Santa Ana River Wasteload Allocation Model Update

April 24, 2019

Overview

- Recalibrate WLAM with rising water as model input and compare results (Task 2o) and Sensitivity run on model calibration with reduced rising water (Task 2p).
- Use the refined calibration version from Task 2o to recalculate streambed recharge under future scenario conditions (per model run) (Task 3g).

Overview

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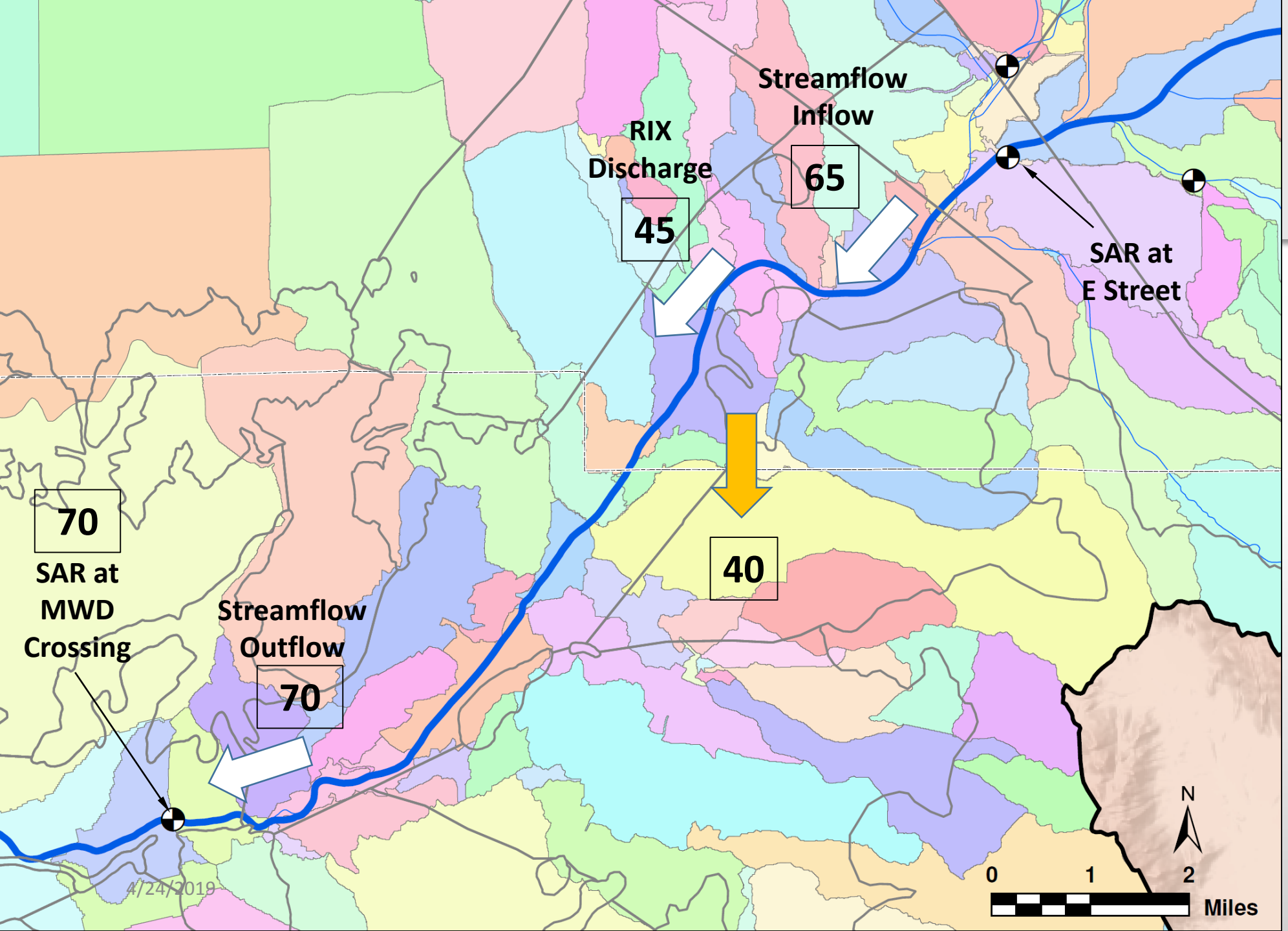
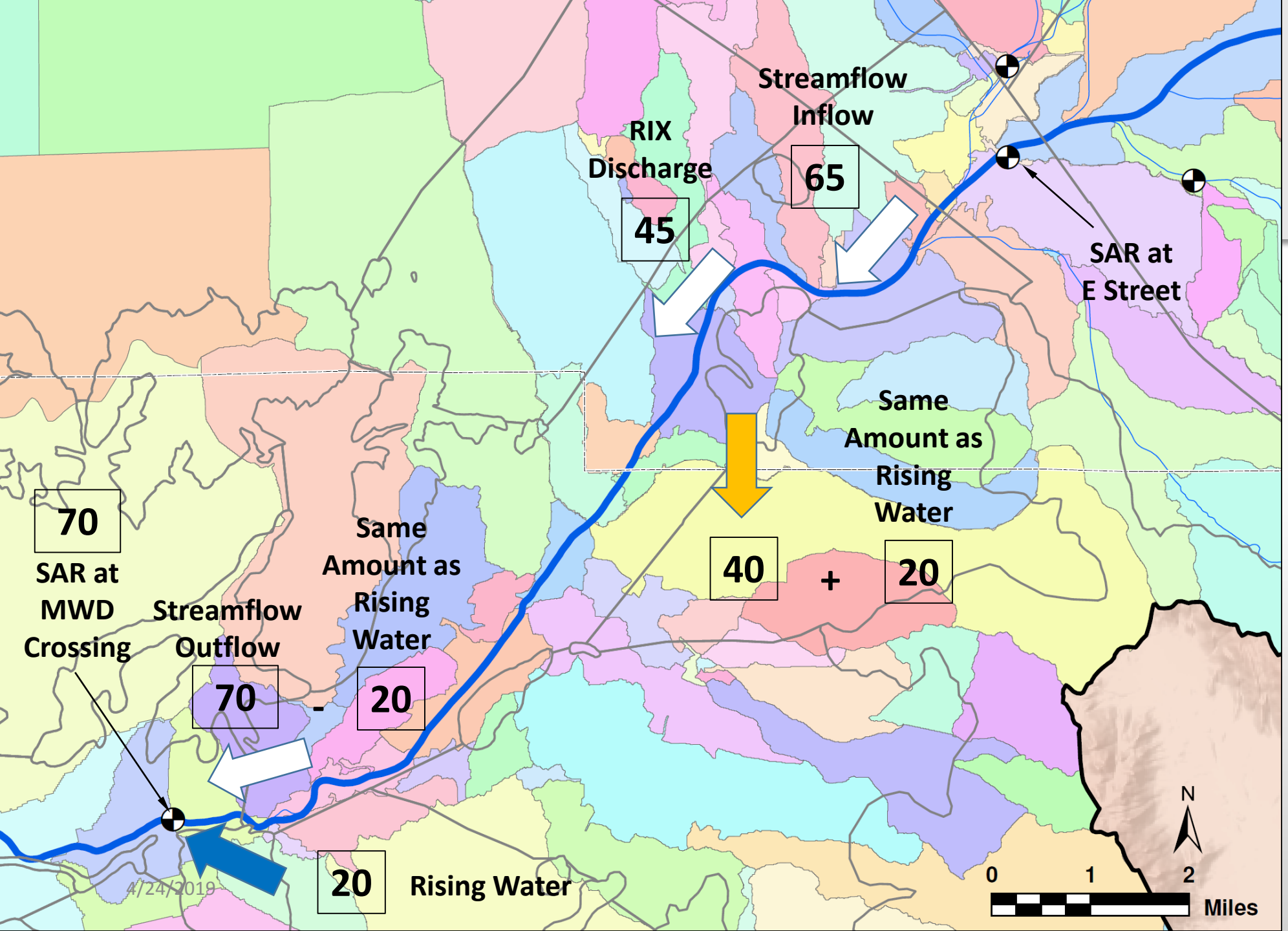
Rising Water Approach 2017 WLAM HSPF



HSPF Model Run:

- Streambed percolation is calculated by the model for Reach 4.
- No Percolation is assumed to occur in Reach 3 due to rising water.
- Model was calibrated so model-calculated flow at MWD Crossing matched observed flow from the MWD gage.

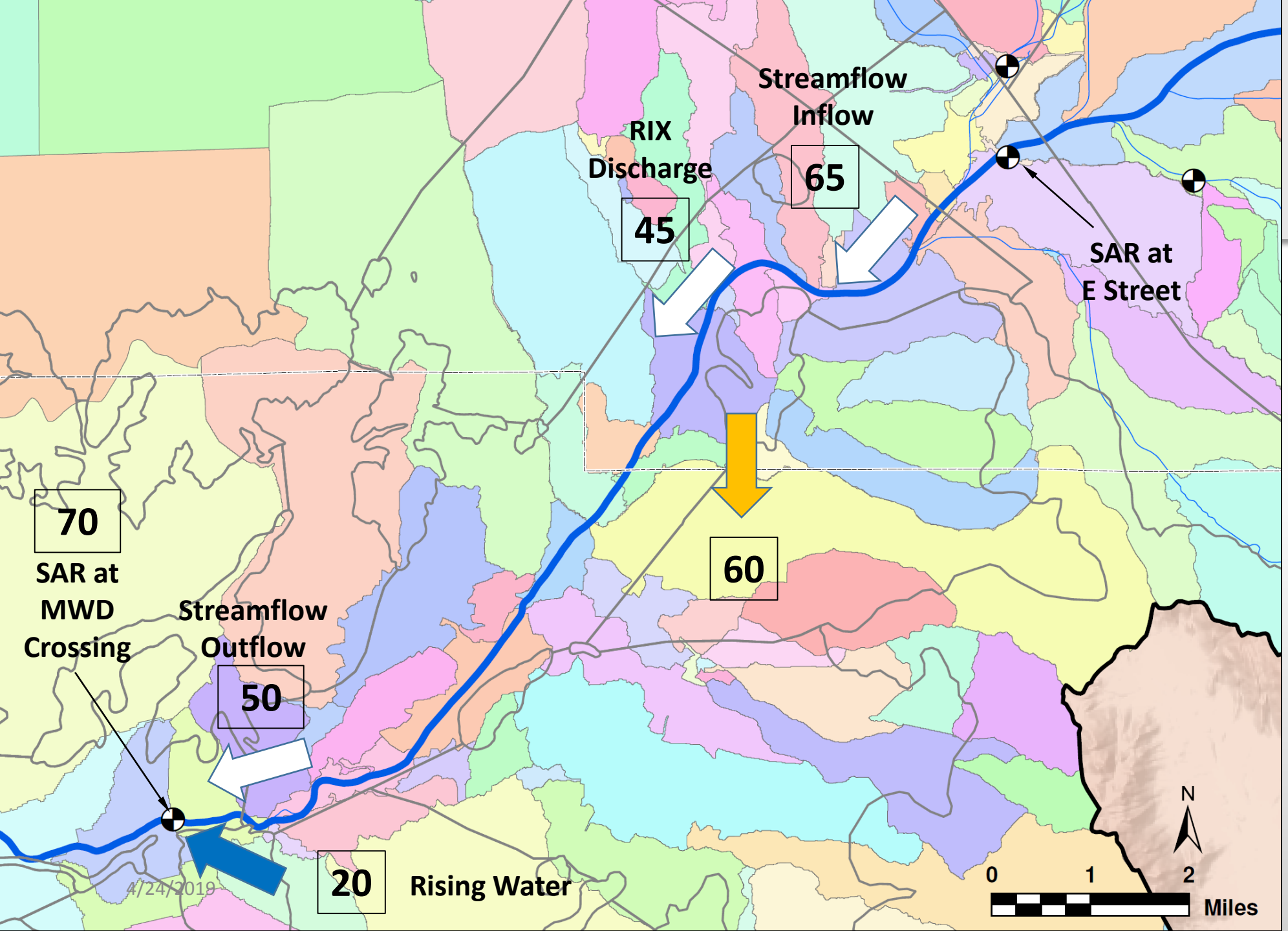
Rising Water Approach 2017 WLAM HSPF (Cont.)



HSPF Post-Processing:

- The amount of rising water was determined from the existing groundwater flow model.
- Since this rising water is contributing to the model-calculated flow at MWD Crossing, additional percolation of the same amount must be added upstream to equilibrate the water balance.

Revised Approach 2017 WLAM HSPF



- Recalibrate WLAM with rising water as model input and compare results (Task 2o).

Hydrographs of Measured and Model-Simulated Daily Streamflow at the Santa Ana River at MWD Crossing
Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (2017 WLAM HSPF)

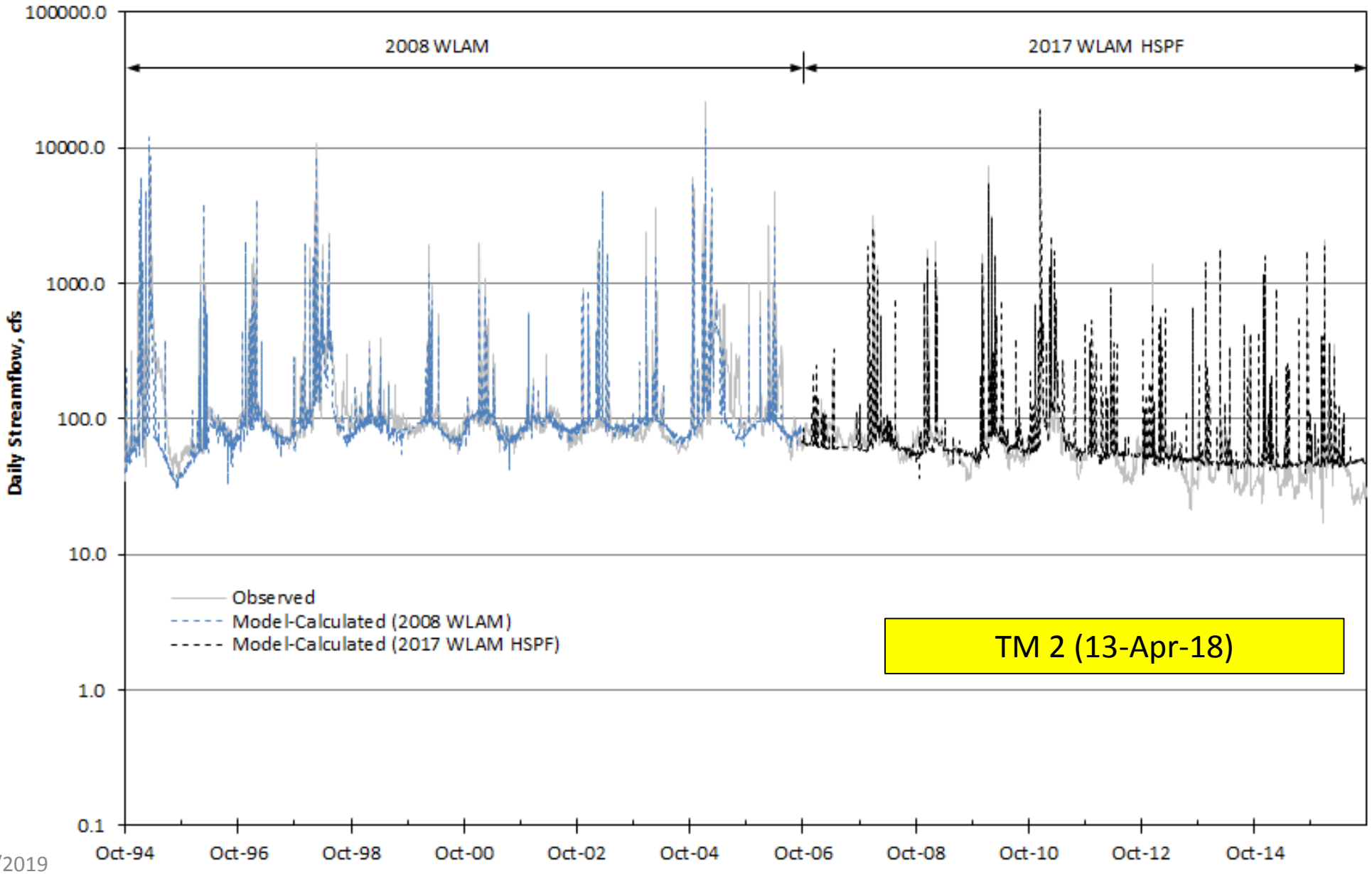


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Figure 39

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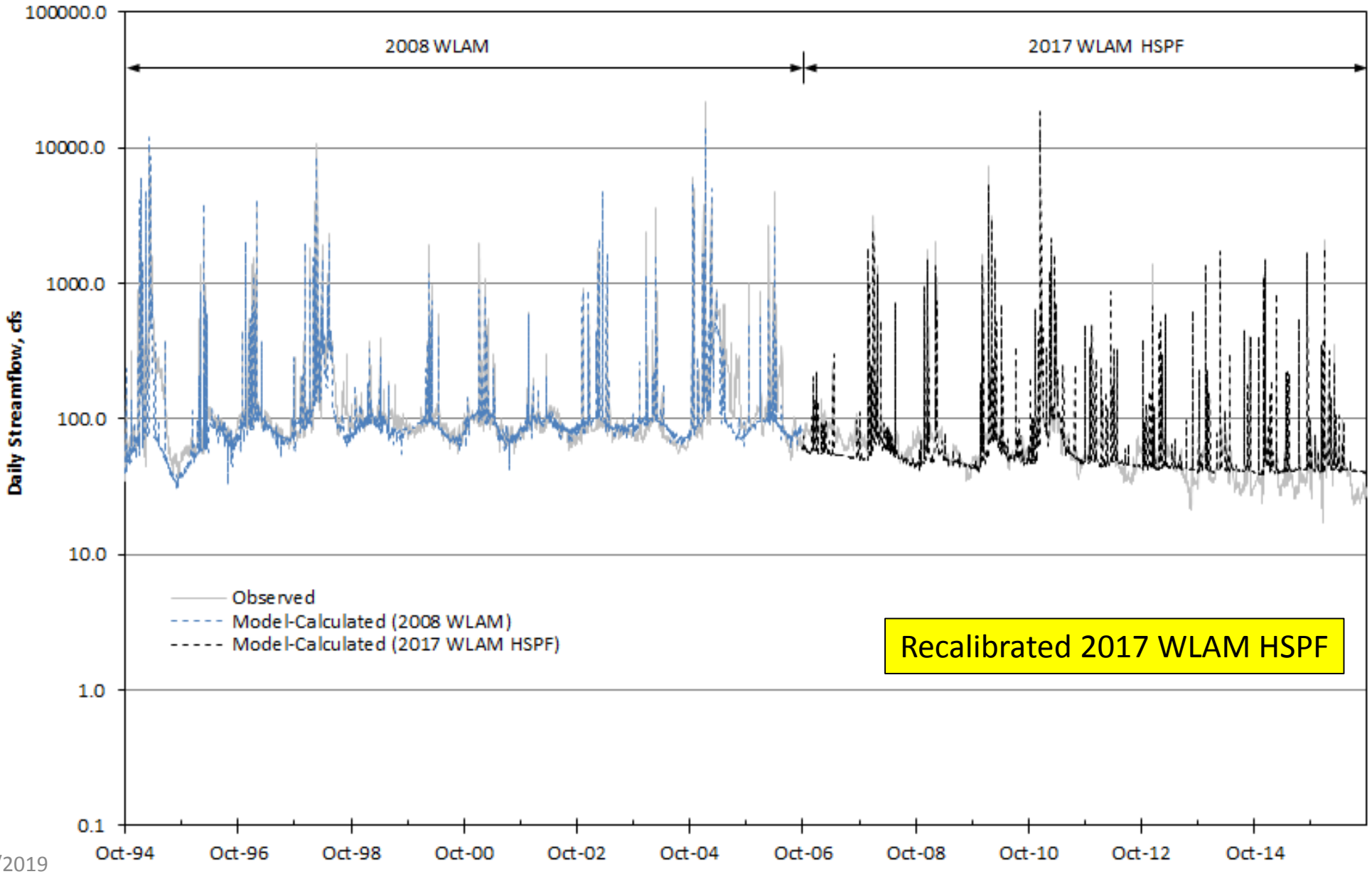

Recalibrated 2017 WLAM HSPF

Figure 39

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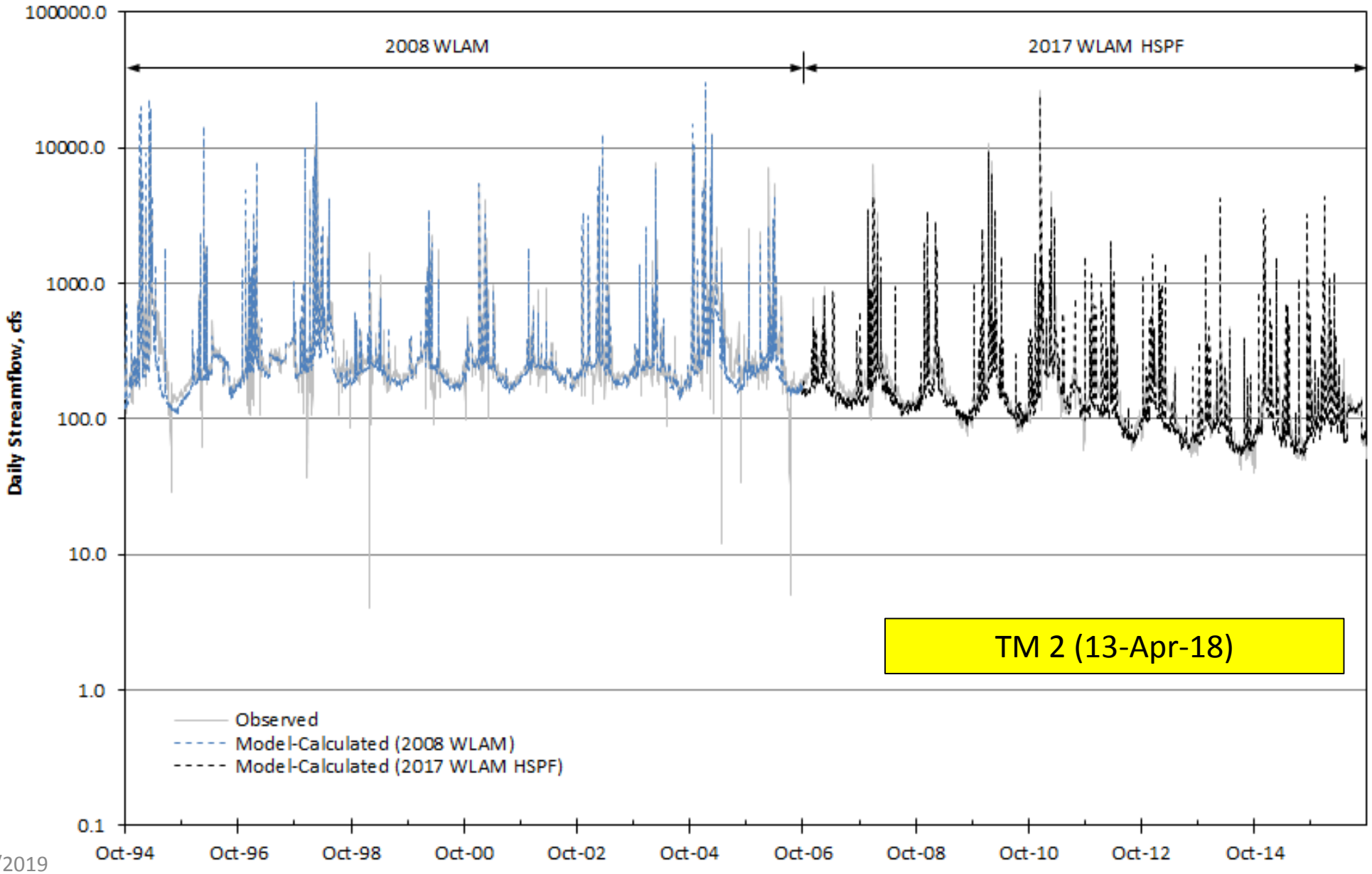

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Figure 43

Hydrographs of Measured and Model-Simulated Daily Streamflow at the Santa Ana River Inflow to Prado Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (WLAM Update)

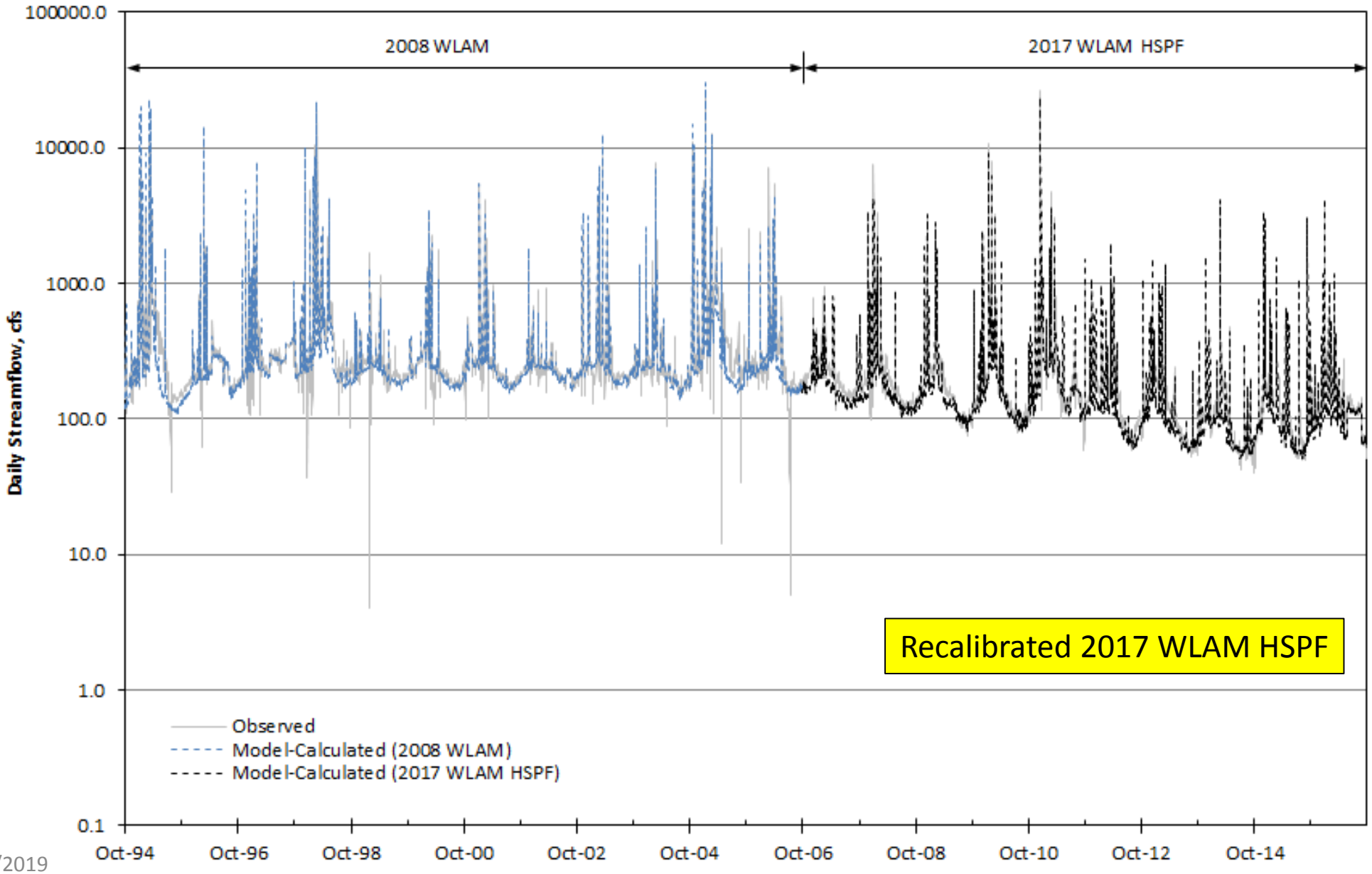

Figure 22

Hydrographs of Measured and Model-Simulated Monthly Streamflow at the Santa Ana River at MWD Crossing – Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (2017 WLAM HSPF)

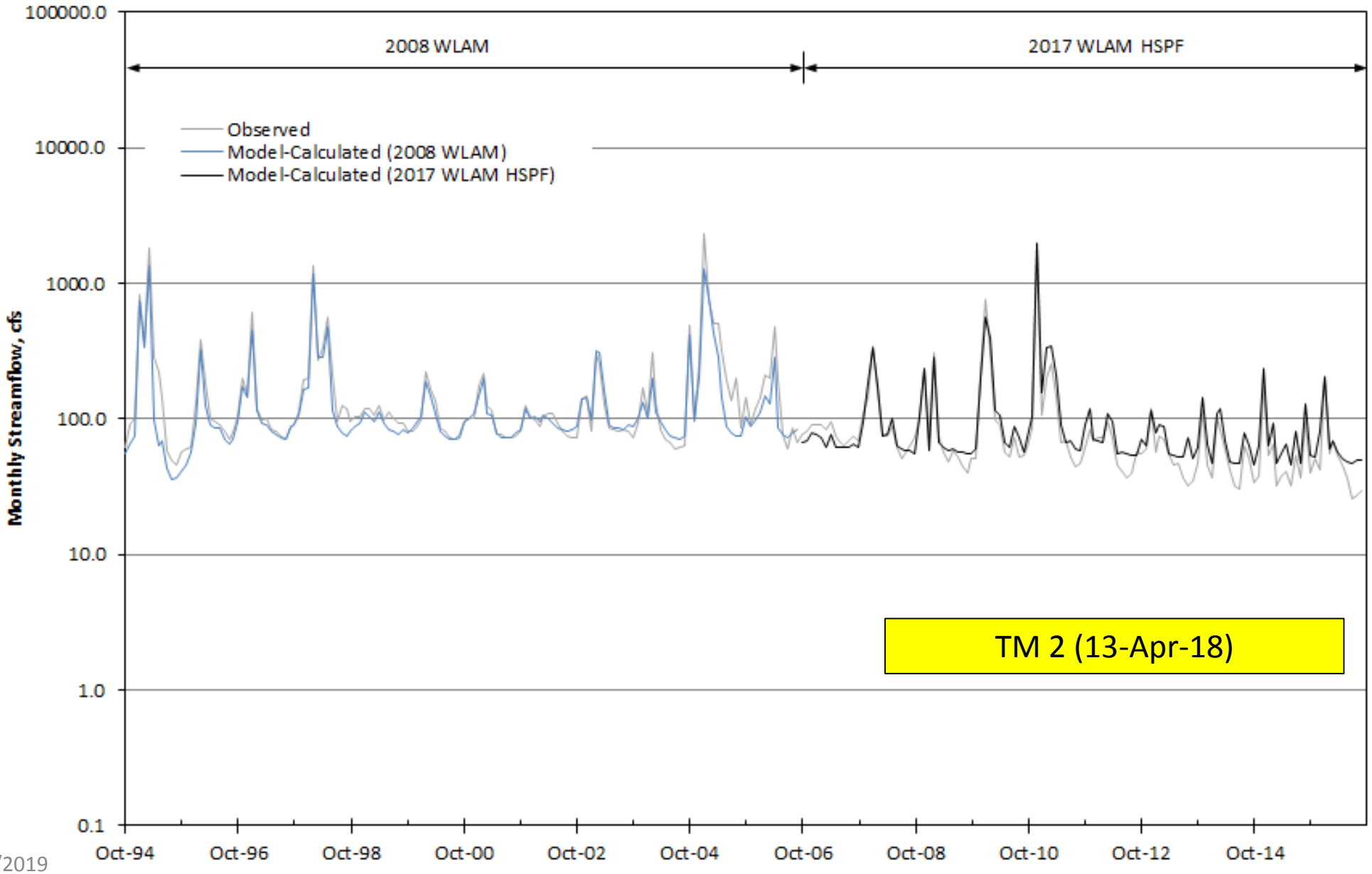

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Figure 48

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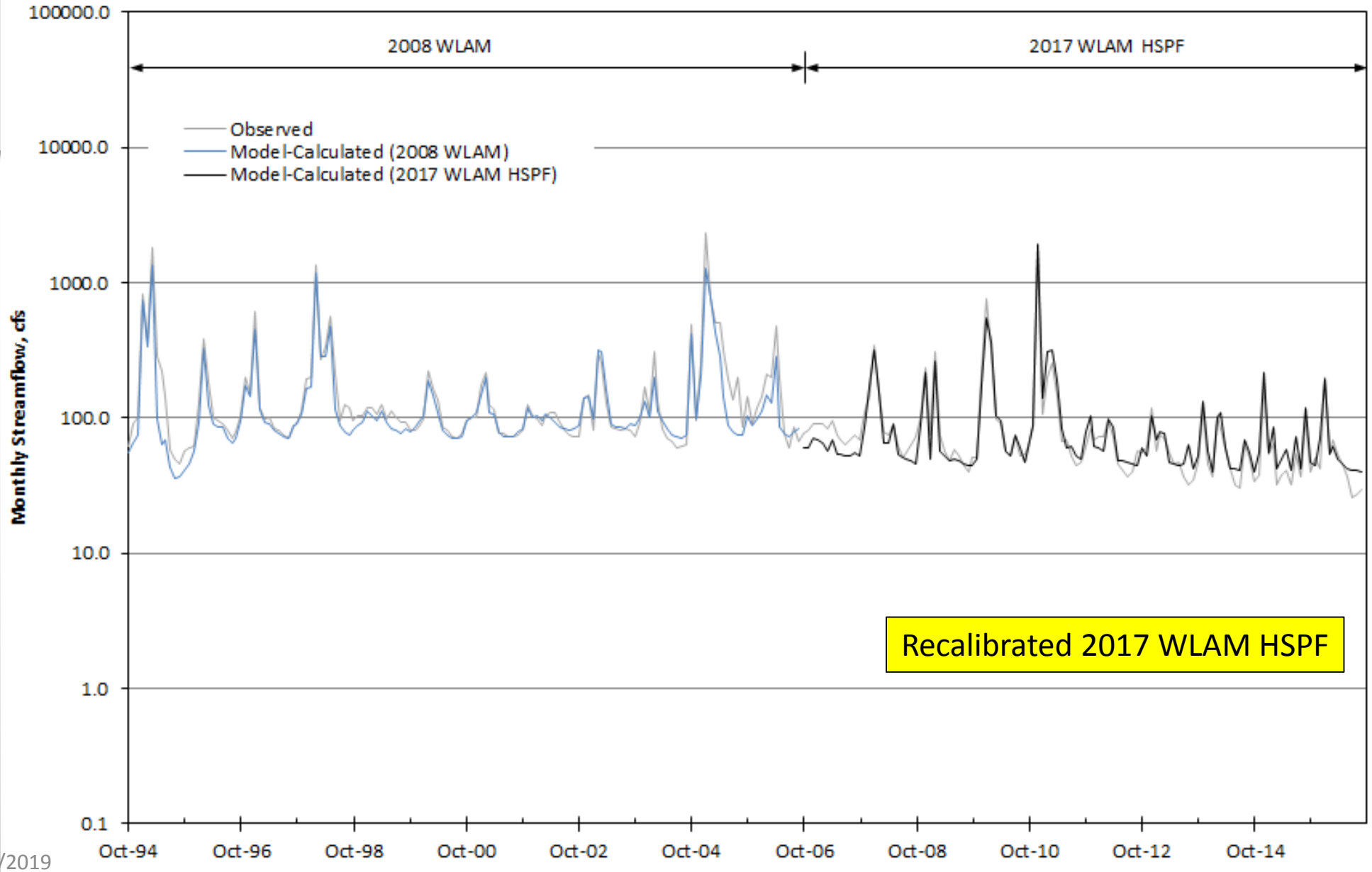

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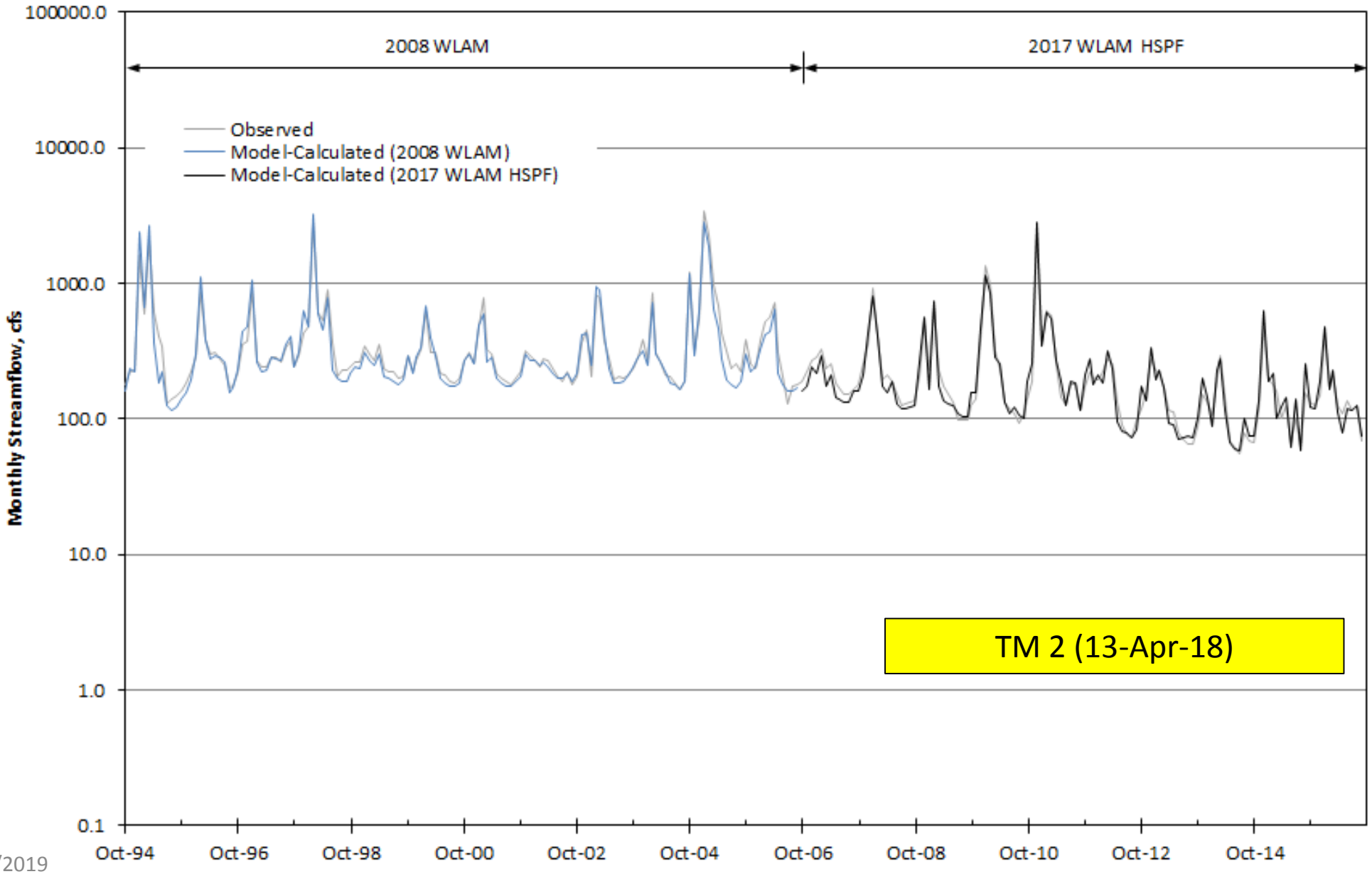

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Figure 52

Hydrographs of Measured and Model-Simulated Monthly Streamflow at the Santa Ana River Inflow to Prado – Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (WLAM Update)

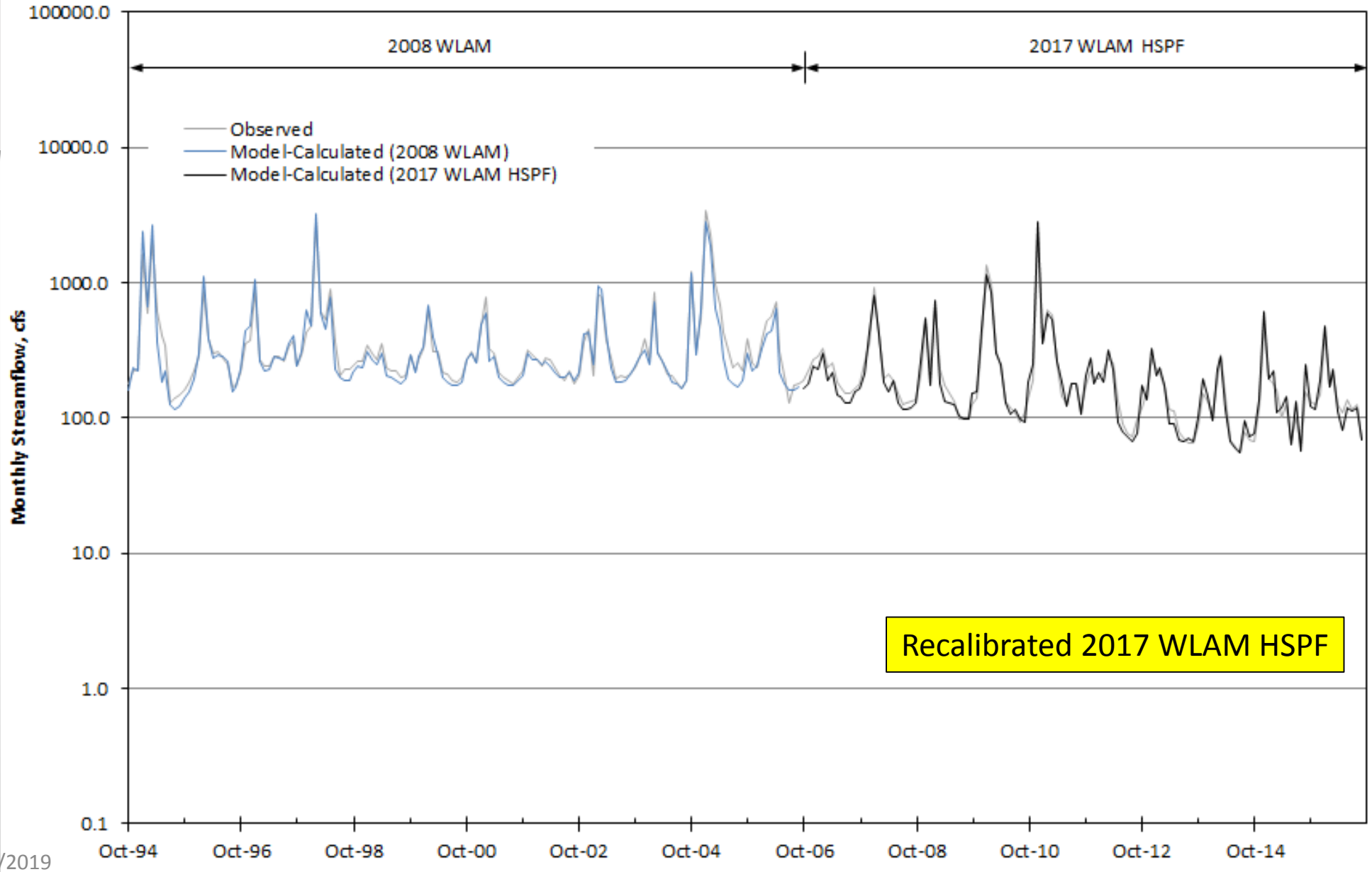
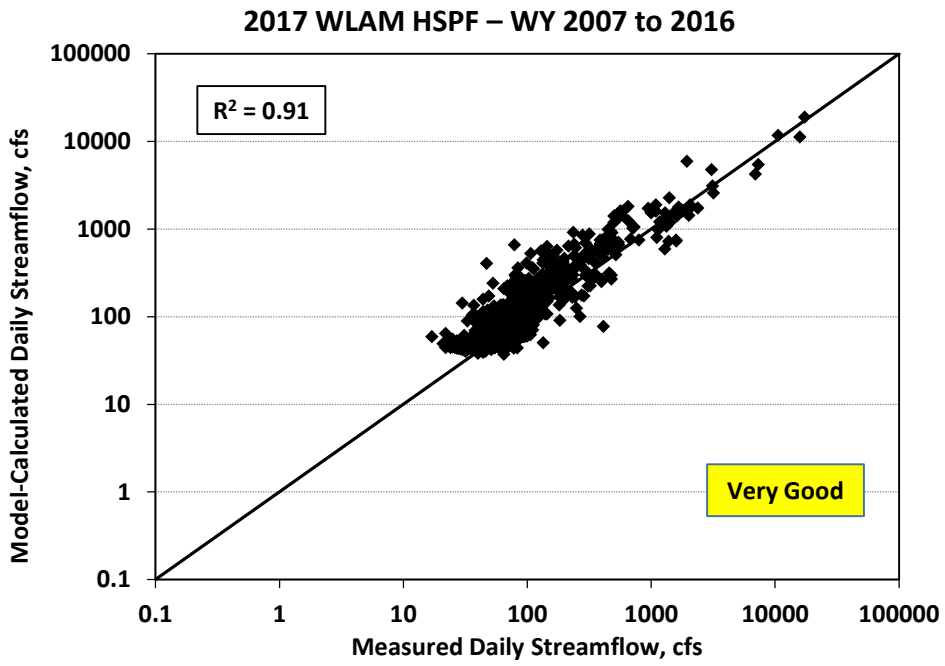
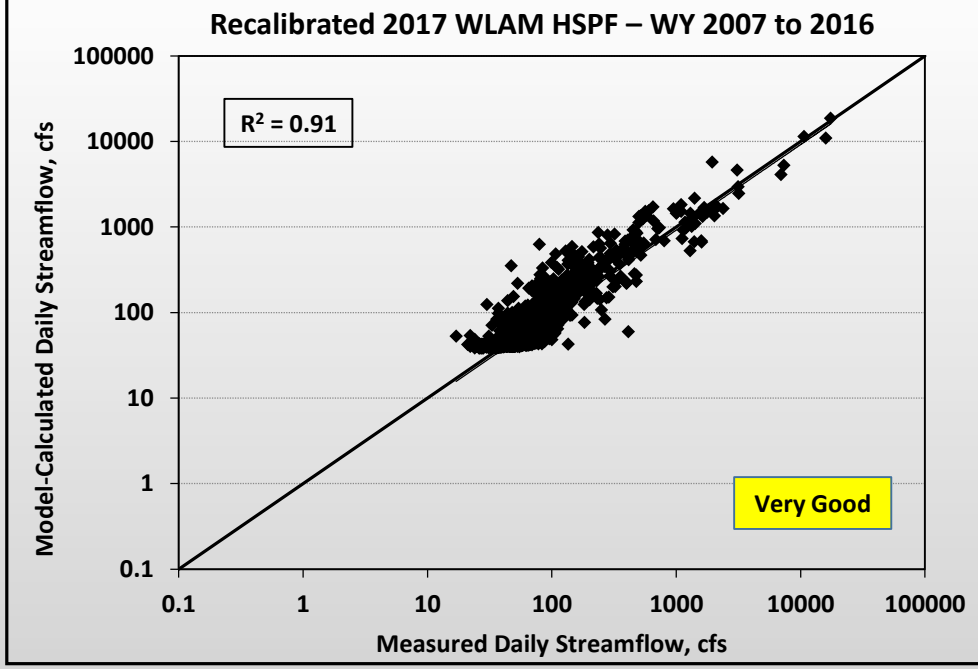
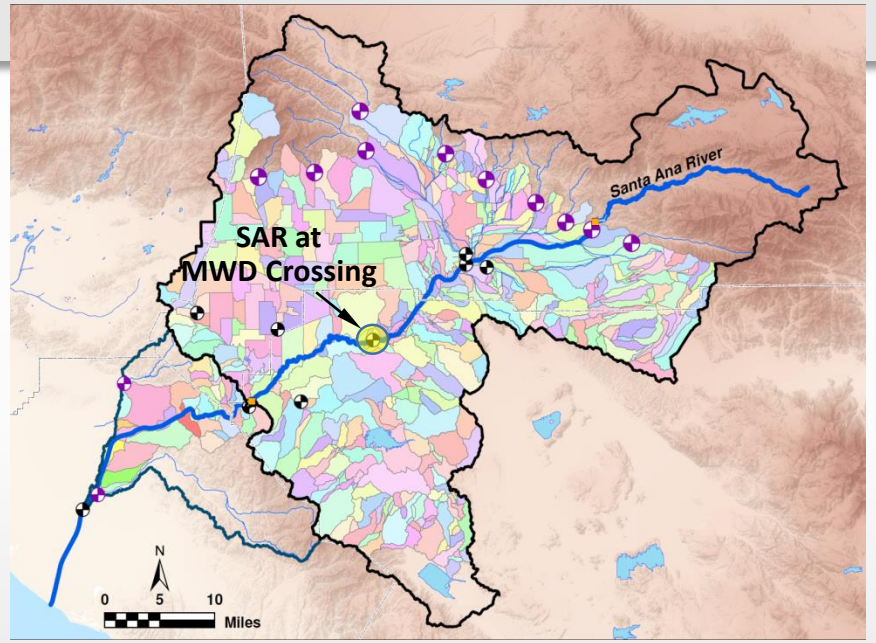


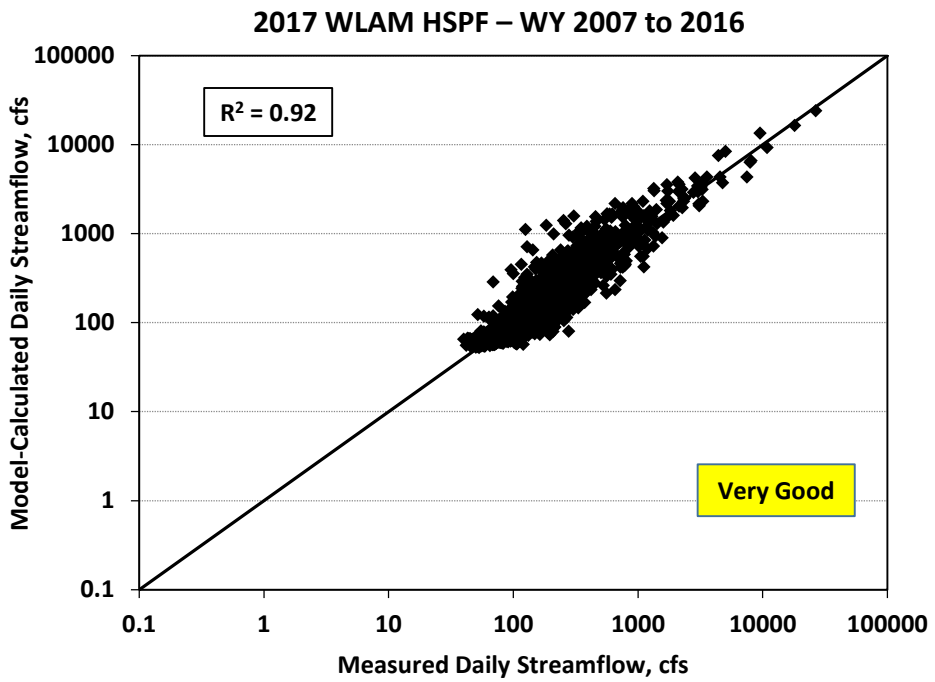
Figure 31

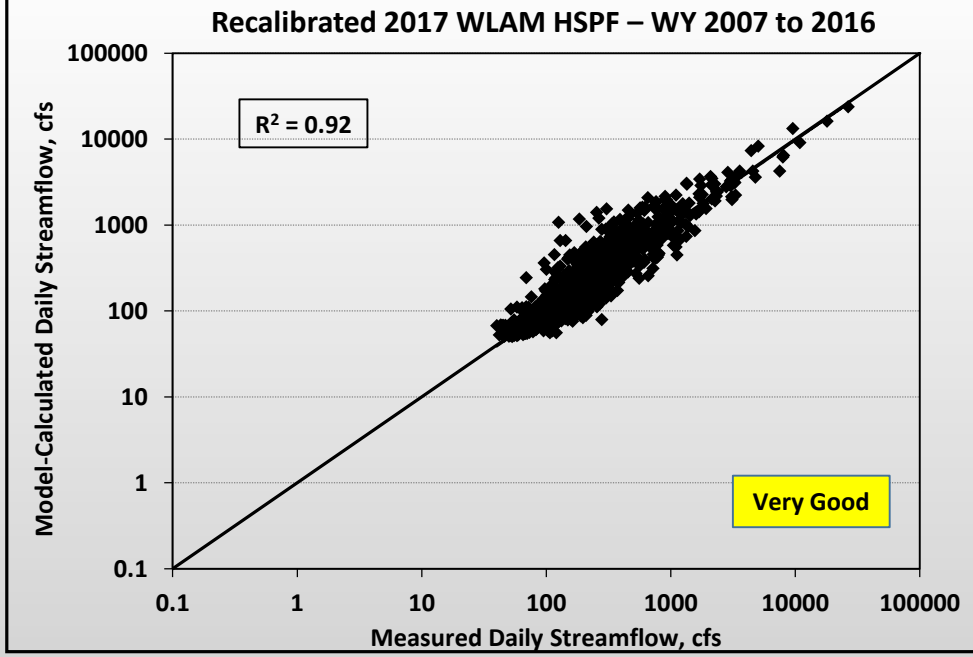


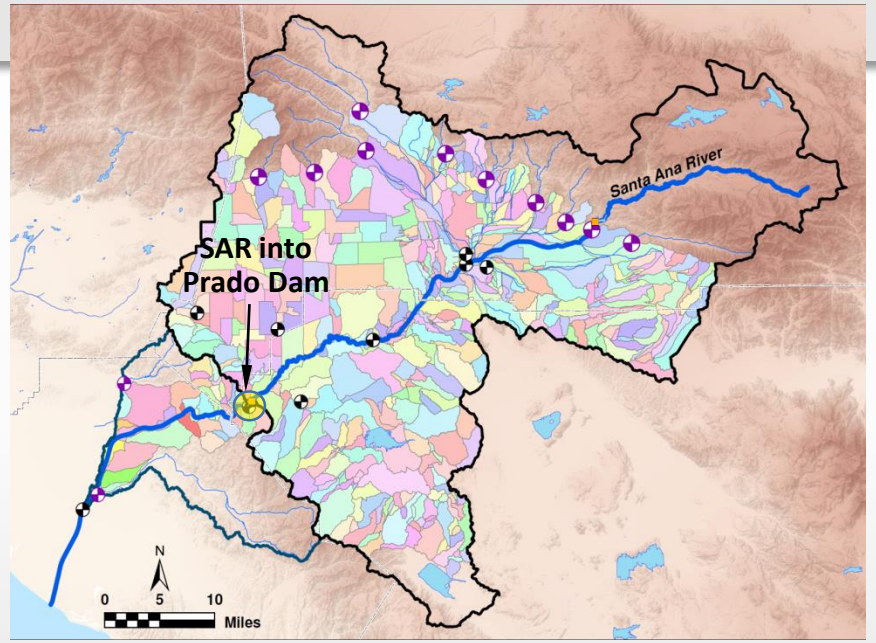




SCATTERPLOTS OF MEASURED AND MODEL-SIMULATED DAILY STREAMFLOW AT THE SANTA ANA RIVER AT MWD CROSSING WATER YEARS 2007 TO 2016 (2017 WLAM HSPF) AND WATER YEARS 2007 TO 2016 (RECALIBRATED 2017 WLAM HSPF)







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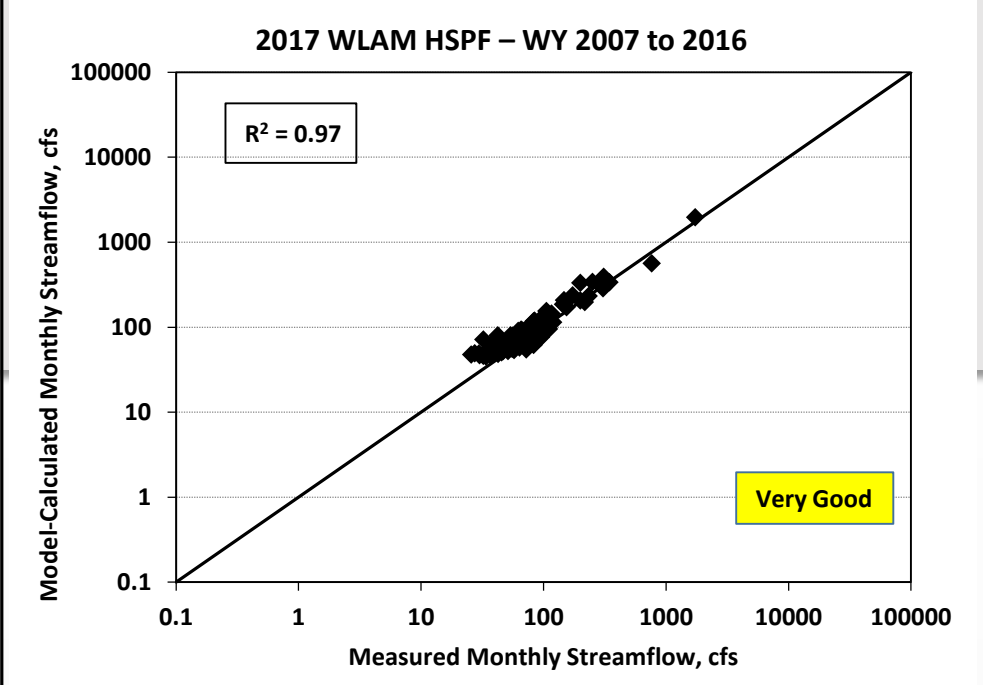

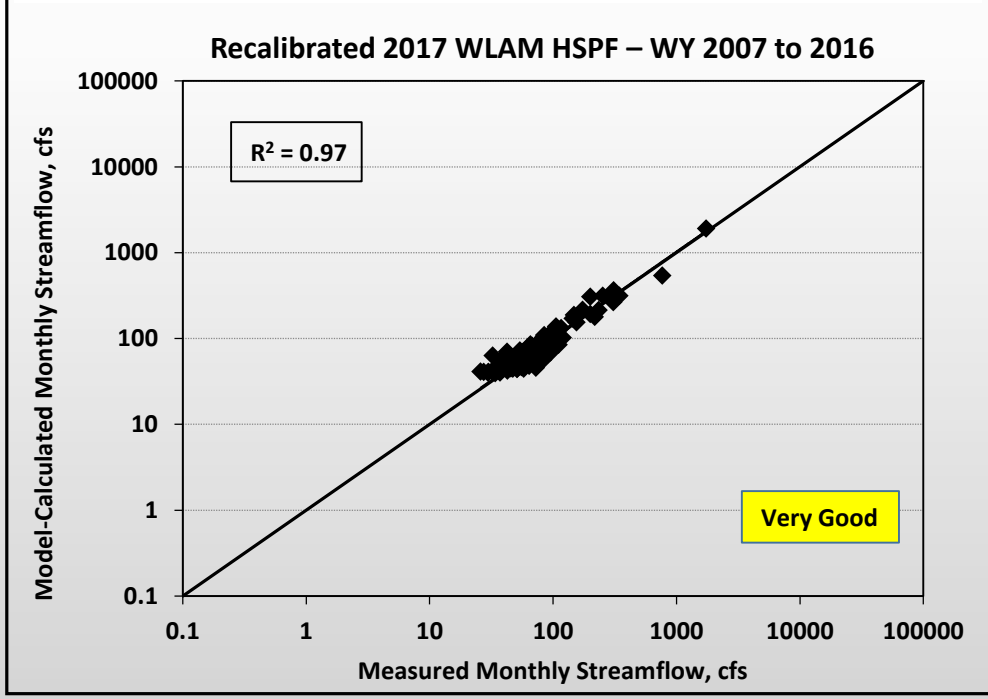

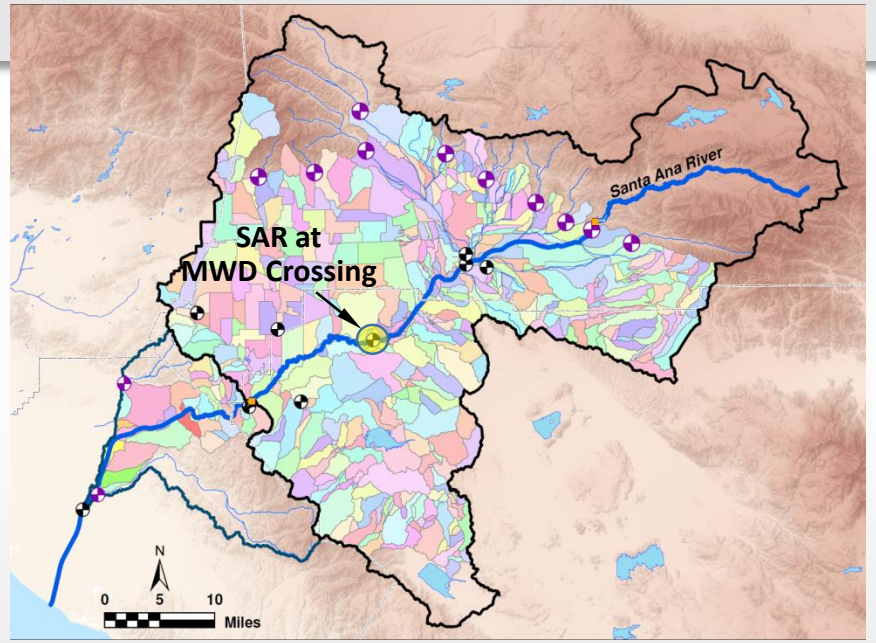

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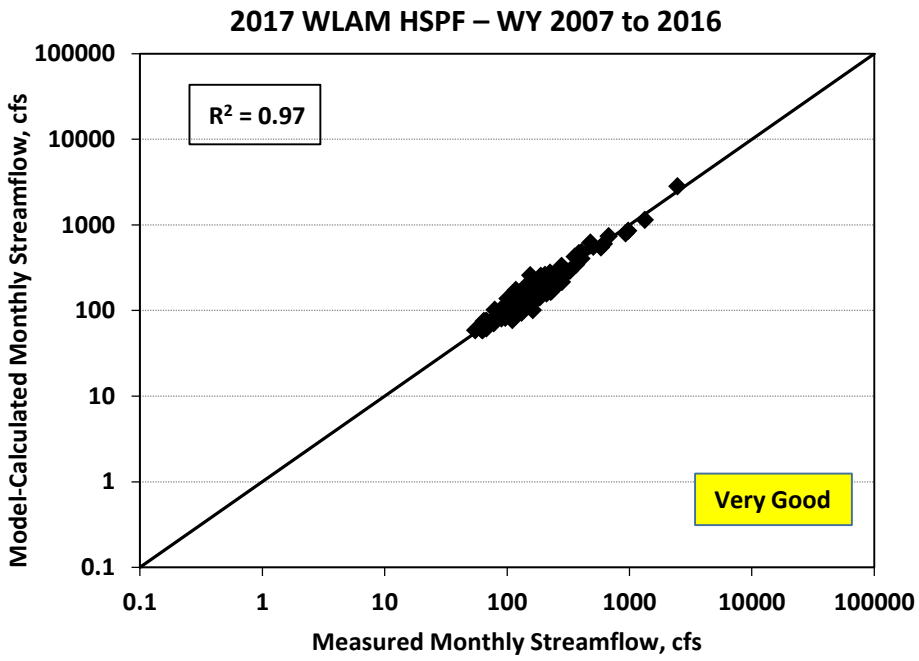

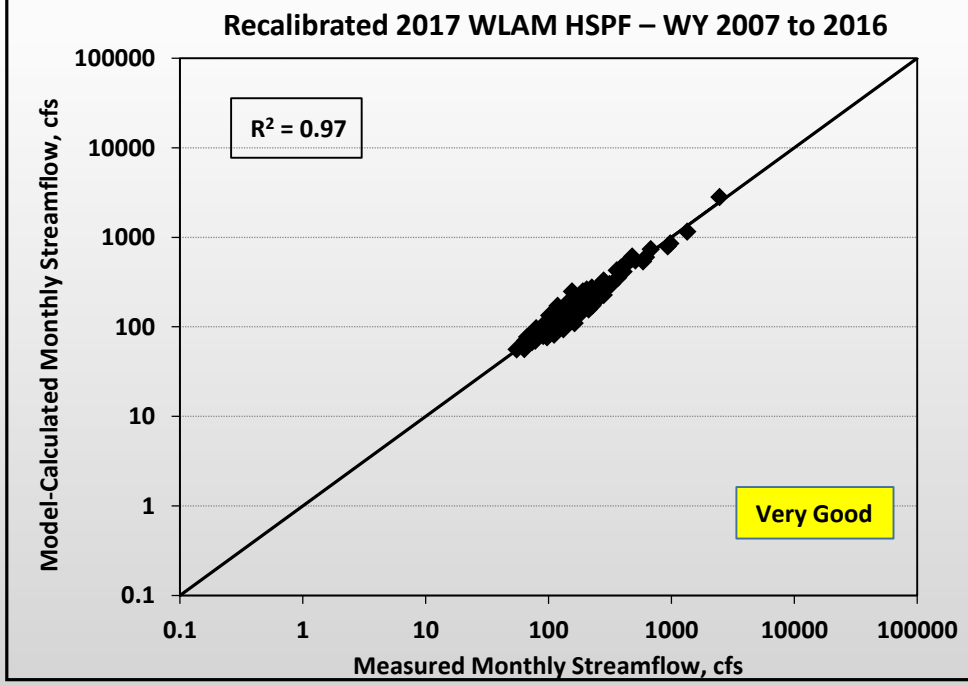

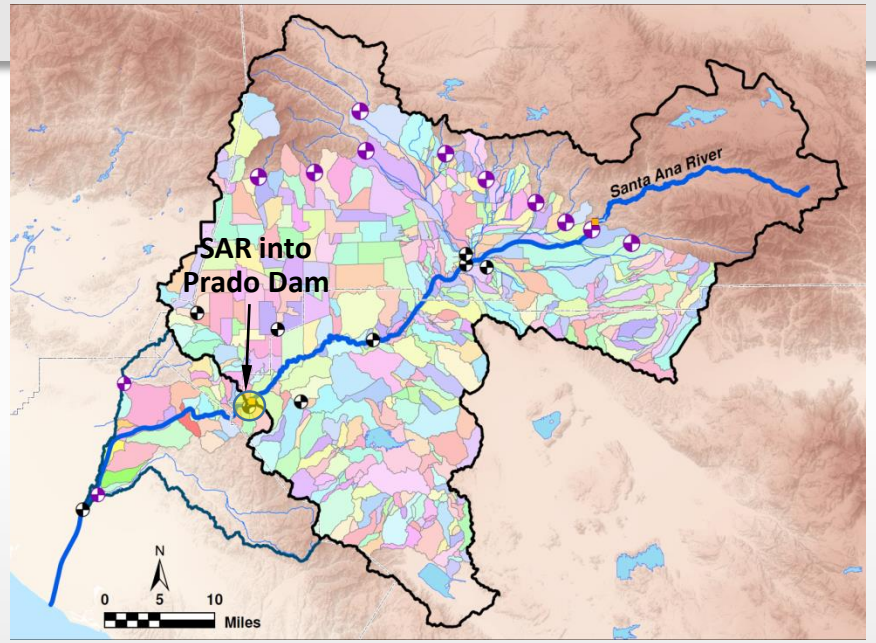

SCATTERPLOTS OF MEASURED AND MODEL-SIMULATED MONTHLY STREAMFLOW AT THE SANTA ANA RIVER INFLOW TO PRADO WATER YEARS 2007 TO 2016 (2017 WLAM HSPF) AND WATER YEARS 2007 TO 2016 (RECALIBRATED 2017 WLAM HSPF)

Measured and Model-Simulated Daily TDS Concentrations at the Santa Ana River at MWD Crossing
Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (2017 WLAM HSPF)

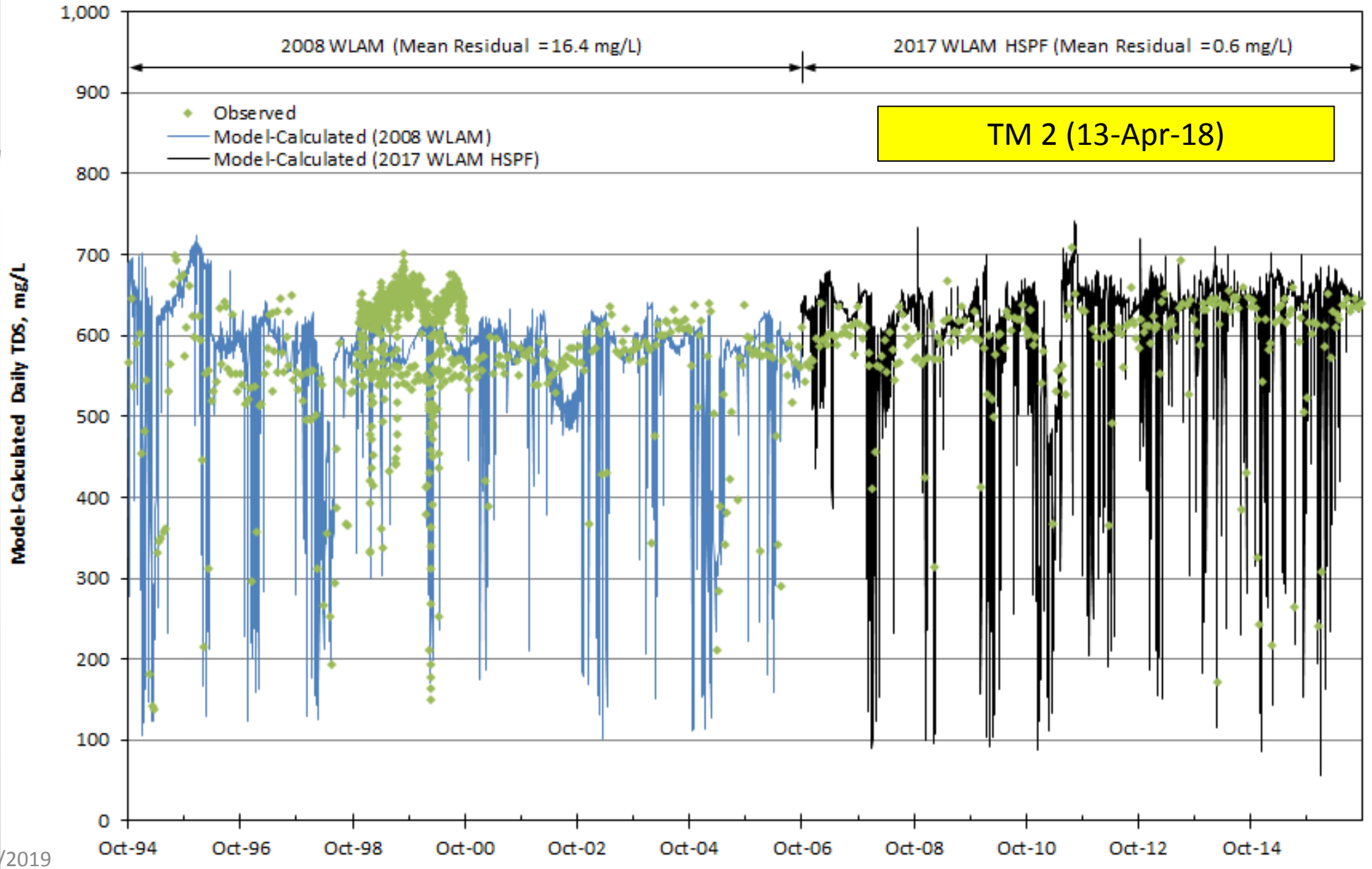

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Figure 72

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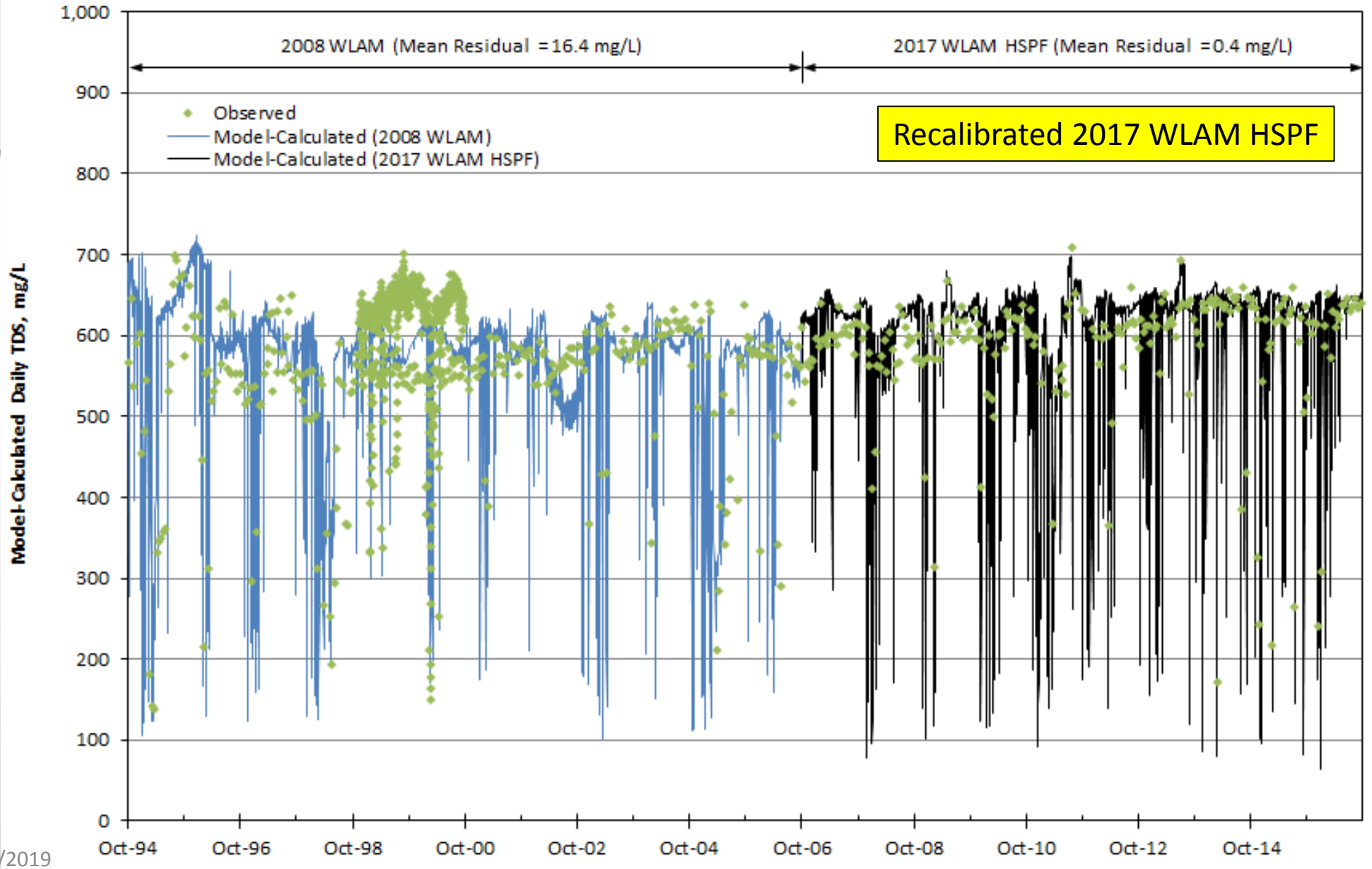

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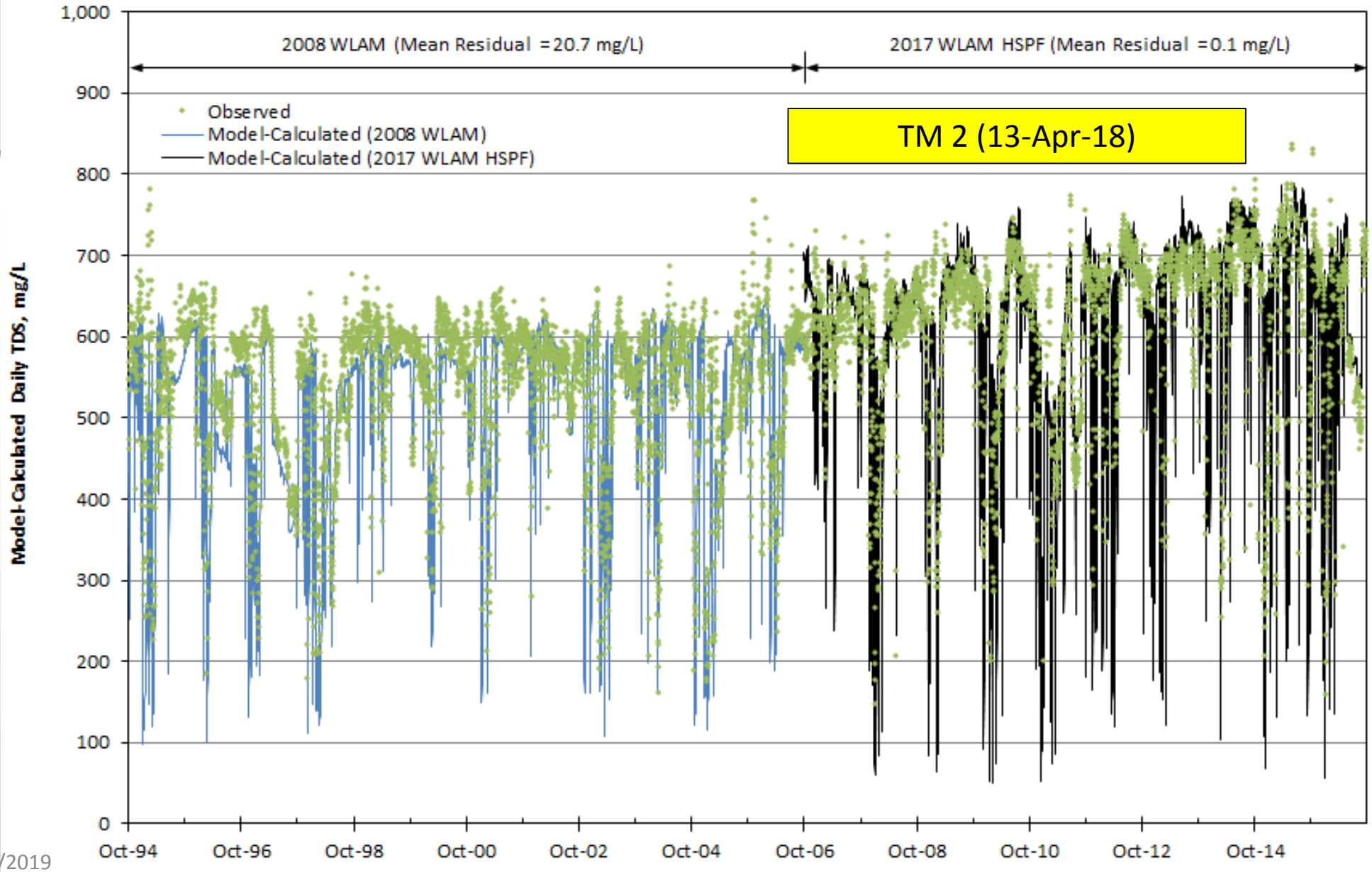

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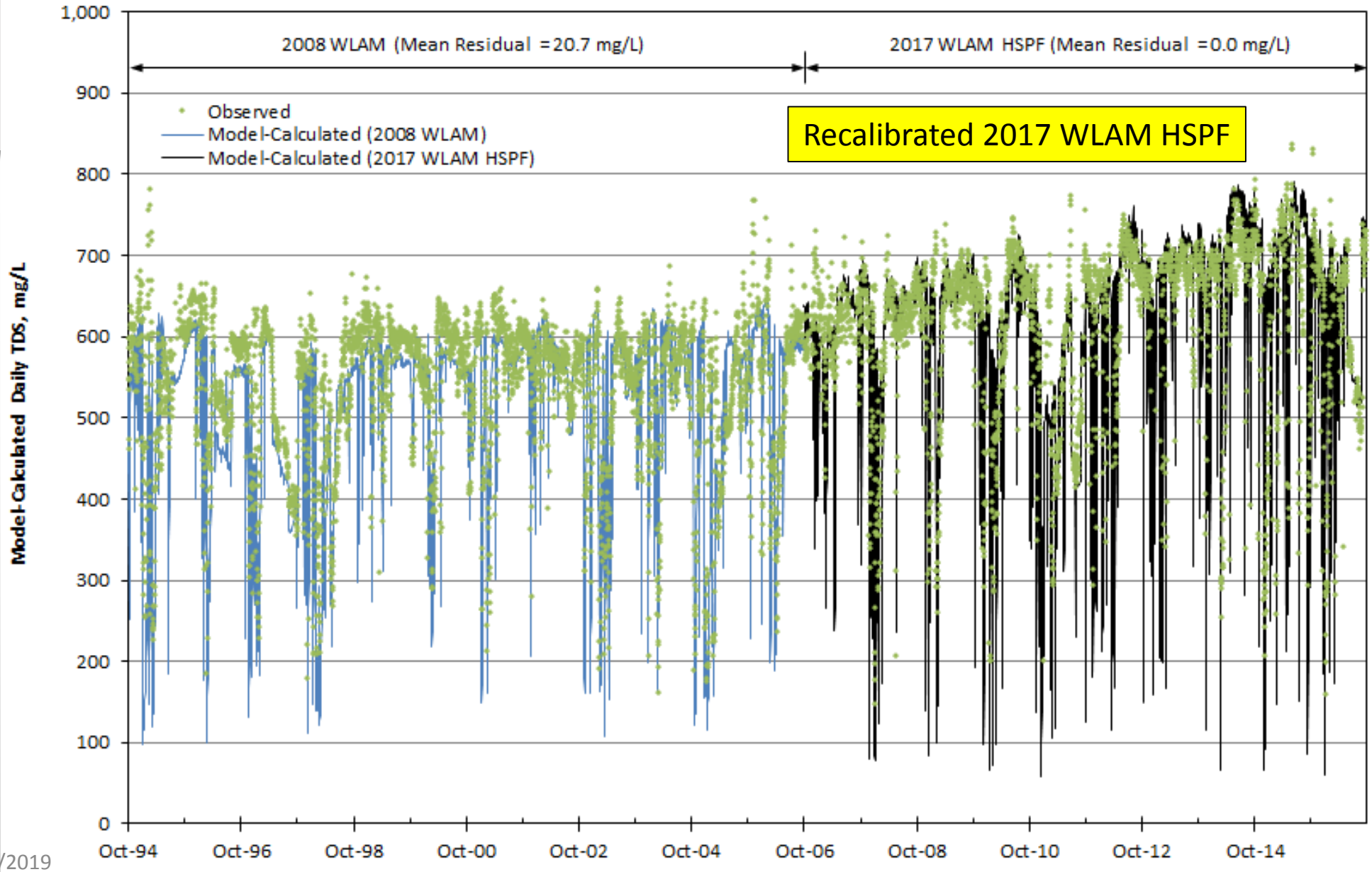

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Measured and Model-Simulated Daily TIN Concentrations at the Santa Ana River at MWD Crossing
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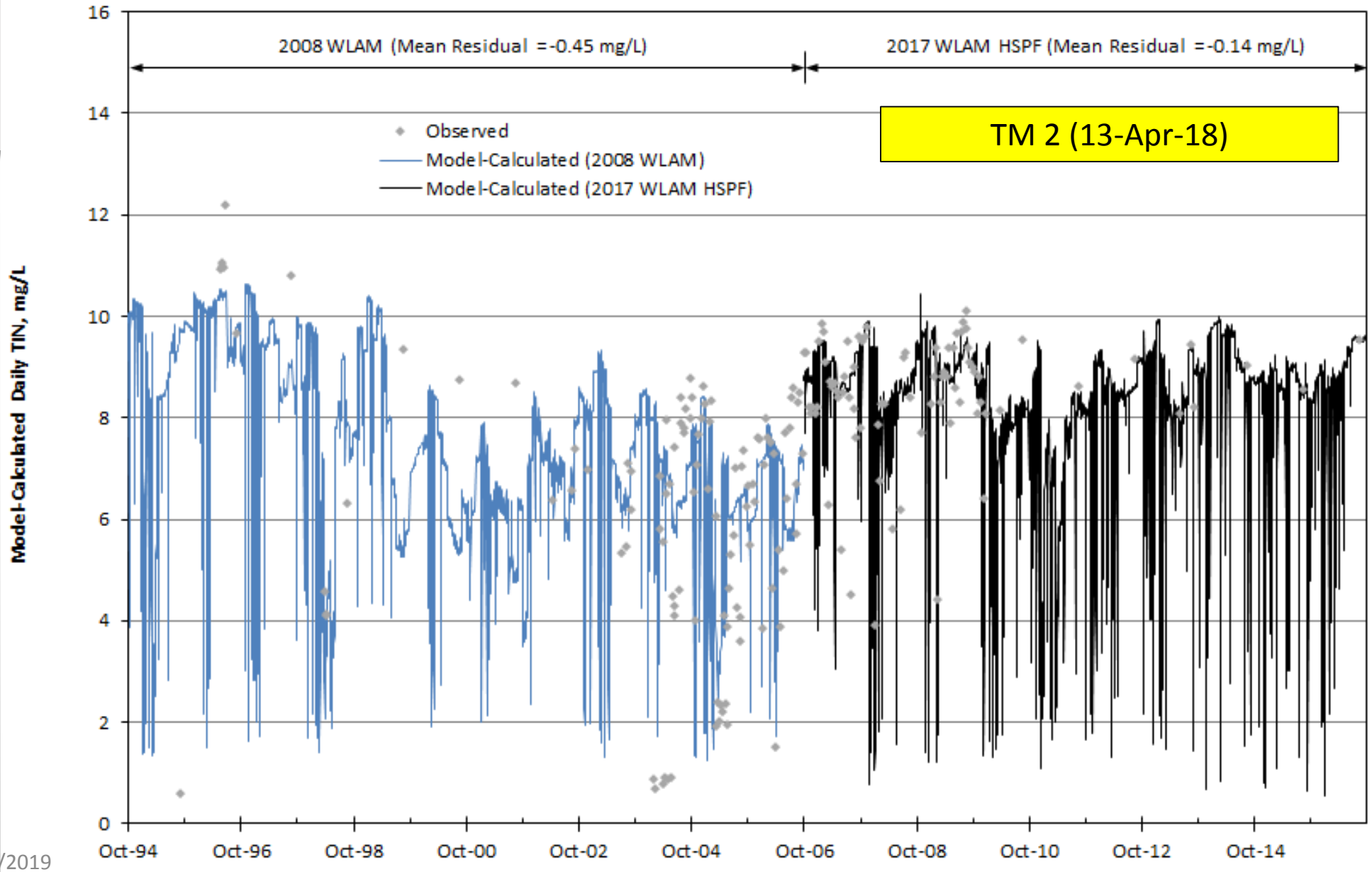

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Figure 75

Measured and Model-Simulated Daily TIN Concentrations at the Santa Ana River at MWD Crossing
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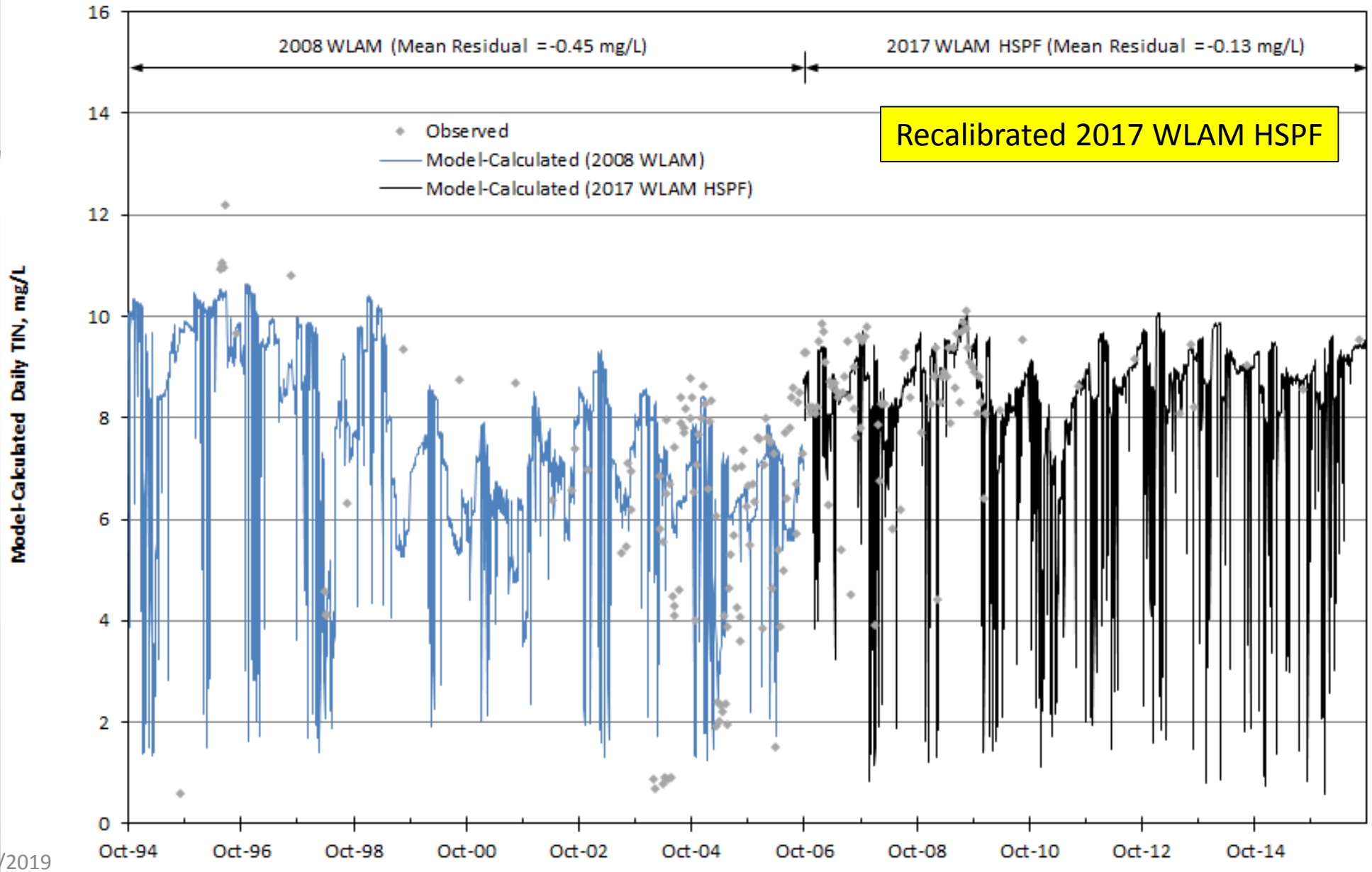

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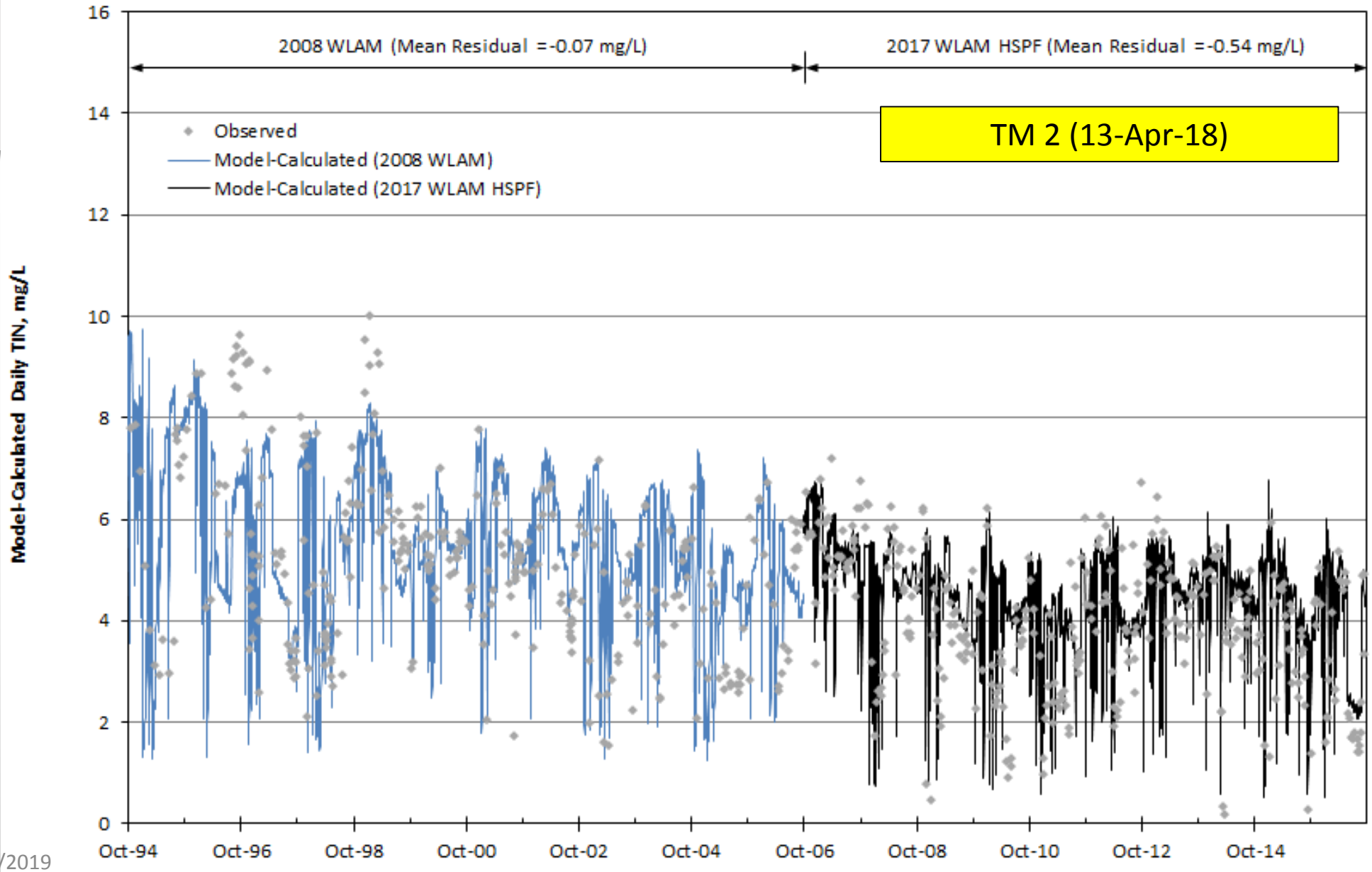

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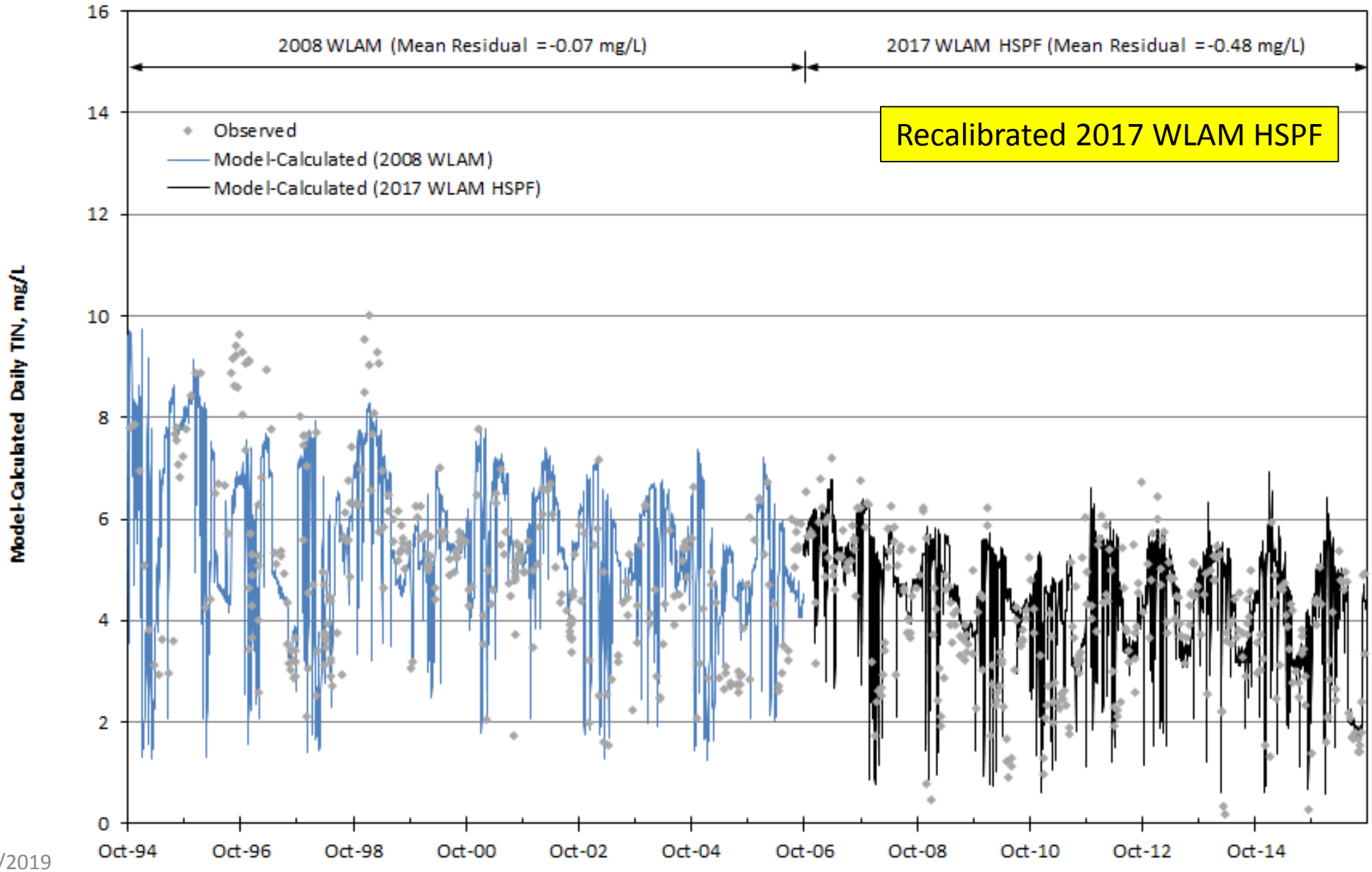

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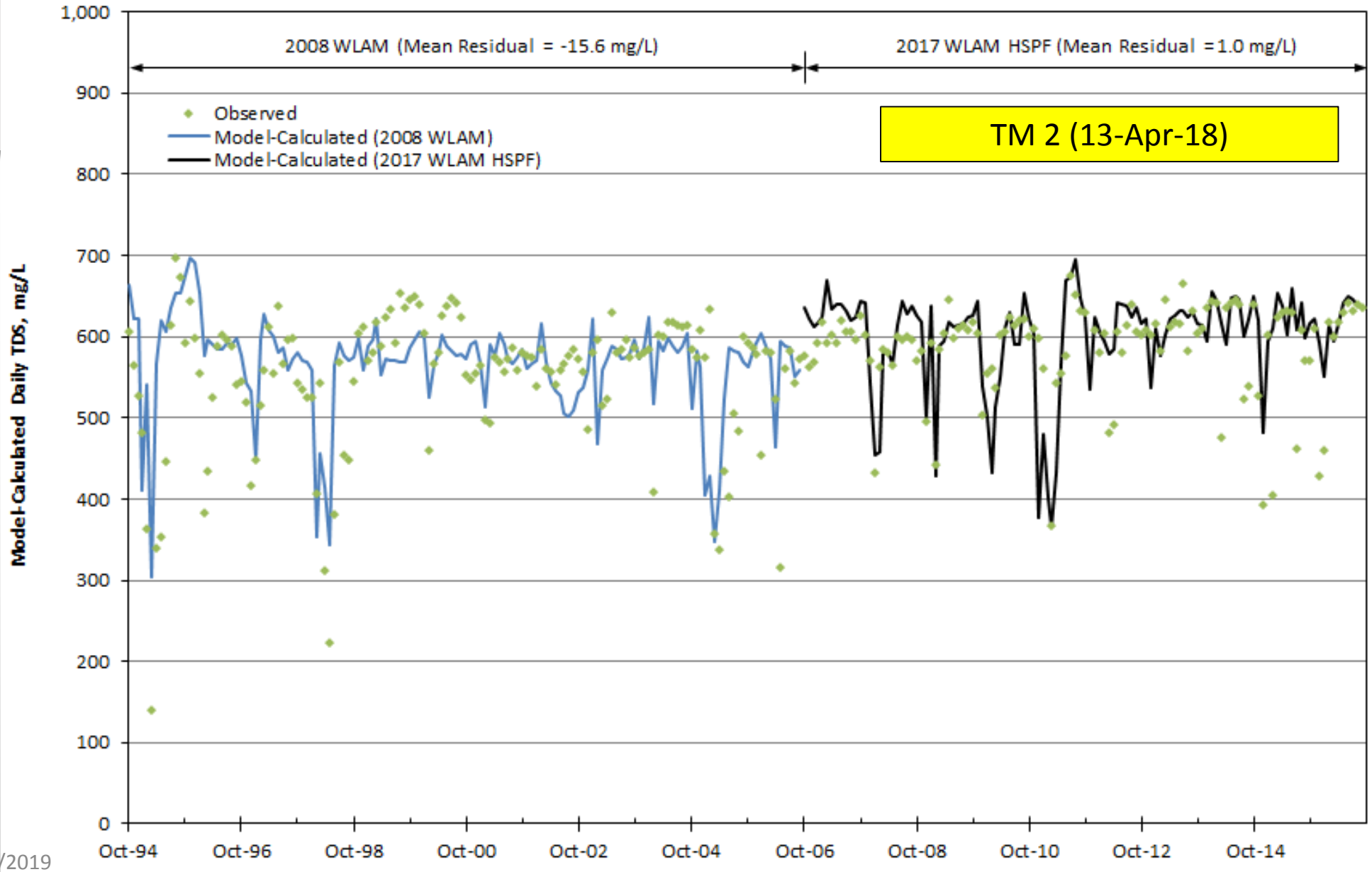

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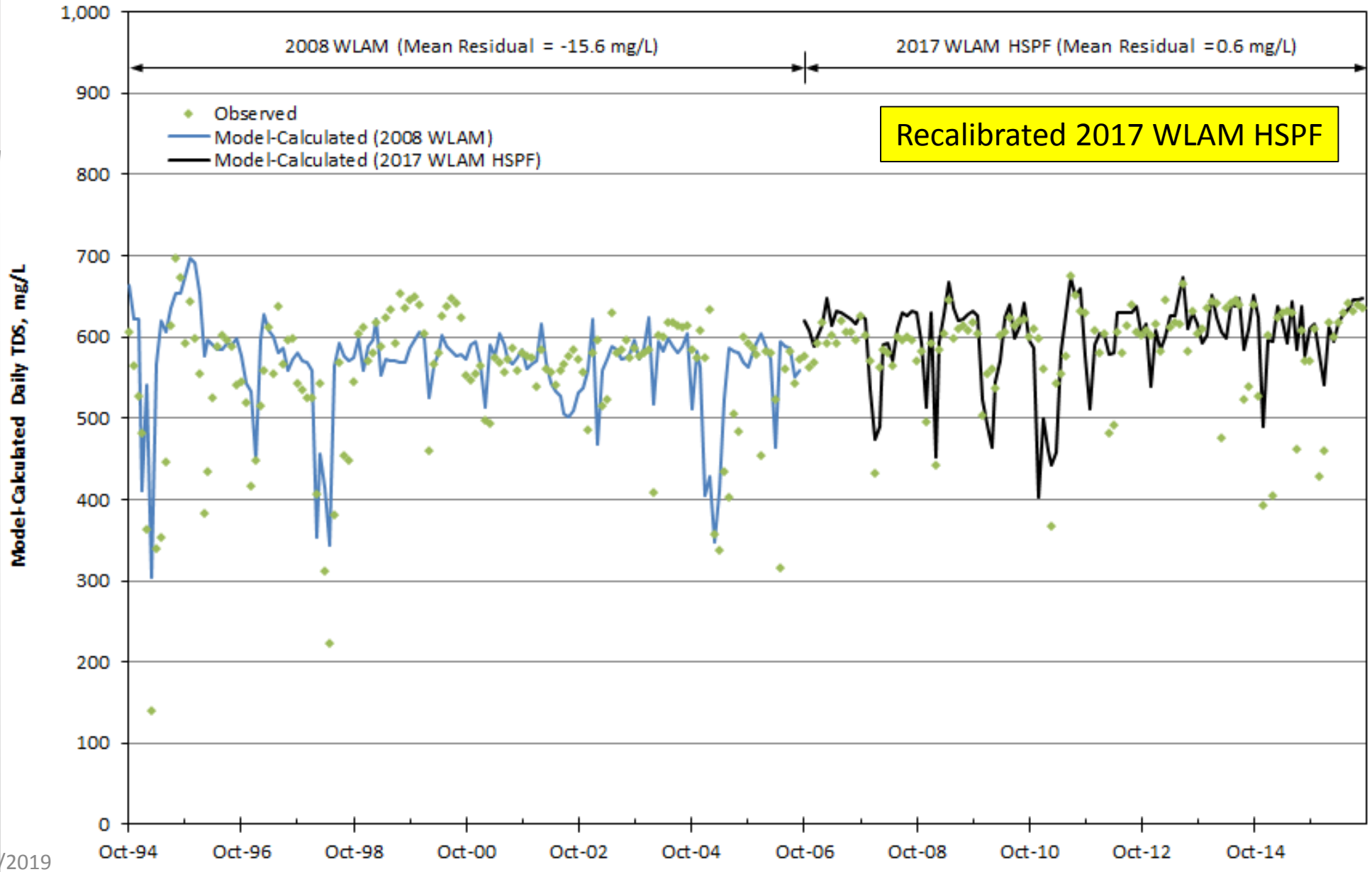

Figure 78

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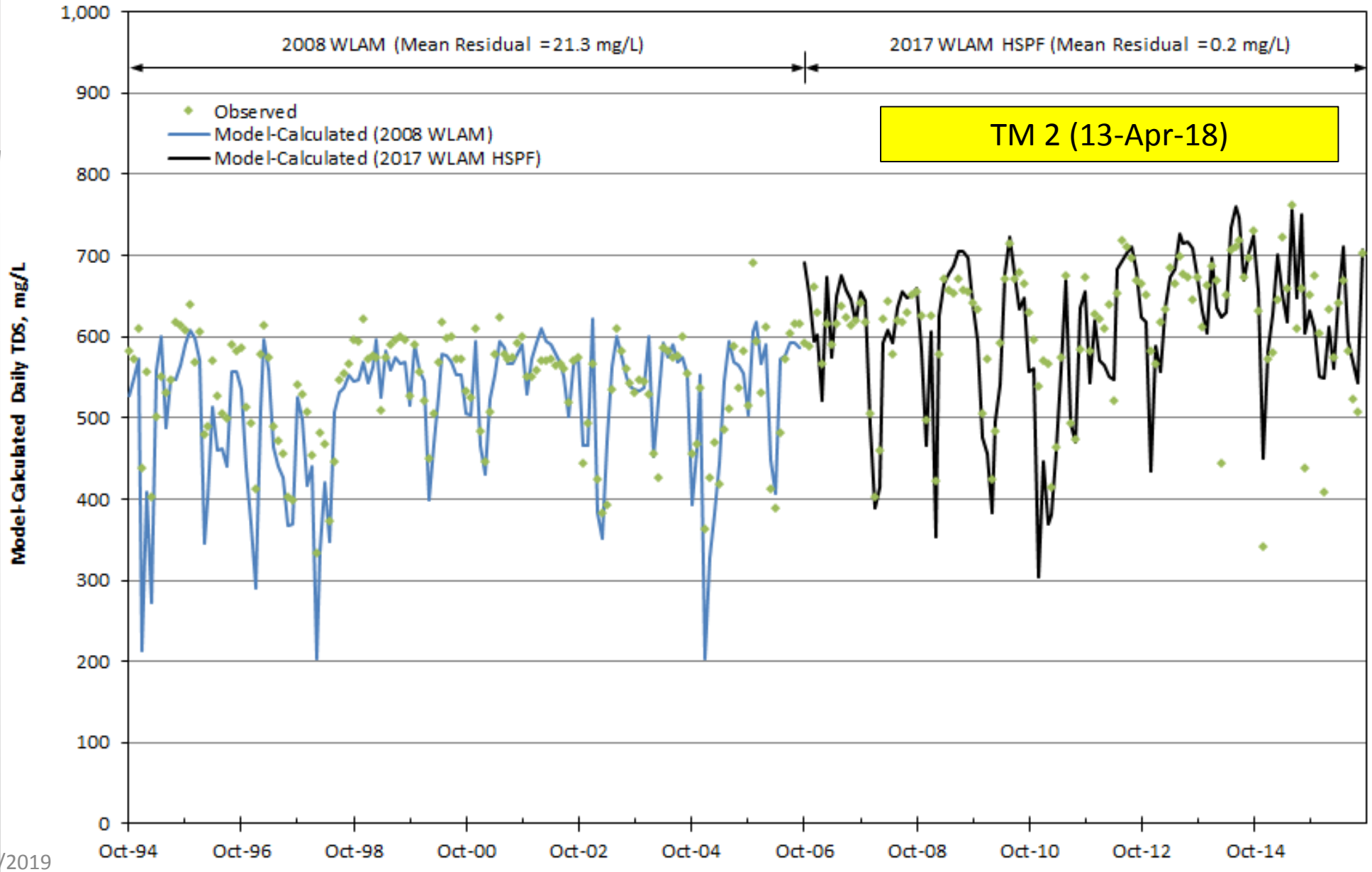
Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (2017 WLAM HSPF)



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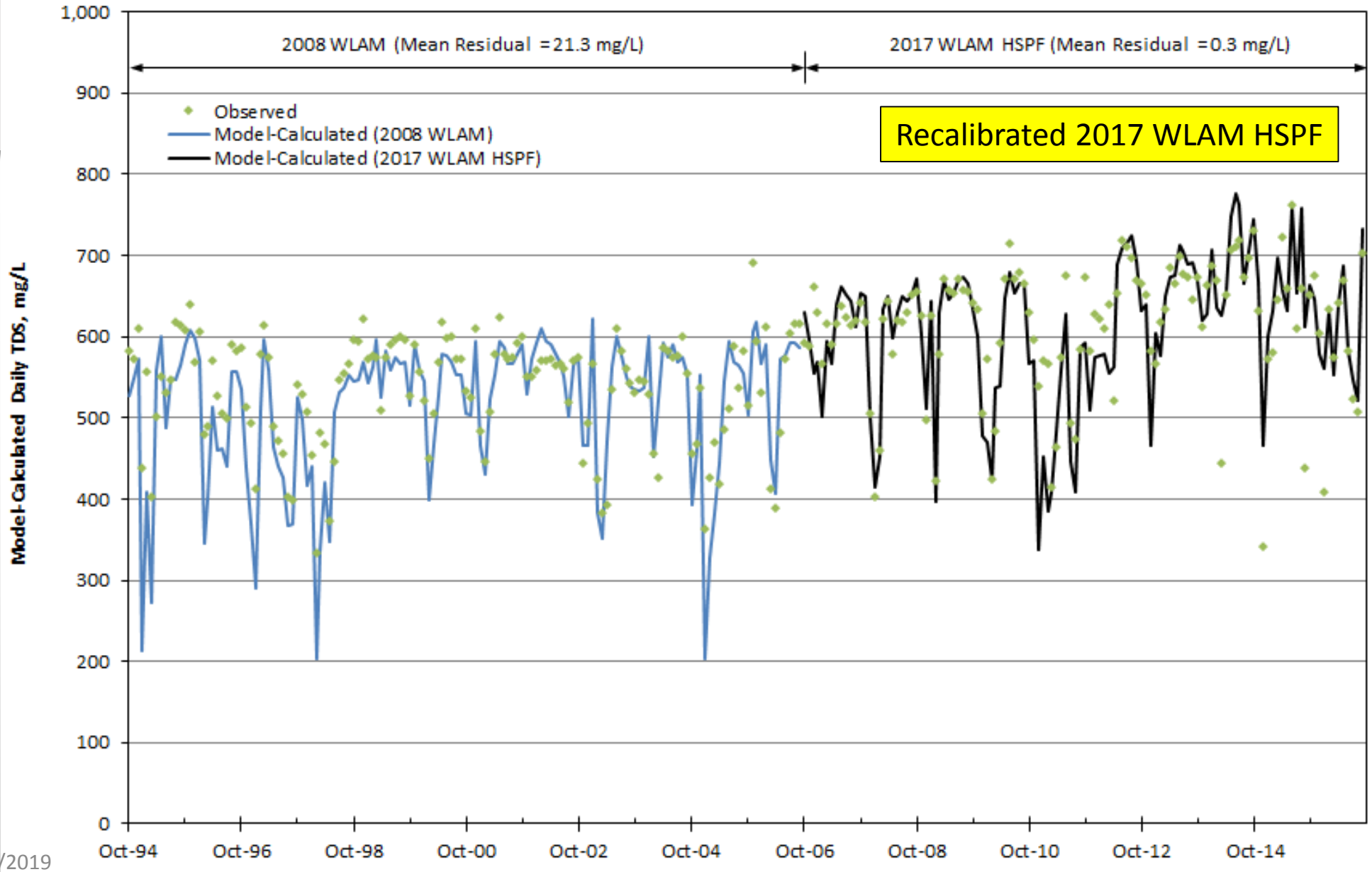

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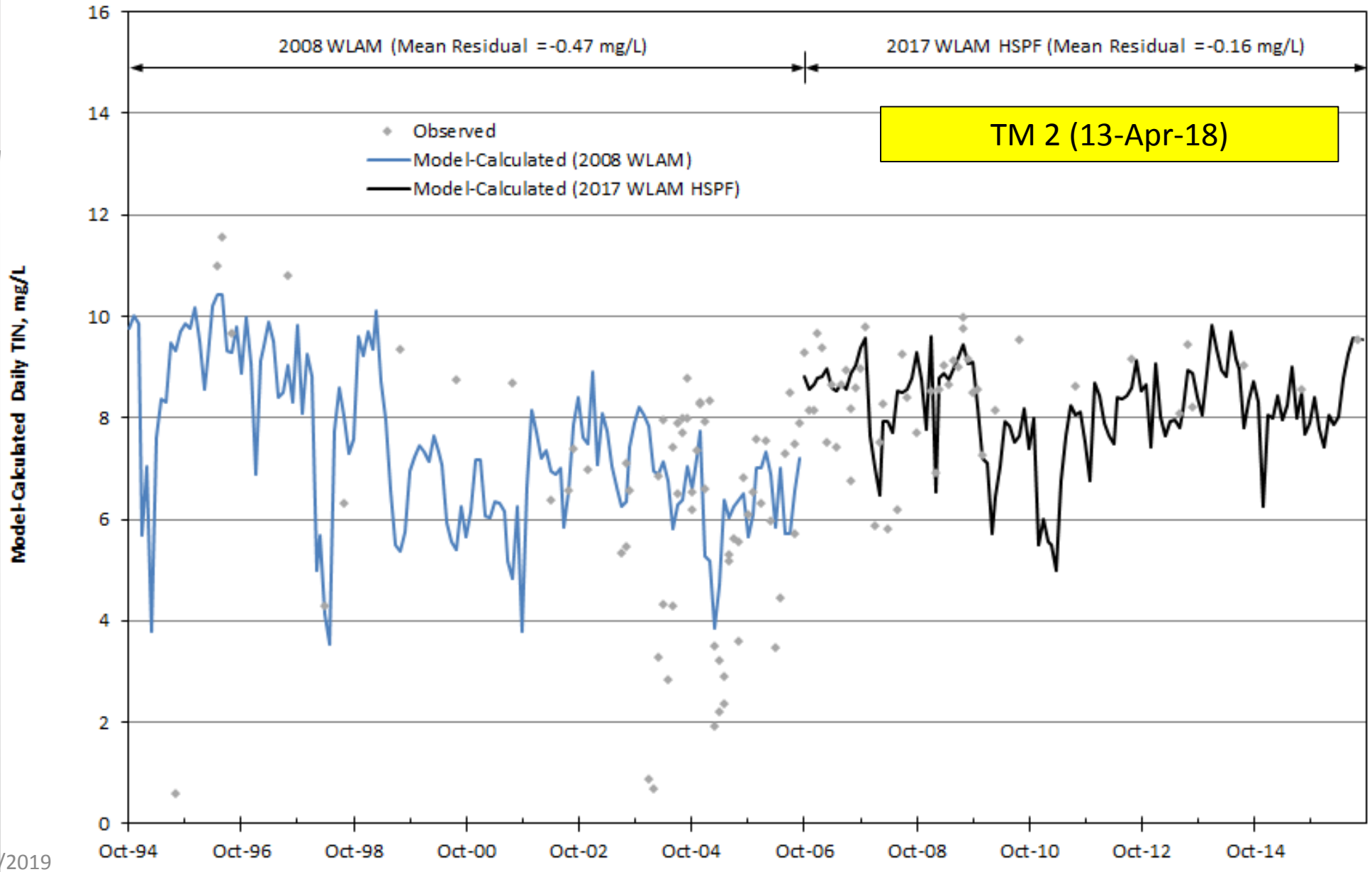

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Figure 81

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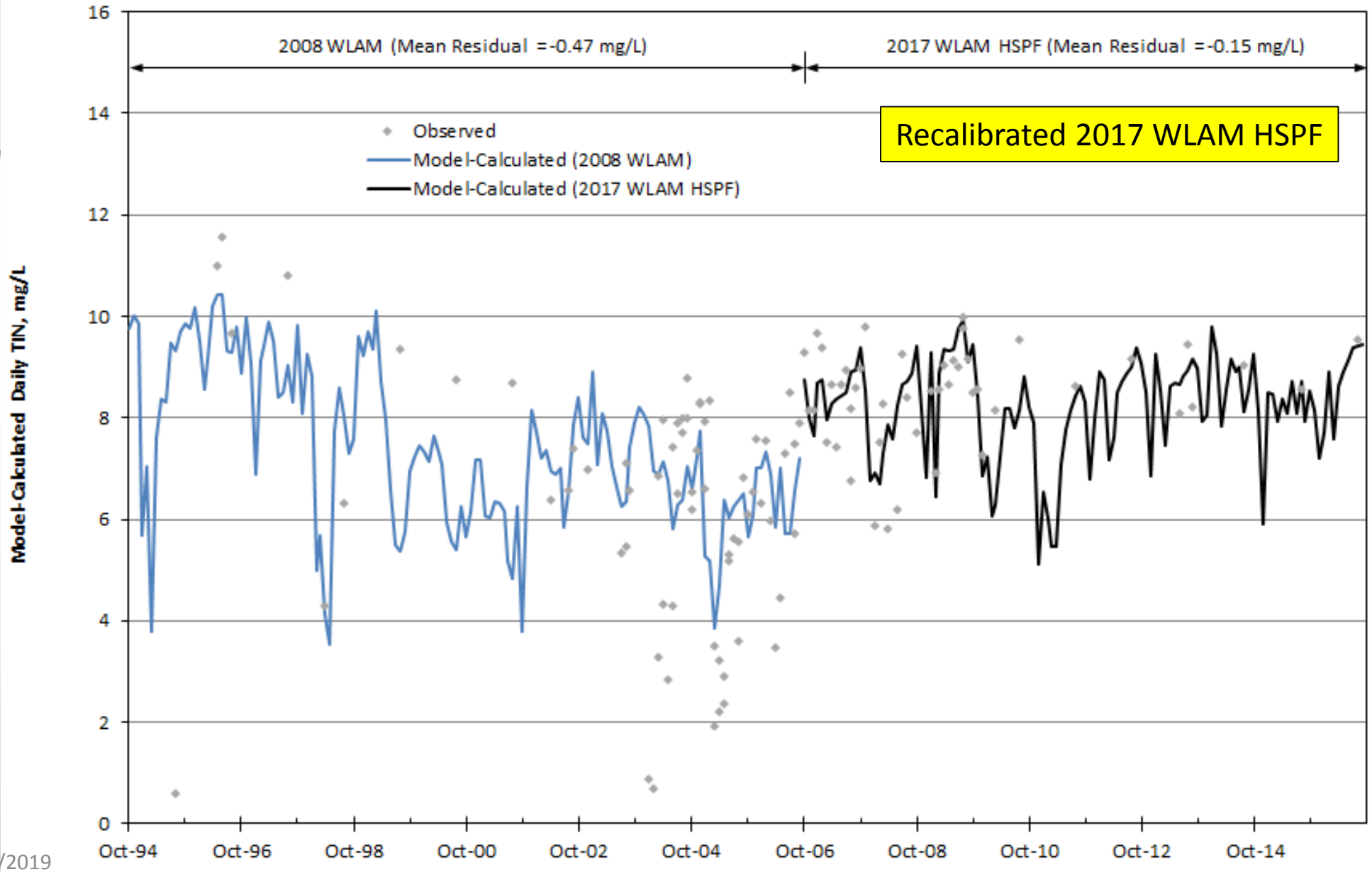

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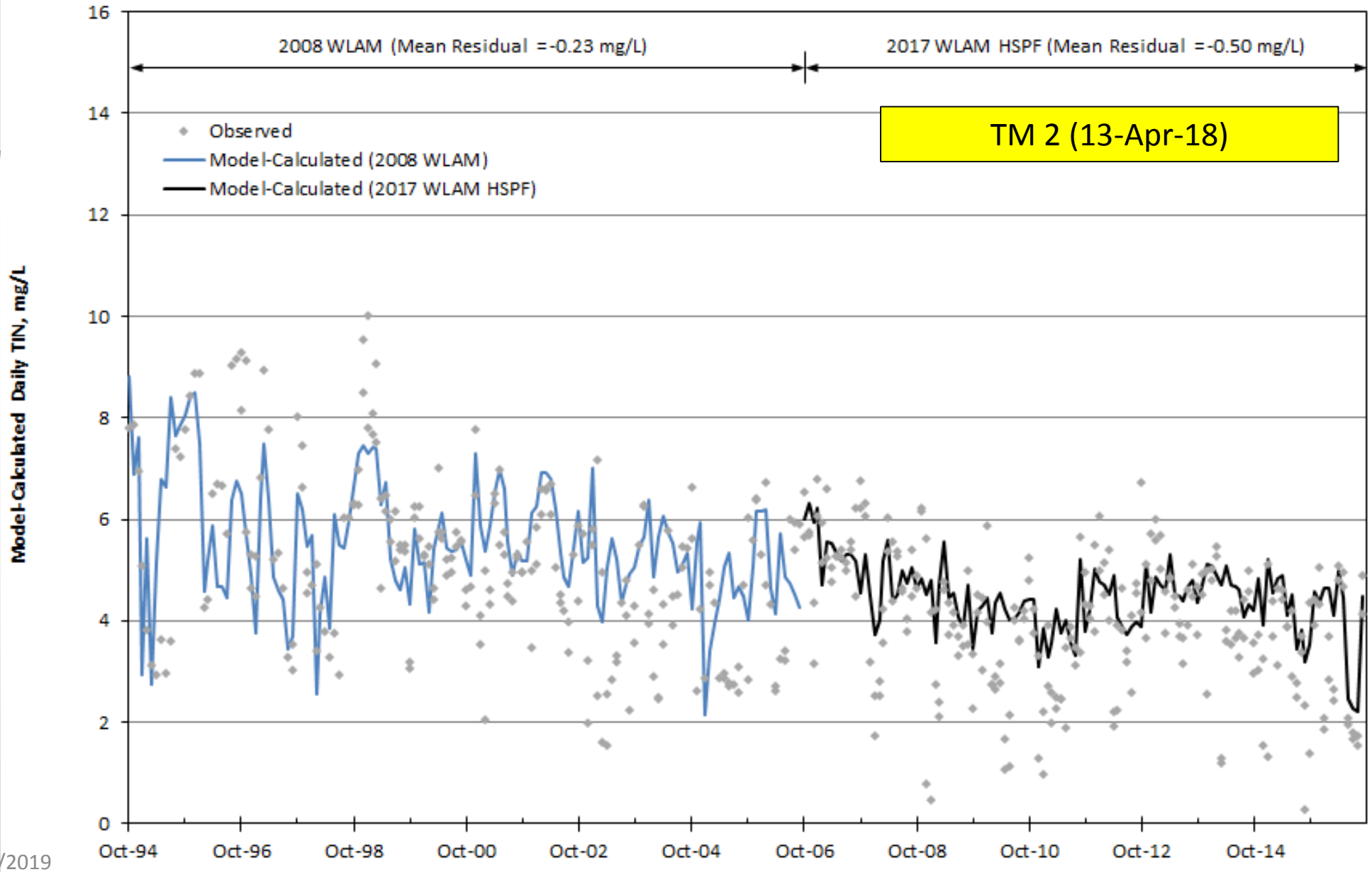

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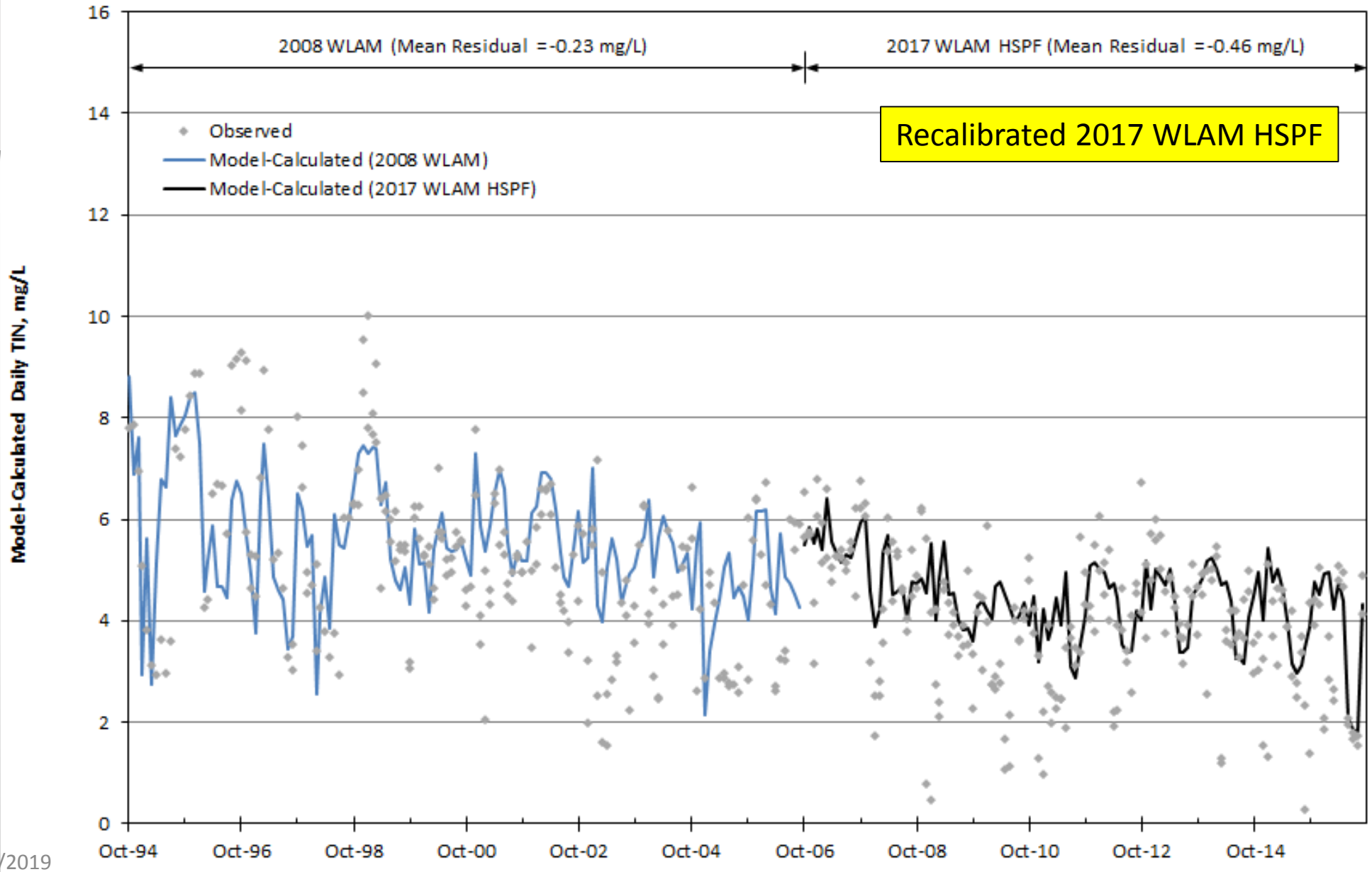


Figure 82

Streamflow Calibration Statistics (Daily)

Gaging Station	2008 WLAM WY 1995-2006	2017 WLAM HSPF WY 2007-2016	Recalibrated 2017 WLAM HSPF WY 2007-2016	Reduced Rising Water 2017 WLAM HSPF WY 2007-2016
Santa Ana River at MWD Crossing				
R^2	0.68	0.91	0.91	0.91
Calibration Performance	Fair	Very Good	Very Good	Very Good
Average Residual, cfs	33.1	-12.0	-1.5	-1.3
Average of Observed, cfs	182.5	97.2	97.2	97.2
Average Residual as Percentage of Observed, %	18%	-12%	-2%	-1%
RMSE	382.9	147.0	145.1	145.1
RMSE as Percentage of Range of Observed, %	2%	1%	1%	1%
Santa Ana River into Prado Dam				
R^2	0.66	0.92	0.92	NA
Calibration Performance	Fair	Very Good	Very Good	NA
Average Residual, cfs	11.4	-1.3	0.0	NA
Average of Observed, cfs	396.3	223.0	223.0	NA
Average Residual as Percentage of Observed, %	3%	-1%	0%	NA
RMSE	681.9	199.7	194.7	NA
RMSE as Percentage of Range of Observed, %	3%	1%	1%	NA

Streamflow Calibration Statistics (Monthly)

Gaging Station	2008 WLAM WY 1995-2006	2017 WLAM HSPF WY 2007-2016	Recalibrated 2017 WLAM HSPF WY 2007-2016	Reduced Rising Water 2017 WLAM HSPF WY 2007-2016
Santa Ana River at MWD Crossing				
R^2	0.91	0.97	0.97	0.97
Calibration Performance	Very Good	Very Good	Very Good	Very Good
Average Residual, cfs	32.9	-12.1	-1.6	-1.3
Average of Observed, cfs	183.3	97.2	97.2	97.2
Average Residual as Percentage of Observed, %	18%	-12%	-2%	-1%
RMSE	110.1	37.4	33.3	33.0
RMSE as Percentage of Range of Observed, %	5%	2%	2%	2%
Santa Ana River into Prado Dam				
R^2	0.93	0.97	0.97	NA
Calibration Performance	Very Good	Very Good	Very Good	NA
Average Residual, cfs	11.5	-1.3	0.1	NA
Average of Observed, cfs	399.0	223.6	223.6	NA
Average Residual as Percentage of Observed, %	3%	-1%	0%	NA
RMSE	123.5	54.2	50.7	NA
RMSE as Percentage of Range of Observed, %	4%	2%	2%	NA

TDS Calibration Statistics (Daily)

Gaging Station	2008 WLAM WY 1995-2006	2017 WLAM HSPF WY 2007-2016	Recalibrated 2017 WLAM HSPF WY 2007-2016	Reduced Rising Water 2017 WLAM HSPF WY 2007-2016
Santa Ana River at MWD Crossing				
Average Residual, mg/L	16.4	0.6	0.4	0.4
Average of Observed, mg/L	591	587	587	587
Average Residual as Percentage of Observed, %	2.8%	0.1%	0.1%	0.1%
Standard Deviation, mg/L	75.5	74.6	73.0	82.2
RMSE	77.3	74.5	72.8	82.1
Santa Ana River below Prado Dam				
Average Residual, mg/L	20.7	0.1	0.8	NA
Average of Observed, mg/L	535	615	615	NA
Average Residual as Percentage of Observed, %	3.9%	0.0%	0.1%	NA
Standard Deviation, mg/L	74.7	101.5	102.4	NA
RMSE	77.4	101.5	102.3	NA

TDS Calibration Statistics (Monthly)

Gaging Station	2008 WLAM WY 1995-2006	2017 WLAM HSPF WY 2007-2016	Recalibrated 2017 WLAM HSPF WY 2007-2016	Reduced Rising Water 2017 WLAM HSPF WY 2007-2016
Santa Ana River at MWD Crossing				
Average Residual, mg/L	-15.6	1.0	0.6	0.7
Average of Observed, mg/L	548	587	587	587
Average Residual as Percentage of Observed, %	-2.8%	0.2%	0.1%	0.1%
Standard Deviation, mg/L	71.6	55.0	53.1	59.2
RMSE	73.0	54.8	52.9	58.9
Santa Ana River below Prado Dam				
Average Residual, mg/L	21.3	0.2	1.1	NA
Average of Observed, mg/L	536	613	613	NA
Average Residual as Percentage of Observed, %	4.0%	0.0%	0.2%	NA
Standard Deviation, mg/L	48.6	51.1	49.6	NA
RMSE	52.9	50.9	49.4	NA

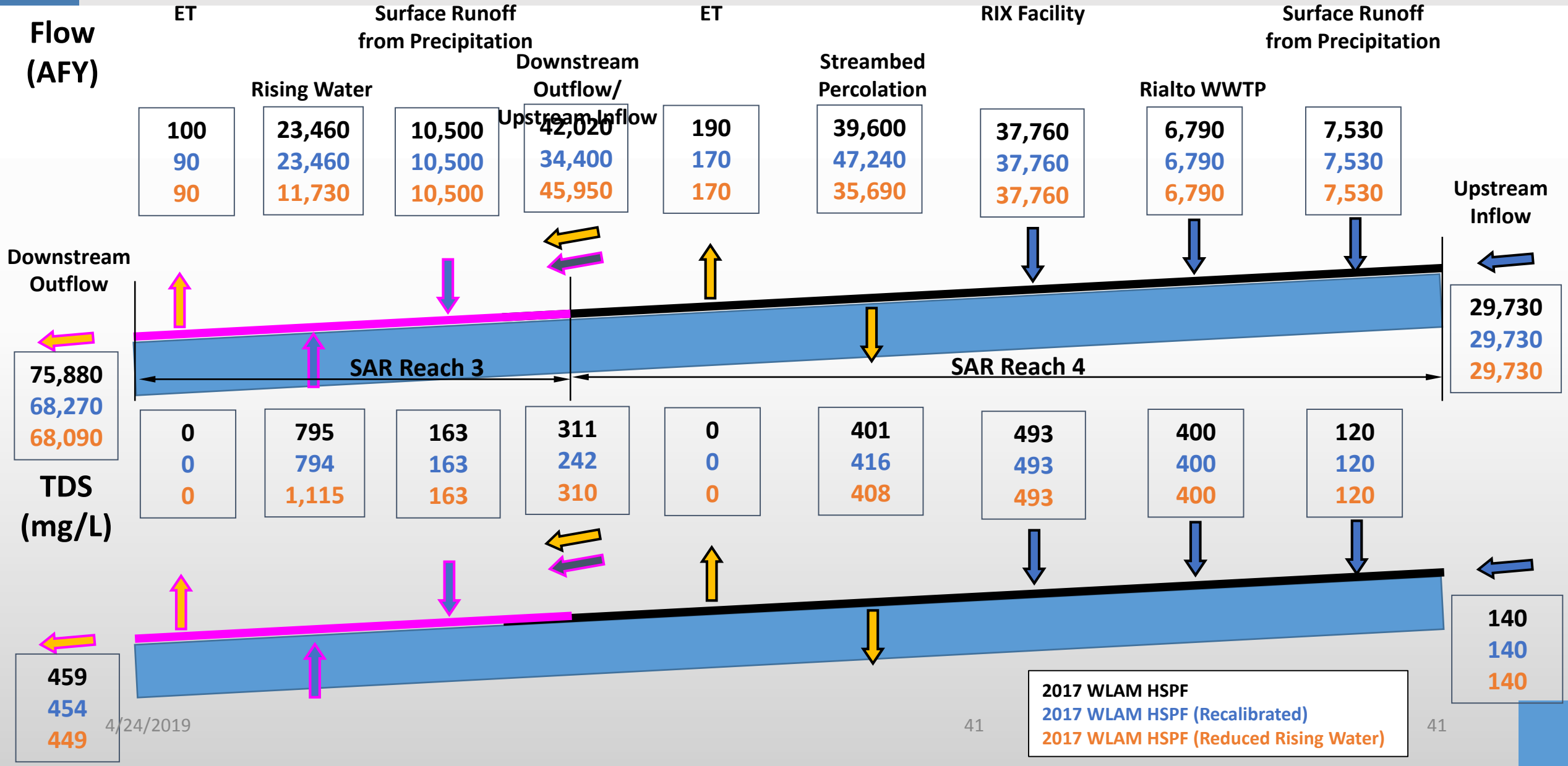
TIN Calibration Statistics (Daily)

Gaging Station	2008 WLAM WY 1995-2006	2017 WLAM HSPF WY 2007-2016	Recalibrated 2017 WLAM HSPF WY 2007-2016	Reduced Rising Water 2017 WLAM HSPF WY 2007-2016
Santa Ana River at MWD Crossing				
Average Residual, mg/L	-0.45	-0.14	-0.13	-0.02
Average of Observed, mg/L	6.14	8.45	8.45	8.45
Average Residual as Percentage of Observed, %	-7.4%	-1.7%	-1.6%	-0.2%
Standard Deviation, mg/L	2.38	1.24	1.23	1.23
RMSE	2.42	1.24	1.23	1.22
Santa Ana River below Prado Dam				
Average Residual, mg/L	-0.07	-0.54	-0.48	NA
Average of Observed, mg/L	5.13	3.92	3.92	NA
Average Residual as Percentage of Observed, %	-1.4%	-13.9%	-12.2%	NA
Standard Deviation, mg/L	1.61	1.22	1.31	NA
RMSE	1.61	1.34	1.40	NA

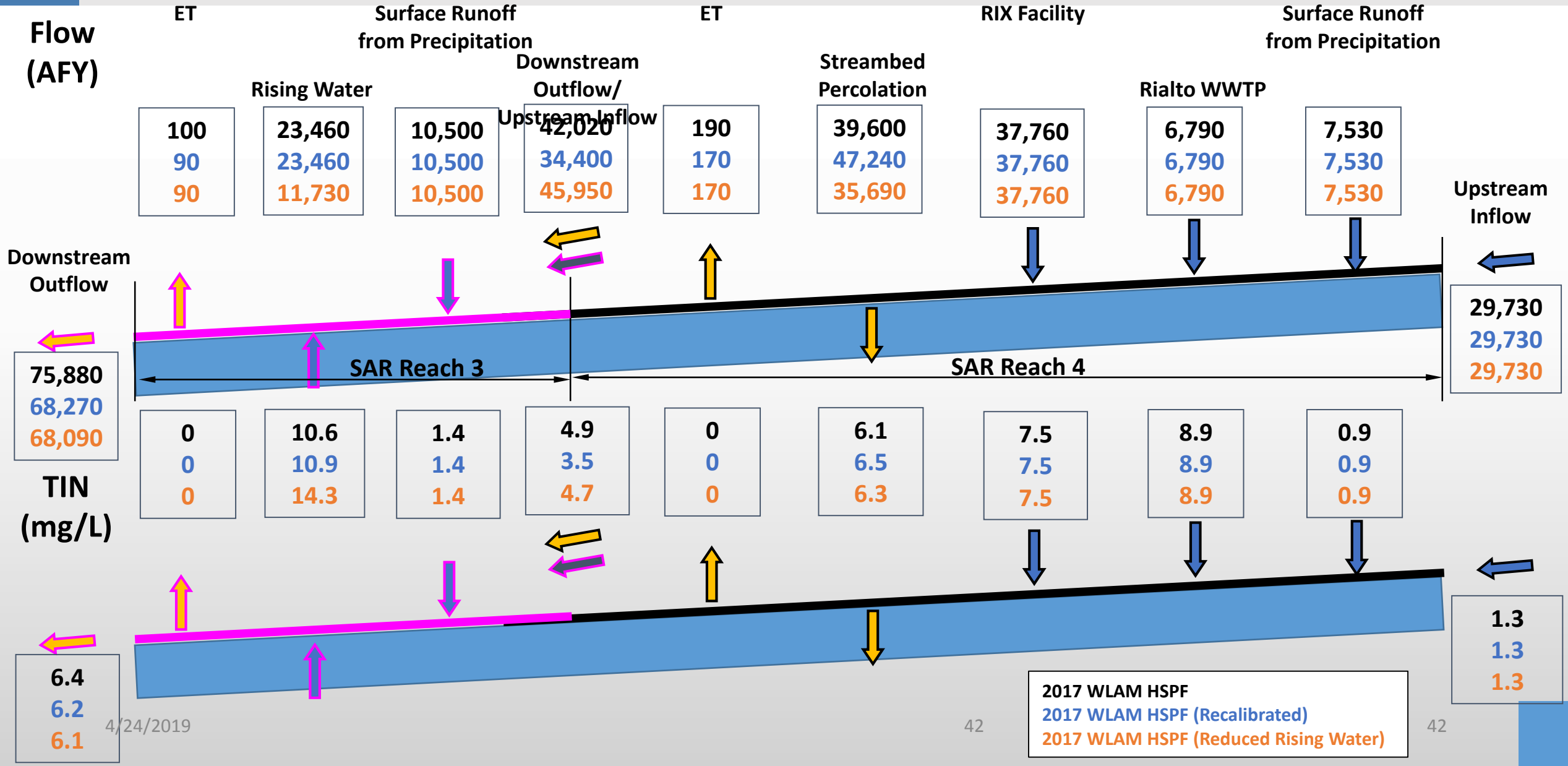
TIN Calibration Statistics (Monthly)

Gaging Station	2008 WLAM WY 1995-2006	2017 WLAM HSPF WY 2007-2016	Recalibrated 2017 WLAM HSPF WY 2007-2016	Reduced Rising Water 2017 WLAM HSPF WY 2007-2016
Santa Ana River at MWD Crossing				
Average Residual, mg/L	-0.47	-0.16	-0.15	-0.02
Average of Observed, mg/L	6.31	8.42	8.42	8.42
Average Residual as Percentage of Observed, %	-7.4%	-1.9%	-1.8%	-0.3%
Standard Deviation, mg/L	2.54	0.93	0.93	0.90
RMSE	2.56	0.93	0.93	0.89
Santa Ana River below Prado Dam				
Average Residual, mg/L	-0.23	-0.50	-0.45	NA
Average of Observed, mg/L	5.21	3.96	3.96	NA
Average Residual as Percentage of Observed, %	-4.4%	-12.6%	-11.5%	NA
Standard Deviation, mg/L	1.49	0.97	1.06	NA
RMSE	1.51	1.08	1.15	NA

Average Annual TDS Mass Balance in SAR Reach 3 and Reach 4 Overlying the Riverside-A GMZ (WY2007-2016)



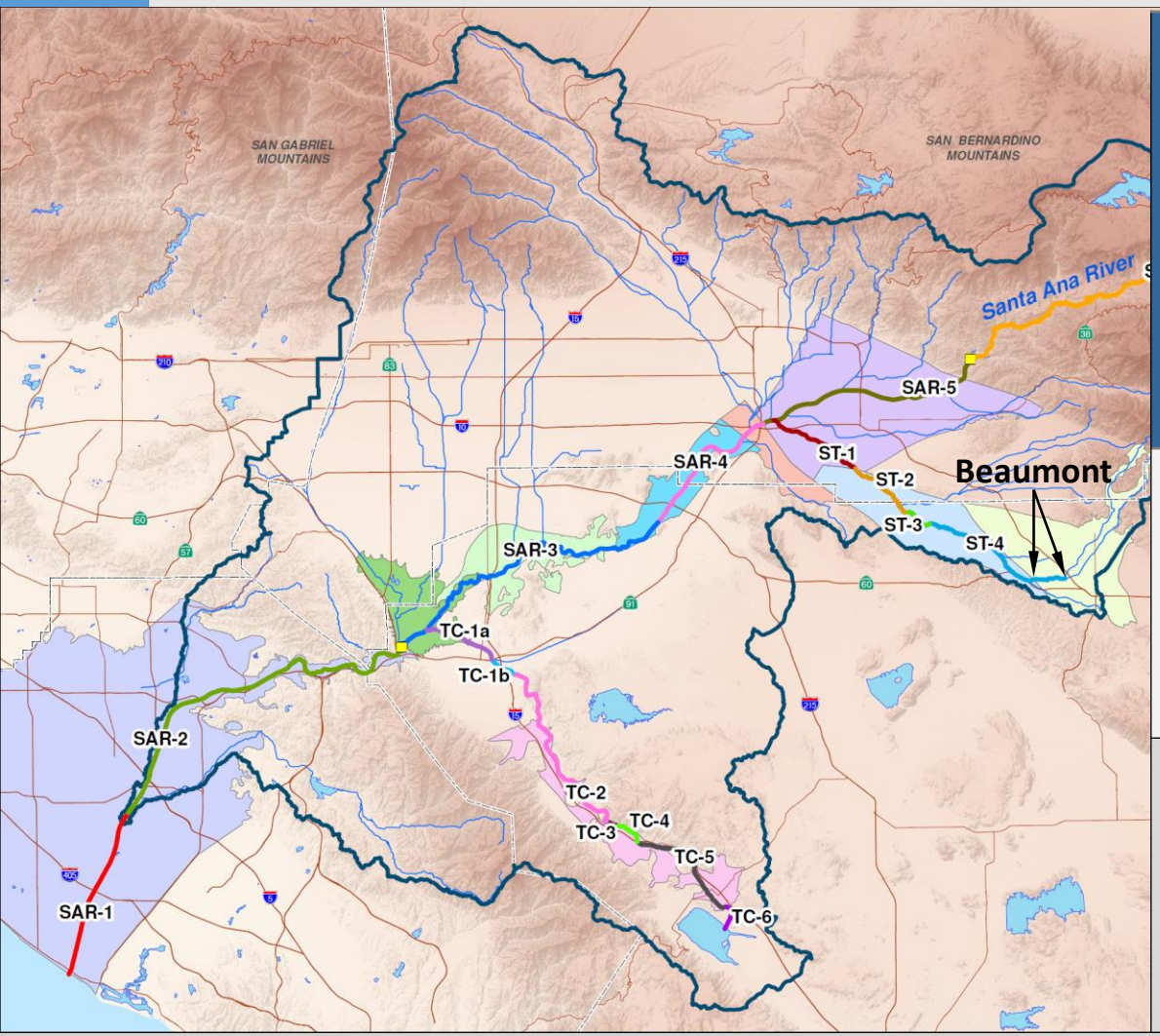
Average Annual TIN Mass Balance in SAR Reach 3 and Reach 4 Overlying the Riverside-A GMZ (WY2007-2016)



Overview

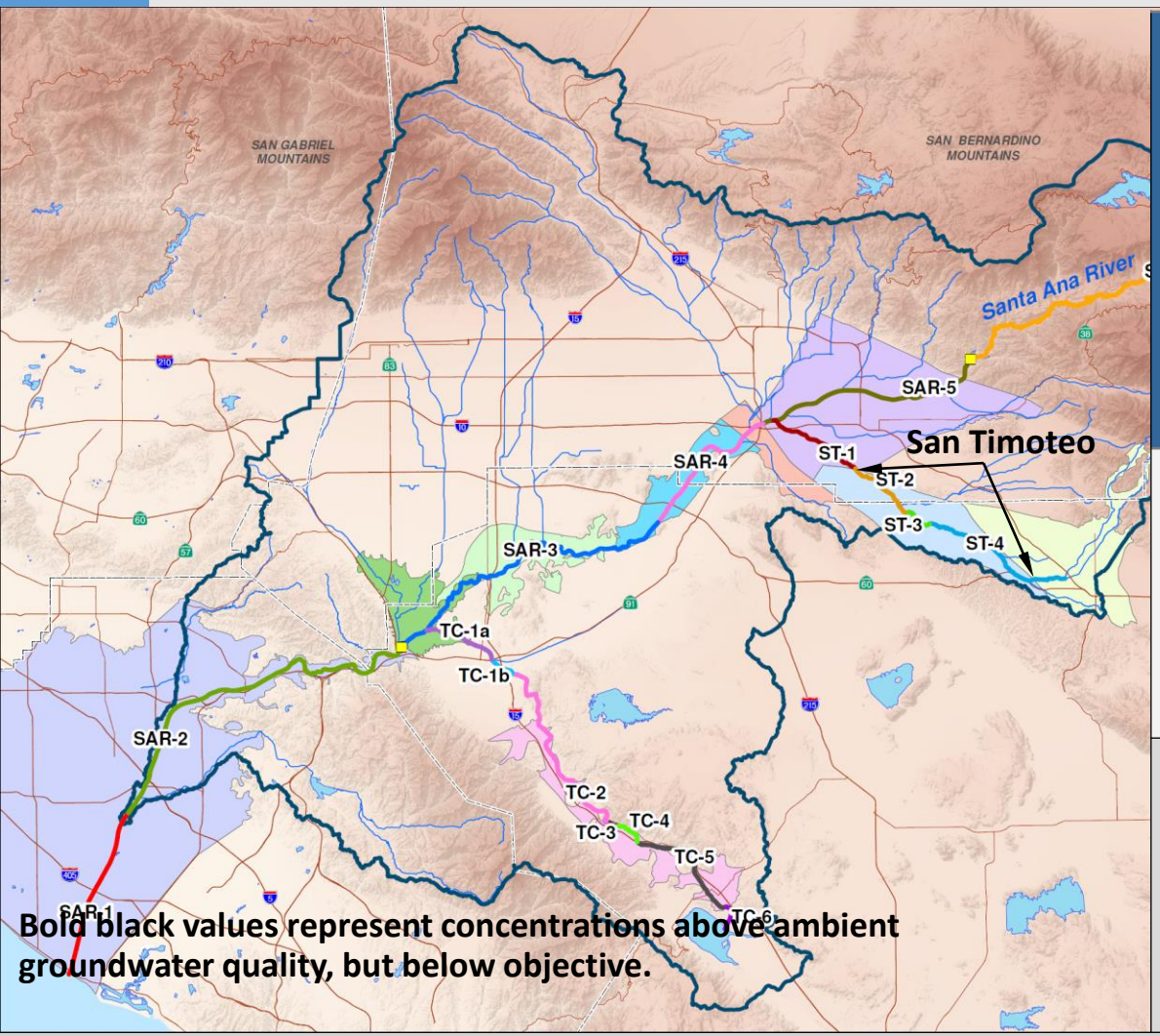
- Recalibrate WLAM with rising water as model input and compare results (Task 2o) and Sensitivity run on model calibration with reduced rising water (Task 2p).
- Use the refined calibration version from Task 2o to recalculate streambed recharge under future scenario conditions (per model run) (Task 3g).

Model Results for Scenario B – 2020 Average Expected Discharge (Reach 4 of the San Timoteo Creek overlying the Beaumont GMZ)



Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	330	290	40	1-year	230	230
				5-year	198	198
				10-year	189	189
				20-year	186	186
TIN	5.0	2.9	2.1	1-year	2.24	2.24
				5-year	1.85	1.85
				10-year	1.71	1.71
				20-year	1.65	1.65

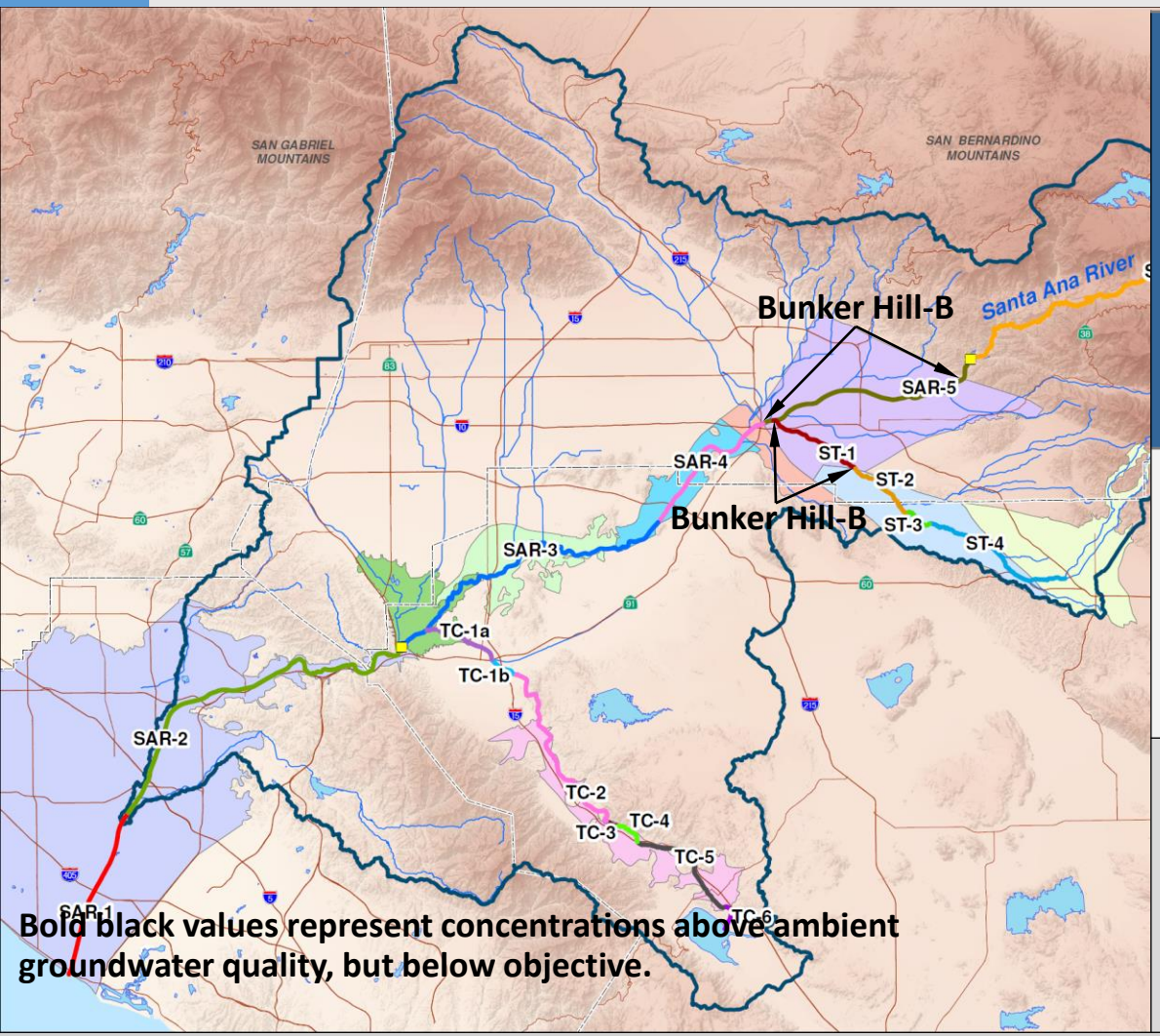
Model Results for Scenario B – 2020 Average Expected Discharge (Reach 2, 3, and 4 of the San Timoteo Creek overlying the San Timoteo GMZ)



Bold black values represent concentrations above ambient groundwater quality, but below objective.

Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	400	420	none	1-year	368	368
				5-year	353	353
				10-year	335	335
				20-year	304	304
TIN	5.0	2.0	3.0	1-year	***4.14***	***4.14***
				5-year	***3.94***	***3.94***
				10-year	***3.72***	***3.72***
				20-year	***3.36***	***3.36***

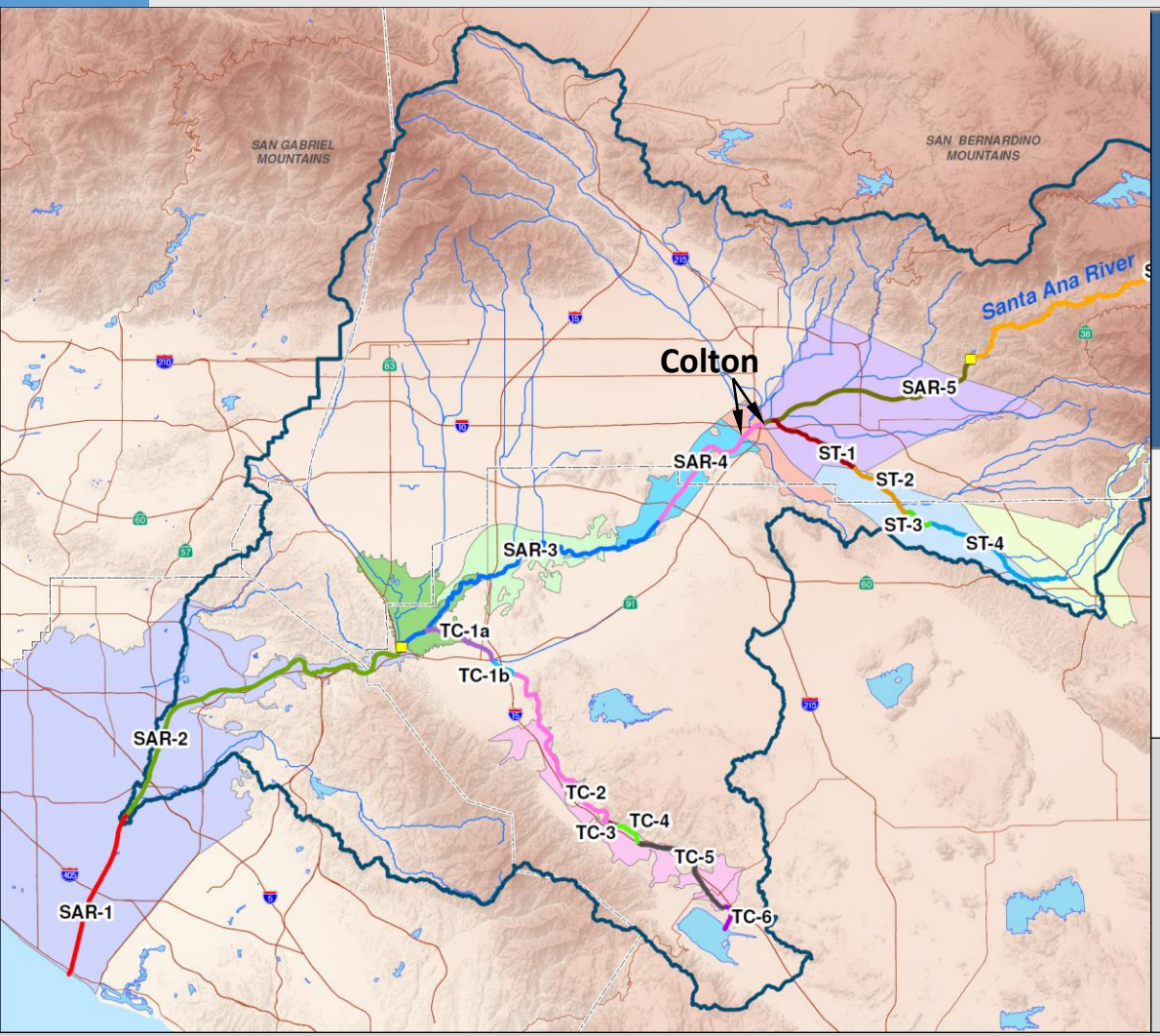
Model Results for Scenario B – 2020 Average Expected Discharge (Reach 1 of the San Timoteo Creek and Reach 5 of the Santa Ana River overlying the Bunker Hill-B GMZ)



Bold black values represent concentrations above ambient groundwater quality, but below objective.

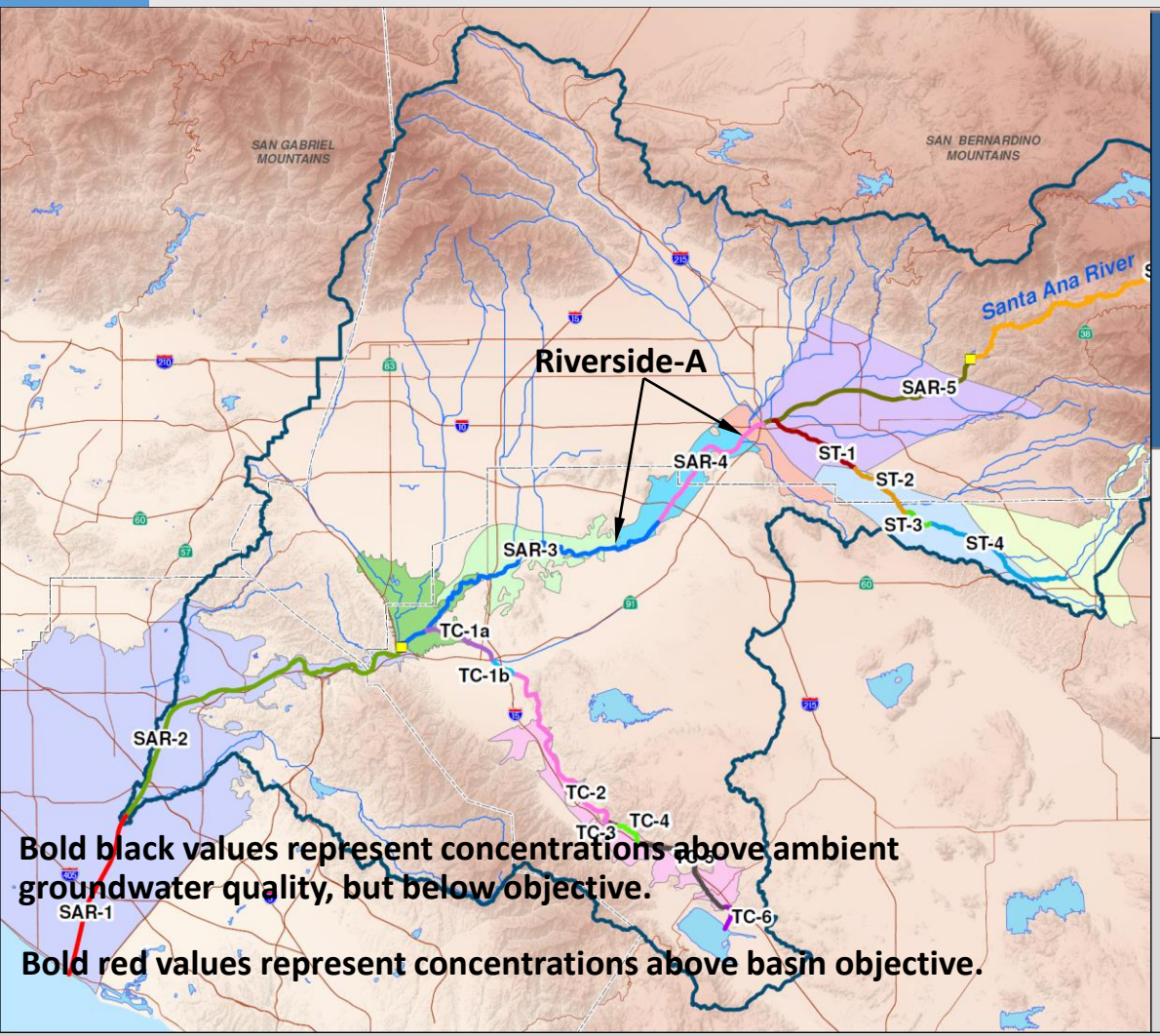
Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	330	290	40	1-year	***319***	***316***
				5-year	273	278
				10-year	257	263
				20-year	244	248
TIN	7.3	5.8	1.5	1-year	3.08	3.13
				5-year	2.61	2.72
				10-year	2.48	2.62
				20-year	2.36	2.50

Model Results for Scenario B – 2020 Average Expected Discharge (Reach 4 of the Santa Ana River overlying the Colton GMZ)



Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	410	480	none	1-year	317	307
				5-year	260	262
				10-year	251	250
				20-year	239	238
TIN	2.7	3.3	none	1-year	2.49	2.36
				5-year	2.04	2.00
				10-year	1.92	1.96
				20-year	1.86	1.85

Model Results for Scenario B – 2020 Average Expected Discharge (Reach 3 & 4 of the Santa Ana River overlying the Riverside-A GMZ)

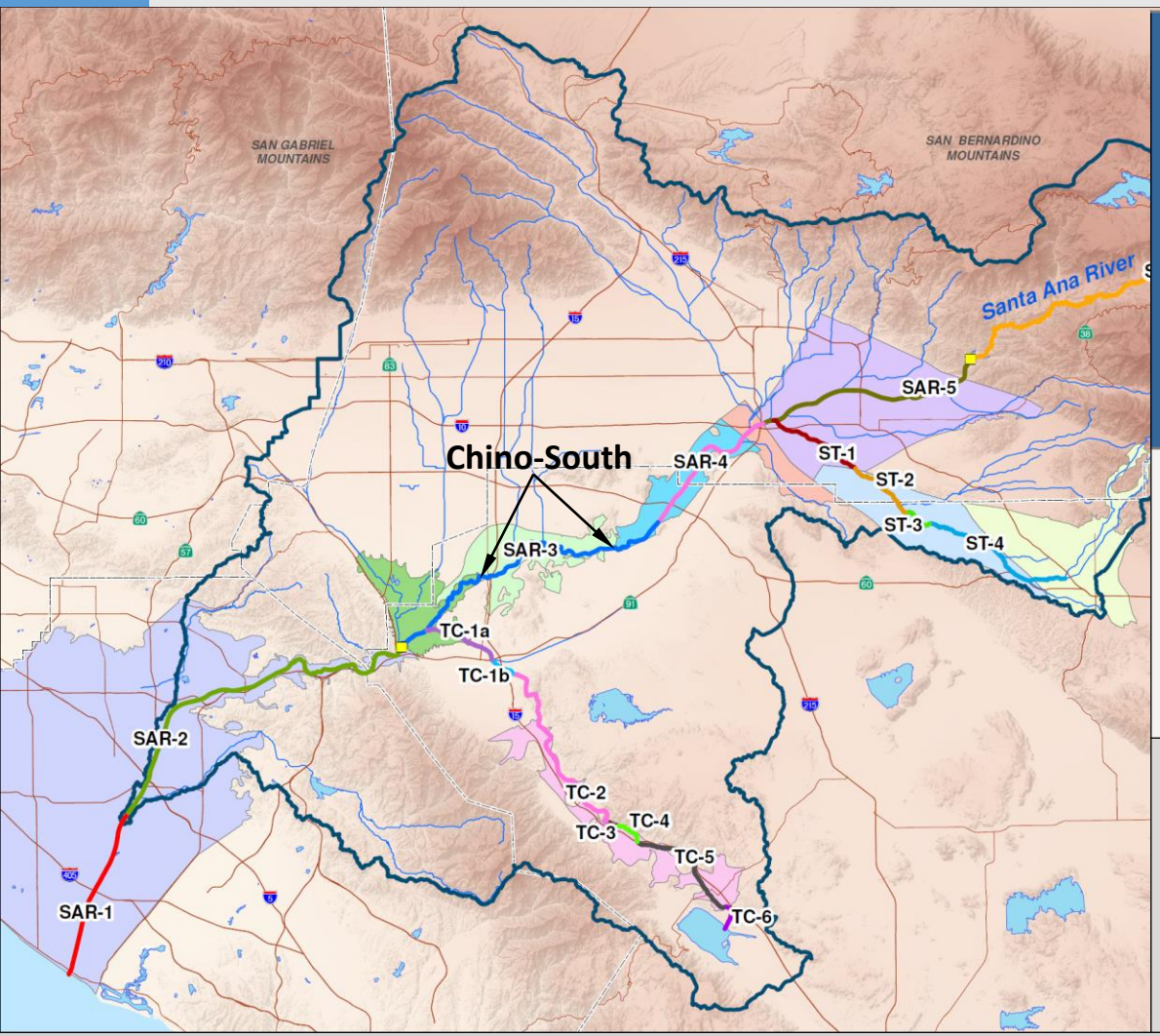


Bold black values represent concentrations above ambient groundwater quality, but below objective.

Bold red values represent concentrations above basin objective.

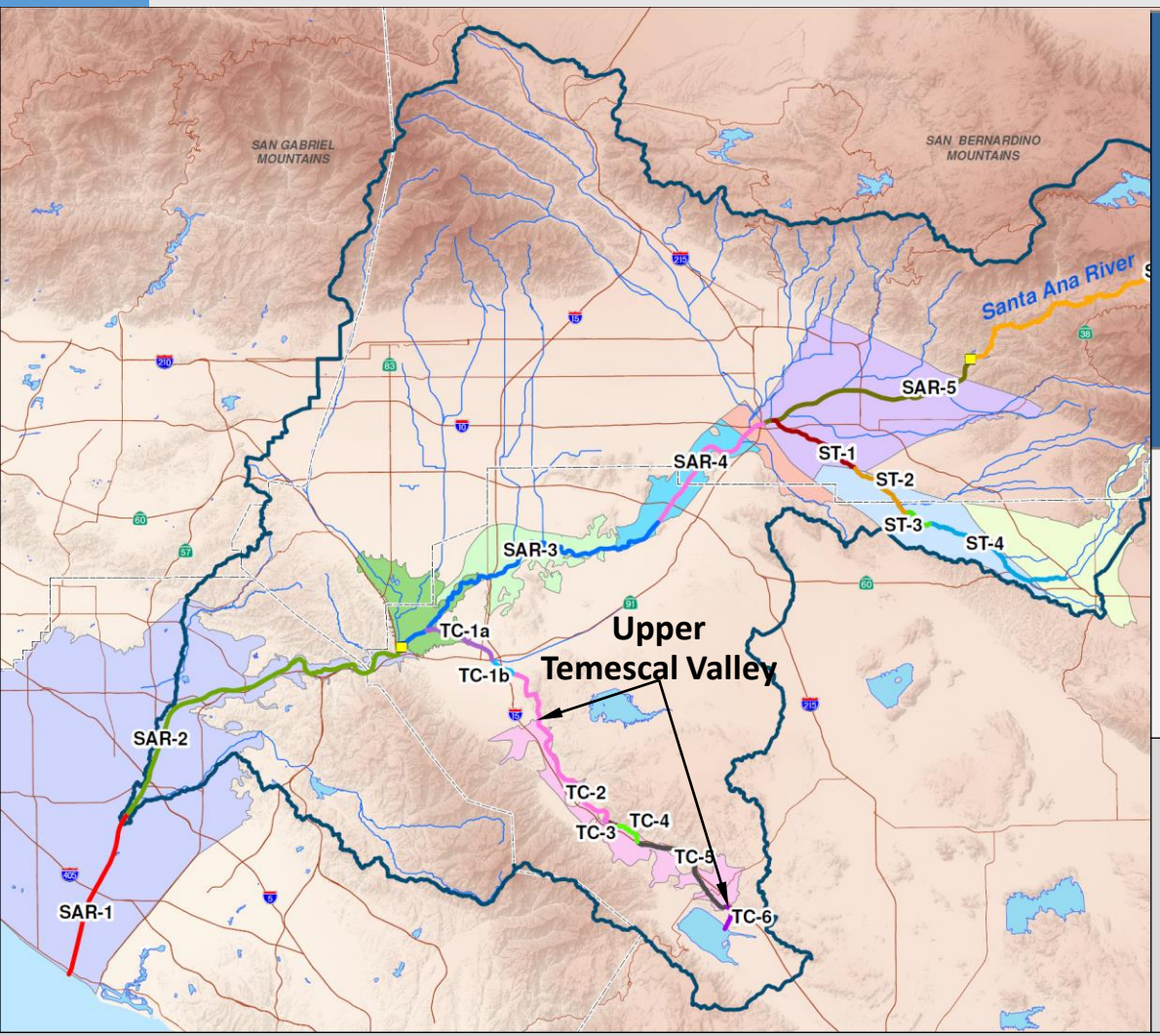
Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	560	440	120	1-year	***482***	***487***
				5-year	***453***	***453***
				10-year	439	440
				20-year	422	422
TIN	6.2	5.6	0.6	1-year	***6.46***	***6.67***
				5-year	***5.98***	***6.14***
				10-year	***5.73***	***5.96***
				20-year	5.49	***5.65***

Model Results for Scenario B – 2020 Average Expected Discharge (Reach 3 of the Santa Ana River overlying the Chino-South GMZ)



Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	680	940	none	1-year	630	644
				5-year	482	506
				10-year	418	466
				20-year	364	413
TIN	5.0	27.8	none	1-year	4.39	4.45
				5-year	3.31	3.47
				10-year	2.84	3.18
				20-year	2.47	2.83

Model Results for Scenario B – 2020 Average Expected Discharge (Reach 2, 3, 4, 5, and 6 of the Temescal Creek overlying the Upper Temescal Valley GMZ)



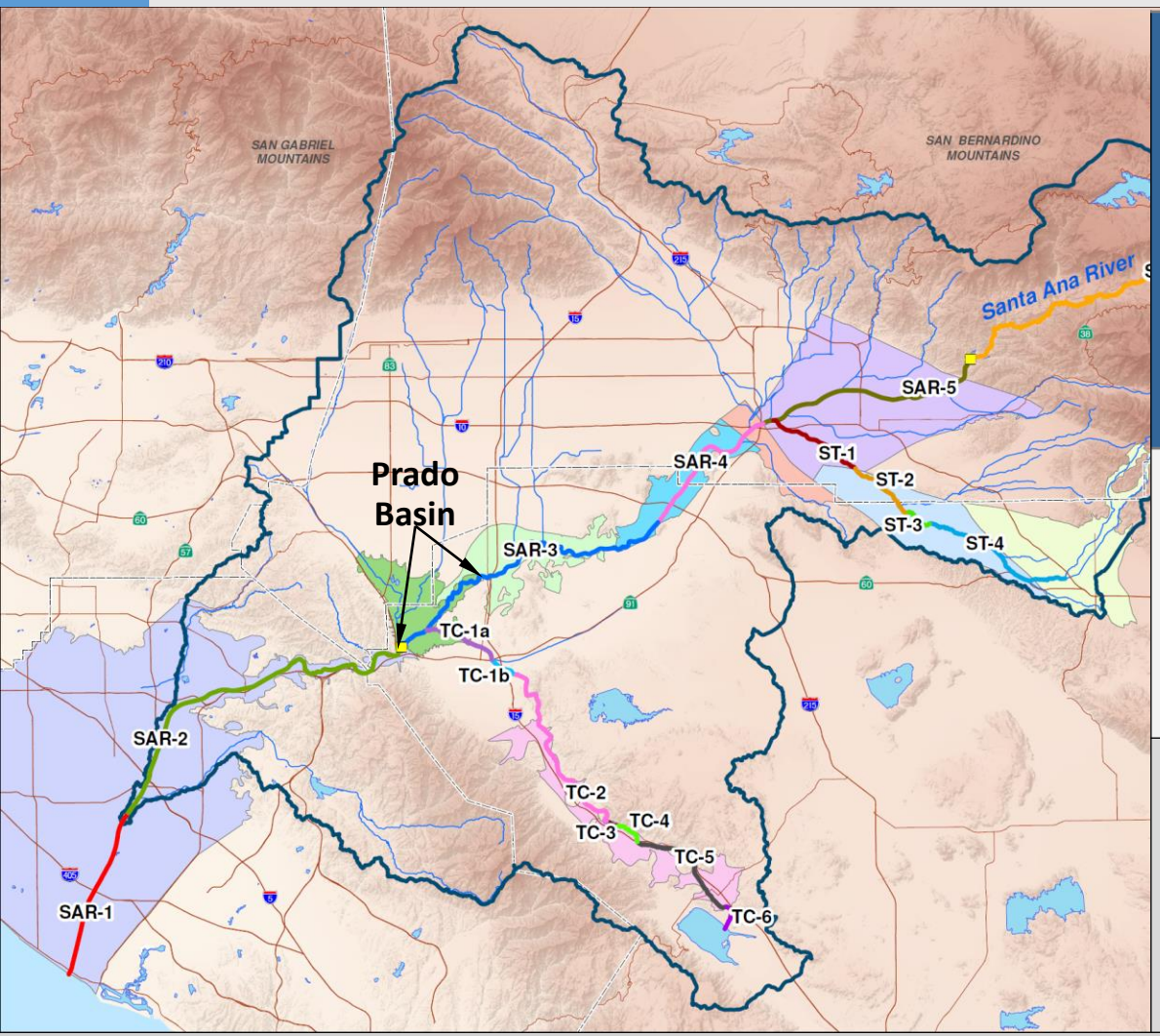
Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	820	822	none	1-year	594	404
				5-year	442	367
				10-year	408	354
				20-year	361	349
TIN	7.9	7.9	none	1-year	6.34	4.48
				5-year	4.66	4.02
				10-year	4.30	3.84
				20-year	3.81	3.75

Lake Elsinore Spill (Table 1)

- No lake spill assumptions will be included in final runs
- Bookend assumptions for Elsinore Valley Discharges capture possible water quality in Temescal Creek

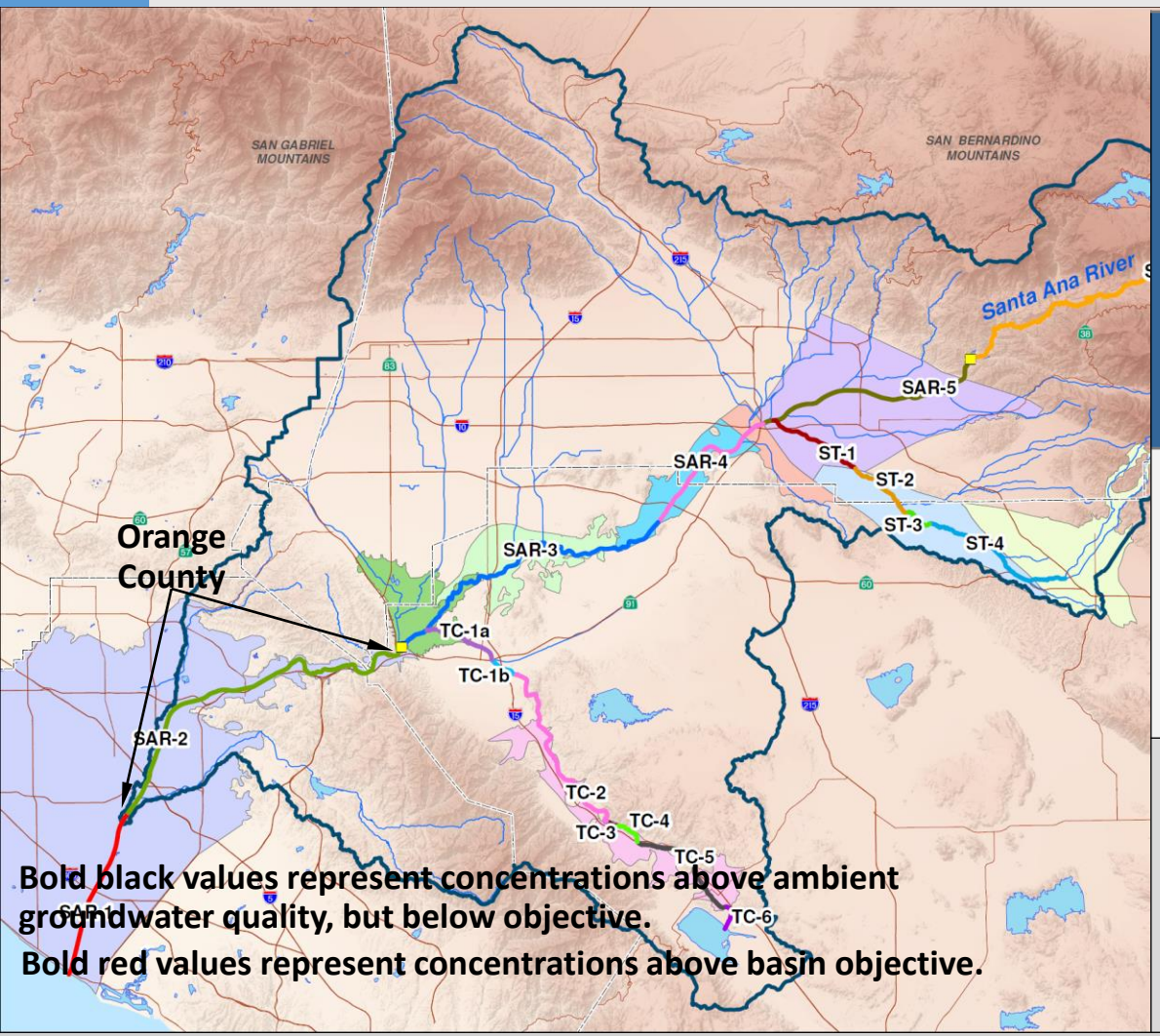
Agency	Facility / Discharge Point	Current Design Capacity [MGD]	2020 Design Capacity [MGD]	2040 Design Capacity [MGD]	Permit TDS [mg/L]	Permit TIN [mg/L]	Version	Scen A 2020 Max Discharge [MGD]	Scen B 2020 Avg Discharge [MGD]	Scen C 2020 Min Discharge [MGD]	Scen D 2040 Max Discharge [MGD]	Scen E 2040 Avg Discharge [MGD]	Scen F 2040 Min Discharge [MGD]
Elsinore Valley Municipal Water District	Regional WWRF - DP001 (Temescal Wash)	8	12	-	700	10.0	TM 3 (28-Sep-18)	0.5 / 12.0	0.5 / 12.0	0.5 / 12.0	0.5 / 16.8	0.5 / 16.8	0.5 / 16.8
							Updated	8.0	0.5	0.5	8.0	0.5	0.5

Model Results for Scenario B – 2020 Average Expected Discharge (Reach 3 of the Santa Ana River overlying the Prado Basin GMZ)



Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	550 - 700	na	none	1-year	634	662
				5-year	617	646
				10-year	610	638
				20-year	600	629
TIN	8.0 - 10.0	na	none	1-year	5.88	6.34
				5-year	5.73	6.18
				10-year	5.66	6.10
				20-year	5.59	6.02

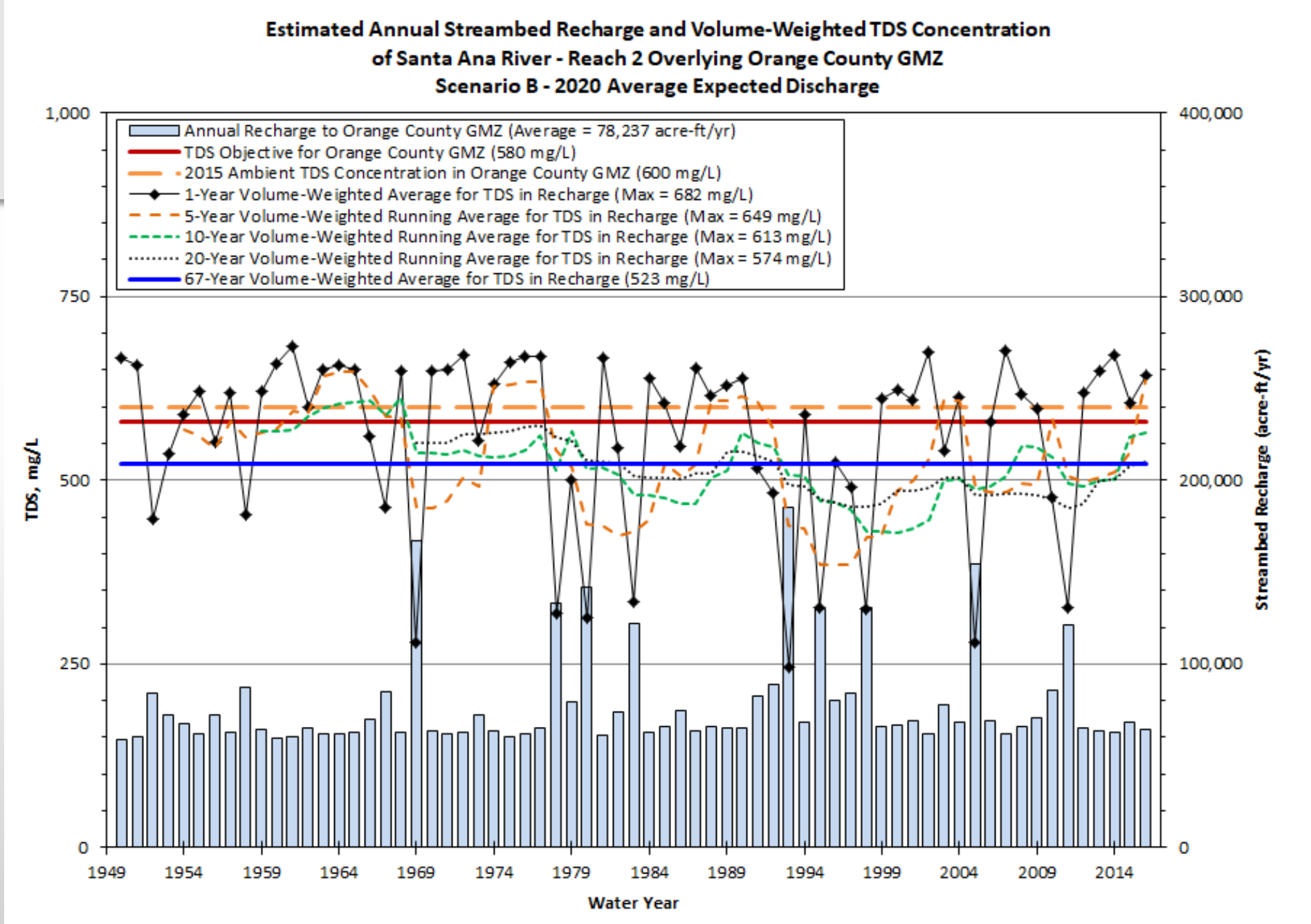
Model Results for Scenario B – 2020 Average Expected Discharge (Reach 2 of the Santa Ana River overlying the Orange County GMZ)

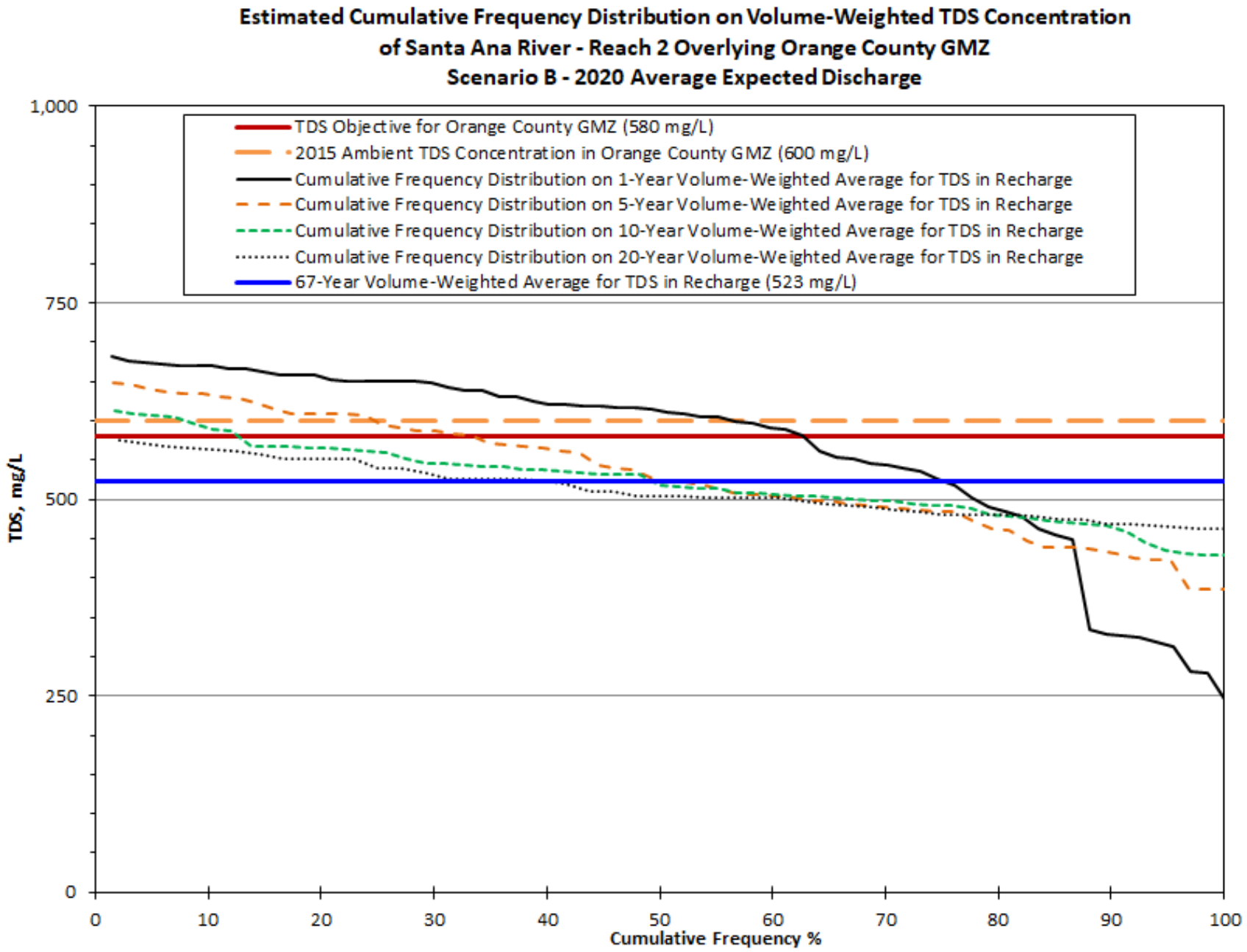


Bold black values represent concentrations above ambient groundwater quality, but below objective.

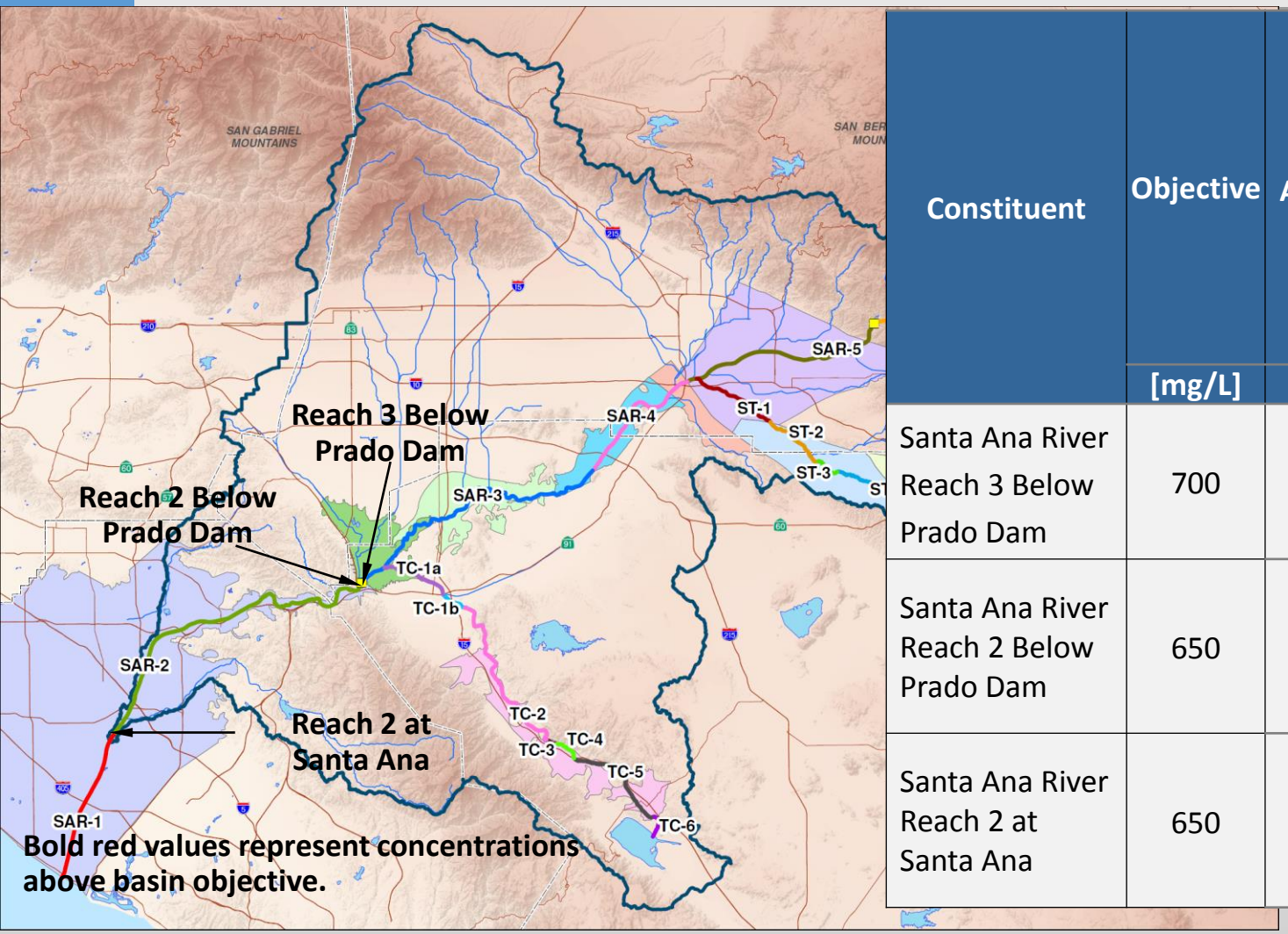
Bold red values represent concentrations above basin objective.

Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
TDS	580	600	none	1-year	285	***682***
				5-year	274	***649***
				10-year	271	***613***
				20-year	269	574
TIN	3.4	3.0	0.4	1-year	0.89	***3.06***
				5-year	0.85	2.93
				10-year	0.82	2.79
				20-year	0.77	2.65


Estimated Annual Streambed Recharge and Volume-Weighted TDS Concentration
of Santa Ana River - Reach 2 Overlying Orange County GMZ
Scenario B - 2020 Average Expected Discharge
Annual Recharge to Orange County GMZ (Average = 78,237 acre-ft/yr)
TDS Objective for Orange County GMZ (580 mg/L)
2015 Ambient TDS Concentration in Orange County GMZ (600 mg/L)
1-Year Volume-Weighted Average for TDS in Recharge (Max = 682 mg/L)
5-Year Volume-Weighted Running Average for TDS in Recharge (Max = 649 mg/L)
10-Year Volume-Weighted Running Average for TDS in Recharge (Max = 613 mg/L)
20-Year Volume-Weighted Running Average for TDS in Recharge (Max = 574 mg/L)
67-Year Volume-Weighted Average for TDS in Recharge (523 mg/L)
TDS, mg/L
Streambed Recharge (acre-ft/yr)
Water Year
1,000
750
500
250
0
400,000
300,000
200,000
100,000
0
1949
1954
1959
1964
1969
1974
1979
1984
1989
1994
1999
2004
2009
2014

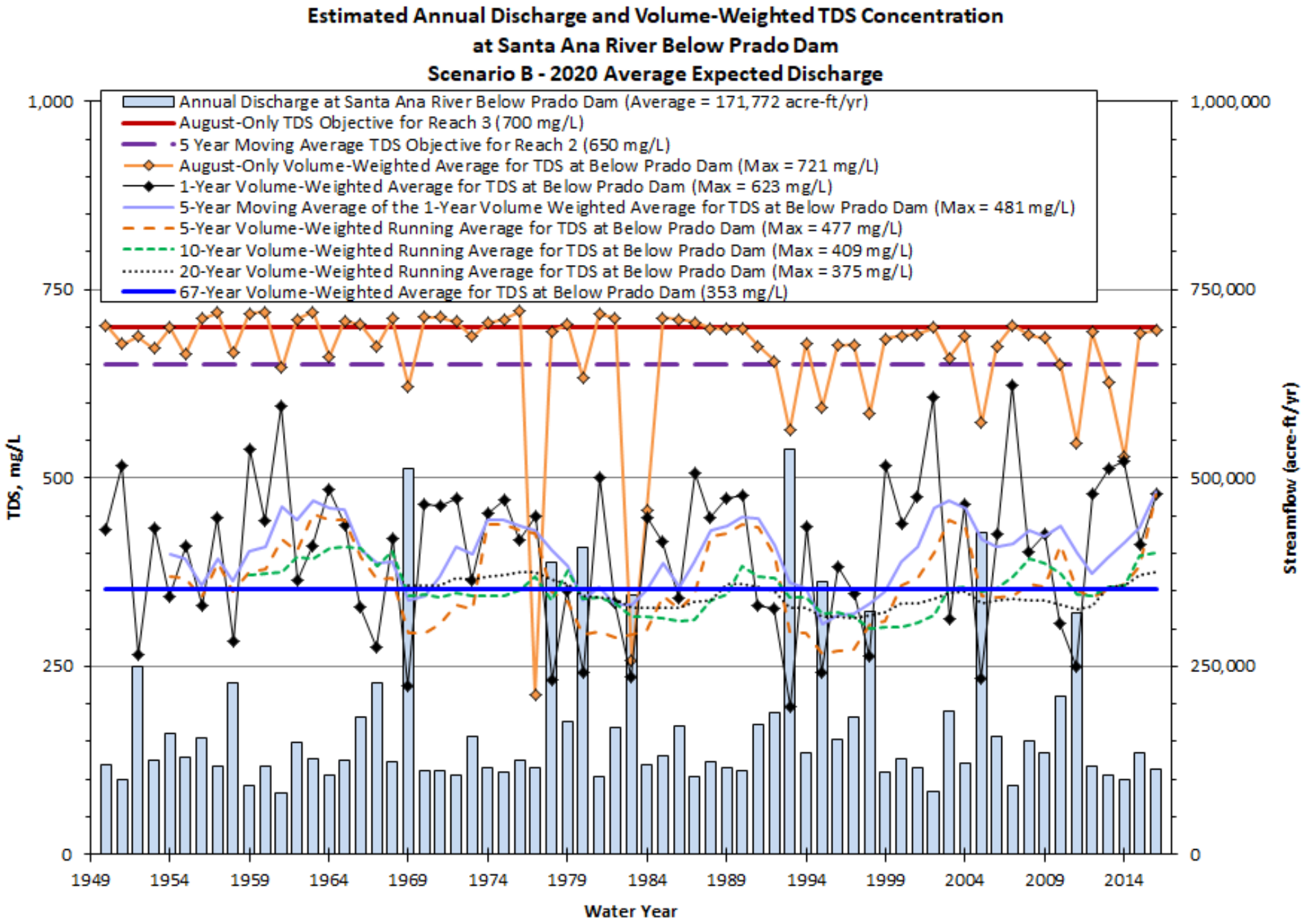

Estimated Cumulative Frequency Distribution on Volume-Weighted TDS Concentration
of Santa Ana River - Reach 2 Overlying Orange County GMZ
Scenario B - 2020 Average Expected Discharge
TDS Objective for Orange County GMZ (580 mg/L)
2015 Ambient TDS Concentration in Orange County GMZ (600 mg/L)
Cumulative Frequency Distribution on 1-Year Volume-Weighted Average for TDS in Recharge
Cumulative Frequency Distribution on 5-Year Volume-Weighted Average for TDS in Recharge
Cumulative Frequency Distribution on 10-Year Volume-Weighted Average for TDS in Recharge
Cumulative Frequency Distribution on 20-Year Volume-Weighted Average for TDS in Recharge
67-Year Volume-Weighted Average for TDS in Recharge (523 mg/L)
TDS, mg/L
1,000
750
500
250
0
0
10
20
30
40
50
60
70
80
90
100
Cumulative Frequency %

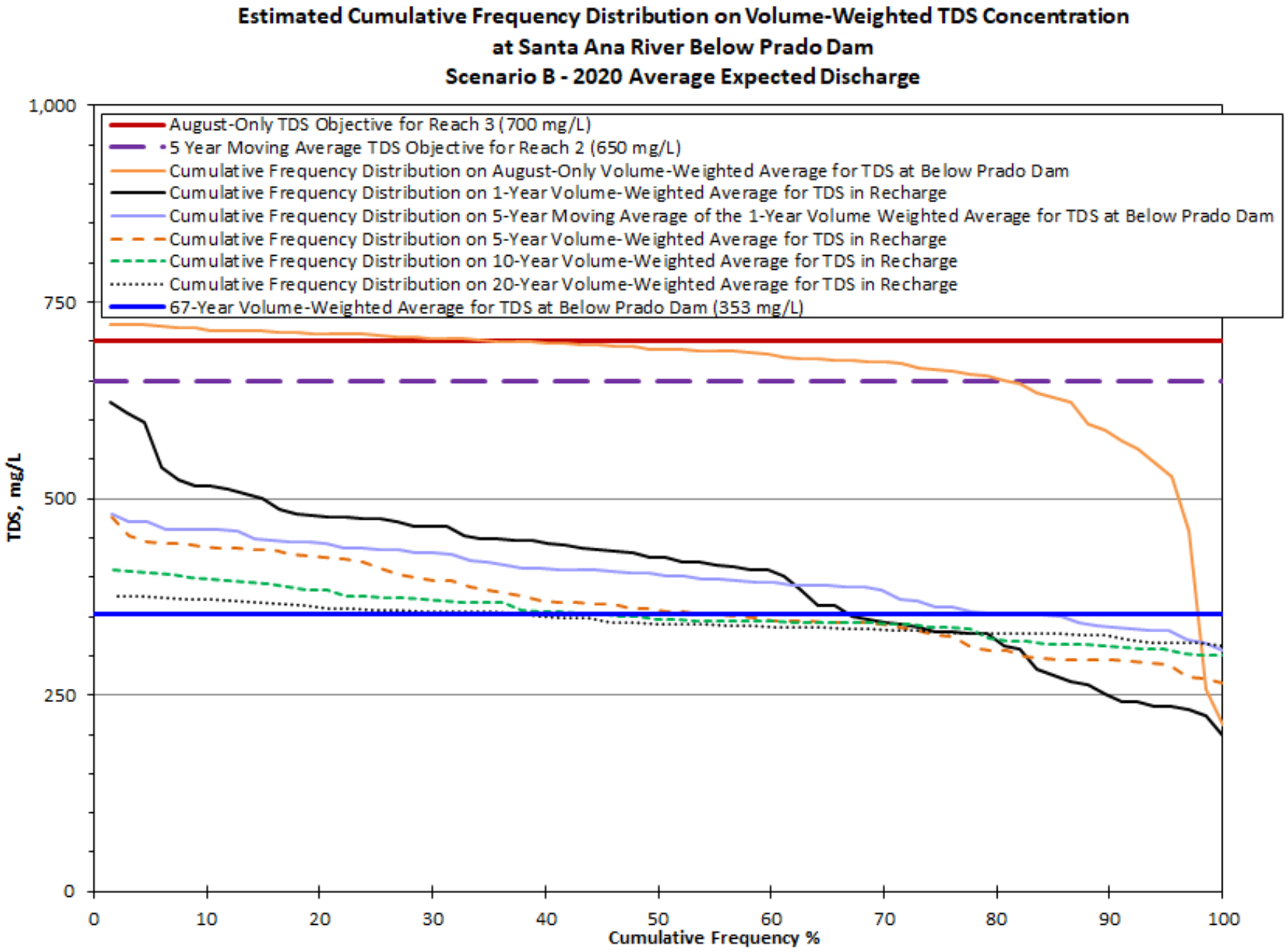
TDS Model Results for Scenario B – 2020 Average Expected Discharge (Surface Water)



Bold red values represent concentrations above basin objective.

Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
Santa Ana River Reach 3 Below Prado Dam	700	550	na	August Only	***714***	***721***
Santa Ana River Reach 2 Below Prado Dam	650	573	na	5-year moving average of the 1-year volume-weighted average	431	481
Santa Ana River Reach 2 at Santa Ana	650	573	na	5-year moving average of the 1-year volume-weighted average	275	176


Estimated Annual Discharge and Volume-Weighted TDS Concentration
at Santa Ana River Below Prado Dam
Scenario B - 2020 Average Expected Discharge
Annual Discharge at Santa Ana River Below Prado Dam (Average = 171,772 acre-ft/yr)
August-Only TDS Objective for Reach 3 (700 mg/L)
5 Year Moving Average TDS Objective for Reach 2 (650 mg/L)
August-Only Volume-Weighted Average for TDS at Below Prado Dam (Max = 721 mg/L)
1-Year Volume-Weighted Average for TDS at Below Prado Dam (Max = 623 mg/L)
5-Year Moving Average of the 1-Year Volume Weighted Average for TDS at Below Prado Dam (Max = 481 mg/L)
5-Year Volume-Weighted Running Average for TDS at Below Prado Dam (Max = 477 mg/L)
10-Year Volume-Weighted Running Average for TDS at Below Prado Dam (Max = 409 mg/L)
20-Year Volume-Weighted Running Average for TDS at Below Prado Dam (Max = 375 mg/L)
67-Year Volume-Weighted Average for TDS at Below Prado Dam (353 mg/L)
TDS, mg/L
Streamflow (acre-ft/yr)
Water Year
1,000
750
500
250
0
1,000,000
750,000
500,000
250,000
0
1949
1954
1959
1964
1969
1974
1979
1984
1989
1994
1999
2004
2009
2014


Estimated Cumulative Frequency Distribution on Volume-Weighted TDS Concentration
at Santa Ana River Below Prado Dam
Scenario B - 2020 Average Expected Discharge
August-Only TDS Objective for Reach 3 (700 mg/L)
5 Year Moving Average TDS Objective for Reach 2 (650 mg/L)
Cumulative Frequency Distribution on August-Only Volume-Weighted Average for TDS at Below Prado Dam
Cumulative Frequency Distribution on 1-Year Volume-Weighted Average for TDS in Recharge
Cumulative Frequency Distribution on 5-Year Moving Average of the 1-Year Volume Weighted Average for TDS at Below Prado Dam
Cumulative Frequency Distribution on 5-Year Volume-Weighted Average for TDS in Recharge
Cumulative Frequency Distribution on 10-Year Volume-Weighted Average for TDS in Recharge
Cumulative Frequency Distribution on 20-Year Volume-Weighted Average for TDS in Recharge
67-Year Volume-Weighted Average for TDS at Below Prado Dam (353 mg/L)
TDS, mg/L
1,000
750
500
250
0
0
10
20
30
40
50
60
70
80
90
100
Cumulative Frequency %

Updated IEUA POTW Discharge

- Projected discharge (varied monthly) was provided by IEUA/Chino Basin Watermaster

Exhibit 1 - Revised Assumptions for IEUA Discharges for Use in Scenarios B and D for the 2017 WLAM

Table A - Projected Aggregate Monthly Discharge - All IEUA DPs - Breakdown by Plant in tables B through E

	July	August	September	October	November	December	January	February	March	April	May	June	Total
2020 af	687	592	803	1,211	1,592	2,536	2,521	2,066	1,887	1,312	1,217	602	17,026
2020 mgd	7.2	6.2	8.7	12.7	17.3	26.7	26.5	24.0	19.8	14.2	12.8	6.5	15.2
2040 af	687	592	803	1,211	1,592	2,536	2,521	2,066	1,887	1,312	1,217	602	17,026
2040 mgd	7.2	6.2	8.7	12.7	17.3	26.7	26.5	24.0	19.8	14.2	12.8	6.5	15.2

Table B - Projected Monthly Discharge for RP1 - 001 (Prado)

	July	August	September	October	November	December	January	February	March	April	May	June	Total
2020 af	106	119	136	132	153	176	154	150	110	106	110	116	1,568
2020 mgd	1.1	1.3	1.5	1.4	1.7	1.8	1.6	1.7	1.2	1.1	1.2	1.3	1.4
2040 af	106	119	136	132	153	176	154	150	110	106	110	116	1,568
2040 mgd	1.1	1.3	1.5	1.4	1.7	1.8	1.6	1.7	1.2	1.1	1.2	1.3	1.4

Table C - Projected Aggregate Monthly Discharge for RP1/RP4 - 002 (Cucamonga Creek)

	July	August	September	October	November	December	January	February	March	April	May	June	Total
2020 af	281	237	451	719	947	1,688	1,473	1,049	1,007	521	542	157	9,073
2020 mgd	3.0	2.5	4.9	7.6	10.3	17.7	15.5	12.2	10.6	5.7	5.7	1.7	8.1
2040 af	281	237	451	719	947	1,688	1,473	1,049	1,007	521	542	157	9,073
2040 mgd	3.0	2.5	4.9	7.6	10.3	17.7	15.5	12.2	10.6	5.7	5.7	1.7	8.1

Table D - Projected Aggregate Monthly Discharge for RP5

	July	August	September	October	November	December	January	February	March	April	May	June	Total
2020 af	28	26	50	187	290	426	513	434	319	215	235	79	2,800
2020 mgd	0.3	0.3	0.5	2.0	3.1	4.5	5.4	5.0	3.3	2.3	2.5	0.9	2.5
2040 af	28	26	50	187	290	426	513	434	319	215	235	79	2,800
2040 mgd	0.3	0.3	0.5	2.0	3.1	4.5	5.4	5.0	3.3	2.3	2.5	0.9	2.5

Table E - Projected Aggregate Monthly Discharge for Carbon Canyon WRP

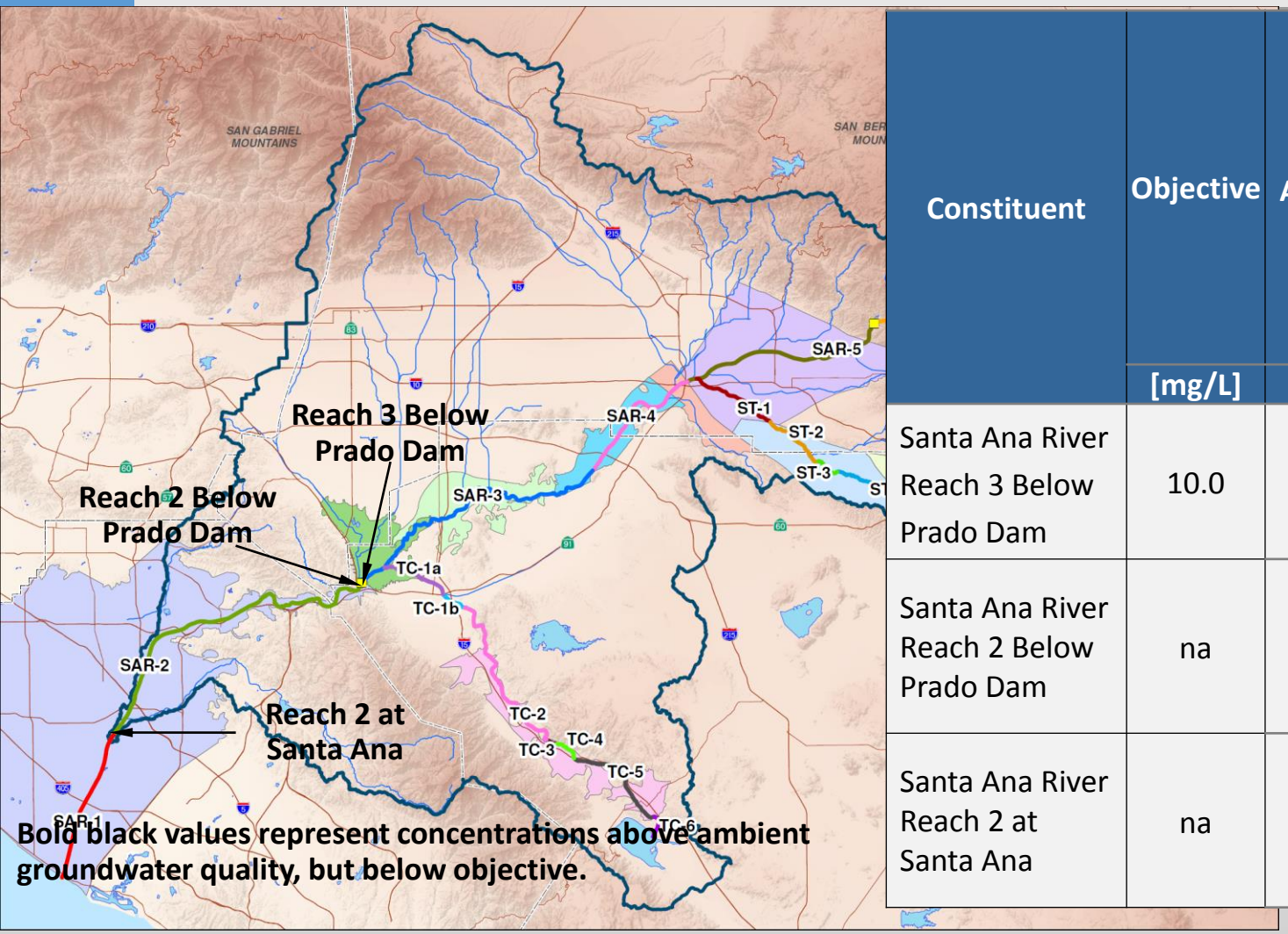
	July	August	September	October	November	December	January	February	March	April	May	June	Total
2020 af	350	238	149	112	108	123	313	424	532	594	358	282	3,584
2020 mgd	3.7	2.5	1.6	1.2	1.2	1.3	3.3	4.9	5.6	6.5	3.8	3.1	3.2
2040 af	350	238	149	112	108	123	313	424	532	594	358	282	3,584
2040 mgd	3.7	2.5	1.6	1.2	1.2	1.3	3.3	4.9	5.6	6.5	3.8	3.1	3.2

Updated Corona Discharge TDS Concentrations (Table 1)

Agency	Facility / Discharge Point	Current Design Capacity [MGD]	2020 Design Capacity [MGD]	2040 Design Capacity [MGD]	Permit TDS [mg/L]	Permit TIN [mg/L]	Scen A 2020 Max Discharge [MGD]	Scen B 2020 Avg Discharge [MGD]	Scen C 2020 Min Discharge [MGD]	Scen D 2040 Max Discharge [MGD]	Scen E 2040 Avg Discharge [MGD]	Scen F 2040 Min Discharge [MGD]
City of Corona	Corona WWTP-1	11.5	-	15	700[G]	10.0	11.5	4.6	1.5	15.0	8.5	1.5

G. A TDS concentration of 665 mg/L is applied in wetter months (December through April) while a concentration of 725 mg/L is applied in drier months (May through November). The average TDS concentration is 700 mg/L.

TIN Model Results for Scenario B – 2020 Average Expected Discharge (Surface Water)



Constituent	Objective	Ambient	Assimilative Capacity	Compliance Period	Maximum Value for the Volume-Weighted Recharge for the Planning Period Hydrology	
					TM 3 (28-Sep-18)	Recalibrated Model with Updated Assumptions (22-Apr-19)
	[mg/L]	[mg/L]	[mg/L]		[mg/L]	[mg/L]
Santa Ana River Reach 3 Below Prado Dam	10.0	2.1	na	August Only	***5.59***	***5.67***
Santa Ana River Reach 2 Below Prado Dam	na	na	na	5-year moving average of the 1-year volume-weighted average	3.56	4.14
Santa Ana River Reach 2 at Santa Ana	na	na	na	5-year moving average of the 1-year volume-weighted average	1.05	1.17