June 15, 2015

Santa Ana Watershed Project Authority
Attn: Mark Norton, Water Resources & Planning Manager
11615 Sterling Avenue
Riverside, CA 92503

Subject: ***Volume-Weighted TDS Concentration of POTW Discharge above Prado Dam during August-September***

Dear Mr. Norton:

Pursuant to the Basin Monitoring Program Task Force's (Task Force) request, Wildermuth Environmental Inc. (WEI) characterized the volume-weighted, total dissolved solids (TDS) concentration of total discharge from publicly-owned treatment works (POTW) that could potentially reach Prado Dam. The background, methods, results, and conclusions of this characterization are described below.

Background

Figure 1 shows the SAR, its regulatory reaches, and the groundwater management zones (GMZs) as defined in the Water Quality Control Plan for the Santa Ana River Basin[1] (Basin Plan). The Basin Plan contains TDS concentration objectives for the SAR and the GMZs, and a plan to manage TDS concentrations pursuant to those objectives.

Reach 3 of the SAR runs from Mission Blvd in Riverside to Prado Dam. There are three primary components of stream discharge in Reach 3: storm flow, non-tributary flow, and base flow. Storm flow is rainfall runoff. Non-tributary flow typically originates from outside the watershed, such as imported water, or is an episodic transfer of water within the watershed. Base flow is the remainder and mainly includes tertiary-treated wastewater discharge from POTWs, rising groundwater, and dry-weather runoff.

The Basin Plan contains a TDS concentration objective of 700 milligrams per liter (mg/L) for base flow of the SAR at the USGS gaging station below Prado Dam (SAR below Prado Dam)—the so-called Reach 3 TDS concentration objective.

To measure compliance with the Reach 3 TDS concentration objective, the Regional Board coordinates a program to measure TDS concentrations in SAR grab samples collected at the SAR below Prado Dam during the summertime (August and September) when the influences of storm discharge are typically at a minimum. The Regional Board uses data from this and other monitoring programs to evaluate the efficacy of its current regulatory approach, including the wasteload allocation.

[1] California Regional Water Quality Control Board, Santa Ana Region. (2011). *Water Quality Control Plan, Santa Ana River Basin (8)*. January 24, 1995 (Updated February 2008 and June 2011).

Figure 2 shows recent data from this program, which indicates that the TDS concentration of the SAR below Prado Dam during August and September has been increasing, and in some instances since 2010, has exceeded the Reach 3 TDS concentration objective of 700 mg/L. The results of the Wasteload Allocation Model Scenario 8 (WLAM Scenario 8)[2] also indicate that under current (2015) and future (2020) POTW planning scenarios, the Reach 3 TDS concentration objective of 700 mg/L is exceeded.

In 2014-15, WEI conducted an investigation and characterization of the causes of recent exceedances of the TDS concentration objective for Reach 3 of the SAR. The investigation showed that the observed summertime increase in TDS concentration of the SAR below Prado Dam from 2004-2012 was correlated with the decrease in IEUA's discharge of relatively low TDS concentration. In other words, the TDS concentration of the SAR below Prado Dam is being diluted by IEUA discharges. The decrease in IEUA's summertime discharge resulted from increased recycled-water reuse and decreased wastewater influent due to the economic recession that began in 2008 and the implementation of indoor water-conservation measures**.**

The investigation also concluded that there are other un-measured gains and losses of discharge within Reach 3 of the SAR (e.g. rising groundwater, streambed recharge, evapotranspiration, dry-weather runoff, etc.) that may be contributing to the recent exceedances of the Reach 3 TDS concentration objective of 700 mg/L.

At the February 18, 2015 Task Force meeting, Risk Sciences recommended that WEI calculate and document the volume-weighted TDS concentration of total POTW discharge during August and September that could potentially reach the SAR below Prado Dam for: (i) historical conditions during 2004-2014 and (ii) future conditions assumed in WLAM Scenario 8. This calculation can be used by the Regional Board in its process to evaluate and adopt the wasteload allocation analyzed in WLAM Scenario 8.

Methodology

Figure 1 shows the Study Area for this investigation, which includes the POTW discharge locations used in the volume-weighted TDS concentration calculation[3]. Table 1 provides information about the monitoring that occurs at each POTW discharge location.

The datasets compiled and used in this investigation included:

- Daily average POTW discharge rates and measured TDS concentrations as recorded by the POTWs and reported to the Regional Board for the months of August and September during the historical period of 2004-2014.
- The projected POTW discharge rates and TDS concentrations assumed in all six scenarios of WLAM Scenario 8 for 2015 and 2020.

The datasets were used to calculate the volume-weighted TDS concentration of total POTW discharge for August through September using the following equations:

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[2] Wildermuth Environmental, Inc. (2015). *Addendum to the 2008 Santa Ana River Wasteload Allocation Model Report: Scenario 8*. Prepared for the Basin Monitoring Program Task Force. January 2015.

[3] All POTW discharges are included in the calculations except for those POTWs that discharge to ponds (City of Redlands) and to San Timoteo Wash (Yucaipa Valley Water District and the City of Beaumont), since these discharges percolate completely to groundwater during the summer and do not reach Prado Dam.

$$\sum(Q * C) = (Q_R * C_R) + (Q_{RIX} * C_{RIX}) + (Q_{RIV} * C_{RIV}) + (Q_W * C_W) + (Q_{RP1} * C_{RP1}) + (Q_{RP4} * C_{RP4}) + (Q_{RP5} * C_{RP5}) + (Q_{CC} * C_{CC}) + (Q_{C1B} * C_{C1B}) + (Q_{C3} * C_{C3}) + (Q_{LL} * C_{LL}) + (Q_{EV} * C_{EV}) + (Q_E * C_E) \quad (1)$$

$$\sum Q = (Q_R + Q_{RIX} + Q_{RIV} + Q_W + Q_{RP1} + Q_{RP4} + Q_{RP5} + Q_{CC} + Q_{C1B} + Q_{C3} + Q_{LL} + Q_{EV} + Q_E) \quad (2)$$

$$TDS_{POTW} = \frac{\sum(Q * C)}{\sum Q} \quad (3)$$

where,

Q = sum of daily discharge for August through September (million gallons)
C = average of TDS concentrations for August through September (mg/L)

and, the subscripts refer to the POTW discharge locations:

R = City of Rialto Municipal Wastewater Treatment Plant - DP-001
RIX = Regional Tertiary Treatment Rapid Infiltration and Extraction Facility - DP-001
RIV = Riverside Regional Water Quality Control Plant - DP-001
W = Western Riverside County Regional Wastewater Treatment Plant - DP-001
RP1 = IEUA DP-001 - effluent from Regional Water Recycling Plant No. 1
RP4 = IEUA DP-002 - effluent from Regional Water Recycling Plants No. 1 and No. 4
RP5 = IEUA DP-007 - effluent from Regional Water Recycling Plant No. 5
CC = IEUA DP-008 - effluent from Carbon Canyon Wastewater Reclamation Facility
C1B = Corona Wastewater Treatment Plant No. 1 - DP-001
C3 = Corona Wastewater Treatment Plant No.3 - DP-001
LL = Lee Lake Water Reclamation Facility - DP-001
EV = EVMWD Regional Water Reclamation Facility - DP-001
E = EMWD Region-wide Water Recycling System - Temescal Creek Discharge - DP-001

Results and Conclusions

Table 2 displays the total discharge for August through September by POTW during the period 2004-2014, and the average of all available TDS measurements associated with that discharge. Figures 3 through 15 are time-series charts that display the data in Table 2 as monthly discharge and measured TDS concentrations for each POTW. The volume-weighted TDS concentration of total POTW discharge during August through September is shown at the bottom of Table 2 as annual values, and is plotted as a time-series chart on Figure 16.

Table 2 and Figure 16 show that:

(i) the total POTW discharge during August and September decreased from about 9,000 million gallons in 2005 to about 5,000 million gallons in 2014, and

(ii) the volume-weighted TDS concentrations of the POTW discharge ranged from 529 to 569 mg/L during 2004-2014, showed no increasing trend, and were always less than the Reach 3 TDS concentration objective of 700 mg/L.

These results and observations are consistent with the conclusion of the prior investigation on summertime TDS concentrations of the SAR below Prado Dam[4]: that the observed summertime increase in TDS concentration of the SAR below Prado Dam since 2004 is correlated with the decrease in POTW discharge of relatively low TDS concentration.

Figure 17 is a time-series chart that displays the same data in Table 2, but as TDS mass. This chart shows that total TDS mass in POTW discharge during August through September declined from about 20,000 US tons in 2005 to about 11,000 US tons in 2014.

Table 3 shows the total discharge for August through September by POTW as assumed in WLAM Scenario 8 (Scenario 8a, 8b, and 8c for 2015; Scenarios 8d, 8e, and 8f for 2020) and its associated TDS concentration. The TDS concentrations assumed in WLAM Scenario 8 are at the maximum permitted TDS concentration for each POTW[5]. The volume-weighted TDS concentrations of total POTW discharge during August through September are shown at the bottom of Table 3 for each scenario, and are included on Figure 16 as part of the time-series chart. Table 3 and Figure 16 show that the volume-weighted TDS concentrations of total POTW discharge as assumed in WLAM Scenario 8 during August through September range from 591 to 602 mg/L for 2015 and 2020, show no increasing trend, and are always less than the Reach 3 TDS concentration objective of 700 mg/L.

The results of this investigation support the conclusions of the prior investigation on summertime TDS concentrations of the SAR below Prado Dam[4]: there are likely other gains and losses of discharge and mass that occur in Reach 3 and Reach 4 (e.g. rising groundwater, streambed recharge, evapotranspiration, dry-weather runoff, etc.), and that some of these discharges may have TDS concentrations much higher than 700 mg/L. An investigation of all factors that affect discharge and TDS concentration in Reach 3 and Reach 4 is necessary to better understand why the recent TDS concentrations of the SAR below Prado Dam during August and September are exceeding the Reach 3 TDS concentration objective of 700 mg/L.

We appreciate the opportunity to serve the Task Force. Please call if you have any questions.

Very truly yours,

Wildermuth Environmental, Inc.

Andy Malone, PG
Principal Geologist

Carolina Sanchez
Staff Engineer

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[4] Wildermuth Environmental, Inc. (2015). *Investigation and Characterization of the Cause(s) of Recent Exceedances of the TDS Concentration Objective for Reach 3 of the Santa Ana River*. Prepared for the Basin Monitoring Program Task Force. February 2015.

[5] The permitted TDS concentration for the City of Corona's Plant 1 discharge is 700 mg/L as an annual average. Since 2008, the average TDS concentration of Plant 1 discharge has been 725 mg/L from May to November. Therefore, 725 mg/L was used in WLAM Scenario 8 and in this analysis for August and September.

Table 1
POTW Discharge Monitoring Locations

POTW Discharge Location	Abbreviated Name	Discharge			Water Quality		
		Measurement Type	Monitoring Frequency	Monitoring Entity	Sample Type	Monitoring Frequency	Monitoring Entity
Regional Tertiary Treatment Rapid Infiltration and Extraction Facility - DP-001	RIX	Daily Average	Daily	City of San Bernardino	Composite	Monthly	City of San Bernardino
City of Rialto Municipal Wastewater Treatment Plant - DP-001	Rialto	Daily Average	Daily	City of Rialto	24-Hour Composite	Monthly	City of Rialto
Riverside Regional Water Quality Control Plant - DP-001	RWQCP	Daily Average	Daily	City of Riverside	Grab/24-Hour Composite	Bi-weekly	CBWM / IEUA / Riverside
Western Riverside County Regional Wastewater Treatment Plant - DP-001[1]	WRCRWTP	Daily Average	Daily	WRCRWA	Grab/Composite	Bi-weekly	CBWM / IEUA / WRCRWA
IEUA DP-001 - effluent from Regional Water Recycling Plant No. 1	IEUA RP-1 (DP-001)	Daily Average	Daily	IEUA	Composite	Bi-weekly	IEUA
IEUA DP-002 - effluent from Regional Water Recycling Plants No. 1 and No. 4	IEUA RP-1 (DP-002)	Daily Average	Daily	IEUA	Composite	Bi-weekly	IEUA
IEUA DP-007 - effluent from Regional Water Recycling Plant No. 5	IEUA RP-5	Daily Average	Daily	IEUA	Composite	Bi-weekly	IEUA
IEUA DP-008 - effluent from Carbon Canyon Wastewater Reclamation Facility	IEUA Carbon Canyon	Daily Average	Daily	IEUA	Composite	Bi-weekly	IEUA
Corona Wastewater Treatment Plant No. 1 - DP-001	Corona 1B	Daily Average	Daily	City of Corona	Grab/Composite	Bi-weekly	CBWM / IEUA / Corona
Corona Wastewater Treatment Plant No.3 - DP-001	Corona 3	Daily Average	Daily	City of Corona	Composite	Monthly	City of Corona
Lee Lake Water Reclamation Facility - DP-001	LLWD	Daily Average	Daily	Lee Lake WD	Composite	Monthly	Lee Lake WD
EVMWD Regional Water Reclamation Facility - DP-001	EVMWD	Daily Average	Daily	Elsinore Valley MWD	Composite	Monthly	Elsinore Valley MWD
Regionwide Water Recycling System -Temescal Creek Discharge - DP-001	EMWD	Daily Average	Daily	Eastern Valley MD	Grab/Composite	Monthly	Eastern MWD

1 -- The Western Municipal Water District Western Water Recycling Facility discharges at the WRCRWTP discharge location.

Table 2

Volume-Weighted TDS Concentration of POTW Discharge during August-September

2004-2014

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total POTW Discharge during August-September (million gallons)	RIX	2,394	2,458	2,484	2,294	2,205	2,124	2,175	2,081	2,043	1,921	1,779
	Rialto	436	411	436	400	404	360	360	356	376	346	357
	RWQCP	1,986	2,014	1,991	1,954	1,898	1,818	1,790	1,773	1,713	1,806	1,693
	WRCRWTP	160	187	195	299	344	389	351	351	343	373	396
	IEUA RP-1 (DP-001)	409	572	228	335	299	272	216	179	130	112	161
	IEUA RP-1 (DP-002)	1,535	1,401	1,060	1,150	791	497	356	269	448	143	212
	IEUA RP-5	375	392	391	342	259	213	279	138	95	0	100
	IEUA Carbon Canyon	487	417	590	643	592	490	21	0	41	93	0
	Corona 1B	193	311	388	187	179	108	192	189	120	108	92
	Corona 3	0	0	0	10	4	6	4	3	0	0	0
	LLWD	32	38	36	38	51	52	47	50	51	0	0
	EVMWD	207	350	351	105	59	41	19	329	36	44	28
	EMWD	0	332	22	0	0	0	0	0	0	0	0
	Total	8,213	8,885	8,171	7,758	7,085	6,370	5,812	5,718	5,396	4,945	4,819
Average TDS concentration of POTW Discharge during August-September (mg/L)	RIX	517	490	486	490	510	490	505	505	490	520	460
	Rialto	510	482	490	453	507	470	498	480	489	486	479
	RWQCP	571	585	616	619	652	626	600	603	647	633	636
	WRCRWTP	596	665	590	545	639	560	555	540	535	550	450
	IEUA RP-1 (DP-001)	482	437	449	469	502	489	511	487	515	536	541
	IEUA RP-1 (DP-002)	476	454	455	474	497	520	500	488	471	511	514
	IEUA RP-5	494	477	489	517	544	548	499	514	516	-	586
	IEUA Carbon Canyon	498	473	482	494	511	505	528	-	532	561	-
	Corona 1B	692	810	823	859	720	735	723	690	670	795	730
	Corona 3	748	720	825	735	725	675	700	605	625	-	-
	LLWD	585	483	479	480	570	535	-	460	555	-	-
	EVMWD	715	715	670	745	760	740	800	560	655	640	635
	EMWD	-	783	753	-	-	-	-	-	-	-	-
Volume-Weighted TDS Concentration of POTW Discharge, during August-September (mg/L)		529	535	539	534	562	544	545	544	548	569	536

1 -- The LLWD POTW was excluded from the 2010 volume-weighted TDS concentration calculations because TDS data was not available for 2010.

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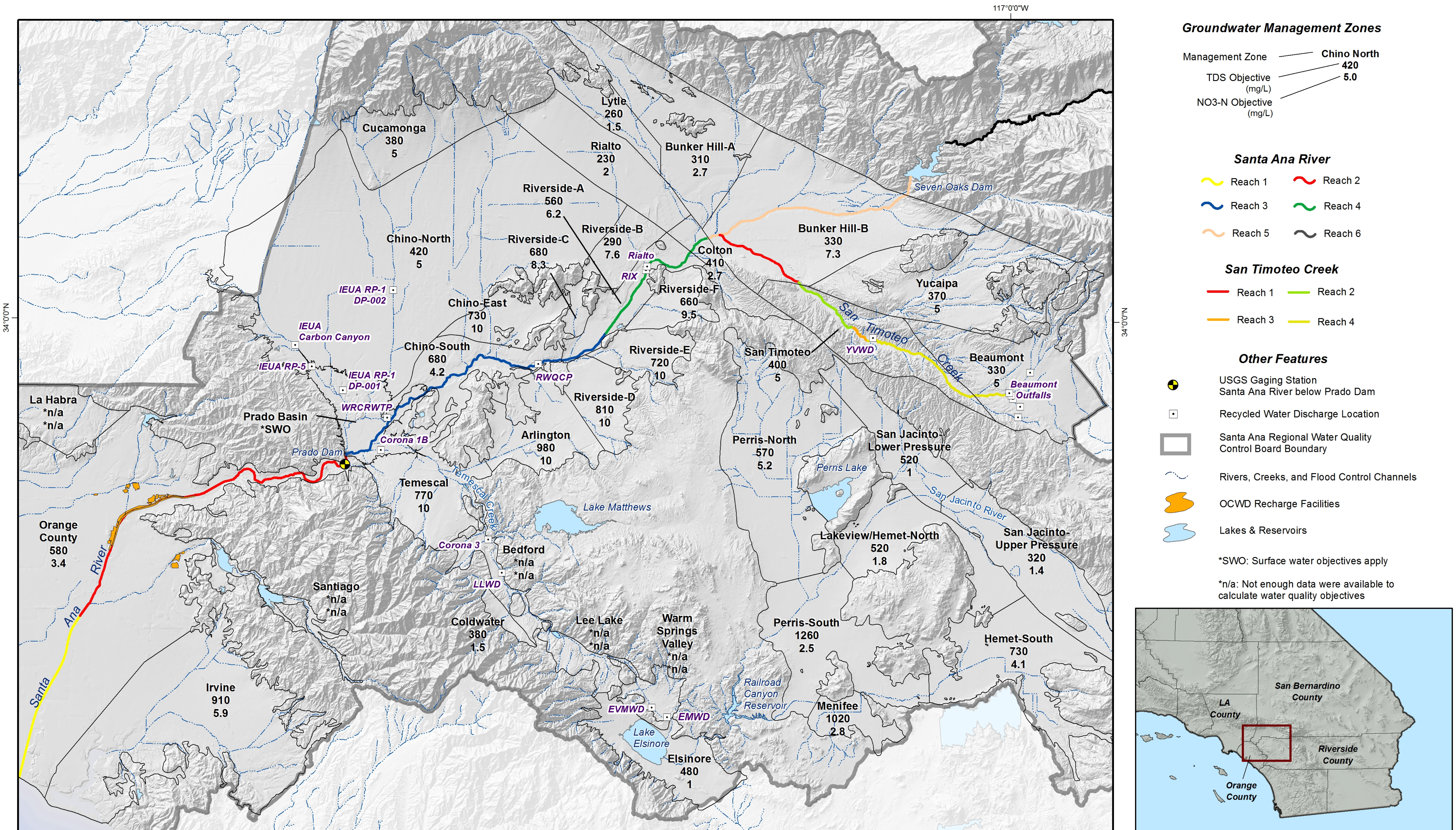
Table 3
Volume-Weighted TDS Concentration of POTW Discharge as Assumed in WLAM Scenario 8 during August-September

POTW Discharge Location	WLAM Scenario 8 TDS Concentration (mg/L)[1]	Total Assumed POTW Discharge during August-September (million gallons)					
		Scenario 8a Low Discharge 2015	Scenario 8b Intermediate Discharge 2015	Scenario 8c High Discharge 2015	Scenario 8d Low Discharge 2020	Scenario 8e Intermediate Discharge 2020	Scenario 8f High Discharge 2020
RIX	550	1,623	1,958	1,958	1,385	1,769	1,940
Rialto	490	395	395	411	468	517	533
RWQCP	650	1,849	1,849	1,910	1,664	1,947	2,007
WRCRWTP	625	488	488	488	248	732	732
Western WRF[2]	550	0	0	8	0	33	53
IEUA RP-1 (DP-001)	550	217	233	417	92	240	431
IEUA RP-1 (DP-002)	550	87	89	113	77	93	119
IEUA RP-5	550	98	102	157	96	160	217
IEUA Carbon Canyon	550	92	92	336	92	220	464
Corona 1B	725	0	0	15	0	0	21
Corona 3	700	0	0	21	0	5	33
LLWD	650	31	31	207	31	214	390
EVMWD	700	0	0	0	0	0	0
EMWD	650	4,911	5,278	6,184	4,184	5,977	7,094
POTW Discharge Assumed during August-September (million gallons)		9,789	10,513	12,225	8,336	11,905	14,034
Volume-Weighted TDS Concentration during August-September (mg/L)		621	619	619	619	620	620

1 -- With one exception, the TDS concentrations associated with POTW discharges were simulated using the wasteload allocation in the current Basin Plan (RWQCB,2008). The exception is the City of Corona's Plant 1 discharge. The current wasteload allocation for TDS of the City of Corona's Plant 1 discharge is 700 mg/L as an annual average.To represent both the high summertime TDS concentrations and the TDS wasteload allocation, the TDS concentration of Plant 1 discharge was assumed to be 725 mg/L from May to November and 665 mg/L from December to April. This modeling strategy was necessary to more accurately simulate the summertime TDS concentration of the SAR below Prado Dam for comparison to the TDS objective for Reach 3 of the SAR.

2 -- The Western Municipal Water District Western Water Recycling Facility discharges at the WRCRWTP discharge location.



Produced by:

WEI
Wildermuth Environmental, Inc.

Author: AEM
Date: 20150518
File: Figure_1.mxd

Investigation and Characterization of the Causes of Recent Exceedances of the TDS Objective for Reach 3 of the Santa Ana River

SAWPA

Santa Ana River Reaches and POTW Discharge Locations

Santa Ana River Watershed

Figure 1

Figure 2
Stream-Flow Discharge and TDS Concentration during August and September
Santa Ana River below Prado Dam

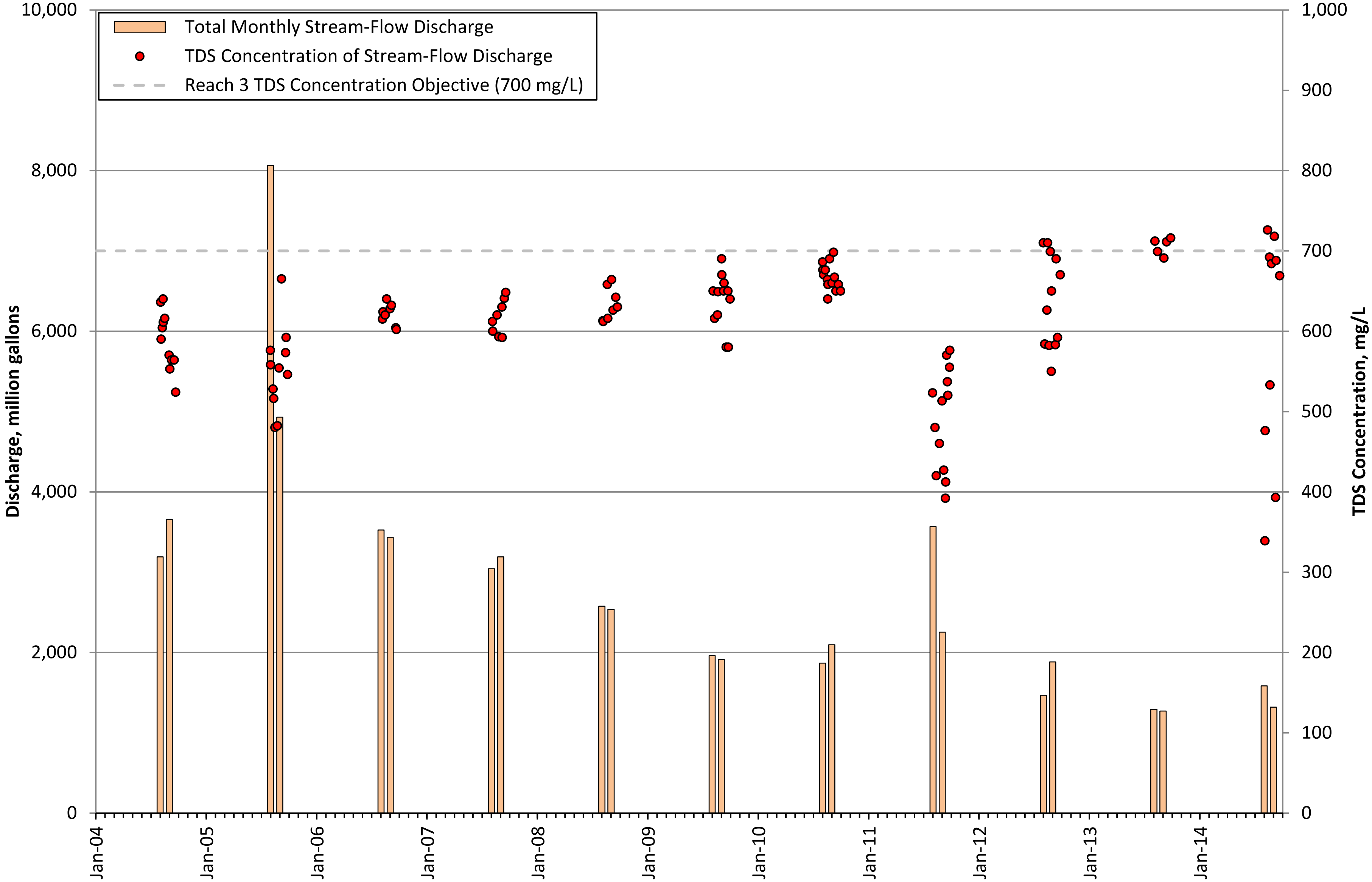


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Figure 3
POTW Discharge and TDS Concentration during August and September
RIX

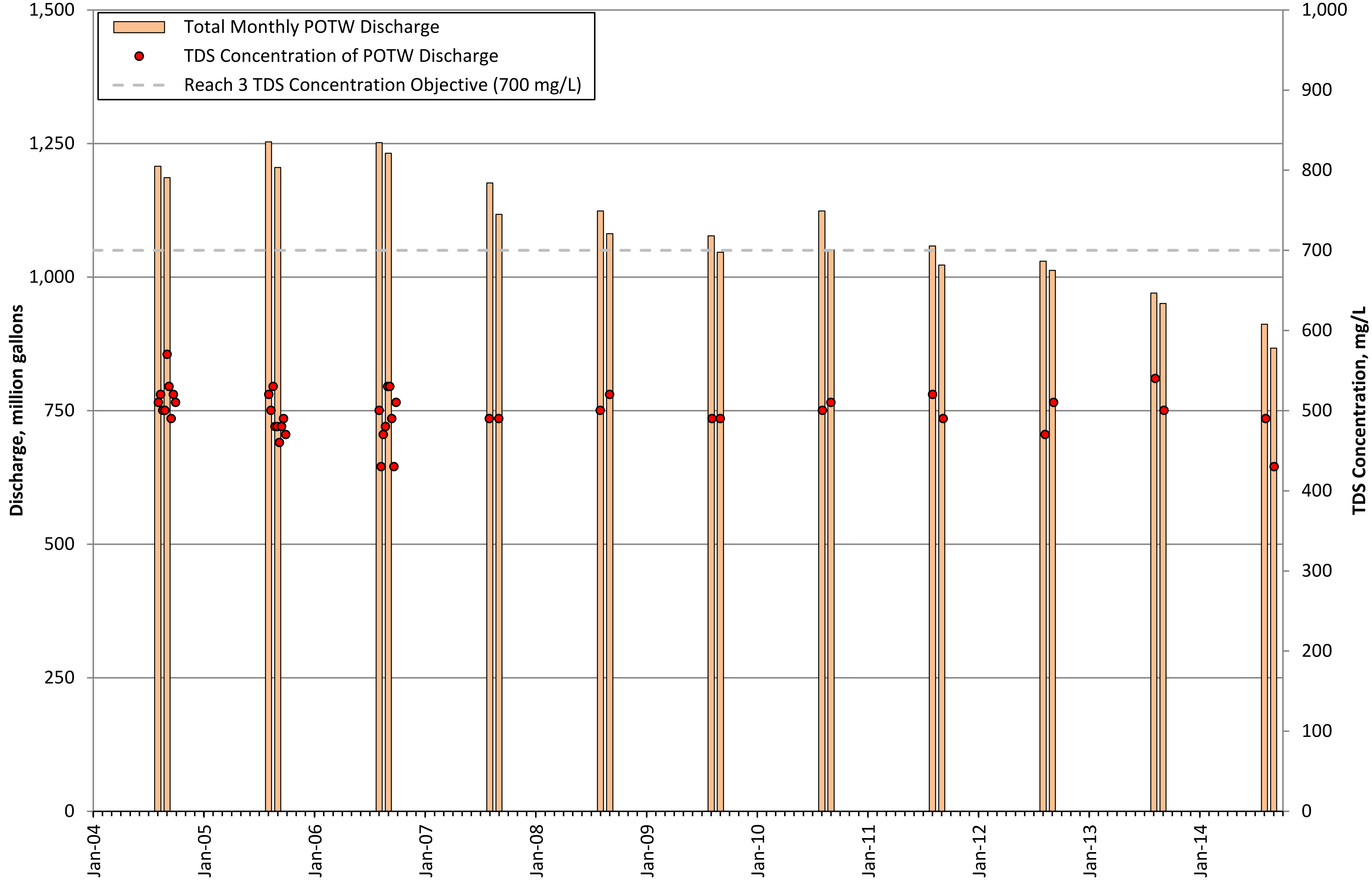

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--2-RIX
6/15/2015

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Figure 4
POTW Discharge and TDS Concentration during August and September
Rialto

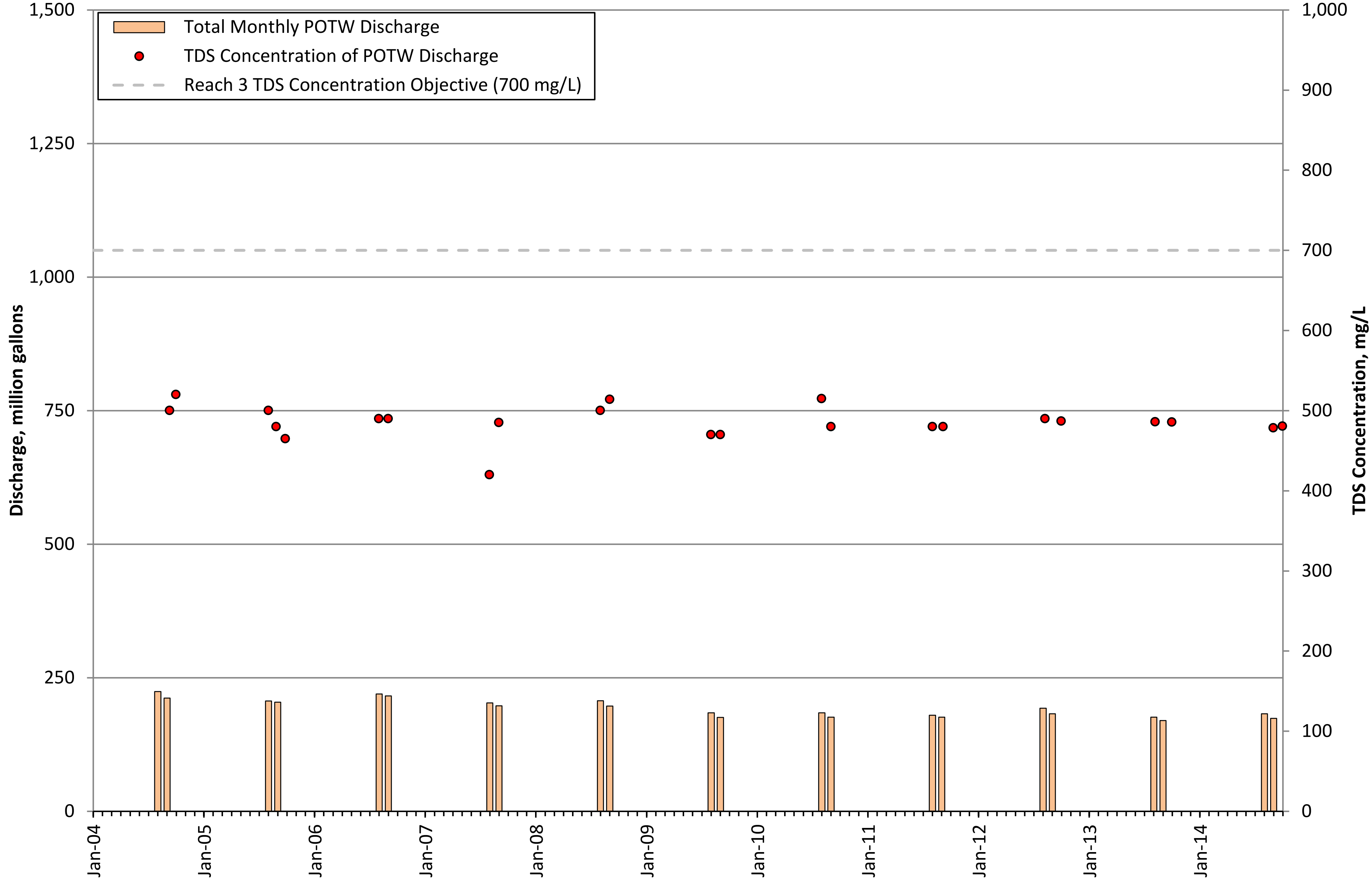

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--3-Rialto
6/15/2015

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Figure 5

Effluent Discharge and TDS Concentration during August and September

RWQCP

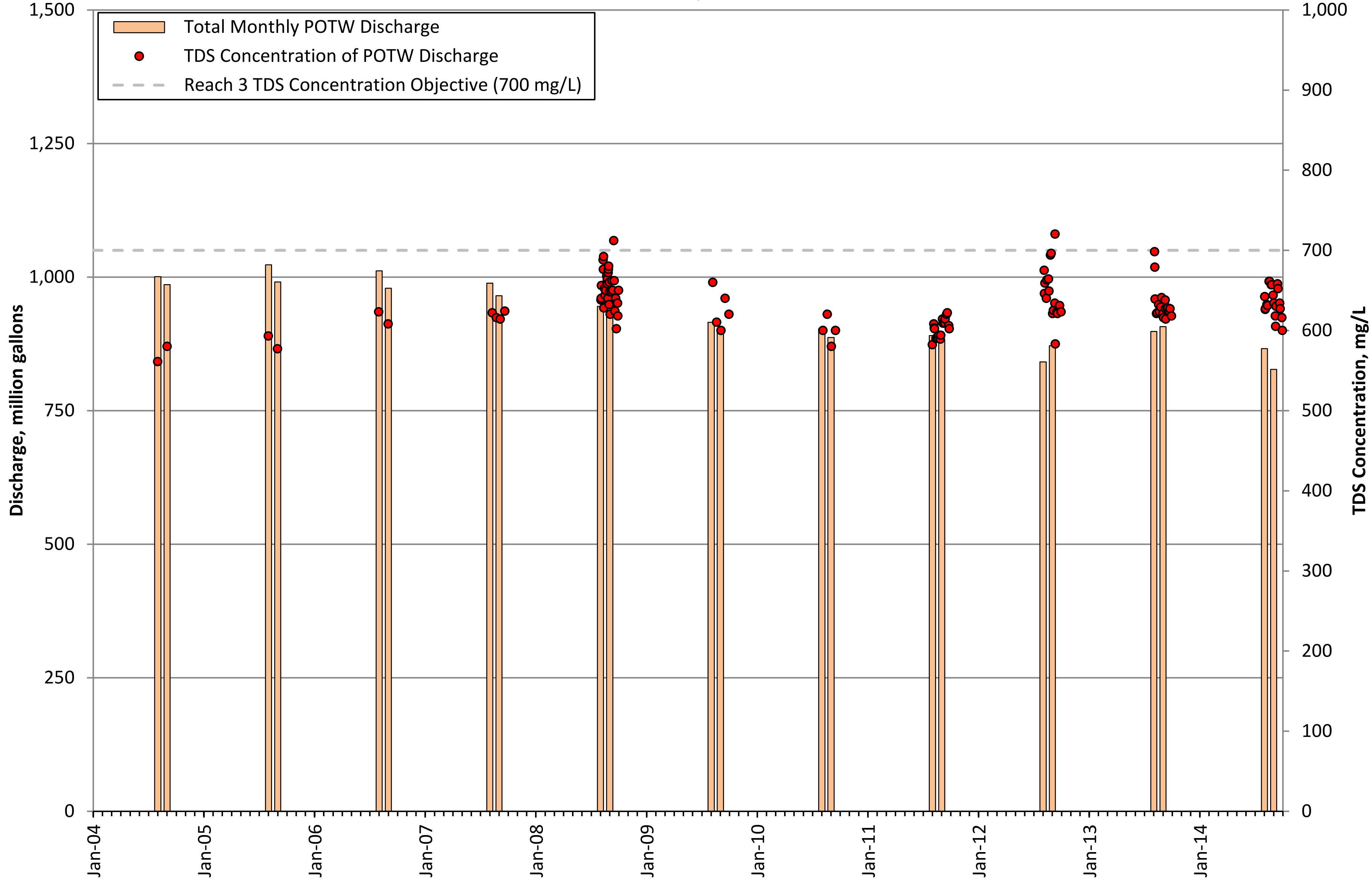

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--4-RWQCP
6/15/2015

Figure 6
Effluent Discharge and TDS Concentration during August and September
WRCRWTP

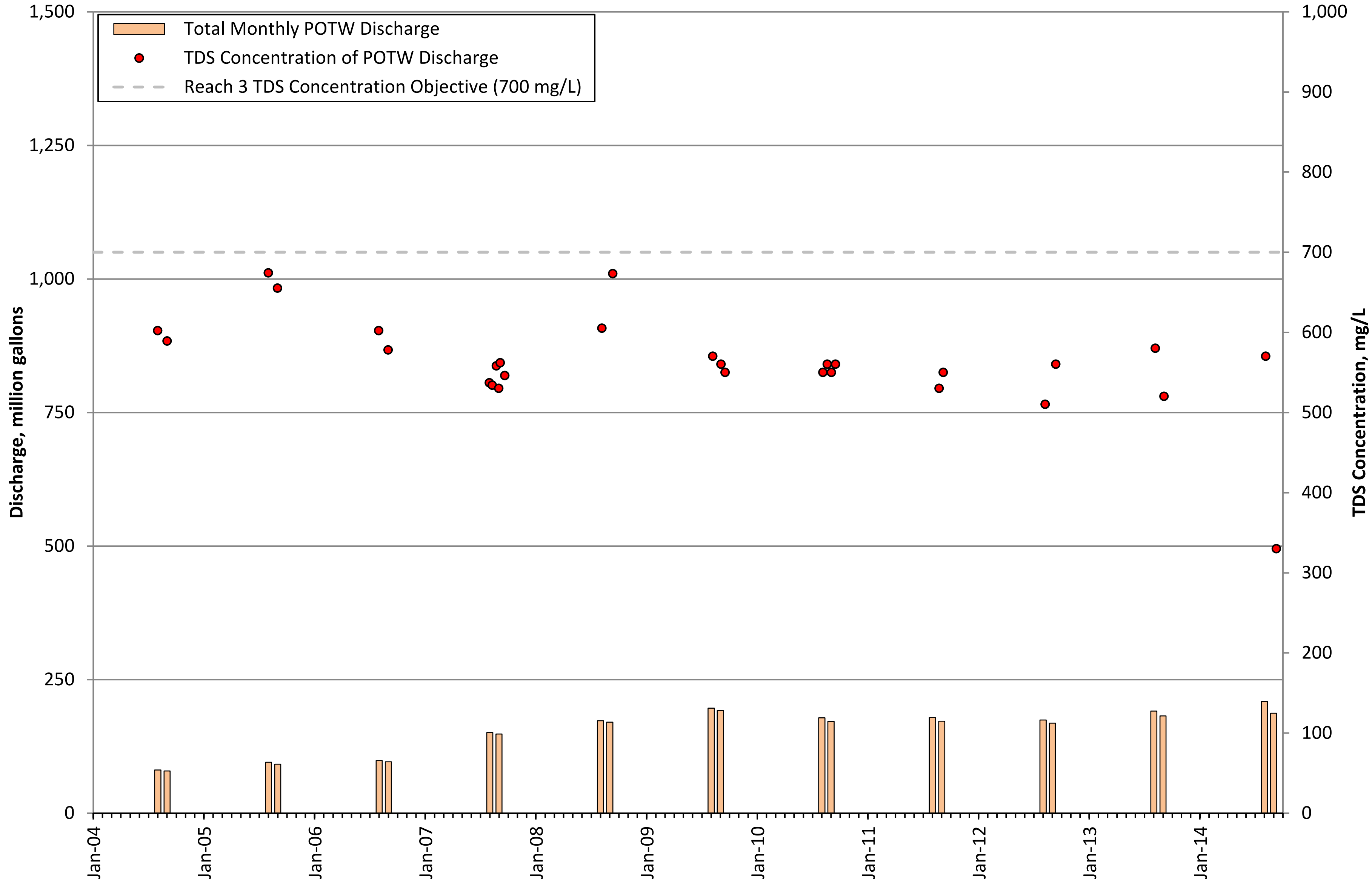

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--5-WRCRWTP
6/15/2015

Figure 7
Effluent Discharge and TDS Concentration during August and September
IEUA RP-1 (DP-001)

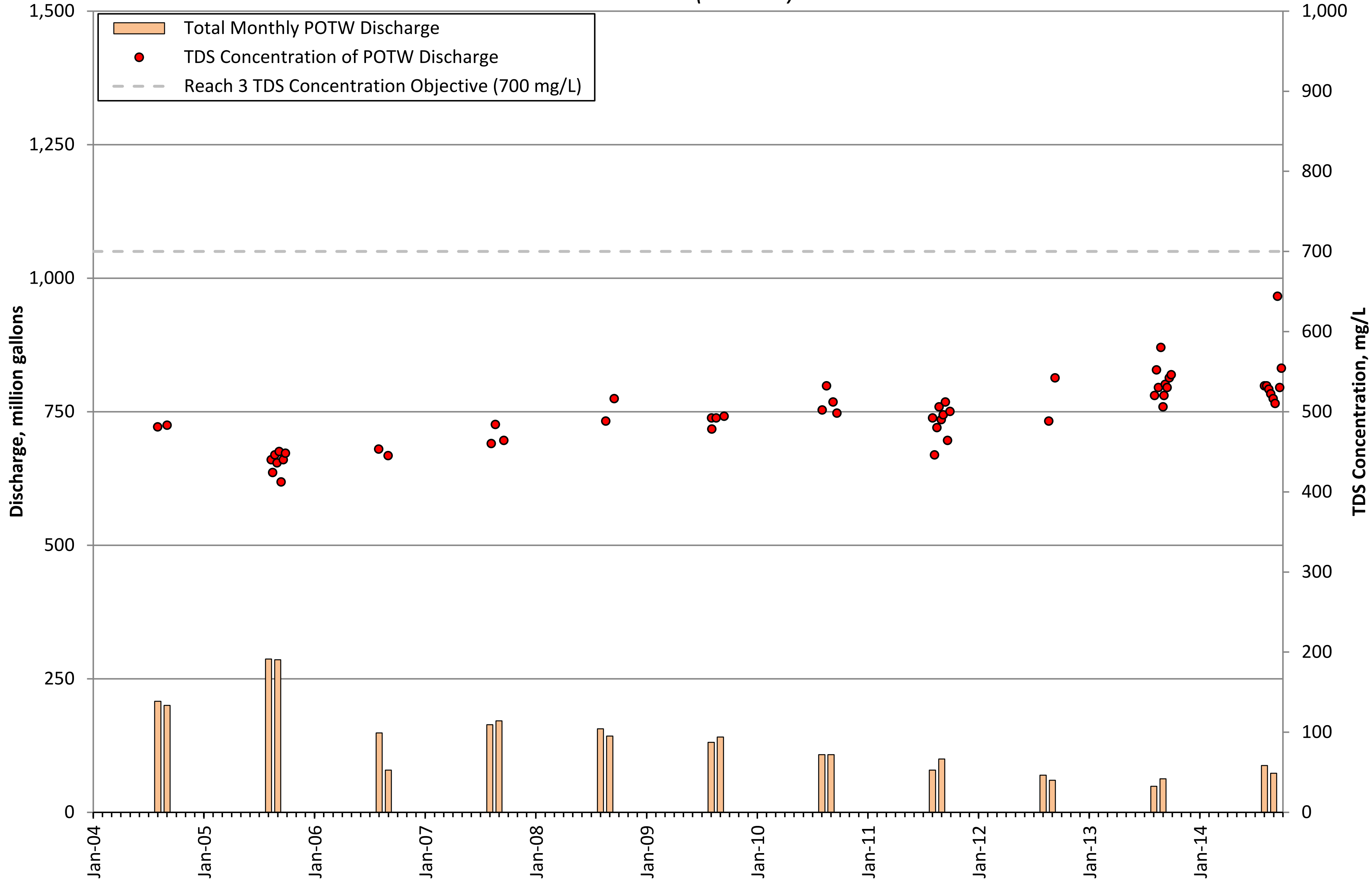

Figure 8

Effluent Discharge and TDS Concentration during August and September

IEUA RP-1 (DP-002)

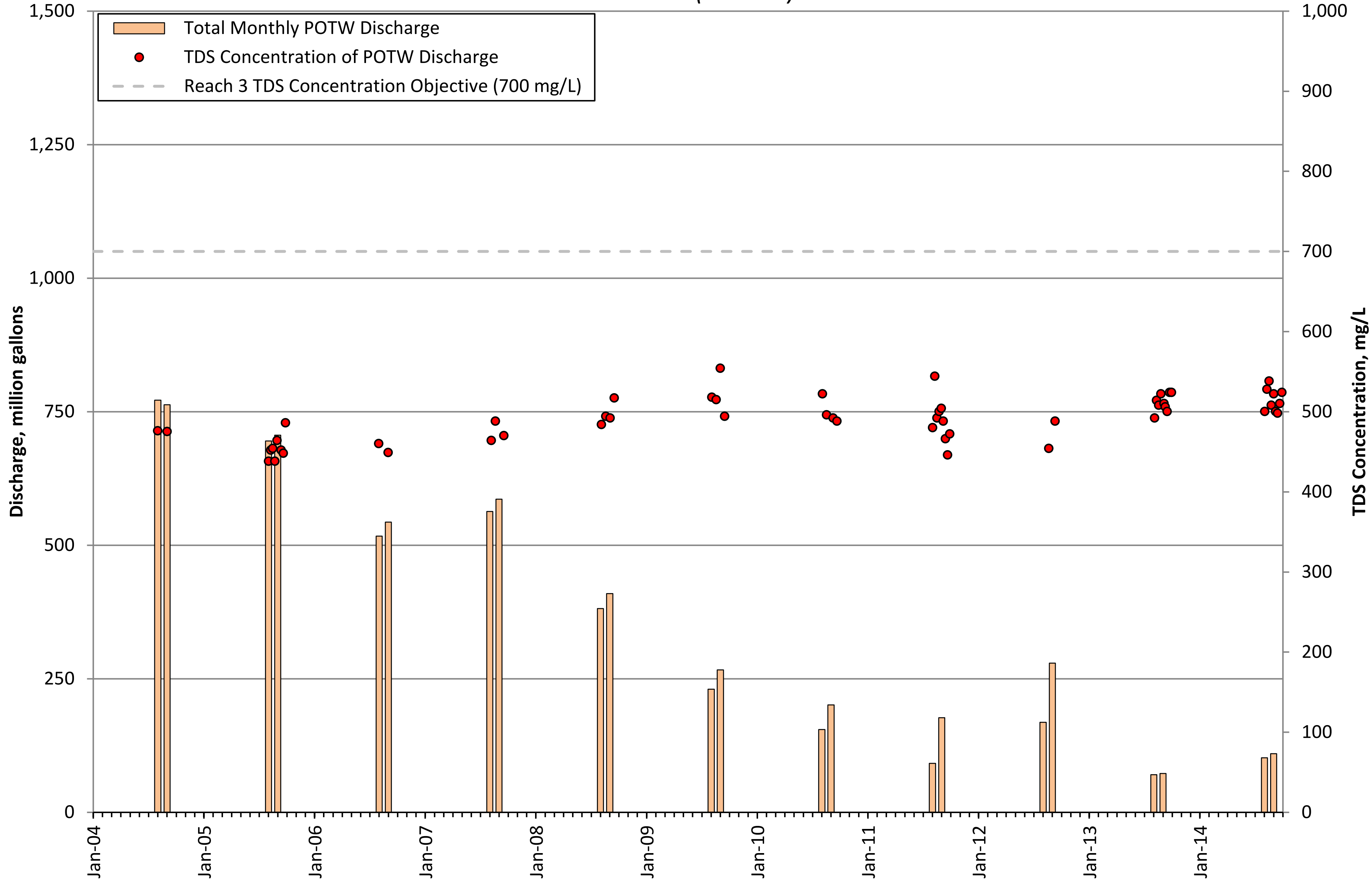

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--7-RP1-Cuc
6/15/2015

Figure 9
Effluent Discharge and TDS Concentration during August and September
IEUA Carbon Canyon

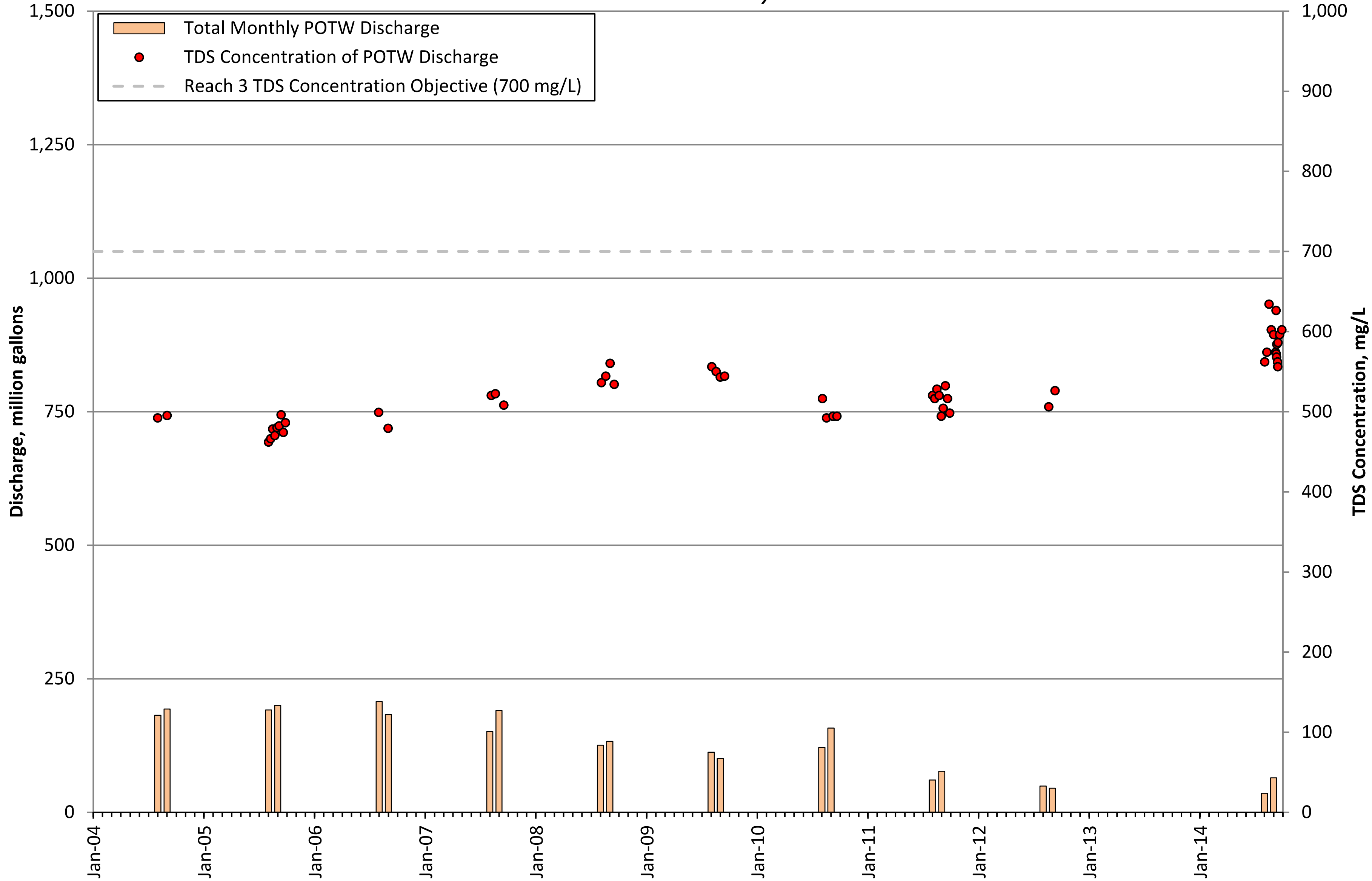

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--8-CrbnCyn
6/15/2015

Figure 10
Effluent Discharge and TDS Concentration during August and September
IEUA RP-5

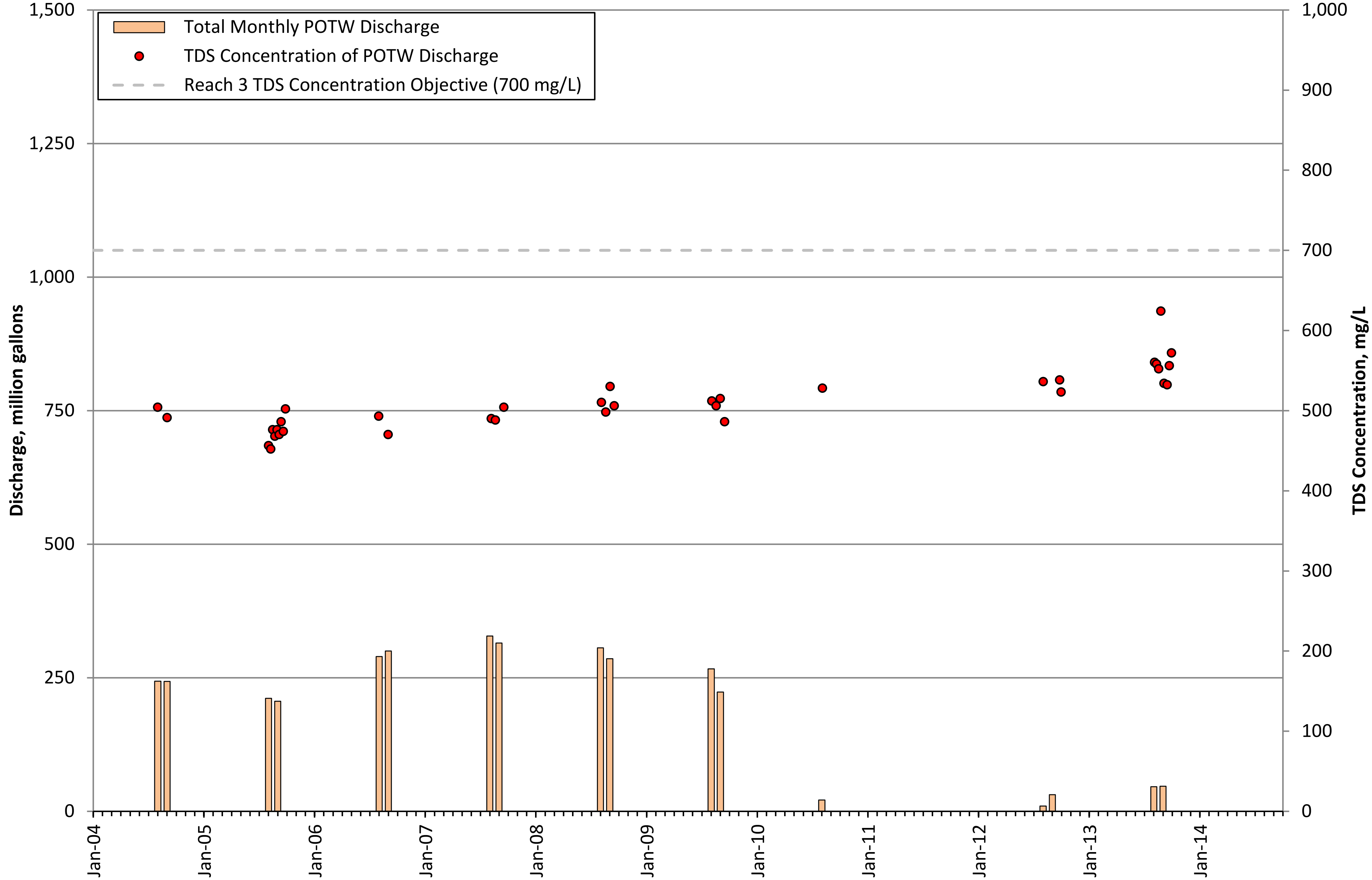

Figure 11
Effluent Discharge and TDS Concentration during August and September
Corona 1

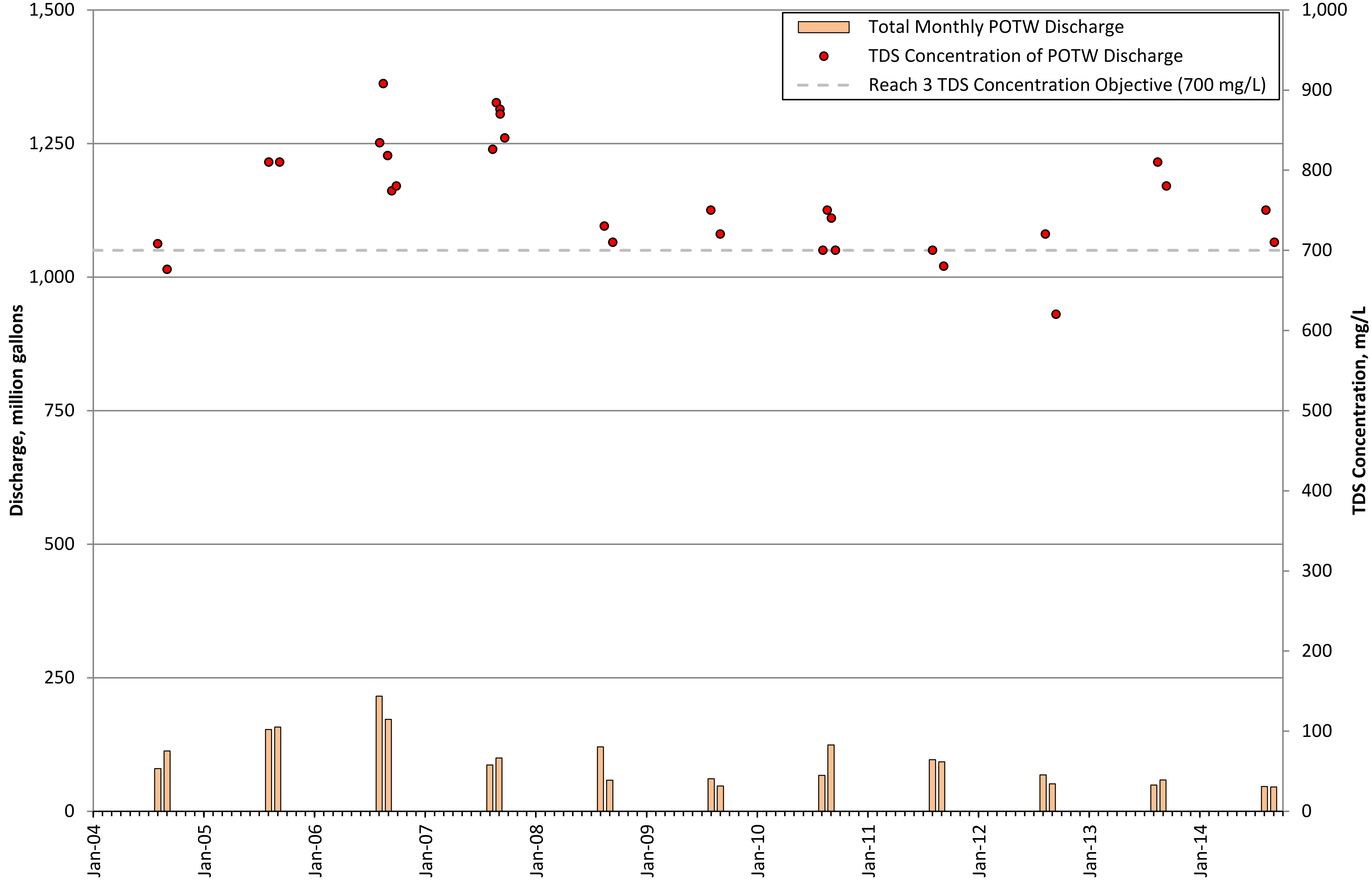

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--10-Corona1
6/15/2015

Figure 12
Effluent Discharge and TDS Concentration during August and September
Corona 3

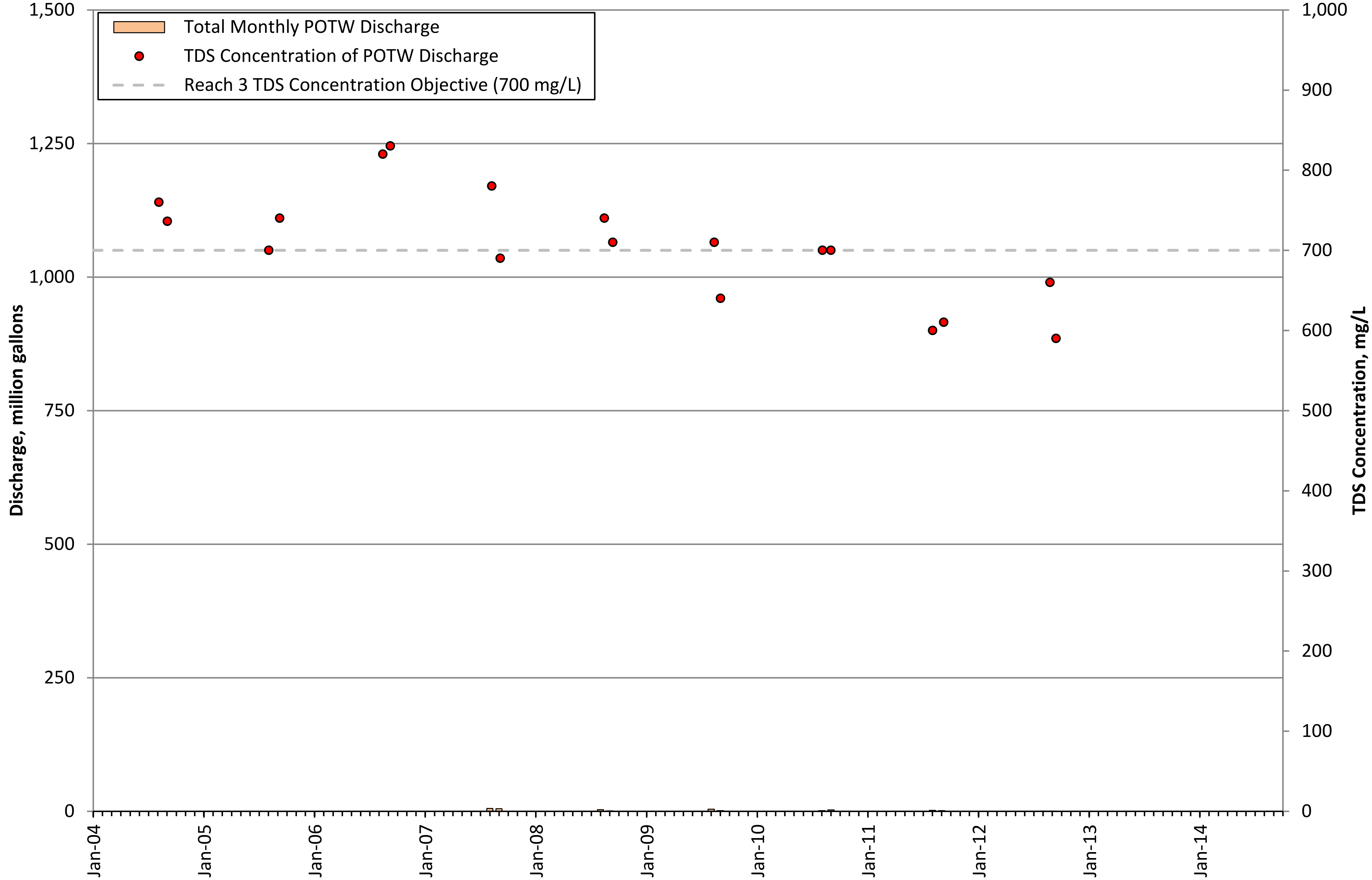

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Figure 13
Effluent Discharge and TDS Concentration during August and September
LLWD

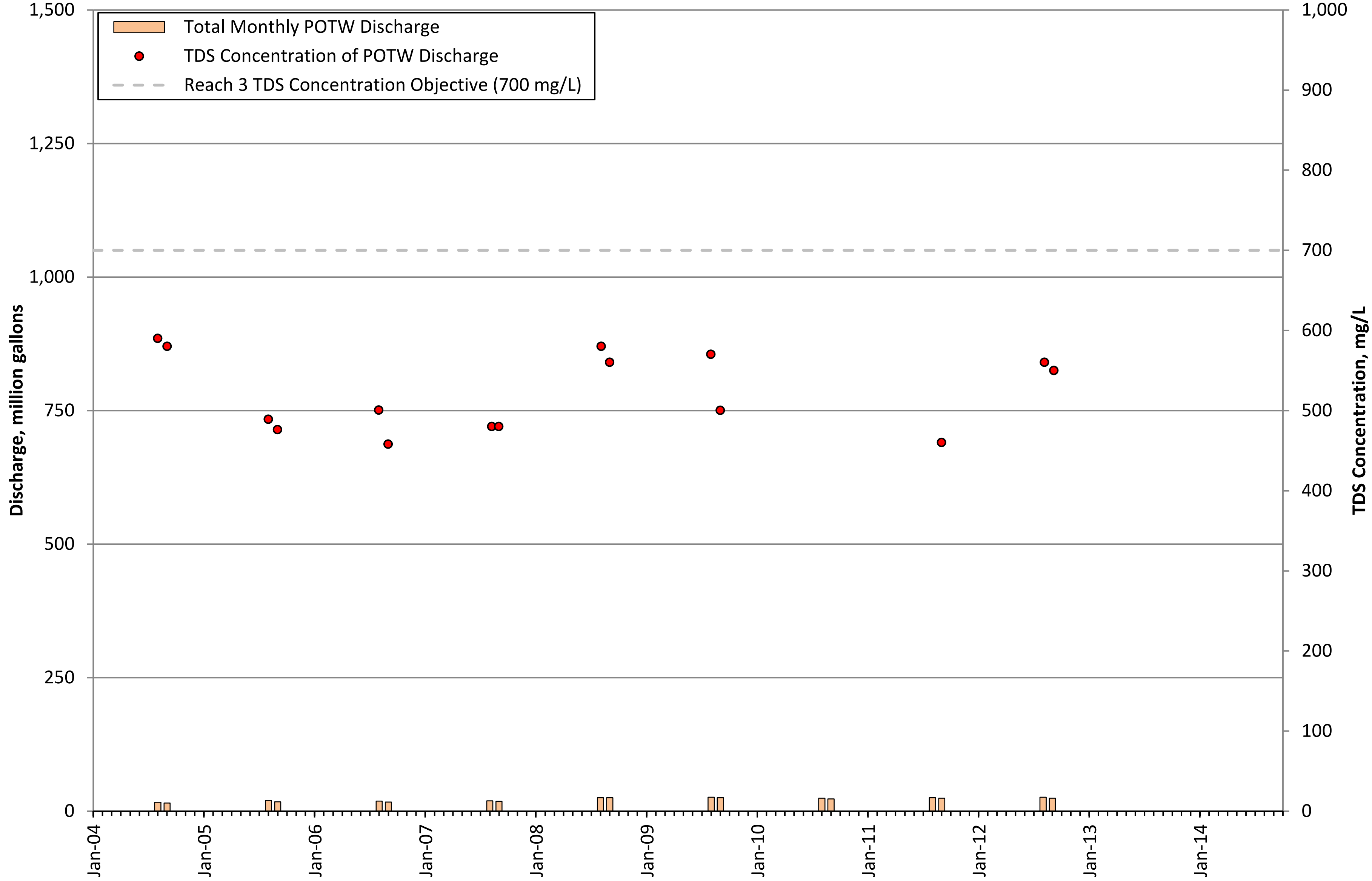

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--12-LeeLake
6/15/2015

Figure 14
Effluent Discharge and TDS Concentration during August and September
EVMWD

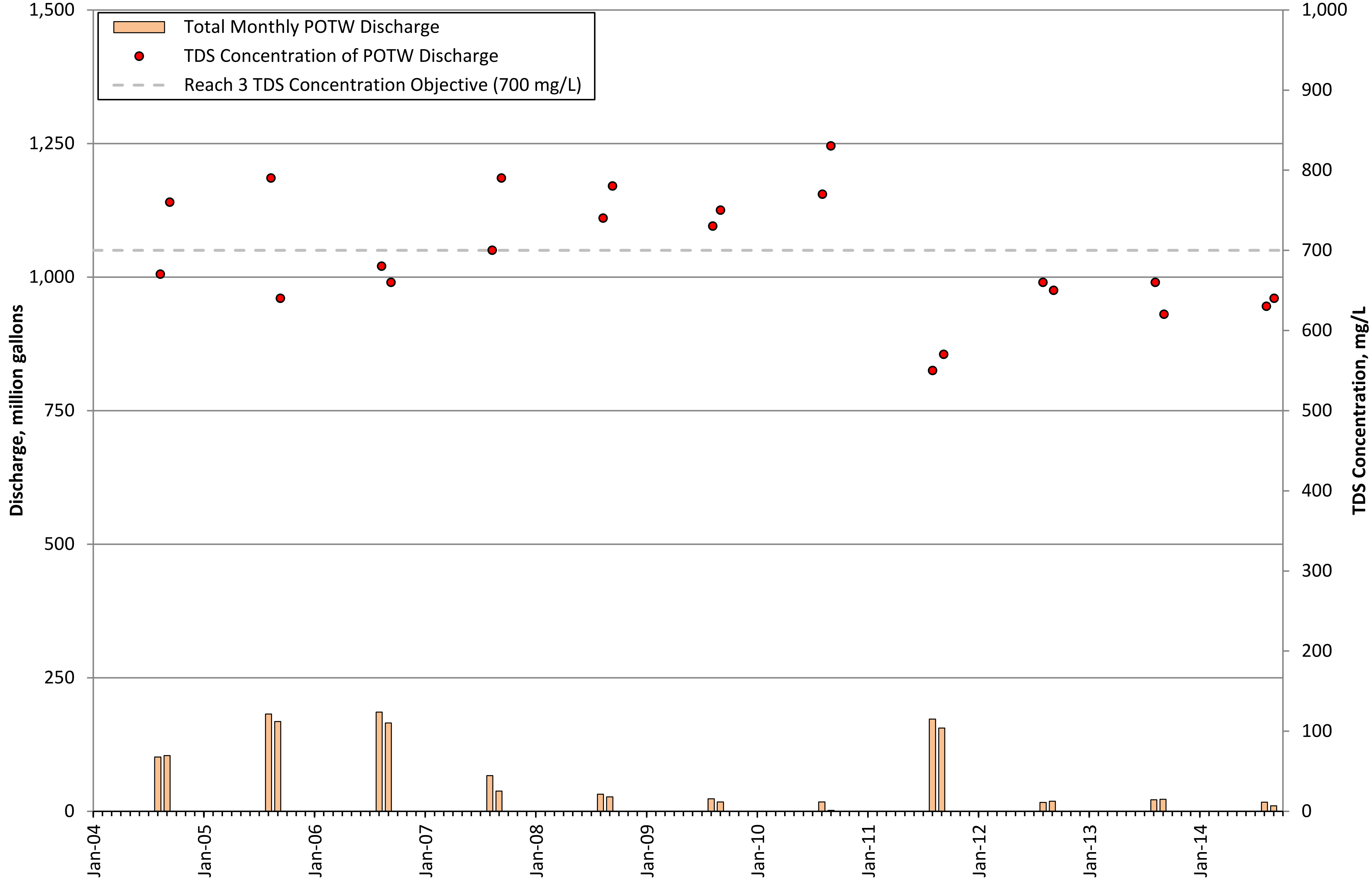

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--13-EVMWD
6/15/2015

Figure 15
Effluent Discharge and TDS Concentration during August and September
EMWD

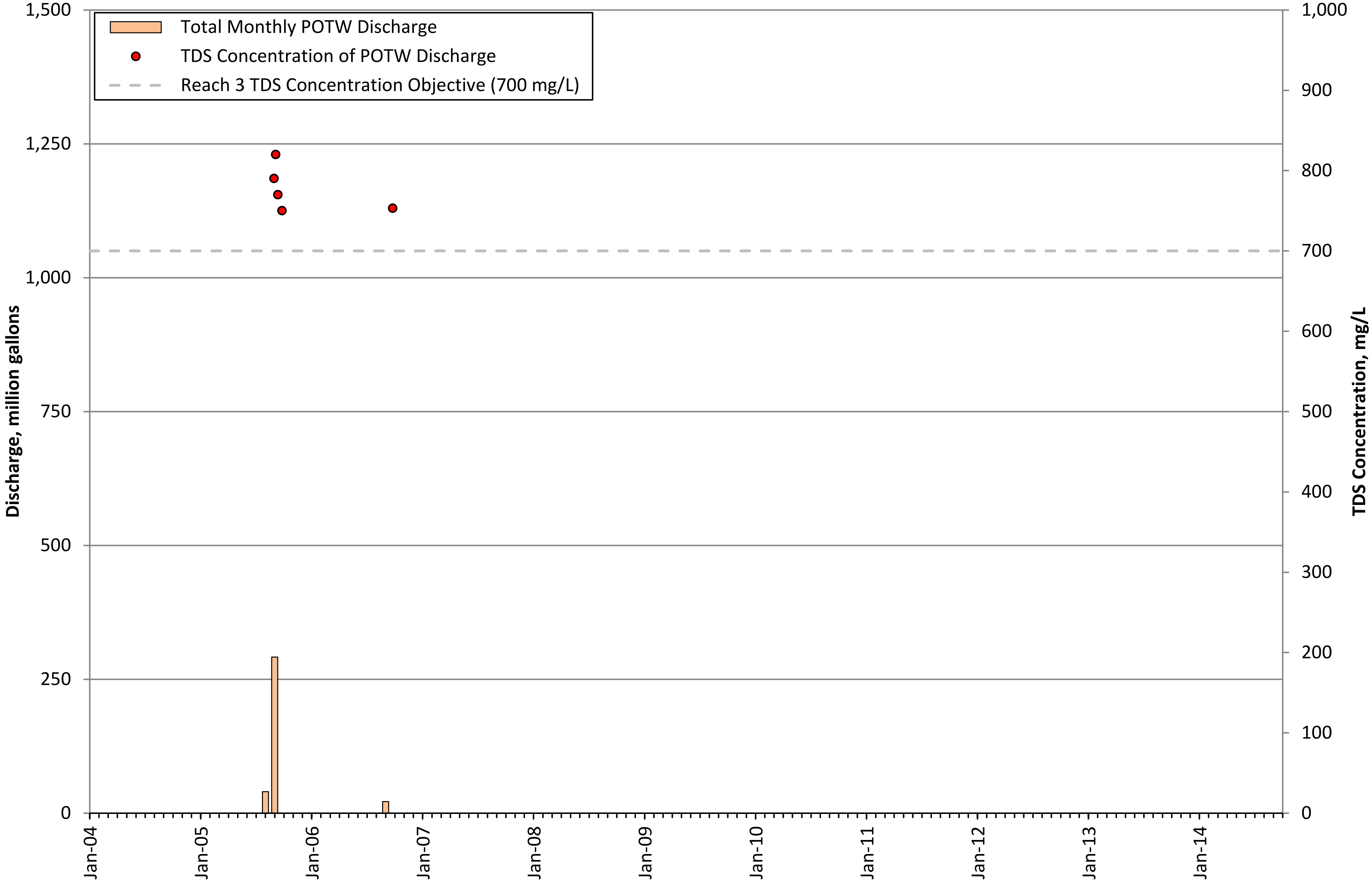

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--14-EMWD
6/15/2015

Figure 16
Historical and Planned POTW Discharge and its Volume-Weighted TDS Concentration during August-September

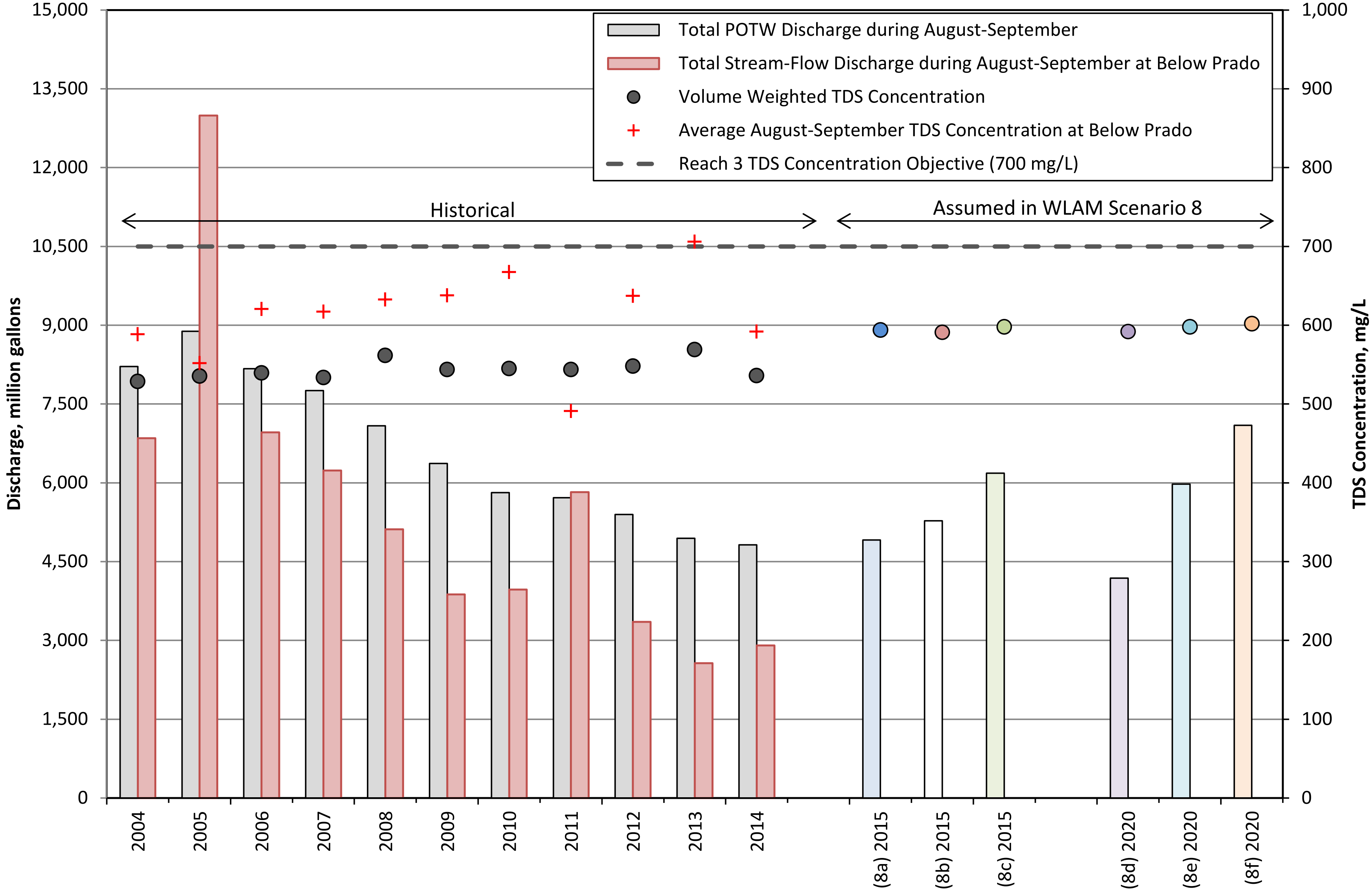

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--15-VolWtd
6/15/2015

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Figure 17
Historical TDS Mass during August-September

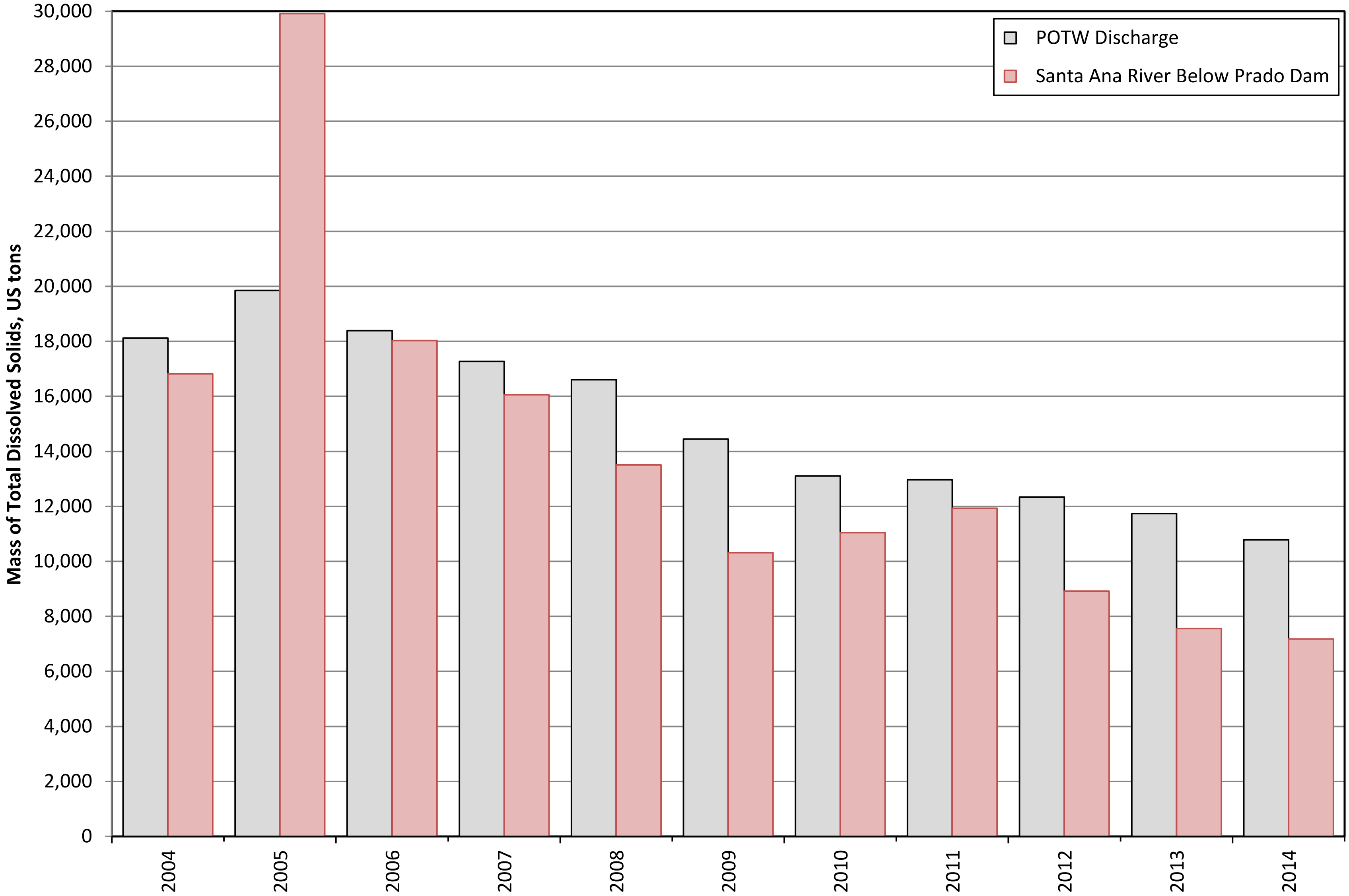

Table 2_2004-2014 POTW Volume-Weighted Calculations_v3--16-TDS Mass
6/15/2015

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