,755
Apr-14	4,329	616	2,664,778
May-14	2,160	698	1,507,815
Jun-14	1,857	702	1,304,490
Jul-14	1,698	711	1,206,771
Aug-14	2,452	635	1,557,234
Sep-14	2,043	672	1,373,065
Oct-14	2,057	572	1,175,631
Nov-14	3,541	575	2,171,523
Dec-14	12,331	612	4,029,366
Jan-15*	8,443	558	4,713,608
Feb-15*	4,181	548	2,292,593
Mar-15	5,971	611	3,647,810
Apr-15	3,055	705	2,153,348
May-15	3,917	649	2,540,633
Jun-15*	2,031	658	1,335,858
Jul-15*	3,114	553	1,722,216
Aug-15*	1,975	594	1,173,280
Sep-15*	3,766	451	1,699,702
Oct-15	4,935	631	3,115,713
Nov-15	3,795	659	2,502,562
Dec-15	4,420	586	2,590,772
Jan-16	11,015	355	3,913,599
Feb-16	6,529	610	3,979,901
Mar-16 **	2,454	493	1,209,018
Apr-16	3,753	629	2,362,198
May-16	3,421	614	2,102,066
Jun-16 **	3,792	570	2,162,097
Jul-16 **	903	520	469,962
Aug-16	3,830	499	1,910,346
Sep-16	2,064	683	1,408,987
Oct-16 **	2,907	637	1,851,646
Nov-16	4,082	574	2,344,955
Dec-16	8,304	337	2,795,675
Jan-17	37,876	218	8,255,609
Feb-17	13,557	407	5,515,481
Mar-17	10,781	508	5,473,628
4/1/2017 **	7,278	784	5,706,514
May-17	2,958	642	1,899,575
6/1/2017 **	1,757	871	1,530,123
Jul-17	2,071	694	1,437,099
Aug-17	2,189	697	1,524,789
Sep-17	2,472	708	1,749,396
Oct-17	2,408	714	1,718,722
Nov-17	3,003	703	2,110,679
Dec-17	2,816	705	1,984,819
Total	**281,449**		**146,120,554**
60 - Month Volume Weighted Average: 519 mg/L			

*Note: *Denotes monthly results with missing EC readings due to instrumentation issues with USGS equipment*
Monthly Flow weighted results with missing EC used for missing days
*** Denotes monthly results with missing EC readings due to instrumentation issues with USGS equipment only available EC data was used*

Figure 3-1. Total Dissolved Solids (TDS) Below Prado Dam



Notes:
TDS Weighted = Monthly flow weighted TDS calculated from EC. Data prior to October 2003 from Watermaster; October 2003 to December 2004 from WeInc, 2005 to 2016 from SAWPA.

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3.2 Santa Ana River Reach 3

3.2.1 Below Prado Dam

In order to determine whether water quality and quantity objectives for base flow in Reach 3 are being met, the Regional Board typically collects a series of grab and composite samples at *Below Prado Dam* during August and September when the influence of storm flows and nontributary flows is at a minimum. In 2017, there were no non-tributary flows and at this time of year there is usually no water impounded behind Prado Dam, the volumes of storm flows, rising water, and nonpoint sources discharges tend to be low, and the major component of base flow is municipal wastewater. Water quality objectives specified for Reach 3 of the SAR by the Basin Plan include TDS, hardness, sodium, chloride, Total Nitrogen (TN), sulfate, Chemical Oxygen Demand (COD) and boron. In 2017, baseflow monitoring below Prado Dam consisted of three sampling events conducted during the months of August and September. The data collected through this program are presented in Table 3-3.

Table 3-3. Results for 2017 Annual Baseflow Monitoring Program for the Santa Ana River at Below Prado Dam (Regional Board Data Only)

Parameter	Units	Basin Plan Objectives SAR Reach 3	9/7/2017	9/14/2017	9/21/2017
Ammonia-Nitrogen	mg/L	***	0.32	0.12	0.16
Boron	mg/L	**0.75**	0.32	0.31	0.35
Calcium	mg/L		91	84	98
Chemical Oxygen Demand (unfiltered)	mg/L	**30**	20	19	15
Chloride	mg/L	**140**	120	120	136
Electrical Conductivity	umhos/cm		1090	1120	1150
Magnesium	mg/L		20	19	22
Nitrate-Nitrogen	mg/L		3.1	2.7	4.5
Nitrite-Nitrogen	mg/L		< 0.1	< 0.1	< 0.1
Organic Nitrogen	mg/L		0.45	0.45	0.29
Potassium	mg/L		17.3	15.8	16.6
Sodium	mg/L	**110**	116	104	118
Sulfate	mg/L	**150**	95	96	109
Total Dissolved Solids	mg/L	**700**	720	740	762
Total Hardness (as CaCO3)	mg/L	**350**	280	300	320
Total Inorganic Nitrogen	mg/L	**10**	3.5	2.8	4.7
Total Kjeldahl Nitrogen	mg/L		0.77	0.57	0.45
Total Nitrogen	mg/L		3.9	3.3	5.0
Total Organic Carbon	mg/L		< 1.8	< 1.8	< 1.8
Turbidity	NTU		< 1.8	< 3.0	< 1.8

Notes: All nitrogen species filtered

**** - Santa Ana River Basin Plan specifies an un-ionized ammonia objectives for WARM designated surface water bodies including site specific objectives for the Santa Ana River and certain tributaries including the middle Santa Ana River, Chino Creek, Mill Creek (Prado Area), Temescal Creek, and San Timoteo Creek. Site specific objectives must be computed based upon temperature and pH.*

A summary of all baseflow monitoring data collected by the USGS, OCWD and the Regional Board at *Below Prado Dam* during 2017 along with Basin Plan objectives for baseflow conditions for SAR Reach 3 water quality are presented in Table 3-4. This includes three monitoring events conducted by the Regional

Board for their annual water quality monitoring of baseflow in the SAR during August and September of 2017. OCWD conducted six baseflow monitoring events at Below Prado Dam2017. However, as the nitrogen species data collected by OCWD was not filtered, it was not used to evaluate the water quality objective for TIN. The USGS conducted two baseflow sampling events at Below Prado Dam in August and September 2017. Table 3-4 presents the results of this monitoring.

Table 3-4. Summary of Annual and Baseflow Water Quality Observations for the Santa Ana River at Below Prado Dam

Constituent	Units	Basin Plan Objectives SAR Reach 3	Baseflow Average	# of Samples
Ammonia-Nitrogen	mg/L	***	0.15	5
Ammonia-Nitrogen (unfiltered)	mg/L		0.10	6
Bicarbonate (as CaCO3)	mg/L		252	8
Boron	mg/L	**0.75**	0.30	9
Calcium	mg/L		91	9
Carbonate (as CaCO3)	mg/L		1.3	8
Chemical Oxygen Demand (unfiltered)	mg/L	**30**	15	8
Chloride	mg/L	**140**	140	11
Electrical Conductivity	umhos/cm		1140	76
Electrical Conductivity (field)	umhos/cm		1152	6
Fluoride	mg/L		0.45	3
Hydroxide (as CaCO3)	mg/L		< 1.0	6
Magnesium	mg/L		20	9
Nitrate-Nitrogen	mg/L		3.4	5
Nitrate-Nitrogen (unfiltered)			3.1	6
Nitrite-Nitrogen	mg/L		0.04	5
Nitrite-Nitrogen (unfiltered)			0.03	6
Organic Nitrogen	mg/L		0.43	5
Organic Nitrogen (unfiltered)			0.70	6
Potassium	mg/L		15.1	9
Sodium	mg/L	**110**	112	9
Sulfate	mg/L	**150**	116	11
Total Alkalinity (as CaCO3)	mg/L		240	10
Total Dissolved Solids	mg/L	**700**	705	15
Total Hardness (as CaCO3)	mg/L	**350**	306	9
Total Inorganic Nitrogen	mg/L	**10****	3.6	5
Total Inorganic Nitrogen (unfiltered)			3.2	6
Total Kjeldahl Nitrogen	mg/L		0.60	3
Total Kjeldahl Nitrogen (unfiltered)			0.73	6
Total Nitrogen	mg/L		4.0	5
Total Nitrogen (unfiltered)			3.9	6
Total Organic Carbon (total)	mg/L		3.9	11
Turbidity	NTU		35.6	8

Notes: Table presents average concentration data

Table summarizes baseflow monitoring data collected by USGS, OCWD and the Regional Board at Below Prado Dam during 2017

**** - Santa Ana River Basin Plan specifies an un-ionized ammonia objectives for WARM designated surface water bodies including site specific objectives for the Santa Ana River and certain tributaries including the middle Santa Ana River, Chino Creek, Mill Creek (Prado Area), Temescal Creek, and San Timoteo Creek. Site specific objectives must be computed based upon temperature and pH.*

***** - Santa Ana River Basin Plan specifies that Total Nitrogen Samples are to be filtered*

The USGS also maintains a gauging station, 11074000, located on the SAR below Prado Dam, shown in Figure 2-1. In 2017, this station recorded flows totaling 178,126 AFY.

A long time-history of water quality data has been collected by USGS along with data collected by OCWD, Regional Board baseflow monitoring program, and by CBWM/IEUA at *Below Prado Dam* and *MWD Crossing*. These data were plotted for each constituent that has a Basin Plan objective for January 1996 through to current (note: Basin Plan objectives for water quality are based on discrete samples) and are included in Appendix A, to show the longer-term trends in baseflow data, and non-baseflow water quality samples, as well as non-volume-weighted five-year moving averages.

3.2.2 Santa Ana River Mainstem between Riverside Narrows and Prado Wetlands

Monitoring of Reach 3, above Prado Dam is performed by OCWD for their SAR Water Quality Monitoring Program and the USGS at MWD Crossing. This included monitoring of the following locations: *MWD Crossing, Van Buren Blvd., Etiwanda Avenue, Hamner Road, and River Road*, as shown in Figure 2-1. OCWD conducted a single monitoring event for each of the locations on August 15, 2017. However, as the nitrogen species data collected by OCWD was not filtered it was not used to evaluate the water quality objective for TIN. Additionally, the USGS collects electrical conductivity and TDS at their gauge located *Santa Ana River at MWD Xing*. Table 3-5 presents a summary of the results of these monitoring efforts for base flow conditions.

An assessment of Baseflow conditions, represented by water quality data collected in August and September of 2017, showed no exceedances of water quality objectives specified in the Basin Plan. The USGS maintains a gauging station, 11066460, located along Reach 3 of the SAR at the MWD Crossing, shown in Figure 2-1. In 2017, this station recorded flows totaling 68,475 AFY.

Table 3-5. Summary of Annual and Baseflow Water Quality Observations for the Santa Ana River – Reach 3 (Between Riverside Narrows and Prado Wetlands)

Constituent	Units	Basin Plan Objectives SAR Reach 3	Baseflow Average	# of Samples
Ammonia-Nitrogen (unfiltered)	mg/L	***	< 0.1	5
Bicarbonate (as CaCO3)	mg/L		231	5
Carbonate (as CaCO3)	mg/L		1.98	5
Chemical Oxygen Demand (unfiltered)	mg/L	**30**	13	5
Chloride	mg/L	**140**	116	5
Electrical Conductivity	umhos/cm		1063	15
Electrical Conductivity (field)	umhos/cm		1064	5
Hydroxide (as CaCO3)	mg/L		< 1.0	5
Nitrate-Nitrogen (unfiltered)	mg/L		5.4	5
Nitrite-Nitrogen (unfiltered)	mg/L		0.012	5
Organic Nitrogen (unfiltered)	mg/L		0.2	5
Sulfate	mg/L	**150**	109	5
Total Alkalinity (as CaCO3)	mg/L		232	5
Total Dissolved Solids	mg/L	**700**	639	9
Total Inorganic Nitrogen (unfiltered)	mg/L	**10****	5.5	5
Total Kjeldahl Nitrogen (unfiltered)	mg/L		0.2	5
Total Nitrogen (unfiltered)	mg/L		5.5	5
Total Organic Carbon	mg/L		3.0	5
Turbidity	NTU		2.7	5

Note: Table presents average concentration data

**** - Santa Ana River Basin Plan specifies an un-ionized ammonia objectives for WARM designated surface water bodies including site specific objectives for the Santa Ana River and certain tributaries including the middle Santa Ana River, Chino Creek, Mill Creek (Prado Area), Temescal Creek, and San Timoteo Creek. Site specific objectives must be computed based upon temperature and pH.*

***** - Santa Ana River Basin Plan specifies that Total Nitrogen Samples are to be filtered*
Site SAR River Road includes data collected by OCWD at "SAR-RIVERRD-01"
Site SAR Hamner includes only data collected by OCWD at "SAR-HAMNER-01"
- Site SAR Etiwanda includes data collected by OCWD at "SAR-ETIWANDA-01"
- Site SAR Van Buren includes only data collected by OCWD at "SAR-VANBUREN-01"
- Site SAR MWD includes data collected by USGS at "Santa Ana River at MWD Xing" and OCWD at "SAR-MWDXING-01"

3.3 Santa Ana River Reach 4

The Basin Plan has specified water quality objectives for SAR Reach 4 for TDS, TIN, and COD. Along SAR Reach 4, OCWD monitors sites, *SAR-MISSION-01*, *SAR-RIVERSIDEAVE-01, and SAR-LACADENA-01*, shown in Figure 2-1. The site designated WR-RIX-01 is located directly in the RIX Outfall pool and is not considered representative of the mainstem of the Santa Ana River.

In 2017, the *SAR-MISSION* and *SAR-RIVERSIDEAVE* sites were monitored once by OCWD in August, but no data was collected at *SAR-LACADENA-01*.

A review of this data showed an insufficient amount of available surface water quality monitoring data to evaluate water quality objective specified in the Basin Plan. Table 3-6 presents a summary of the results of this monitoring.

Table 3-6. Summary of Water Quality Observations for Santa Ana River Reach 4

Constituent	Units	Basin Plan Objective SAR Reach 4	SAR Reach 4 Average	# of Samples
Ammonia-Nitrogen	mg/L	***	< 0.1	2
Bicarbonate (as CaCO3)	mg/L		184	2
Carbonate (as CaCO3)	mg/L		< 1	2
Chemical Oxygen Demand (unfiltered)	mg/L	**30**	15	2
Chloride	mg/L		88	2
Electrical Conductivity	umhos/cm		845	2
Hydroxide (as CaCO3)	mg/L		< 1.0	2
Nitrate-Nitrogen	mg/L		6.5	2
Nitrite-Nitrogen	mg/L		0.038	2
Organic Nitrogen	mg/L		< 0.1	2
Sulfate	mg/L		77	2
Total Alkalinity (as CaCO3)	mg/L		184	2
Total Dissolved Solids	mg/L	**550**	511	2
Total Inorganic Nitrogen	mg/L	**10**	6.5	2
Total Kjeldahl Nitrogen	mg/L		< 0.2	2
Total Nitrogen	mg/L		6.6	2
Total Organic Carbon	mg/L		2.4	2

Note: Table presents average concentration data

**** - Santa Ana River Basin Plan specifies an un-ionized ammonia objectives for WARM designated surface water bodies including site specific objectives for the Santa Ana River and certain tributaries including the Middle Santa Ana River, Chino Creek, Mill Creek (Prado Area), Temescal Creek, and San Timoteo Creek. Site specific objectives must be computed based upon temperature and pH.*

3.4 Santa Ana River Reach 5

The Basin Plan has specified water quality objectives for the SAR Reach 5 for TDS, hardness, sodium, chloride, TIN, sulfate, and COD. Along the SAR Reach 5, OCWD monitors a single site, *SAR-WATERMAN-01*, shown in Figure 2-1. In 2017, no data was collected at *SAR- WATERMAN -01,* as during the time scheduled for sampling there was no stream flow.

The USGS maintains a gauging station, 11059300, located along the SAR at E Street near San Bernardino, shown in Figure 2-1. In 2017, this station recorded flows totaling 21,334 AFY.

4 Conclusions and Recommendations

4.1 Conclusions

The five-year running average TDS concentration, for samples collected immediately below Prado Dam, continues to comply with the water quality objectives established for Reach 2 of the Santa Ana River and the underlying Orange Country Groundwater Management Zone (530 mg/L,. 650 mg/L and 580 mg/, respectively). However, the average TDS concentration of the 15 samples collected at the same location in August and September of 2017 exceeded the water quality objective established for Reach 3 during baseflow conditions (705 mg/L vs. 700 mg/L, respectively).

Average TDS concentrations measured during summer baseflow conditions have been slowly increasing at Prado Dam for the last 10-12 years (see Figure 3-1). In 2015, the Basin Monitoring Program Task Force commissioned an investigation to determine what was causing this trend. The study found that average TDS concentrations were increasing because the POTWs were discharging less treated wastewater to the Santa Ana River system.[5] During the late summer months of August and September, the combined volume-weighted average TDS concentration for the nine municipal effluents that eventually converge at Prado Dam ranges between 535-570 mg/L.[6] High quality (low TDS) municipal effluent tends to dilute low quality (high TDS) discharges from other sources (e.g. dry weather urban runoff, rising groundwater, etc.) that also contribute flows to Reach 3. In the period from 2005 to 2014, POTWs reduced the total volume of treated wastewater discharged to Reach 3 of the Santa Ana River (and its major tributaries) by 45%; from 145 mgd down to 79 mgd. Additional modeling revealed that, if the total volume of municipal effluent discharge had remained unchanged, average TDS concentrations at Prado Dam would also have remained stable. The reduction in wastewater flows, and the subsequent loss of dilution, is also responsible for the long-term rising trend in the average concentration of various individual salt ions (i.e. chloride, sodium and sulfate) during baseflow conditions.

In 2017, the average baseflow concentration of Total Nitrogen at Prado Dam was 4 mg/L, well below the water quality objective established for Reach 3. Long-term water quality monitoring data confirms that average nitrogen concentrations are continuing to slowly decline over time (see Figure 3-2). This is also the result of discharging less treated wastewater into the river system because the average nitrogen concentration in municipal effluent ranges from 8-10 mg/L. In addition, some of the observed trend toward lower average nitrogen concentrations is likely due to the operation of OCWD's treatment wetlands immediately above Prado Dam.

[5] Wildermuth Environmental, Inc. Investigation and Characterization of the Cause(s) of Recent Exceedances of the TDS Concentration Objective for Reach 3 of the Santa Ana River. Feb. 11, 2015.
[6] Wildermuth Environmental, Inc. Volume-Weighted TDS Concentration of POTW Discharges above Prado Dam during August-September. June 15, 2015.

Baseflow samples are also collected further upstream where the MWD pipeline crosses the Santa Ana River in Riverside. The average TDS concentration of these samples was 639 mg/L and the average TIN concentration was 5.5 mg/L. Both values were in compliance with the water quality objectives for Reach 3 of the river.

The average TDS concentration for the two samples collected in Reach 4 of the Santa Ana River was 511 mg/L which complies with the applicable water quality objective of 550 mg/L. The average TIN concentration in these same two samples was 6.5 mg/L which complies with the applicable water quality objective of 10 mg/L.

4.2 Recommendations

The Task Force has now been implementing the approved monitoring plan for more than ten years. Recently numerous issues have arisen regarding the proper way to collect, analyze, interpret and report the resulting data. Therefore, the Task Force would like to initiate comprehensive discussions at upcoming meetings to address these concerns.

1) The monitoring plan should be formally reviewed and revised to ensure that we are collecting all the data necessary to assess compliance with relevant water quality objectives and the overall effectiveness of the new wasteload allocation (scheduled for adoption in early 2019). In particular, should the program be expanded to include the major tributaries to the Santa Ana River (e.g. Chino Cr., Mill-Cucamonga Cr., Temescal Cr., Hole Lake Cr., San Timoteo Cr., etc.)?

2) The monitoring plan should include a list of parameters to be analyzed, identify the sites to be sampled, and specify the sampling schedule. A Quality Assurance Project Plan (QAPP) should also be prepared to support the monitoring program. Some decision must also be made as to whether the monitoring data must be uploaded to CEDEN or other state database.

3) The Basin Plan should be revised to include a clear definition of what constitutes "baseflow" with respect to the water quality objectives for Reach 3. Should data influenced by summer precipitation in August and September be included? Can we use data from other months to characterize baseflow conditions provided that no recent precipitation has occurred? Should data influenced by state water project transfers be excluded?

4) In order to assure more consistent application of water quality standards, the question of when and where to use filtered vs. unfiltered samples should be re-visited. If it is appropriate to evaluate compliance with TIN objectives by measuring TN using a filtered sample (as is done in Reach 3), then it may also be appropriate to use this same procedure elsewhere in the watershed.

5) The existing water quality objectives for various salt ions may no longer be necessary. Most were established based on very limited sampling data collected in the early 1980's. All were intended to represent antidegradation targets not use impairment thresholds. The Nitrogen/TDS Task Force recommended that these objectives for individual salt ions be eliminated because it was more efficient and effective to implement the state Antidegradation Policy (Res. 68-16) using TDS instead. This would be consistent with the State Board's decision in the Chino Basin MWD permitting case (WQO 82-5) which provides the Regional Board with such discretion.

6) Should the monitoring program be expanded to integrate other discharges governed by NPDES permits (e.g. MS4 permits, deminimus discharge permits, CAFO permits, etc.).

5 Response to Comments

Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality

City of Corona - Jennifer McMullin on 5/24/18 and 8/21/18

Page/Table/Section	Detail	Response to Comments
Table 2-1	Footnote indicates *No flow at these sites in 2017. Was there really no flow or just insufficient amount to measure? If so maybe note no flow detected above certain threshold.	When OCWD goes out to collect samples, such water samples will be collected if there is water flowing, even if only a trickle. If the water samplers encounter some wet areas but the water is not flowing the sample will not be collected. Typically, at the sites where no flow is indicated, these sites are completely dry. So it would be more accurate to say no flow rather than insufficient amount to measure.
Figure 2-1, Figure 3-2	Does the Santa Ana River Regional Bacteria Monitoring Program only monitor bacteria? The figures include the monitoring sites for this program but they are labeled differently in the legend of each figure.	Monitoring data removed from report.
Table 3-3	Table should read Reach 2 not Reach 3. Also footnotes include Reach 3 instead of Reach 2.	Table 3-3 and footnotes updated.
page 3-6	1996 though current change to actual date, (I think would be 1996-2015).	Figure 3-1 and figures in Appendix B are updated annually when data is available
page 3-14	Temescal Creek (SAR-Temescal-02) should be Temescal Creek (CK-Temescal-02)	Site label updated.
	· The footer of the report should be 2018	Text revised.
page 1-2, second paragraph	"Water quality and flow data were also collected from tributaries to the SAR and, where appropriate, were compared to Basin Plan objectives to determine compliance." Do we need this sentence or did we remove all data related to tributaries?	Text removed.
page 4-3, last sentence in item 5)	-This would be consistent with the State Board's decision… this sentence is missing "be"	Text revised.

Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality

Regional Board - Cindy Li on 6/12/18

Page/Table/Section	Detail	Response to Comments
Page 3-1 Santa Ana River Reach 2.	We understand you have included the data collected at SAR below Prado Dam in the evaluation of compliance with SAR Reach 2 water quality Objective (Table 3-3). This is incorrect. The Basin Plan intends for the monitoring at SAR below Prado Dam to be used to assess if the water quality objective for base flow in Reach 3 are being met (Page 4-29 of the Basin Plan). To avoid confusion, the Regional Board staff proposes to clarify the divide between SAR Reach 2 and Reach 3, so that the monitoring stations below Prado Dam will be physically located in SAR Reach 3. (See email sent to Mark Norton on June 7, 2018). Subsequently you have created a new Table 3-3 (sent in an email dated May 25 from Tim Moore), which correctly listed the individual test results collected by the Region Board staff from September 7 to October 5, 2017. All the sampling results show that the TDS objective of 700 mg/L were exceeded; 4 out of 5 samples exceeded the Sodium objective of 110 mg/L. The Task Force members will need to propose a study to investigate the cause(s) why the TDS and Sodium objectives are being exceeded. The investigation should include statistical analyses that show the historical trends of TDS concentrations, and correlation with precipitation, operations of the Dam, or discharges of POTWs, and suggest regulatory actions such as revise the effluent limits to make sure that WQOs will not be exceeded.	Comment noted, reach 2 data removed and the analysis of "at Below Prado Dam" evaluated against Reach 3 WQ Objectives.
Page 2-4, Table 2-4.	It is not clear why you have included the Regional Water Quality Monitoring Task Force sampling locations. What are objective of this monitoring program? What monitoring parameters are being tested?	Data removed as it no longer fit the parameters of this report.
Figures B-2 to B-16	all the parameters are shown as 5-yr moving average as compared to the relevant objectives (if any). The objectives were not expressed in 5-yr moving average. Please revise the figures.	Figures revised to include Basin WQ Objectives
Front page, Table 3-3	The Date under the SAWPA logo in the footer of the document has the date "June 2017", and "August 2017" in the revised Table 3-3 page. This should be June 2018.	Date updated
PDF Edits; Memo provided	Heather Boyd's comments are imbedded in the PDF document. I have included the memo referenced in her comments. **REFERENCE:** Regional Board 2017 SAR WQ Rpt Comments_HB.pdf Regional Board 2017 SAR WQ Rpt Comments_HB Memo.DOCX	

Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality

EMWD - Al Javier

Page/Table/Section	Detail	Response to Comments
Page 3-2, Figure 3-1	indicate 650 mg/L for the Objective	Objective updated.
Page 3-5, 1st Paragraph	"OCWD conducted sixteen ~~near~~ monthly monitoring events at Below Prado Dam *(indicate time period?)* , including seven monitoring events conducted in August through October 2017.	Text revised.
	Additionally, the Santa Ana River Regional Bacteria Monitoring program ~~also~~ collects field samples on Santa Ana River Reach 2 downstream of Imperial Highway (P3-0C10)	Text removed.
Page 3-7	"However, as the nitrogen species data collected by OCWD was not filtered, it was not used to evaluate the water quality objective for TIN."	Comma added
Page 3-9	In August 2017, OCWD monitored station *CK-CHINO-03,* located north of Pine Avenue Bridge and just west of El Prado Road, ~~once in August of 2017~~.	Text revised.
Page 3-11	~~In 2017,~~ OCWD monitored the *Cucamonga Creek near Mira Loma (CK-CUCAMONGA_02) and Mill Creek* (CK-MILL-01) sites once in August of 2017.	Text revised.
Page 3-12	In 2016, an ~~exceedance of~~ elevated value(s) above the antidegradation target was observed.	Text revised.
Page B-11, Figure B-11	indicate the 750 mg/L Objective	objective added
Page B-14, Figure B-14	indicate the 110(?) mg/L Objective	objective added
Page B-15, Figure B-15	indicate the 150(?) mg/L Objective	Objective added
Page B-16, Figure B-16	shift the legend slightly to right	Text repositioned.

Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality

State Board - Heather Boyd (1 of 3)

Page/Table/Section	Detail	Response to Comments
Page 1-1, Paragraph 3	Who are the participants required to conduct the investigations?	Pursuant to the 2004 Basin Plan Amendment, certain participants in the N/TDS Task Force are required to conduct the investigations.
Page 1-1, Paragraph 4	Is the monitoring program required to be evaluated annually, or some other time period, to make sure that the objectives of the monitoring are being met?	The 2004 Basin Plan Amendment only specifies the preparation of an annual report.
Page 1-1, Paragraph 6	Refer to comments submitted in my memo to Cindy Li re: definition of baseflow and ways to explore better defining this.	
Page 1-1, Paragraph 6	I think we need to revisit this assumption. I need to review what was written about this approach. I remember reading in the BPA that they didn't actually look at the monitoring; they just assumed that the existing monitoring was sufficient. Has anyone ever done an analysis of the monitoring?	This issue is being investigated as part of the new WLAM update.
Page 1-1, Paragraph 7	What are these commitments and where are they specified/documented?	Item to be discussed.
Page 2-1, Paragraph 3	There is really no specified time period -i.e., number of samples, just in August and September. To make the monitoring program more robust, I suggest we do some stats analyses to determine how many samples it would take to see any changes.	The Task Force agrees that the Monitoring Plan should be updated to address such issues.
Page 2-1, Paragraph 4	Where are these data and locations shown? I think these 3 sentences are confusing. Where is monitoring performed with a greater sampling frequency? The previous sentence states that monthly and quarterly samples are collected from SAR at Imperial and along the SAR below Prado Dam and its tributaries. The following sentence states that above Prado Dam sampling is only conducted one time.	Text revised.
Page 2-1, Paragraph 4	Is this for all the stations above Prado Dam? So, they are only sampled once in August? Only one sample in August is used to evaluate water quality for the other reaches? Is a one time event sufficient?	Item to be discussed.
Page 2-1, Paragraph 4	Is any of this data submitted to CEDEN? Have we used any of this data in the 303(d) assessment? Is there a requirement to upload data into CEDEN since it is surface water? Are there associated QAPPs and MPs for the data collection?	Data is not uploaded to CEDEN. There is an approved Monitorng Plan but no QAPP.
Page 2-3, Paragraph 2	Is this MP available for review? What are the objectives of this monitoring? If one of the objectives is to protect downstream groundwater uses -OCWD, -why is ok for them to monitor on Reach 3 versus below Prado Dam?	Narrative removed from report.
Page 2-3, Paragraph 2	Why were they reduced? What was the objective of the initial MP?	Narrative removed from report.
Page 2-3, Paragraph 3	This monitoring should not be included unless it is required per the 2004 BPA or if it adds additional nutrient or mineral data.	Monitoring data removed from report.
Page 2-3, Paragraph 3	"This **includeds** monitoring designed to" - change includeds to includes	Narrative removed from report.
Page 2-4, Paragraph 1	For what constituents? How does bacteria monitoring fit in with the objectives of the baseflow monitoring at Prado? How does this monitoring fit in with the requirement for an annual report required as part of the 2004 BPA for N/TDS?	Narrative removed from report.
Page 3-1, Paragraph 1,	"Water quality objectives specified for Reach 2 of the SAR by the Basin Plan include only a TDS objective of 650 mg/L. No other water quality objectives are specified for Reach 2." - This is not true. Narrative objectives also apply.	Text will be revised to delete the word "only" and to state there is no numeric objective for TIN in R2.
Page 3-1, Paragraph 1,	Is it stipulated in our Basin Plan that the TDS value comes from the SAR Watermaster Annual Reports? How do we make sure that in the next assessment, the correct number is used?	Text revised for clarity.

Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality
State Board - Heather Boyd (2 of 3)

Page/Table/Section	Detail	Response to Comments
	water year -SAR watermaster versus annual year -Basin Plan	
Page 3-1, footnote to table	For assessment purposes, we would use the objective and calculation specified in the Basin Plan. Not sure whether the Basin Plan specifies using the SAR watermaster calculated value of TDS?	Text revised for clarity.
Page 3-2, Paragraph 4	We should discuss this. How much water can OC capture in all of its recharge basins? What is the	This question is being investigated as part of the updated WLAM.
Page 3-5, Paragraph 1, first sentence	We discussed this issue. Separate out RB data to show compliance with R3 objectives -intended purpose of data.	Text revised.
Page 3-5, Paragraph 1, last sentence	Is one of the specified objectives of this specific monitoring to provide data to the SAR annual report? It's great there is data, but the sampling is conducted in November. We really need to determine what baseflow constitutes and what data and when we include it.	Monitoring data removed from report.
Page 3-7, Paragraph 1	Is there a difference between the filtered and non filtered values? How much? Is all other data collected and summarized for R3 TN filtered?	The difference between the filtered and unfiltered samples is unknown as we only receive results for the unfiltered samples from OCWD. Yes, all the other TN data is filtered.
Page 3-7, Paragraph 1	Again, do we use these data if the 2004 BPA specified what data to use in AR? Also, without a definition of baseflow, which months do we include/not include? What happens with rain events? Please refer back to my previous comments about the need to define baseflow.	Only data from August & September used to characterize baseflow WQ. Non-tributary flows (OC-59) excluded). Rare rain events usually ID's in a footnote.
Page 3-7, Paragraph 2	But, the sentence above said that the values are presented as an average of baseflow conditions? Why present the data -it complicates matters. Should only present data required by the BPA. What is the purpose of presenting additional data if those data are not collected for the intended purpose? If these data should be included and used, then that is a different story.	Text removed.
Page 3-8, Title of Table 3-4	For the annual report, we should determine the minimum list of constituents. If there is a desire to collect additional constituents outside of what is in our Basin Plan, this should be agreed to.	At a minimum, TIN (TN) & TDS must be evaluated. MP also states that other constituents must also be reported when measured.
Page 3-9, Paragraph 4	Should we try and recon a suitable place for sampling? If we can't sample anywhere, what is the point of specifying objectives for this reach?	Narrative removed from report.
Page 3-9, Paragraph 5	Why only one data point?	Narrative removed from report.
Page 3-9, Paragraph 5	See previous comments about the inclusion of this data into the AR.	Narrative removed from report.
Table 3-5, pH Constituent, Chino Creek Rch 1B	need to list both min and max pH -assessment looks at min and max	Monitoring data removed from report.
Page 3-10	"No in-sream monitoring is currently performed in Reach 2 of Chino Creek" - why?	Narrative removed from report.
Page 3-12, Paragraph 1, last sentence	Why include data? Is monitoring of Cucamonga Creek required per the 2004 BPA?	Narrative removed from report.
Page 3-14, Paragraph 2	How does this creek fit into the required SAR sampling per the 2004 BPA? Do we want to keep track of lack of flow? Can we plot flow over time? Is there anything we can do about changes in flow? Are there any minimum flow requirements for this creek?	Narrative removed from report.

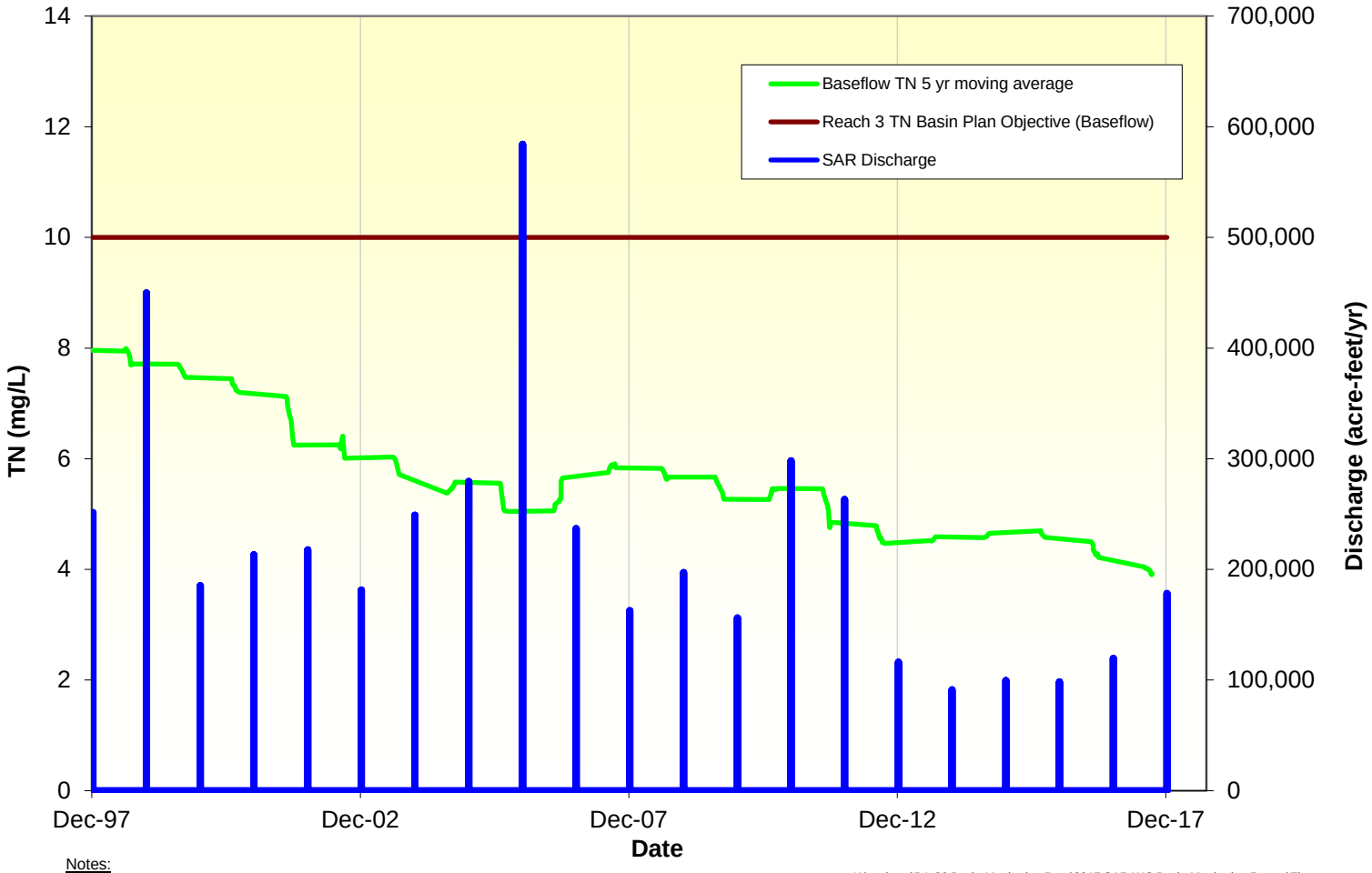
Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality

State Board - Heather Boyd (3 of 3)

Page/Table/Section	Detail	Response to Comments
Page 3-15, Paragraph 2	"A review of this data showed an insufficient amount of available surface water quality monitoring data to evaluate water quality objective specified in the Basin Plan." - Is this statement referring to the data specifically collected at SAR-Cadena or all the data collected on SAR-R4? Why are the data collected not sufficient to evaluate R4 objectives? Has this happened previously? Isn't a requirement of the 2004 BPA to collect and assess R4 objectives? Who is responsible for ensuring that requisite data are collected for this reach? Are the stakeholders wanting to add or supplement the existing monitoring with the bacteria monitoring? Is the idea to use the bacteria monitoring sampling to supplant the previous monitoring required per the 2004 BPA?	MP states that Task Force will rely on existing monitoring data. Historically, BMPTF has relied on data collected by other programs (OCWD, MSAR, etc.) Need to update monitoring plan.
Page 3-16, Paragraph 1	Does the SAR AR require reporting of flow? I think we should take notice of flow and look at flows over time and include in the report.	Annual total stream flows are reported and shown in the graphs. New tools being developed as part of the updated WLAM effort.
Page B-2, Legend	"Baseflow TN 5 yr moving average" - Why is TN shown as a 5 yr moving average if the WQO is not specified as a 5 year moving average? I think if trends are to be shown, the use of a statistical trend analysis should be conducted and then displayed.	Monitoring plan specifies that graphs will also show a 5-year moving average trend line.

Appendix A
Water Quality Trends
at Below Prado Dam and MWD Crossing
1996 to Current

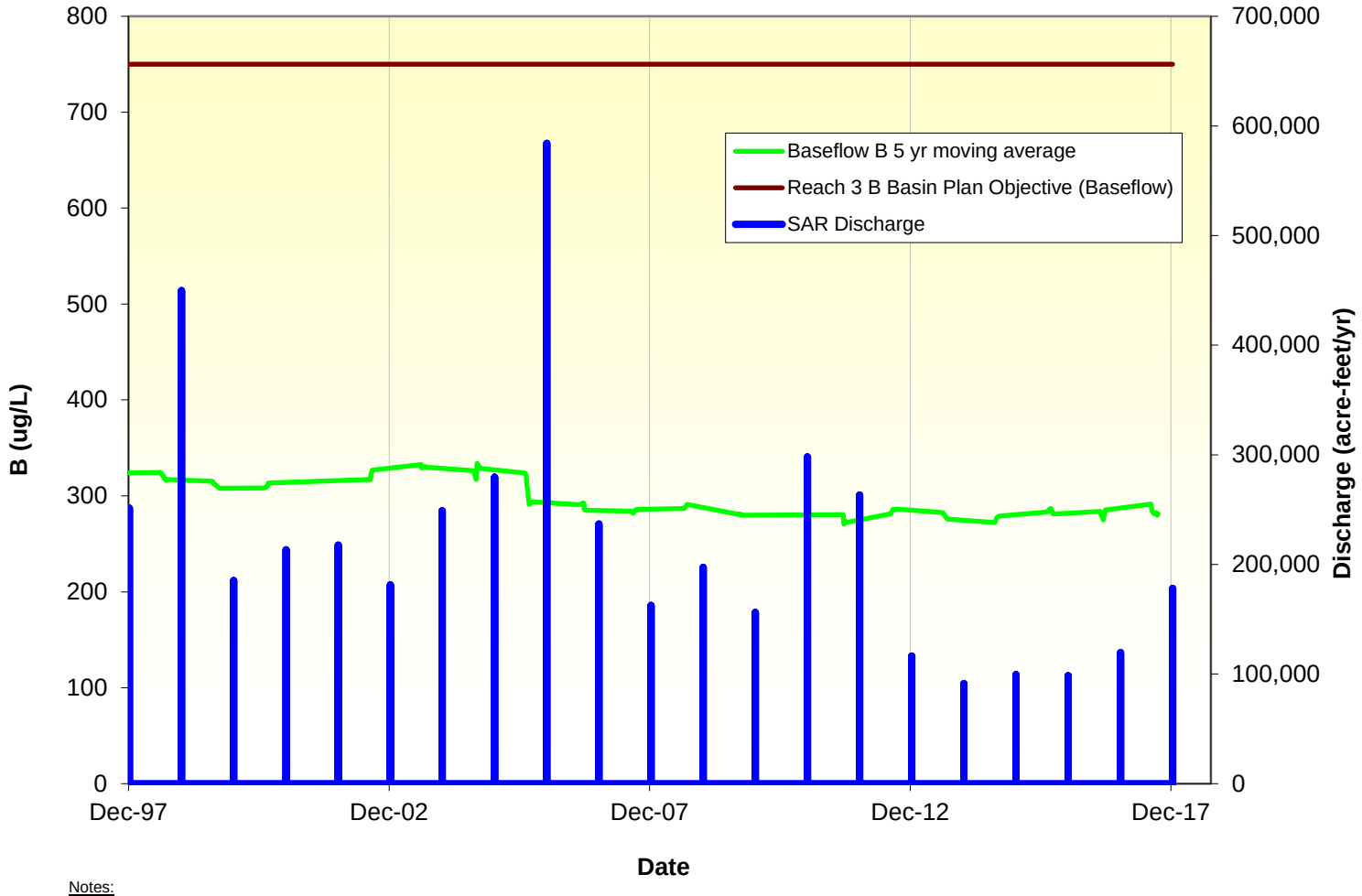
Figure 3-2. Total Nitrogen (TN) Below Prado Dam



Notes:
Baseflow = TN samples from RWQCB, USGS, HCMP, OCWD for August and September.

K:\projects\PA-20 Basin Monitoring Prog\2017 SAR WQ Basin Monitoring Report\Figures

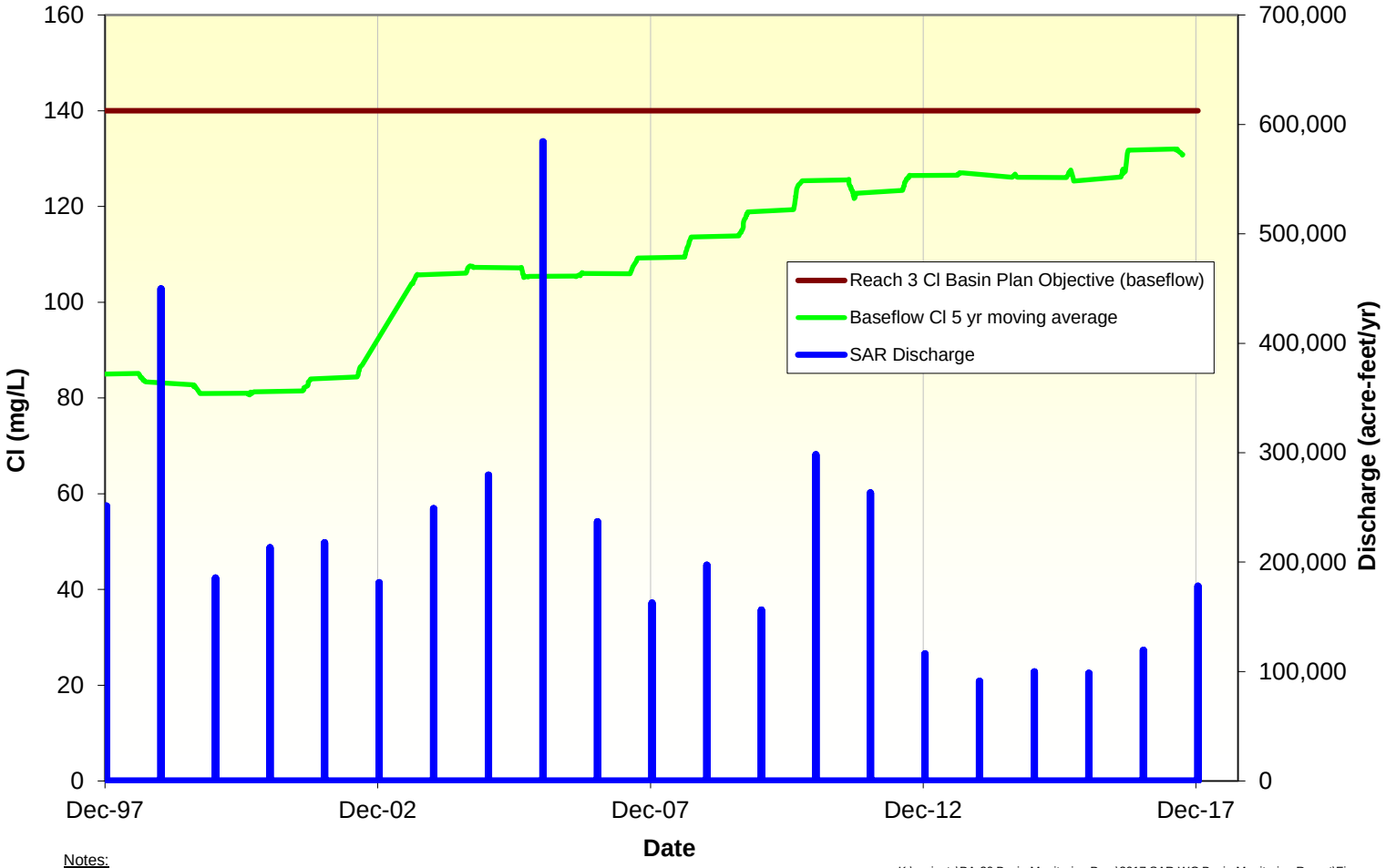
Figure 3-3. Boron (B) Below Prado Dam



Notes:
Baseflow = B samples from RWQCB, USGS, HCMP, OCWD for August and September.

K:\projects\PA-20 Basin Monitoring Prog\2017 SAR WQ Basin Monitoring Report\Figures

Figure 3-4. Chloride (Cl) Below Prado Dam



Notes:
Baseflow = Cl samples from RWQCB, USGS, HCMP, OCWD for August and September

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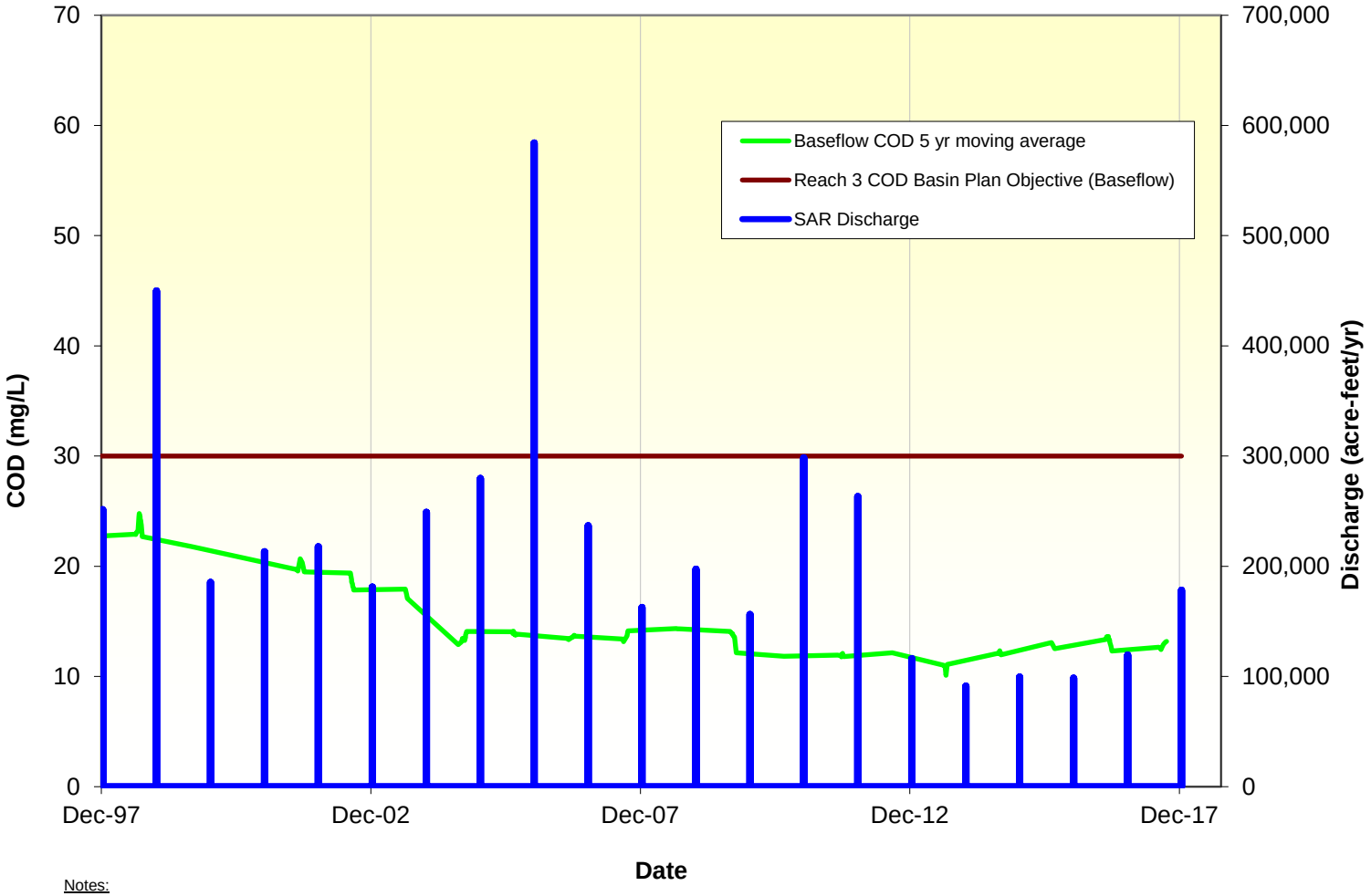
Figure 3-5. Chemical Oxygen Demand (COD) Below Prado Dam



Notes:
Baseflow = COD samples from RWQCB, USGS, HCMP, OCWD for August and September

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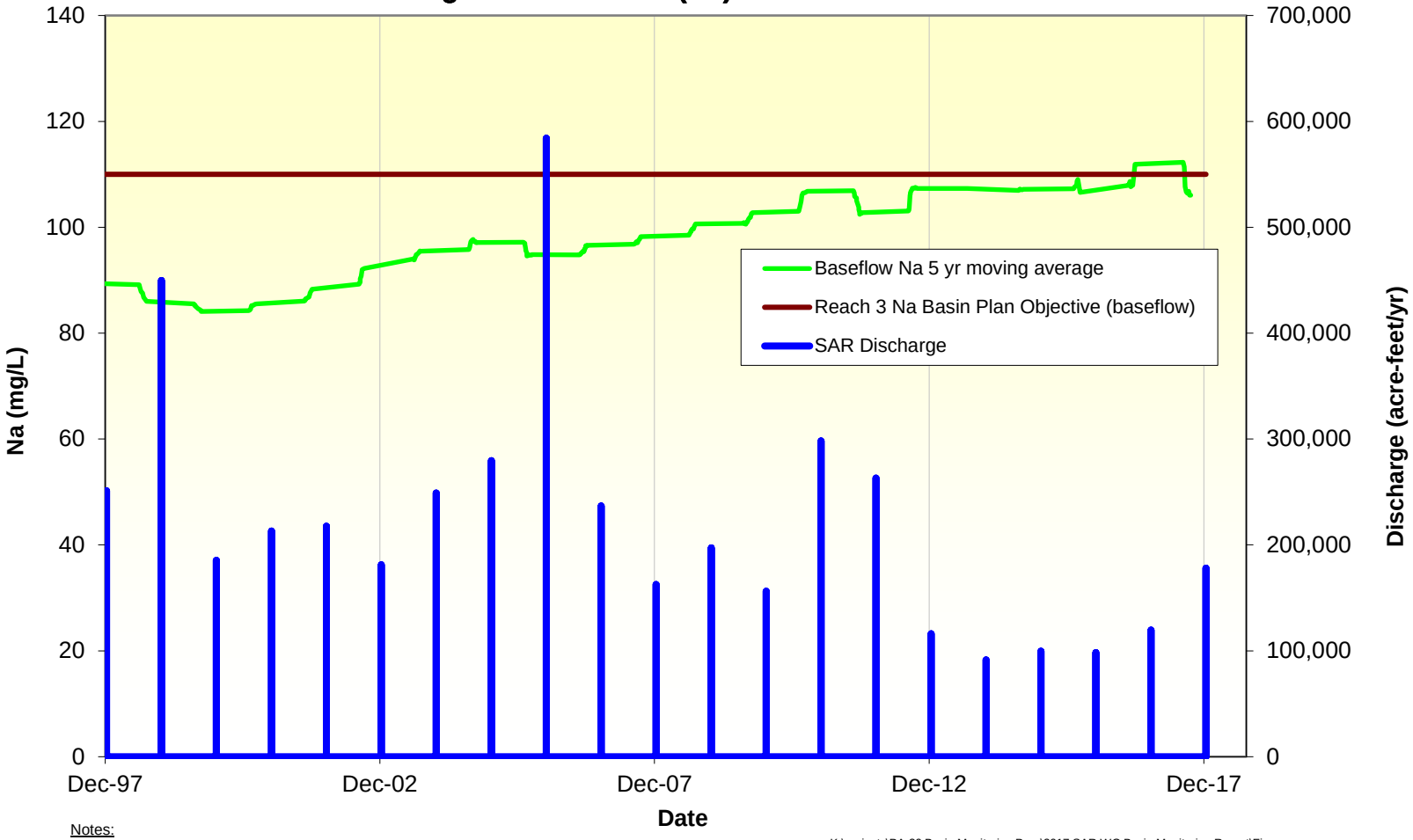
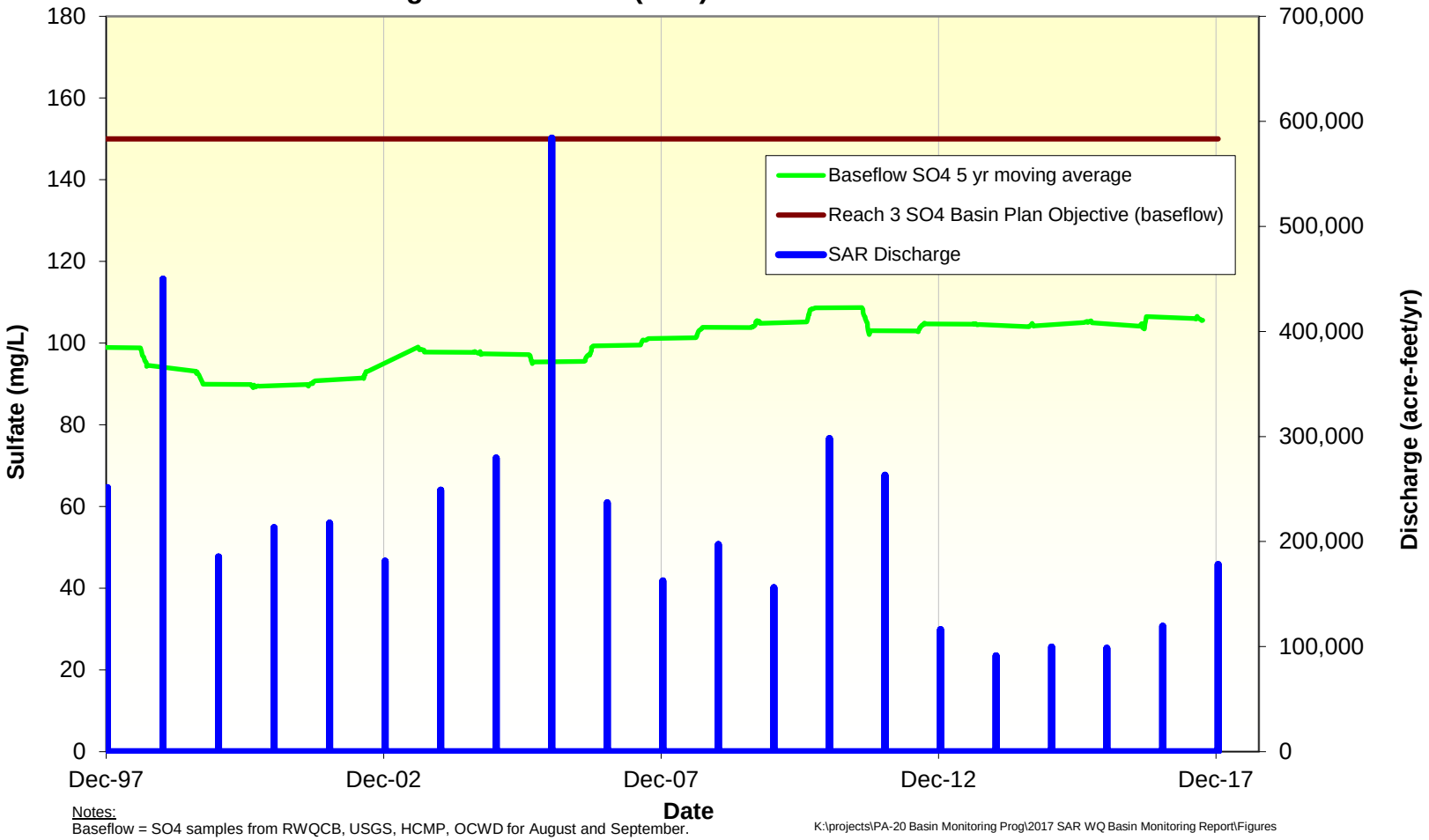
Figure 3-6. Sodium (Na) Below Prado Dam



Notes:
Baseflow = Na samples from RWQCB, USGS, HCMP, OCWD for August and September.

K:\projects\PA-20 Basin Monitoring Prog\2017 SAR WQ Basin Monitoring Report\Figures

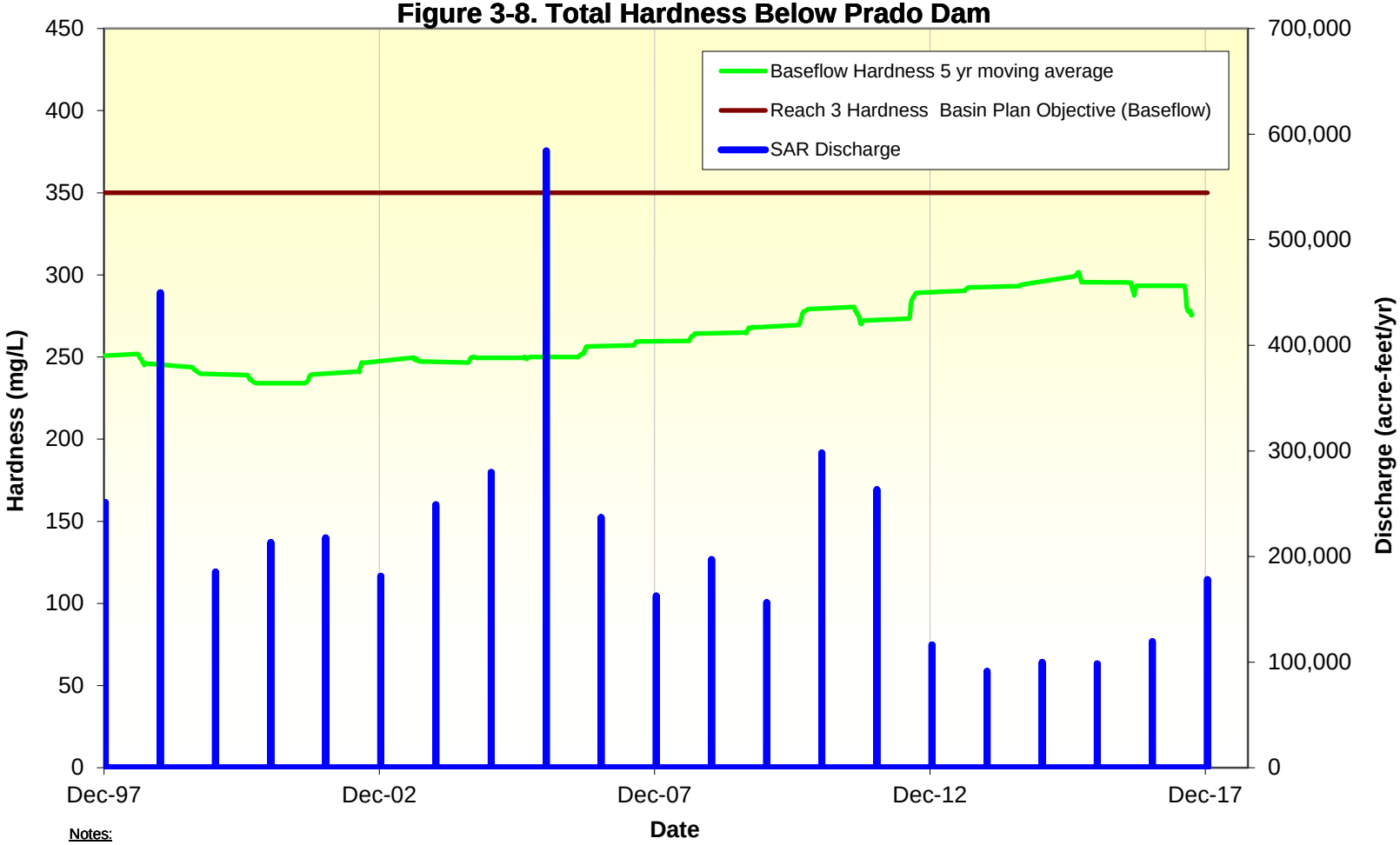
Figure 3-7. Sulfate (SO4) Below Prado Dam



Notes:
Baseflow = SO4 samples from RWQCB, USGS, HCMP, OCWD for August and September.

K:\projects\PA-20 Basin Monitoring Prog\2017 SAR WQ Basin Monitoring Report\Figures

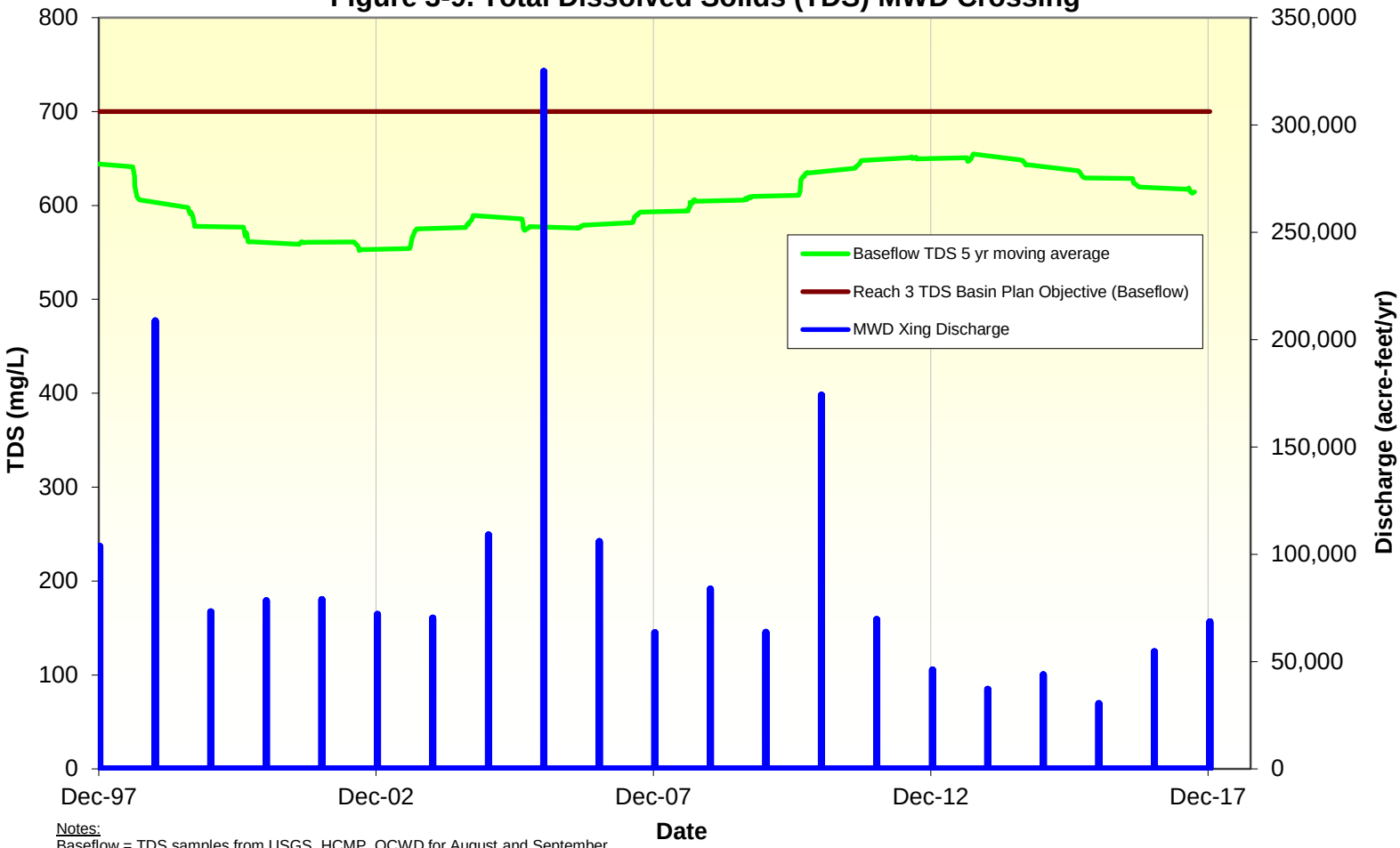
Figure 3-8. Total Hardness Below Prado Dam



Notes:
Baseflow = Hardness samples from RWQCB, USGS, HCMP, OCWD for August and September.

K:\projects\PA-20 Basin Monitoring Prog\2017 SAR WQ Basin Monitoring Report\Figures

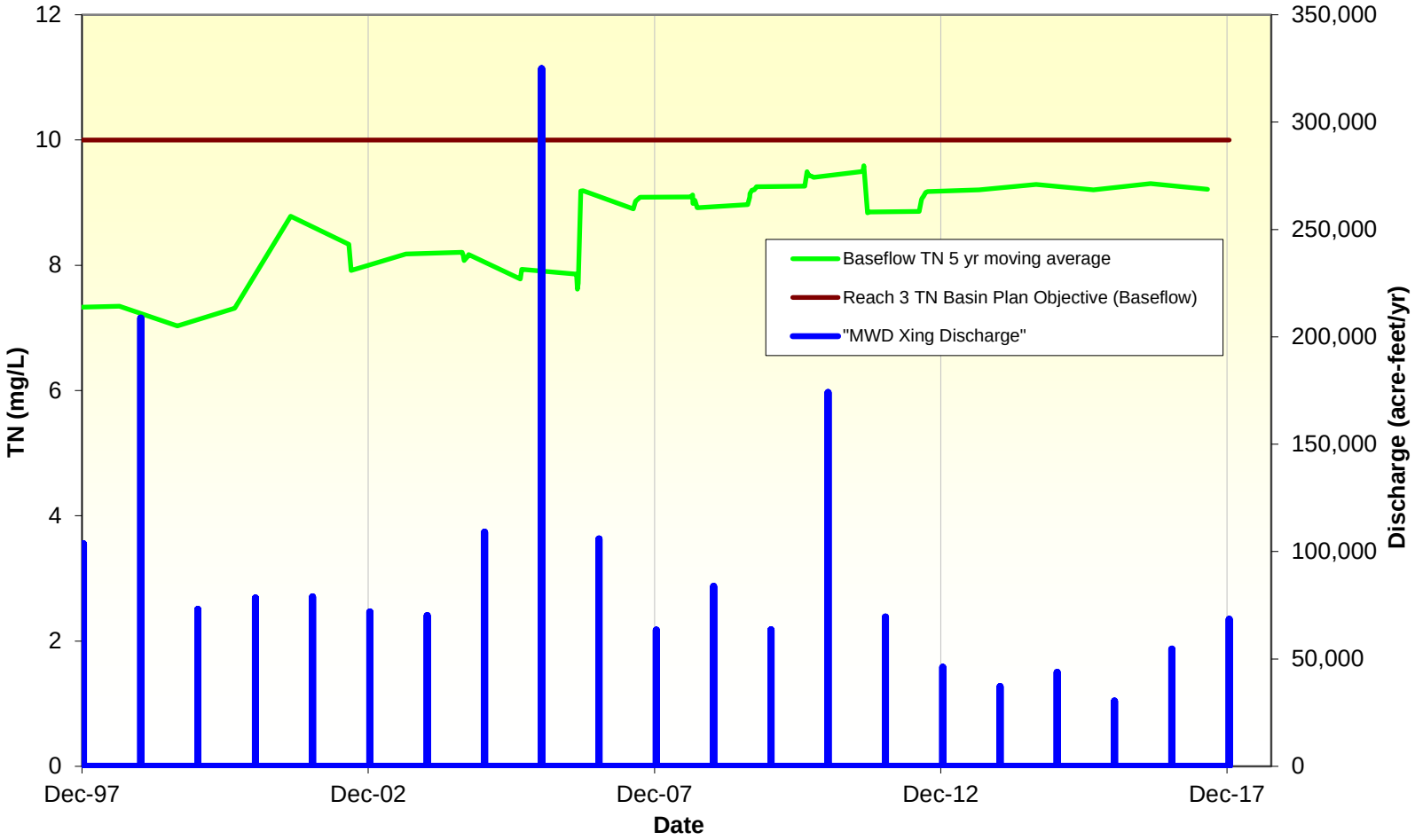
Figure 3-9. Total Dissolved Solids (TDS) MWD Crossing



Notes:
Baseflow = TDS samples from USGS, HCMP, OCWD for August and September.

K:\projects\PA-20 Basin Monitoring Prog\2016SAR WQ Basin Monitoring Report\Figures

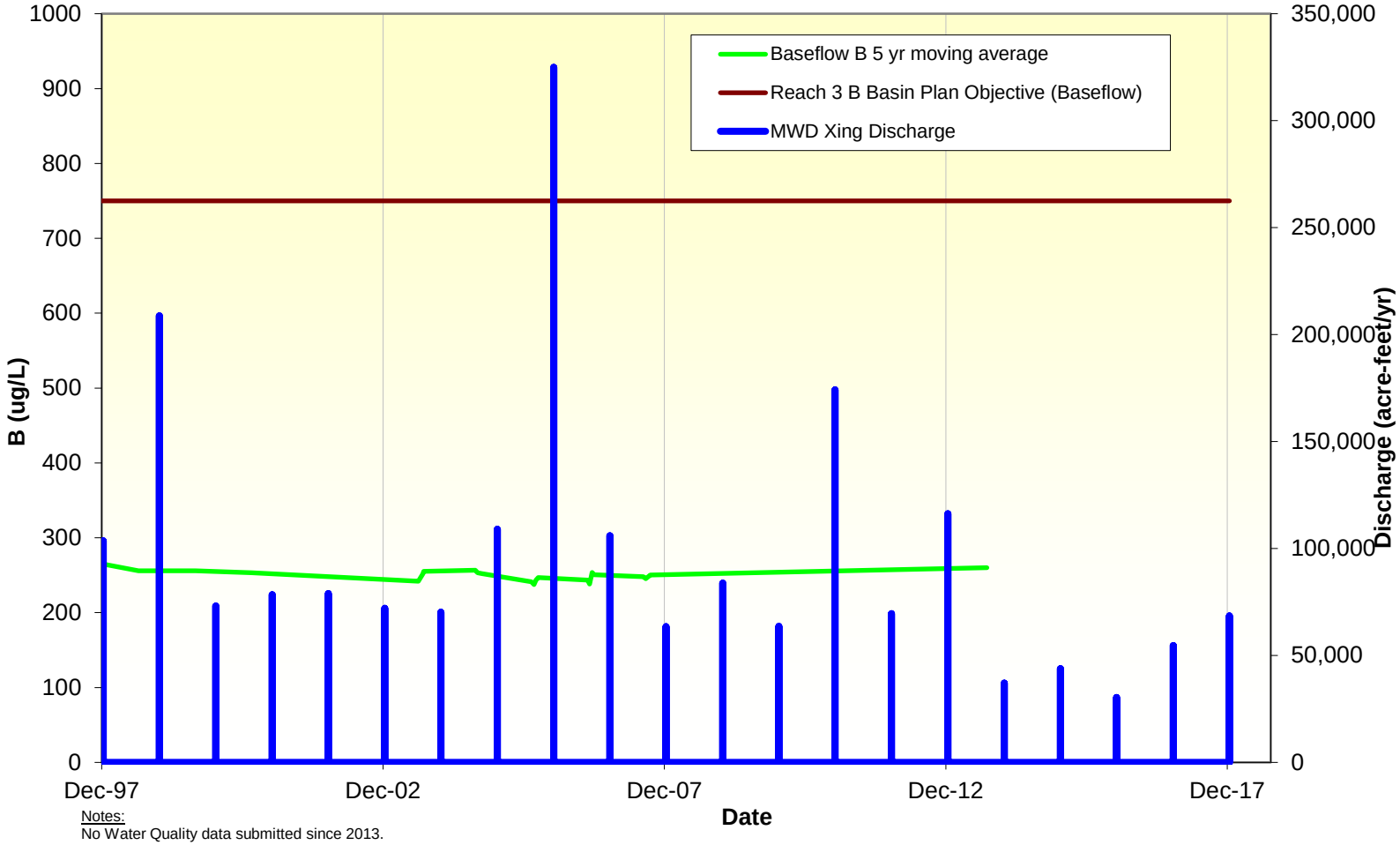
Figure 3-10. Total Nitrogen (TN) MWD Crossing



Notes: Baseflow = TN samples from USGS, HCMP, OCWD for August and September.

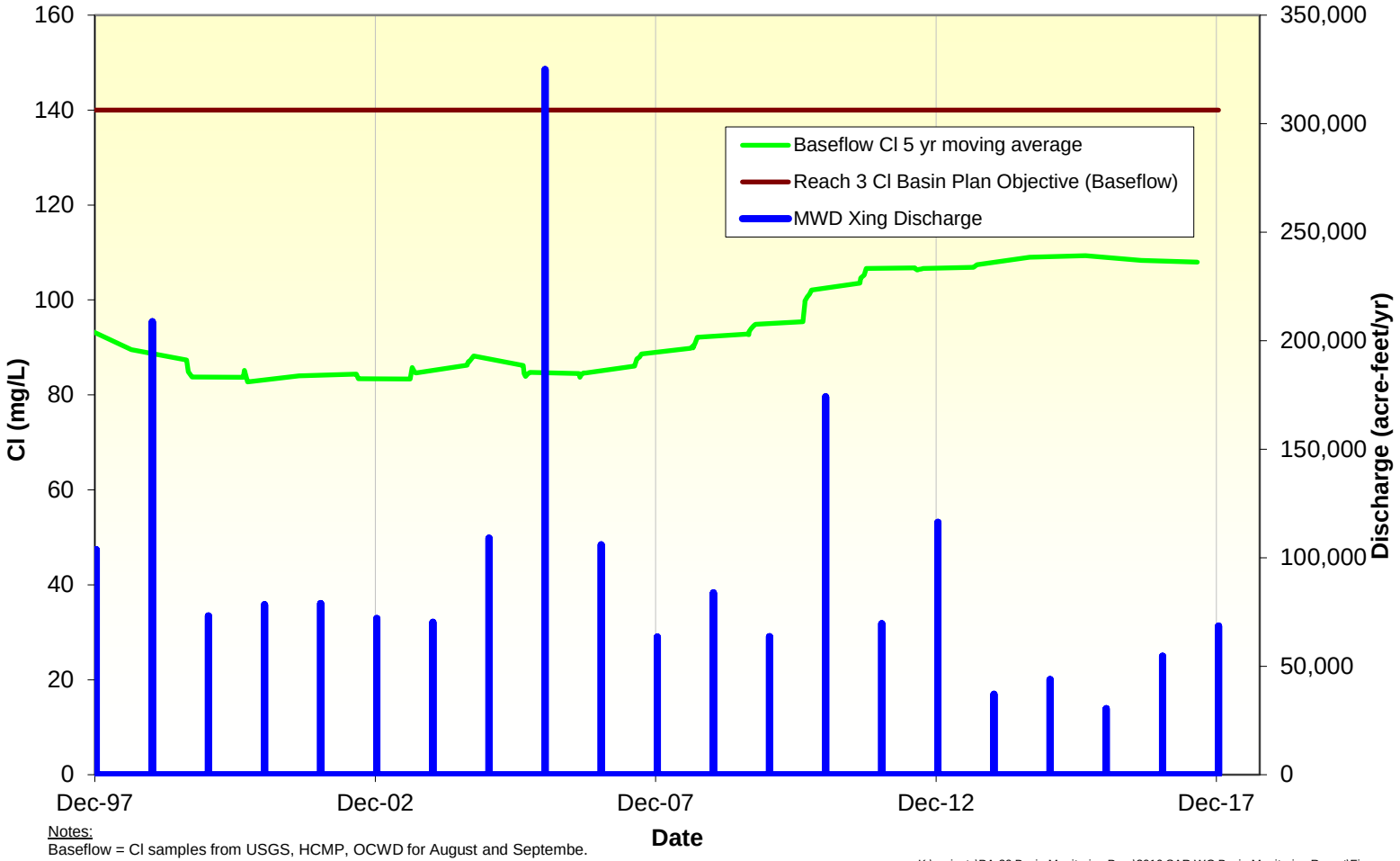
K:\projects\PA-20 Basin Monitoring Prog\2017 SAR WQ Basin Monitoring Report\Figures

Figure 3-11. Boron (B) MWD Crossing



Notes:
No Water Quality data submitted since 2013.

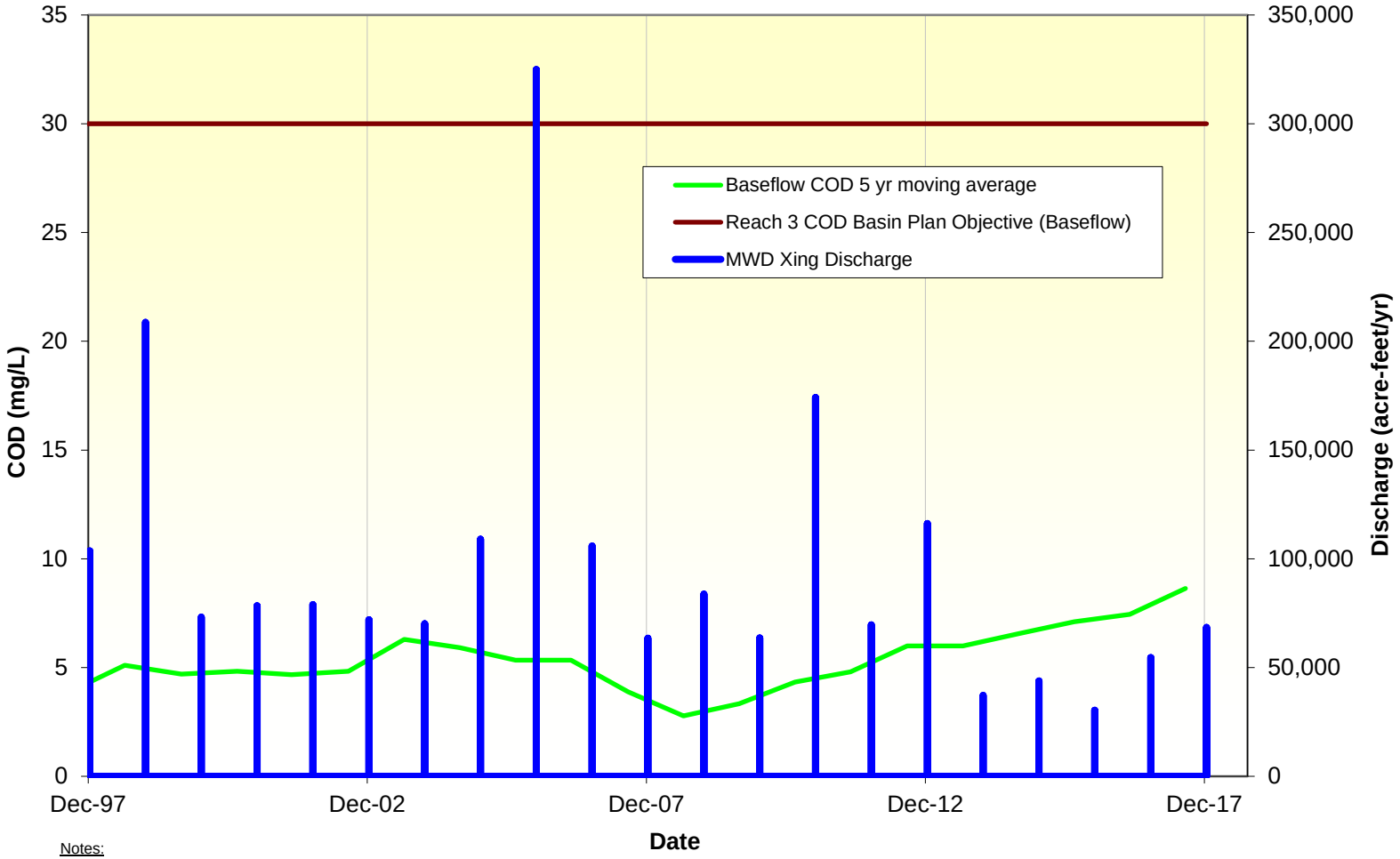
Figure 3-12. Chloride (Cl) MWD Crossing



Notes:
Baseflow = Cl samples from USGS, HCMP, OCWD for August and Septembe.

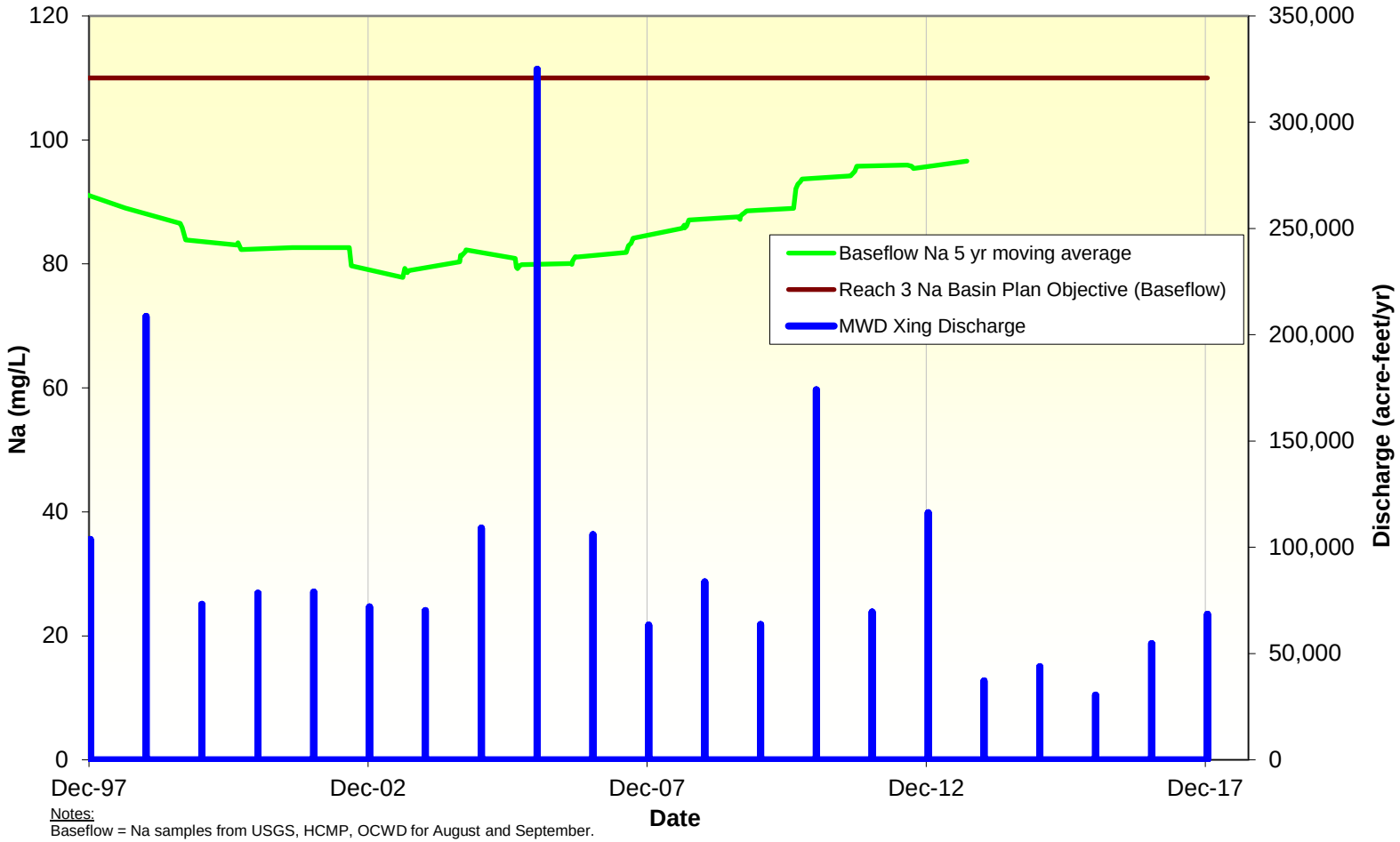
K:\projects\PA-20 Basin Monitoring Prog\2016 SAR WQ Basin Monitoring Report\Figures

Figure 3-13. Chemical Oxygen Demand (COD) MWD Crossing



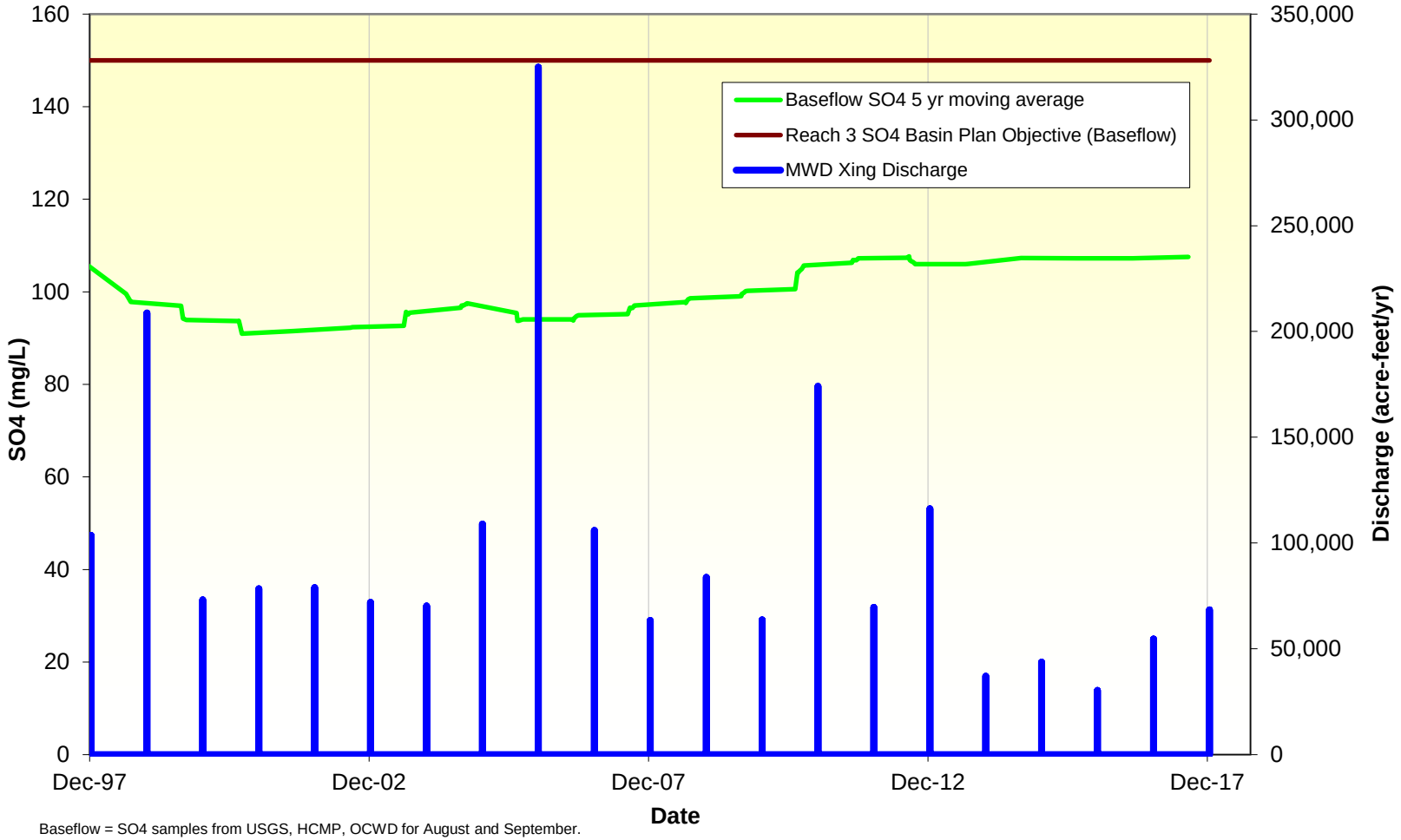
Notes:
Baseflow = COD samples from USGS, HCMP, OCWD for August and September.

Figure 3-14. Sodium (Na) MWD Crossing



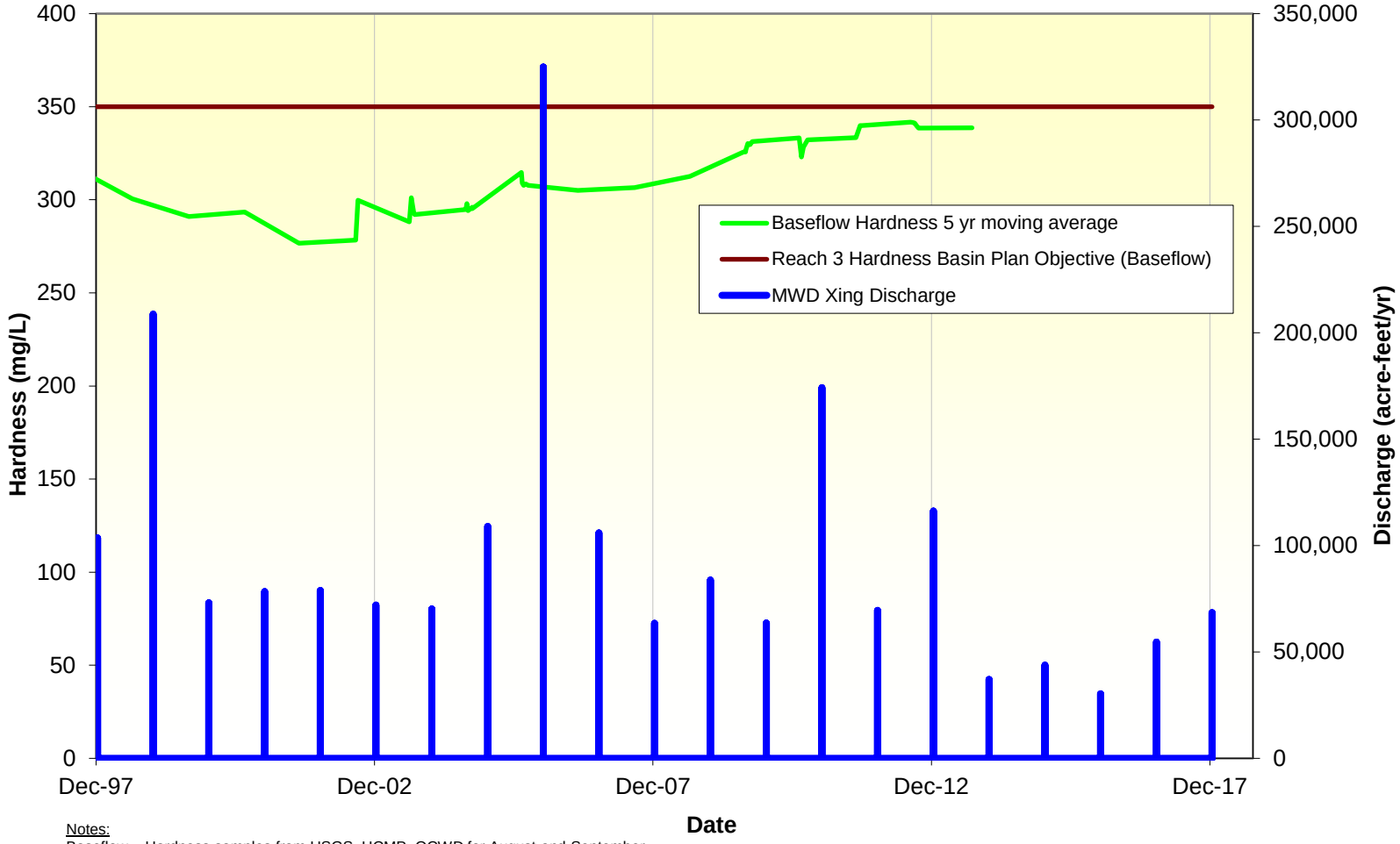
Notes:
Baseflow = Na samples from USGS, HCMP, OCWD for August and September.
No Water Quality data submitted for 2014 - 2017.

Figure 3-15. Sulfate (SO4) MWD Crossing



Baseflow = SO4 samples from USGS, HCMP, OCWD for August and September.

Figure 3-16. Total Hardness MWD Crossing



Notes:
Baseflow = Hardness samples from USGS, HCMP, OCWD for August and September.
No Water Quality data submitted for 2014 - 2017.

Appendix B
All 2017 Water Quality and Flow Data
(*Included on Enclosed CD*)

Comments and Responses to 2017 Draft Annual Report of Santa Ana River Water Quality

City of Corona - Jennifer McMullin on 5/24/18 and 8/21/18

Page/Table/Section	Detail	Response to Comments
Table 2-1	Footnote indicates "No flow at these sites in 2017. Was there really no flow or just insufficient amount to measure? If so maybe note no flow detected above certain threshold.	When OCWD goes out to collect samples, such water samples will be collected if there is water flowing, even if only a trickle. If the water samplers encounter some wet areas but the water is not flowing the sample will not be collected. Typically, at the sites where no flow is indicated, these sites are completely dry. So it would be more accurate to say no flow rather than insufficient amount to measure.
Figure 2-1, Figure 3-2	Does the Santa Ana River Regional Bacteria Monitoring Program only monitor bacteria? The figures include the monitoring sites for this program but they are labeled differently in the legend of each figure.	Monitoring data removed from report.
Table 3-3	Table should read Reach 2 not Reach 3. Also footnotes include Reach 3 instead of Reach 2.	Table 3-3 and footnotes updated.
page 3-6	1996 though current change to actual date, (I think would be 1996-2015).	Figure 3-1 and figures in Appendix B are updated annually when data is available
page 3-14	Temescal Creek (SAR-Temescal-02) should be Temescal Creek (CK-Temescal-02)	Site label updated.
	· The footer of the report should be 2018	Text revised.
page 1-2, second paragraph	"Water quality and flow data were also collected from tributaries to the SAR and, where appropriate, were compared to Basin Plan objectives to determine compliance." Do we need this sentence or did we remove all data related to tributaries?	Text removed.
page 4-3, last sentence in item 5)	-This would be consistent with the State Board's decision... this sentence is missing "be"	Text revised.