Santa Ana River Wasteload Allocation Model Update

BASIN MONITORING PROGRAM TASK FORCE

April 16, 2018

Overview

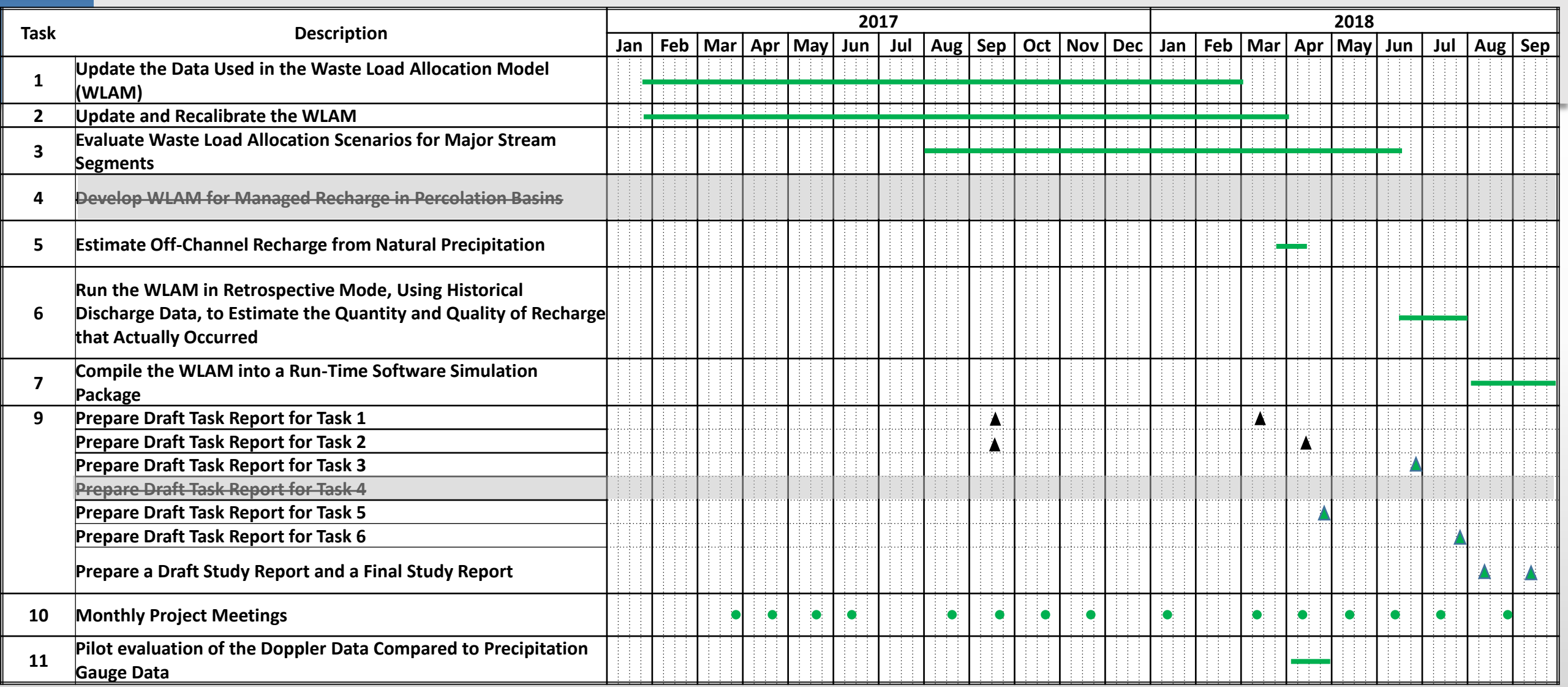
- Review of Project Schedule
- Overview of Revised Draft TM No. 2
- Status of Task 3 – Evaluate Waste Load Allocation Scenarios for Major Stream Segments

Overview

- **Review of Project Schedule**
- Overview of Revised Draft TM No. 2
- Status of Task 3 – Evaluate Waste Load Allocation Scenarios for Major Stream Segments

Updated Project Schedule

Task	Description
1	Update the Data Used in the Waste Load Allocation Model (WLAM)
2	Update and Recalibrate the WLAM
3	Evaluate Waste Load Allocation Scenarios for Major Stream Segments
4	~~Develop WLAM for Managed Recharge in Percolation Basins~~
5	Estimate Off-Channel Recharge from Natural Precipitation
6	Run the WLAM in Retrospective Mode, Using Historical Discharge Data, to Estimate the Quantity and Quality of Recharge that Actually Occurred
7	Compile the WLAM into a Run-Time Software Simulation Package
9	Prepare Draft Task Report for Task 1
	Prepare Draft Task Report for Task 2
	Prepare Draft Task Report for Task 3
	~~Prepare Draft Task Report for Task 4~~
	Prepare Draft Task Report for Task 5
	Prepare Draft Task Report for Task 6
	Prepare a Draft Study Report and a Final Study Report
10	Monthly Project Meetings
11	Pilot evaluation of the Doppler Data Compared to Precipitation Gauge Data



▲ Date TM Submitted

Updated Project Schedule (16-Apr-18)

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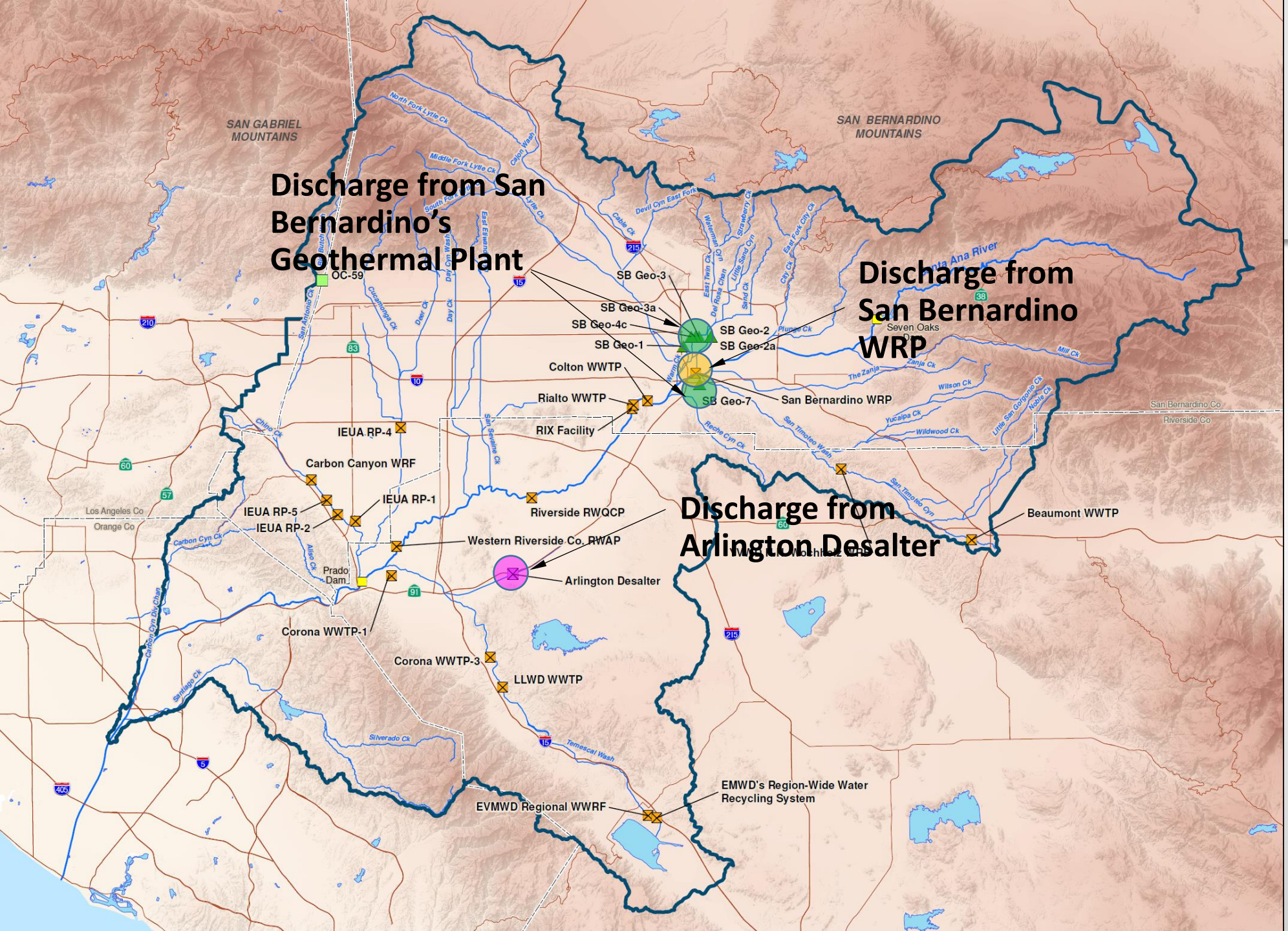
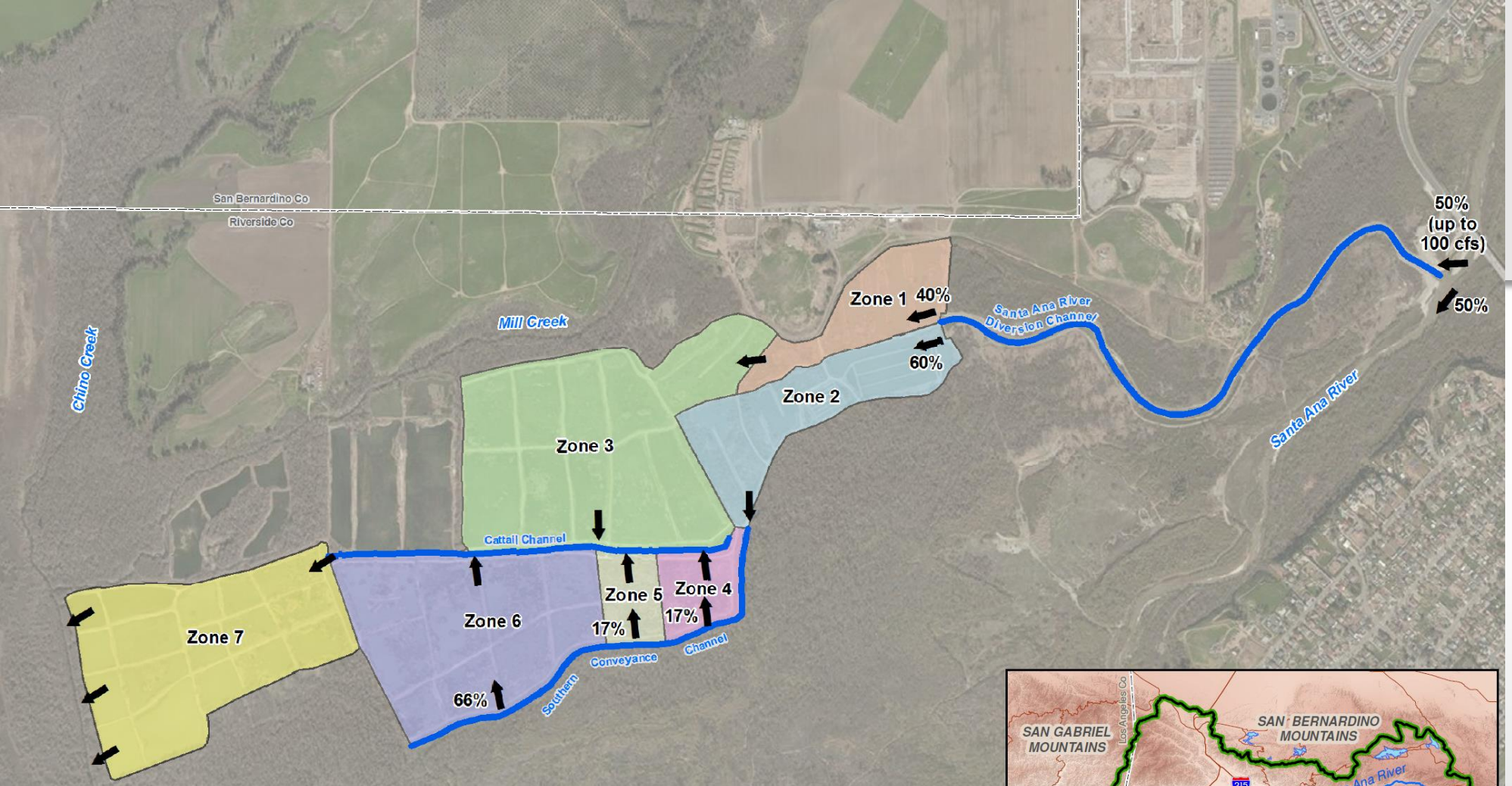
Summary of Comments for TM-2: WLAM Update and Recalibration

Source		No Action Necessary	Minor Edit	Additional Explanation or Table/ Figure	Additional Work/ Model Calibration	Total No. of Comments
		Corresponding Comment Number				
Prior to Workshop	IEUA/ CBWM	G-2, 11	5, 6, 7, 8, 9, 13, 17, 19, 20, 21	1,2, 4, 10, 12, 14, 15, 16, 18, 22	3, 23	24
	OCWD	13	2, 4, 8, 12, 15	1, 3, 5, 6, 10, 11, 14	7, 9	15
	RWQCB	-	1, 2, 3	5	4, 6, 7	7
	SAWPA	-	2, 3	1, 5, 6	4, 7	7
Risk Sciences		-	4, 14, 15, 16, 17, 18, 32, 34, 35, 36, 37, 38, 39, 40	1, 2, 8, 9, 10, 11, 13, 19, 20, 21, 22, 24, 25, 26, 27, 29, 30, 31, 33, 41	3, 5, 6, 7, 12, 23, 28	41
					Total	94

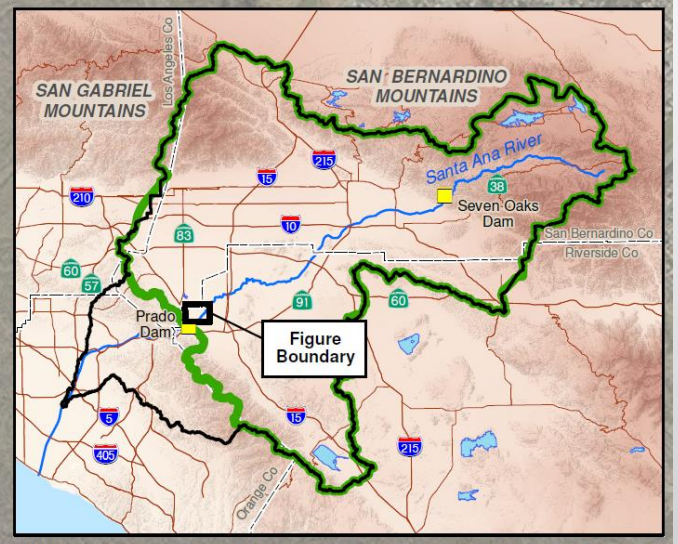
Additional Discharge



Impoundment Spreadsheet Model for the Prado Wetlands



Zone	Area [acres]	Outflow Weir Box Height [ft]	Zone Capacity [acre-ft]
1	30	7	207
2	48	7	336
3	126	5	629
4	17	5	86
5	14	7	98
6	92	5	462
7	95	5	476
TOTAL	422	-	2,295



Wetland Pond Conveyance Channel

Wetland Pond Zone

Flow Direction (Relative percentage of flow indicated at points of diversion)

Differences between WLAM Versions (In Section 2.3 of the Revised Draft TM. No 2)

- Computer Code,
- Sub-Watershed,
- Soil Data,
- Land use Data,
- Precipitation Data,
- Evapotranspiration Stations,
- Streamflow Gaging Stations,
- TIN/TDS Streamflow Gaging Stations,
- Publicly owned treatment works (POTW) and Other Discharge data,
- Rising Water (Flow)
- Rising Water (TDS/TIN),
- Nitrogen Reaction Coefficients,
- Calibration Period,
- Calibration Methodology,
- Methods Used to Account for Flow at Select Locations, and
- Calibration Criteria

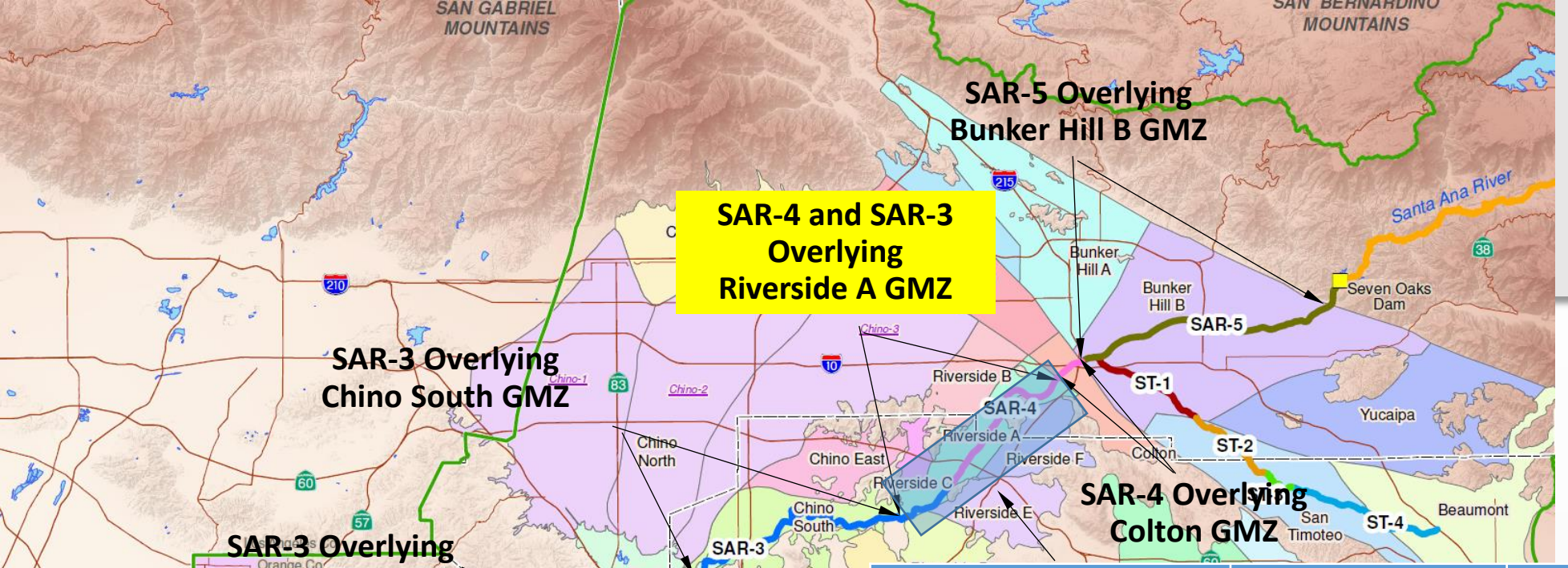
Differences between WLAM Versions (Cont.)

Item	2004 WLAM	2008 WLAM	2017 WLAM HSPF
Calibration Criteria	Monthly Flow: • R^2 • Percent Error TDS/TIN: None (not enough data)	Monthly Flow: • R^2 • Root mean square error (RMSE)* • RMSE Percent of Average Flow • Nash-Sutcliffe Efficiency (NSE) TDS/TIN: None (not enough data) *Note: RMSE formula was applied incorrectly (using measured data instead of squared residuals) – leading to an underestimation of the residuals.	Daily Flow and Monthly Flow: • R^2 • Average Residual **(NEW)** • Average Residual Percentage of Observed **(NEW)** • RMSE • RMSE as Percentage of Range of Observed TDS/TIN **(NEW)**: • Average Residual • Average Residual Percentage of Observed • Standard Deviation • RMSE

Differences between WLAM Versions (Cont.)

Item	2004 WLAM	2008 WLAM	2017 WLAM HSPF
Methods used to Account for Flow at Select Locations	Not Applicable (model files unavailable)	• Added flow at San Timoteo Creek near Loma Linda and Chino Creek at Schaefer Avenue • Applied discharge from Corona WWTP #1 above Temescal Creek at Main Street gage instead of below Refer to Section 3.3 for details	• Model-Simulated

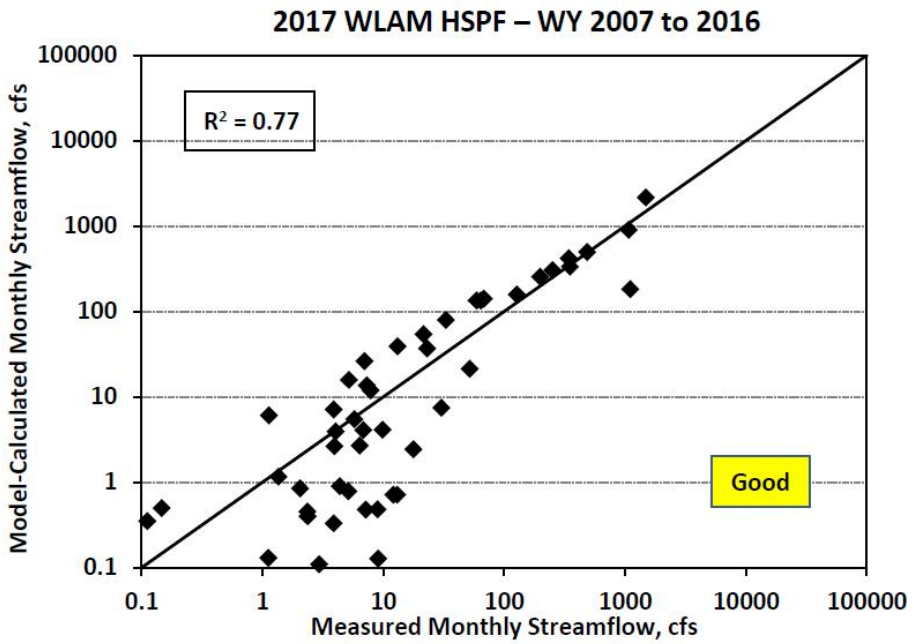
Average Mass Balance (by Source) for Flow, TDS, and TIN

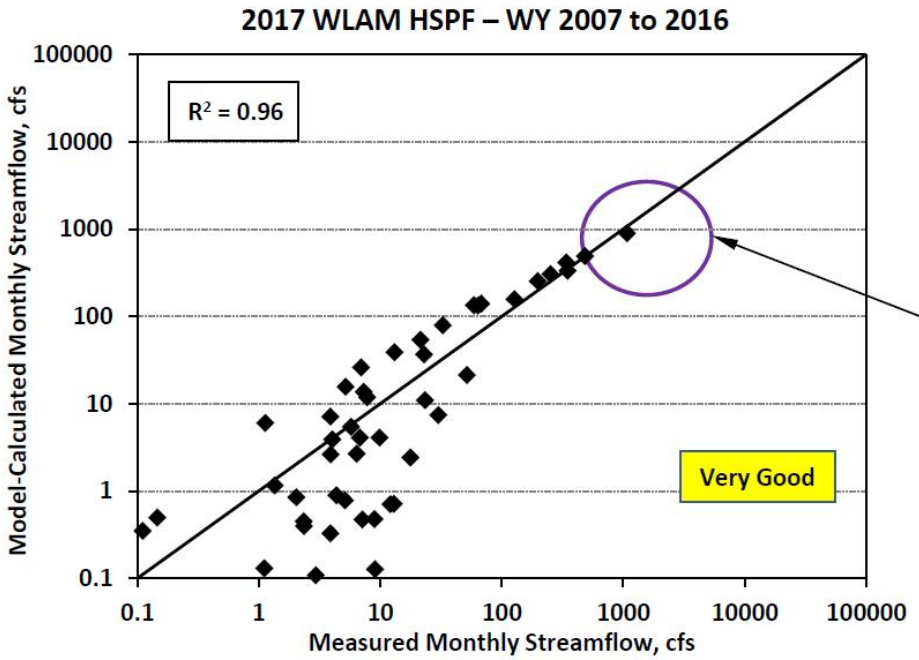


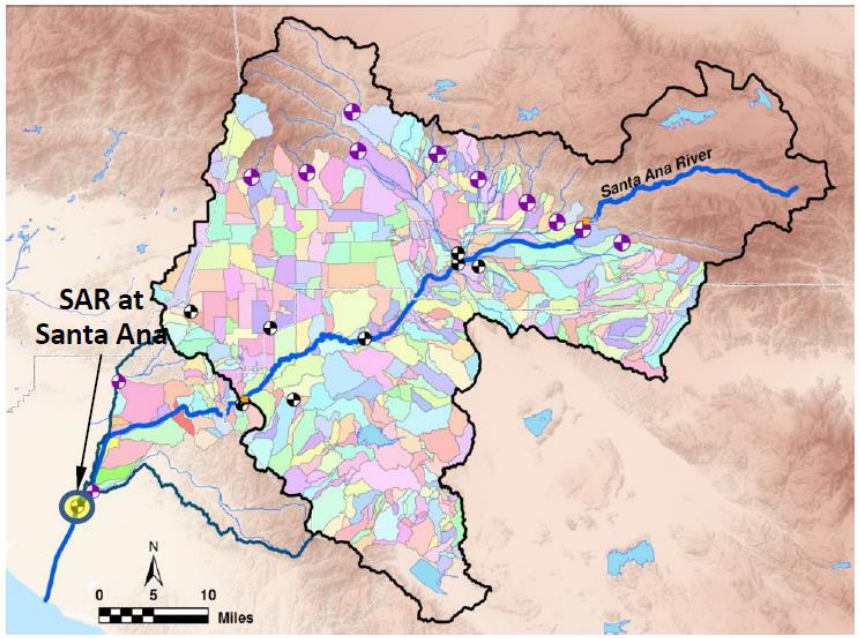
Source	Flow [acre-ft/yr (% of total)]	TDS [tons/yr (% of total)]	TIN [tons/yr (% of total)]
Direct Precipitation and Atmospheric Deposition	110 (0%)	10 (0%)	0 (0%)
Surface Runoff	47,660 (41%)	7,220 (12%)	70 (8%)
Colton WWTP	0 (0%)	0 (0%)	0 (0%)
Rialto WWTP	6,800 (6%)	3,710 (6%)	80 (9%)
RIX Facility	37,760 (33%)	25,280 (40%)	390 (44%)
Rising Water	23,460 (20%)	26,230 (42%)	340 (39%)
TOTAL	115,790 (100%)	62,450 (100%)	880 (100%)

Outlier Analysis for Simulated Monthly Streamflow Performance

Gaging Station	R^2		Average Residual, cfs	
	2017 WLAM HSPF WY 2007-2016	Outliers Removed	2017 WLAM HSPF WY 2007-2016	Outliers Removed
San Timoteo Ck near Loma Linda	0.68	0.68	-1.38	-1.38
Warm Ck near San Bernardino	0.91	0.91	-1.31	-1.31
Santa Ana River at E Street	0.97	0.97	-6.32	-6.22
Santa Ana River at MWD Crossing	0.97	0.97	-12.09	-12.09
Temescal Ck at Main Street	0.84	0.94	-0.69	-0.69
Chino Ck at Schaefer Avenue	0.83	0.83	-2.27	-2.32
Cucamonga Ck near Mira Loma	0.94	0.94	-0.22	-0.22
Santa Ana River into Prado Dam	0.97	0.97	-1.26	-1.26
Santa Ana River at Santa Ana	0.77	0.77	0.13	0.16







Calibration improved after data between December 19, 2010 and January 12, 2011 were removed (very high flow)

SCATTERPLOTS OF MEASURED AND MODEL-SIMULATED MONTHLY STREAMFLOW AT THE SANTA ANA RIVER AT SANTA ANA WATER YEARS 2007 TO 2016 (2017 WLAM HSPF)

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Data Request Form Sent to POTWs

DISCHARGE to SURFACE WATER	Current	2020	2040
Maximum Expected Discharge (MGD)			
Average Expected Discharge (MGD)			
Minimum Expected Discharge (MGD)			

RECYLED WATER for IRRIGATION or REUSE	Current	2020	2040
Maximum Expected Reuse (MGD)			
Average Expected Reuse (MGD)			
Minimum Expected Reuse (MGD)			

RECYCLED WATER for AQUIFER RECHARGE	Current	2020	2040
Maximum Expected Recharge (MGD)			
Average Expected Recharge (MGD)			
Minimum Expected Recharge (MGD)			

WATER QUALITY	TIN	TDS
Effluent Limit in Current Discharge Permit (mg/L)		
Recent 12-mos. Volume Weighted Average (mg/L)		
Est. 12 mos. Volume Weighted Average in 2040 (mg/L)		

Status of POTW Data Request

POTW	Reply with Complete Form	Reply with Incomplete/Different Form	Need Additional Clarification from POTW	Need to be Reviewed by Board
Beaumont WWTP		✓	✓	
YVWD H.N. Wochholz WRF	✓			
City of Redlands	✓		✓	
SBVMWD SNRC		✓	✓	✓
Rialto WWTP	✓			
RIX facility		✓	✓	
Riverside RWQCP		✓		

Status of POTW Data Request

POTW	Reply with Complete Form	Reply with Incomplete/Different Form	Need Additional Clarification from POTW	Need to be Reviewed by Board
IEUA RPs and CCWRF		✓	✓	
Western Riverside County RWAP	✓			
Corona WWTPs	✓		✓	✓
Temescal Valley WRF	✓			✓
EVMWD Regional WWRF		✓	✓	✓
EMWD Regional WRFs		✓	✓	
USACE SARMP Phase 4, 5A, and 5B		✓	✓	

Major Assumptions for Waste Load Allocation Scenarios

Scenario	Hydrology	Land Use	Maximum Expected Discharge	Average Expected Discharge	Minimum Expected Discharge
A	WY 1950-2016	2020 Conditions (2012 Land Use)	X		
B				X	
C					X
D		2040 Conditions (General Plan, 2040)	X		
E				X	
F					X

Is 2012 the best available land use data? Land use in 2012 was heavily influenced by the recent recession. Since then, the development boom was re-started.