Recomputation of Ambient Water Quality in the Santa Ana River Watershed

BMPTF: May 13, 2020

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Ambient Water Quality Phases

1: Data Gathering

- ✓ Data Compilation
- ✓ QA/QC, Process, and Upload recent data

2: Point Statistics

- ✓ Calculate Water Quality Point Statistics
- ✓ Shapiro-Wilk Test for Normality

3: Computations

- ✓ Groundwater Elevation Contours
- ✓ Nitrate, TDS Concentrations
- ✓ Compute ambient water quality for GMZs

4: Interpretive Tools

- ✓ Innovative Interpretive Tools

AWQ DRAFT TM

- Draft Technical Memorandum
- Released for comment on April 16, 2020
- Please respond with comments on the Draft TM by Monday, May 18, 2020

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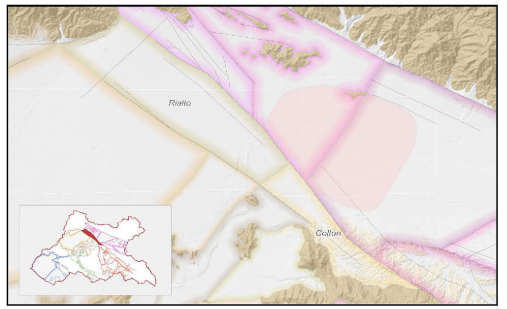
Attachment B
Subwatershed Packets

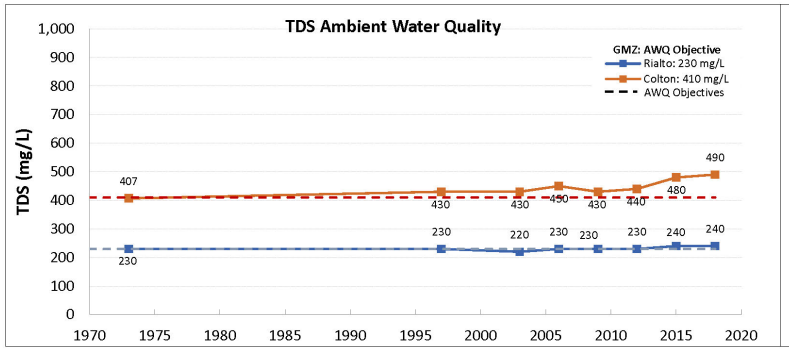
Attachment Contents:

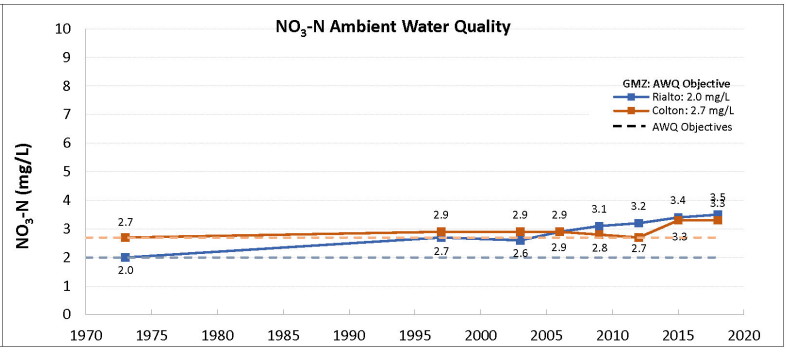
B12-1 Groundwater Storage and Elevation Contours Fall 2018
B12-2 NO_3-N Concentration and Contour Map
B12-3 TDS Concentration and Contour Map
B12-4 NO_3-N Concentration Change (1996-2015 to 1999-2018)
B12-5 TDS Concentration Change (1996-2015 to 1999-2018)



TDS and Nitrate Water Quality Objectives, Ambient Water Quality, and Assimilative Capacity

Management Zone	Water Quality Objective	Historical Ambient (1954-1973)[1]	1997 Ambient (1978-1997)	2003 Ambient (1984-2003)	2006 Ambient (1987-2006)	2009 Ambient (1990-2009)	2012 Ambient (1993-2012)	2015 Ambient (1996-2015)	2018 Ambient (1999-2018)	Difference from 2015 to 2018	Assimilative Capacity
Total Dissolved Solids (mg/L)											
Colton	410	407	430	430	450	430	440	480	490	10	None (-80)
Rialto	230	230	230	220	230	230	230	240	240	0	None (-10)
Nitrate as Nitrogen (mg/L)											
Colton	2.7	2.7	2.9	2.9	2.9	2.8	2.7	3.3	3.3	0.0	None (-0.6)
Rialto	2.0	2.0	2.7	2.6	2.9	3.1	3.2	3.4	3.5	0.1	None (-1.5)





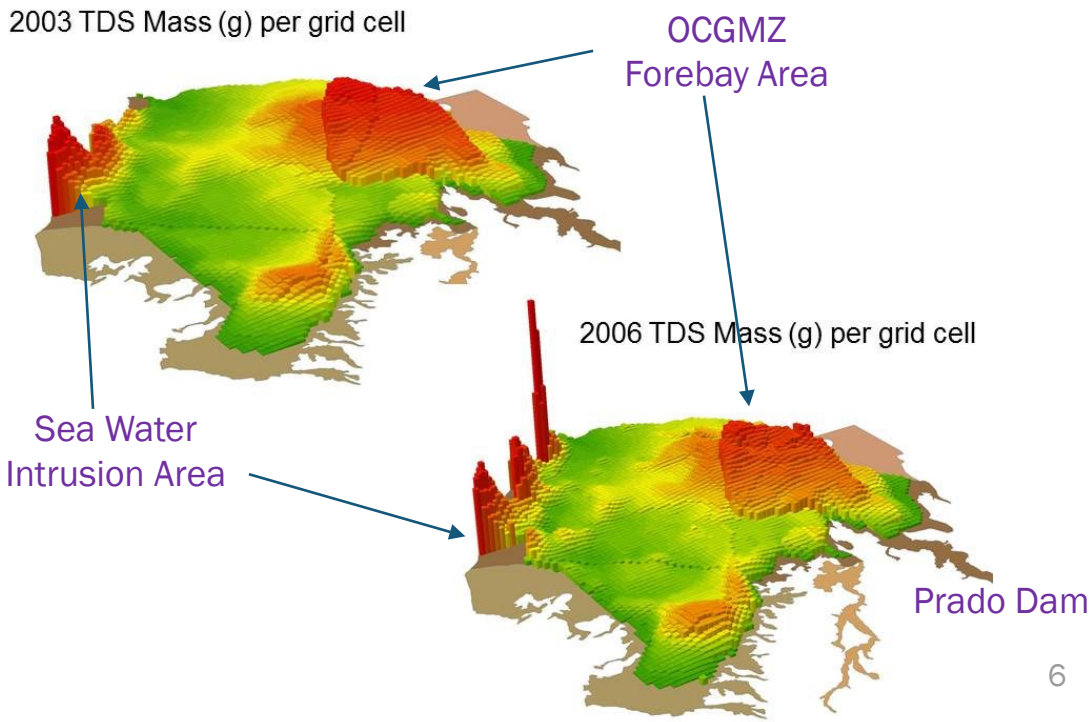
Questions that AWQ Tools can help Answer

- Ambient TDS concentrations in the OC GMZ have increased from 560 mg/L (2003) to 590 mg/L (2006) to 600 mg/L (2009).
- This increase in ambient TDS concentrations is mainly due to the increased monitoring of seawater intrusion in the coastal regions of the management zone.
- From the 2006 report to present, the technical memorandum includes discussions of Methodological Factors (previously called “artificial factors”).
- The accessibility of on-line maps allows BMPTF members to readily confirm (or not) hypotheses about the root causes of changes in groundwater quality.

Interpretive Tools Analysis

Recall that the purpose of the interpretive tools is to attempt to characterize the factors that may have influenced changes in AWQ over time, and to determine whether the changes are real ***(systemic factors)*** or are artifacts of the methodology ***(methodological factors).***

- The two maps on this slide show the *mass* of TDS per grid cell.
- The sea water intrusion area shows the methodological change in TDS concentrations from 2003 to 2006. The 2006 data set is more robust and provides a better delineation of the area.
- The forebay mass of TDS is high due to the aquifer thickness and high specific yield.



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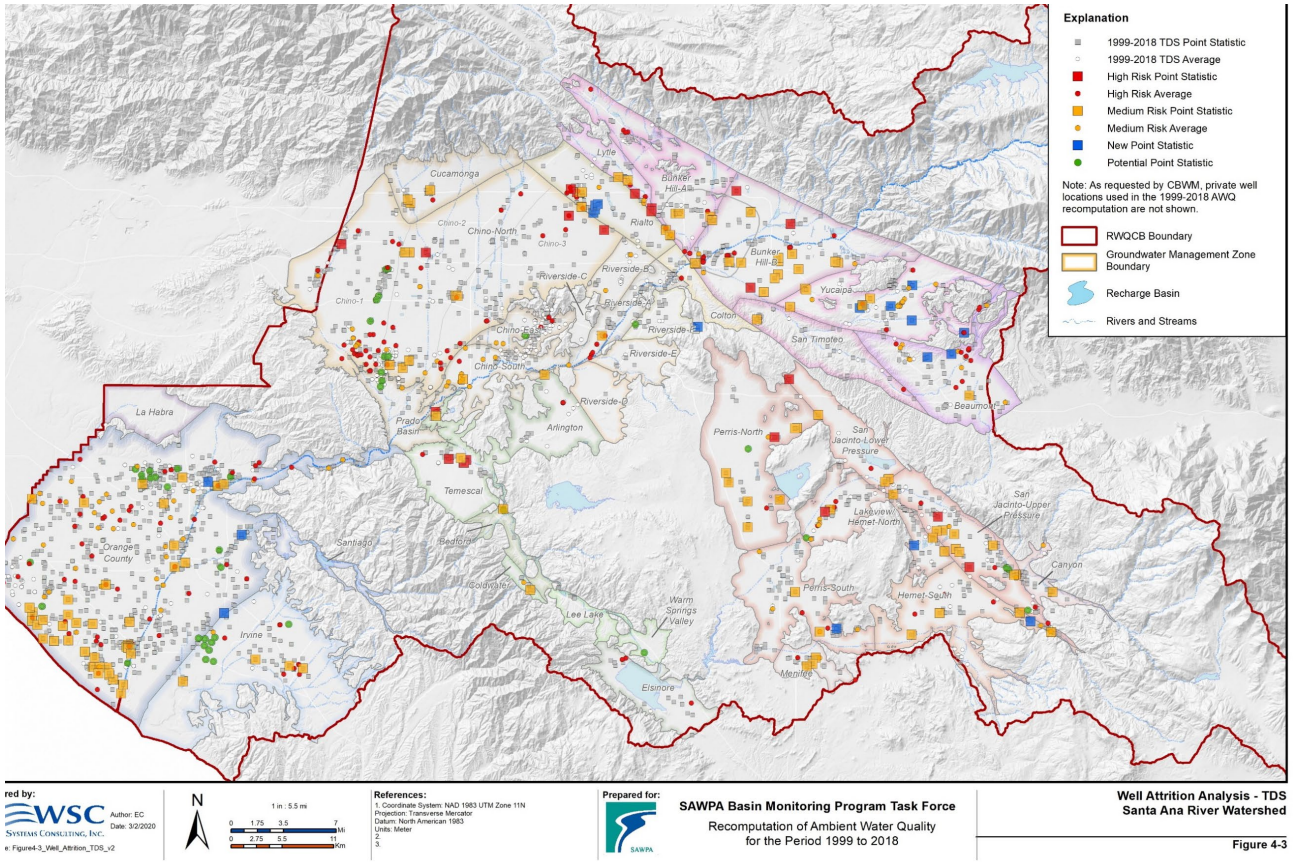
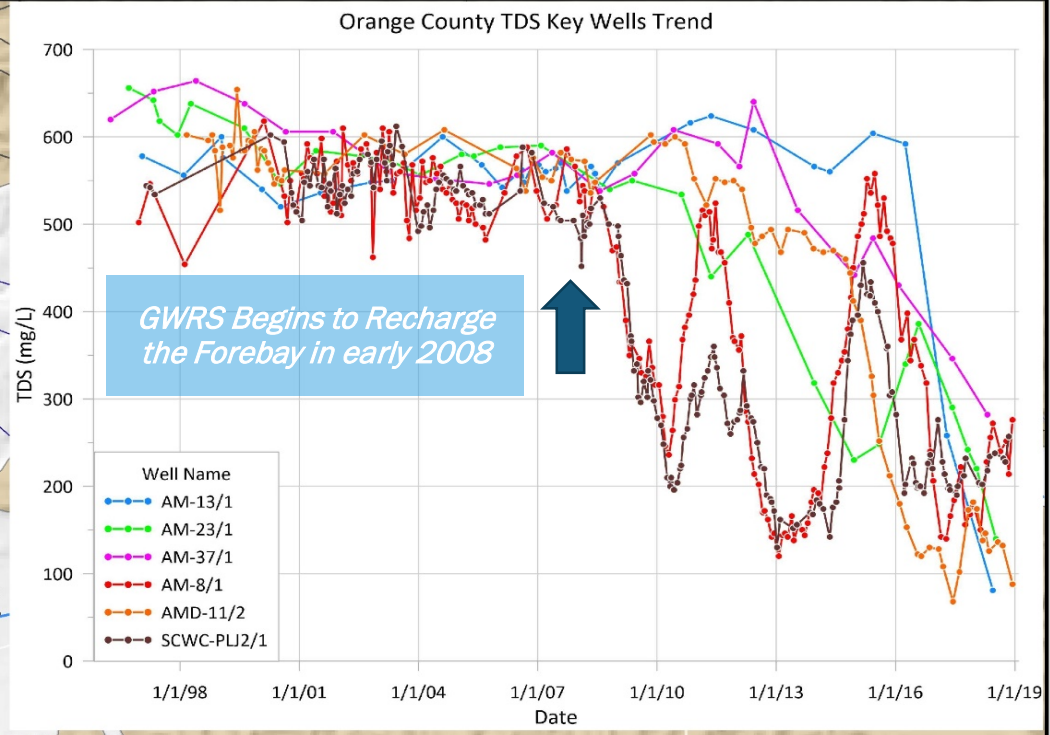
Interpretive Tools Analysis

- Orange County GMZ Forebay Area
- Chino South and East GMZs
- Riverside-A GMZ
- Bunker Hill-B GMZ



Orange County GMZ (TDS)



Orange County

Carbon Canyon Creek

FM-7A/1 734

FM-1/1 657

SCWC-PLJ2/1 391

AM-8/1 456

AMD-11/2 558

AM-13/1 563

AM-23/1 543

AM-37/1 556

AMD-7/1/WB1/MP1 947

YLWD-5/1 645

WBS-3/1/ WB1/MP2 597

WBS-2A/1/ WB1/MP2 637

O-3/1 602

GG-24/1 569

EOCW-W/1 583

La Jolla Basin

Placentia Basin

Raymond Basin

Anaheim Lake

Miller Basin

Kraemer Basin

Miraloma Basin

La Palma Basin

Olive Basin

Warner Basins

Huckleberry Basin

Conrock Basin

Mills Pond

Weir Ponds

Main River System

Off-River System

Upper Five Coves Basin

Lower Five Coves Basin

Lincoln Basin

Burris Basin

Fletcher Basin

River View Basin

Smith Basin

Santiago Basins

Santiago Creek

Explanation

TDS: Key Well 20-Year Trend

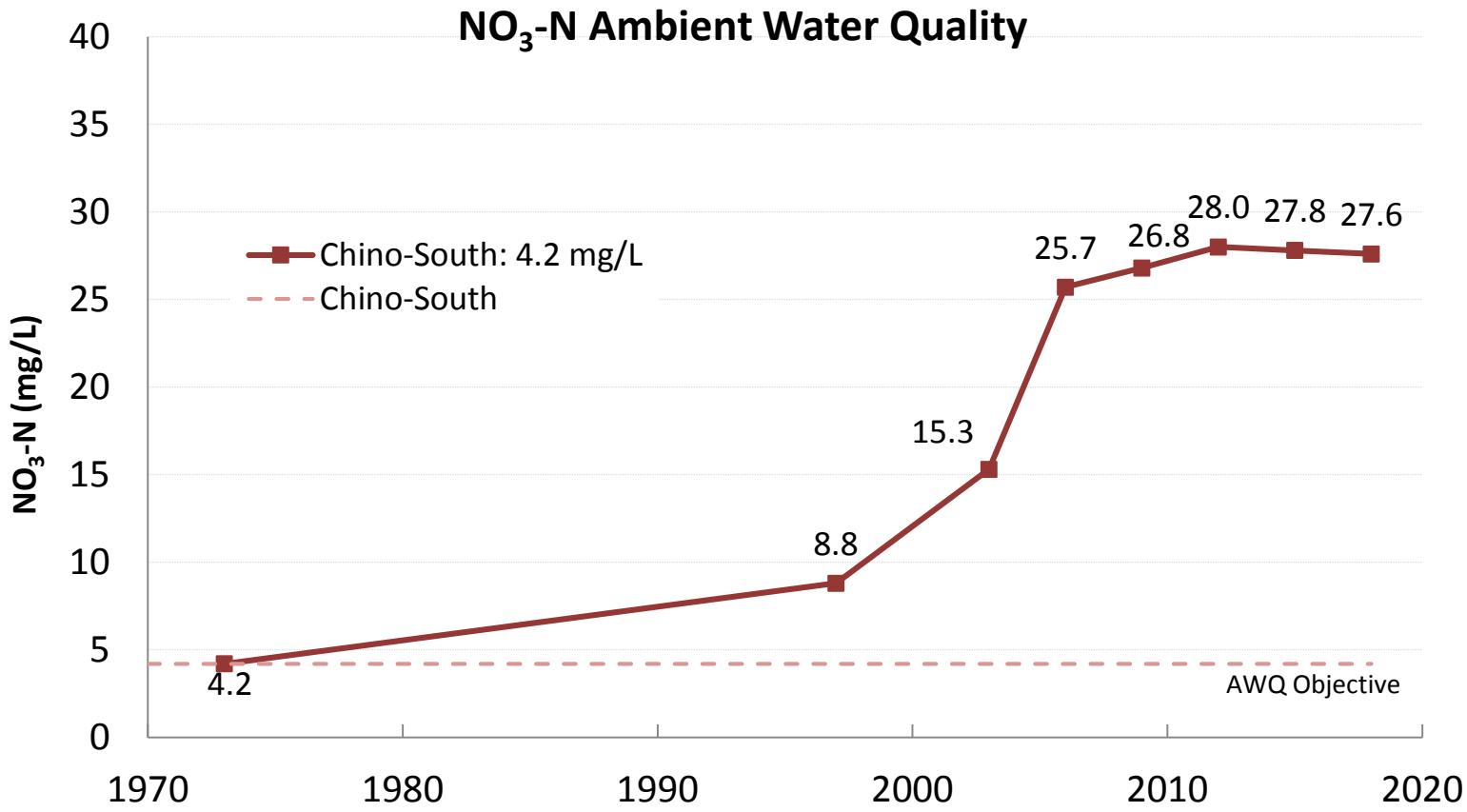
- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing
- 1999-2018 Point Statistic
- 300 Spring 2018 Groundwater Elevation Contours
- RWQCB Boundary
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

Chino South GMZ

- Basin Plan Amendment revise from 4.2 mg/L to 5 mg/L.
- Higher quality Santa Ana River water is entering the Chino-South GMZ.
- Groundwater appears to be undergoing further soil aquifer treatment (SAT).



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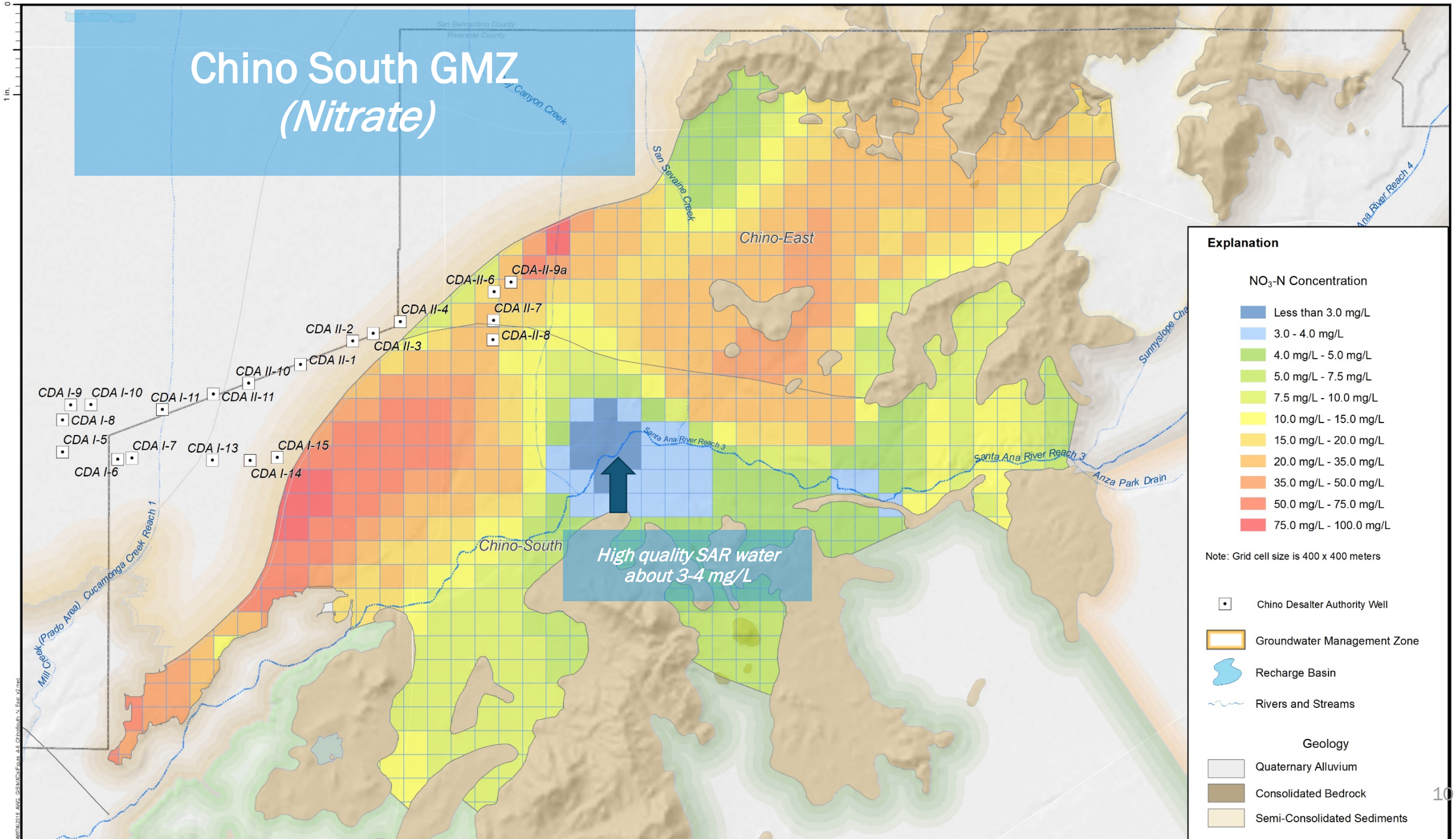
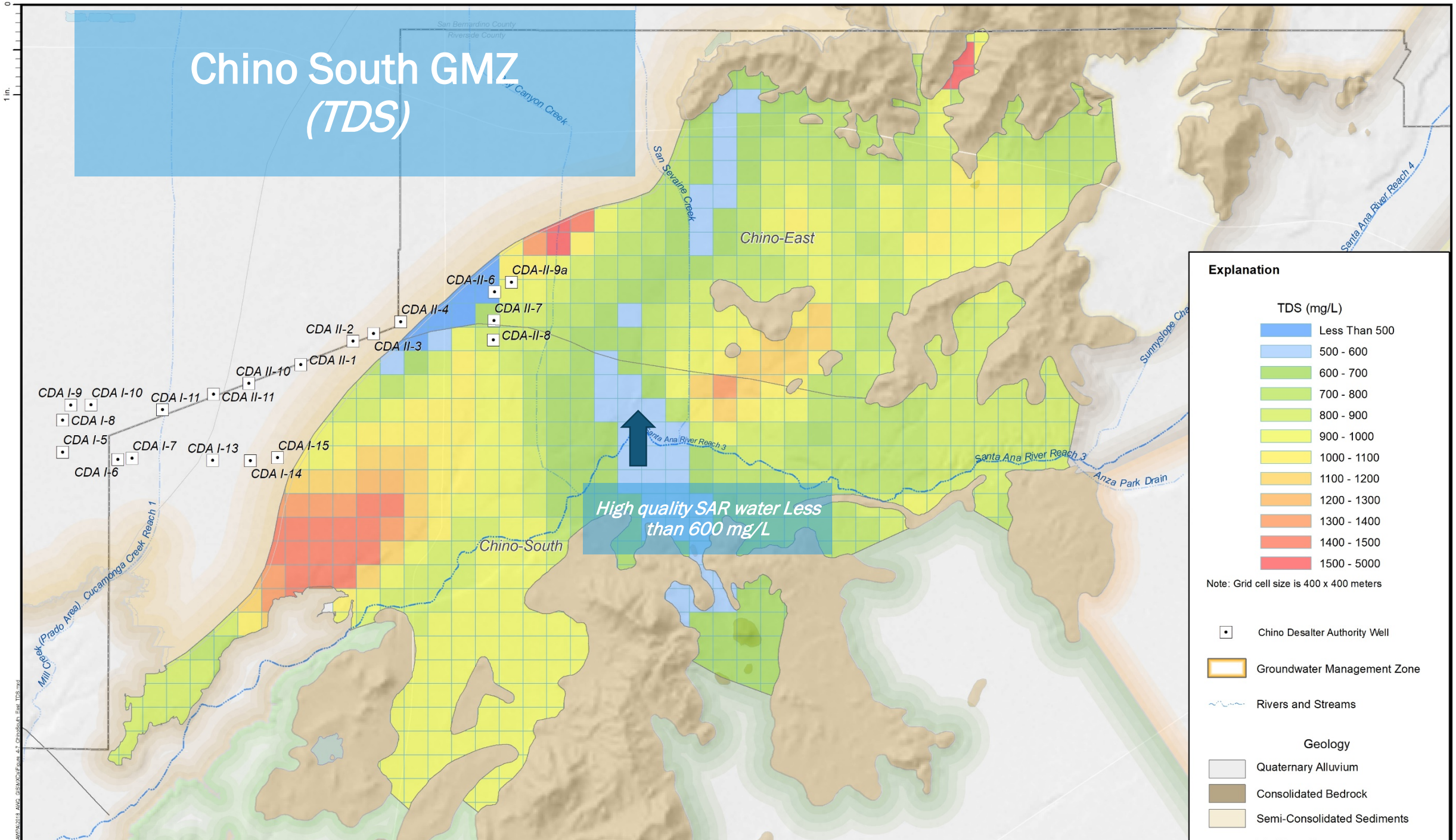
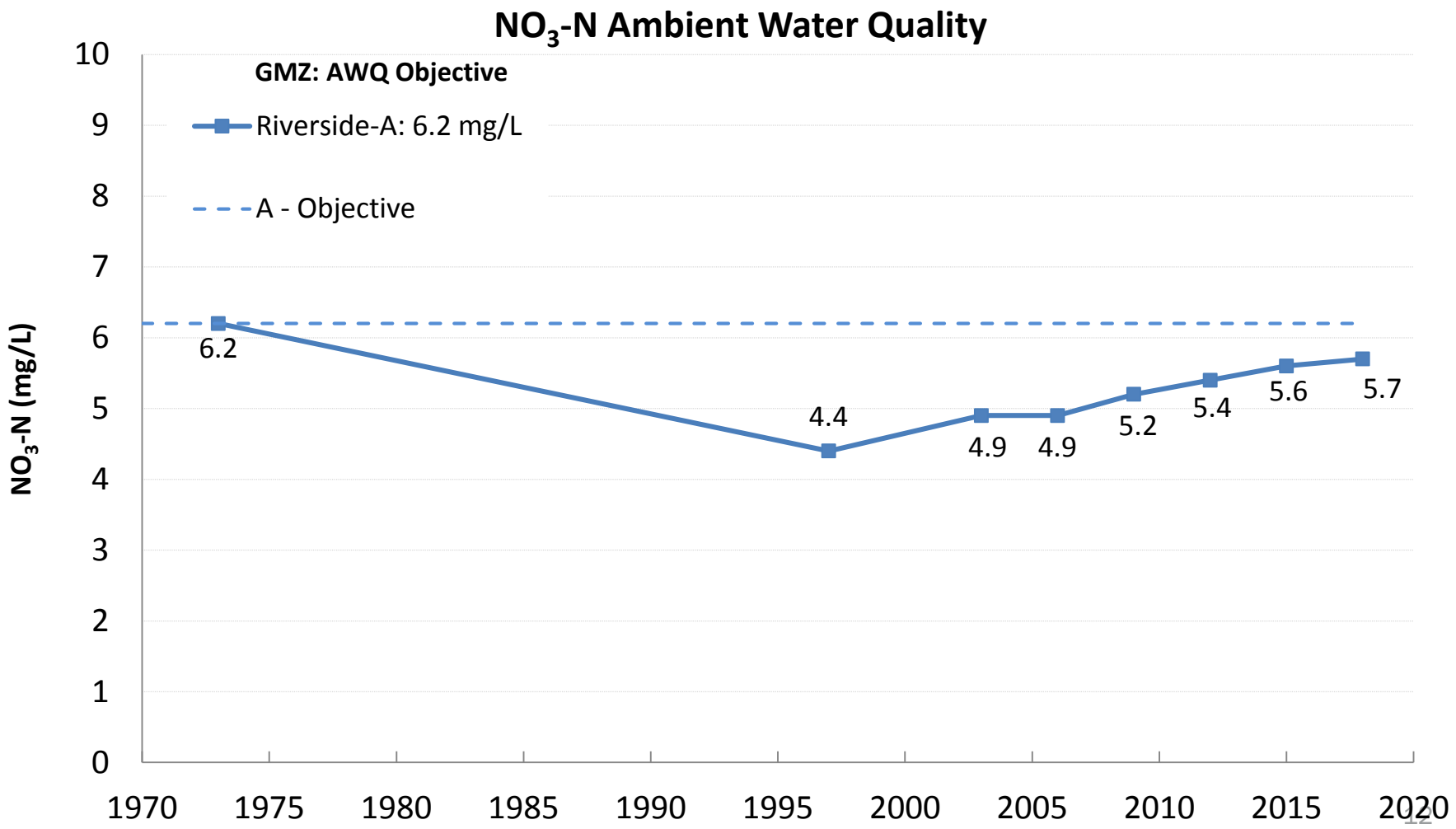

Chino South GMZ
(Nitrate)
San Bernardino County
Riverside County
San Sevaine Creek
Chino-East
Chino-South
CDA-II-6
CDA-II-9a
CDA II-4
CDA II-7
CDA II-2
CDA II-3
CDA-II-8
CDA II-1
CDA II-10
CDA I-9
CDA I-10
CDA I-11
CDA II-11
CDA I-8
CDA I-5
CDA I-7
CDA I-13
CDA I-15
CDA I-6
CDA I-14
Santa Ana River Reach 3
Santa Ana River Reach 4
Anza Park Drain
Sunnyslope Che
Cucamonga Creek Reach 1
Mill Creek (Prado Area)
High quality SAR water
about 3-4 mg/L
Explanation
NO3-N Concentration
Less than 3.0 mg/L
3.0 - 4.0 mg/L
4.0 mg/L - 5.0 mg/L
5.0 mg/L - 7.5 mg/L
7.5 mg/L - 10.0 mg/L
10.0 mg/L - 15.0 mg/L
15.0 mg/L - 20.0 mg/L
20.0 mg/L - 35.0 mg/L
35.0 mg/L - 50.0 mg/L
50.0 mg/L - 75.0 mg/L
75.0 mg/L - 100.0 mg/L
Note: Grid cell size is 400 x 400 meters
Chino Desalter Authority Well
Groundwater Management Zone
Recharge Basin
Rivers and Streams
Geology
Quaternary Alluvium
Consolidated Bedrock
Semi-Consolidated Sediments


Chino South GMZ
(TDS)
San Bernardino County
Riverside County
San Sevaine Creek
Chino-East
Chino-South
Santa Ana River Reach 4
Santa Ana River Reach 3
Anza Park Drain
Sunnyslope Che
Mill Creek (Prado Area)
Cucamonga Creek Reach 1
CDA-II-6
CDA-II-9a
CDA II-4
CDA II-7
CDA II-2
CDA II-3
CDA-II-8
CDA II-1
CDA II-10
CDA I-9
CDA I-10
CDA I-11
CDA II-11
CDA I-8
CDA I-5
CDA I-7
CDA I-13
CDA I-15
CDA I-6
CDA I-14
High quality SAR water Less than 600 mg/L
Explanation
TDS (mg/L)
Less Than 500
500 - 600
600 - 700
700 - 800
800 - 900
900 - 1000
1000 - 1100
1100 - 1200
1200 - 1300
1300 - 1400
1400 - 1500
1500 - 5000
Note: Grid cell size is 400 x 400 meters
Chino Desalter Authority Well
Groundwater Management Zone
Rivers and Streams
Geology
Quaternary Alluvium
Consolidated Bedrock
Semi-Consolidated Sediments

Riverside – A GMZ

- Assimilative capacity for TIN and TDS.
- Incidental recharge of recycled water is likely to degrade existing water quality in the, but it is not likely to cause or contribute to an exceedance of the WQO.



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Riverside – A GMZ

- The Colton Landfill appears to be contributing nitrate into Riverside-A GMZ above the WQOs and above MCLs. Nitrate concentrations in monitoring wells have been increasing over time in several wells, beginning in about 2004. The saturated volume of groundwater in grid cells near the Colton Landfill; while the mass of nitrate contributed by the Colton Landfill is relatively small compared with the rest of the Riverside-A GMZ, the concentrations are locally significant.
- Four Colton Landfill monitoring wells now have the requisite number of samples to become a point statistics :
- CL-06: 2.3 mg/L
- CL-09: 17.5 mg/L
- CL-10S: 19.4 mg/L
- CL-10D: 26.6 mg/L
- The addition of these wells to the AWQ Recomputation has resulted in contour lines being located further to the west and northwest, changing the estimated AWQ for this portion of the Riverside-A GMZ.

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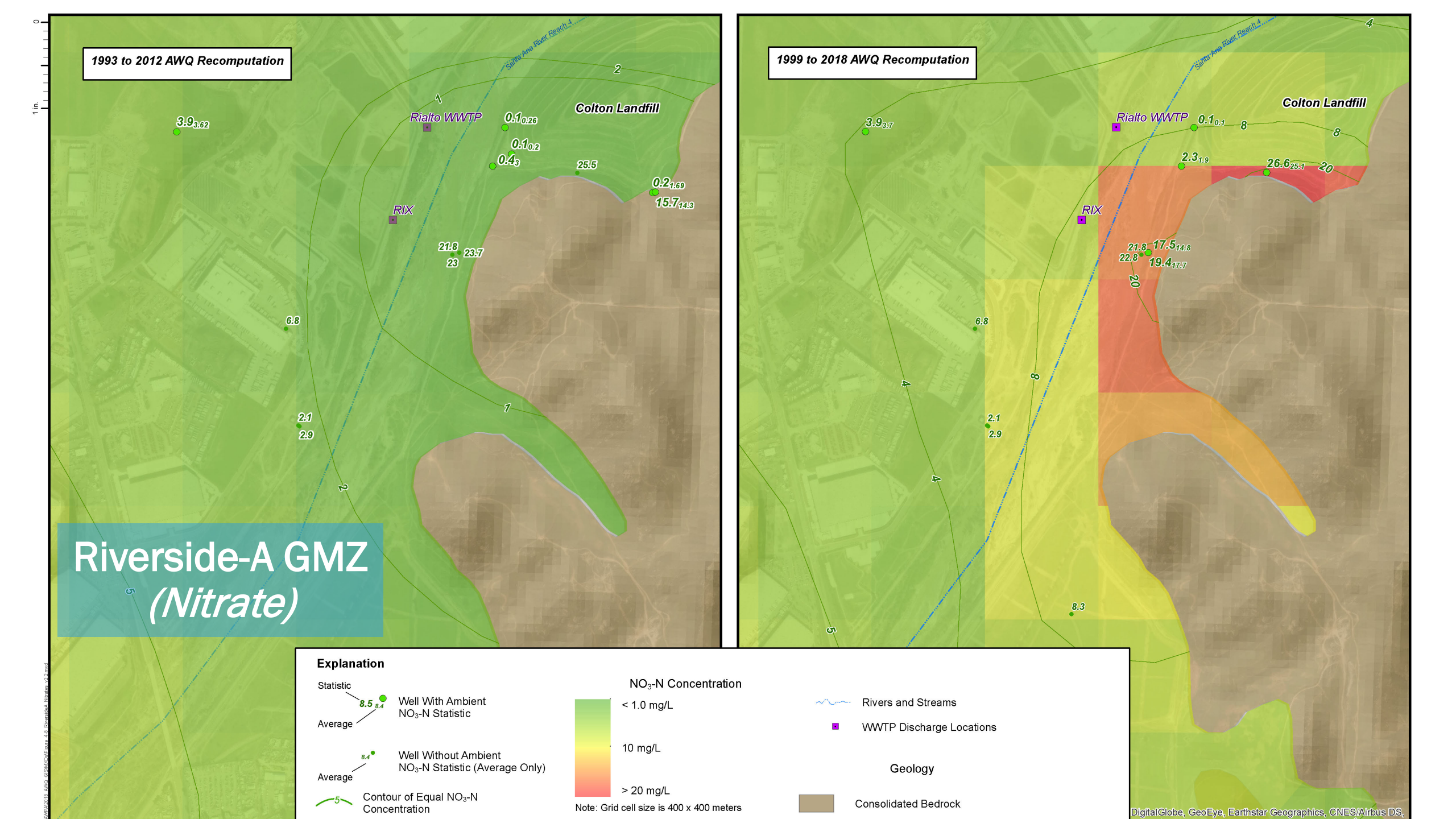
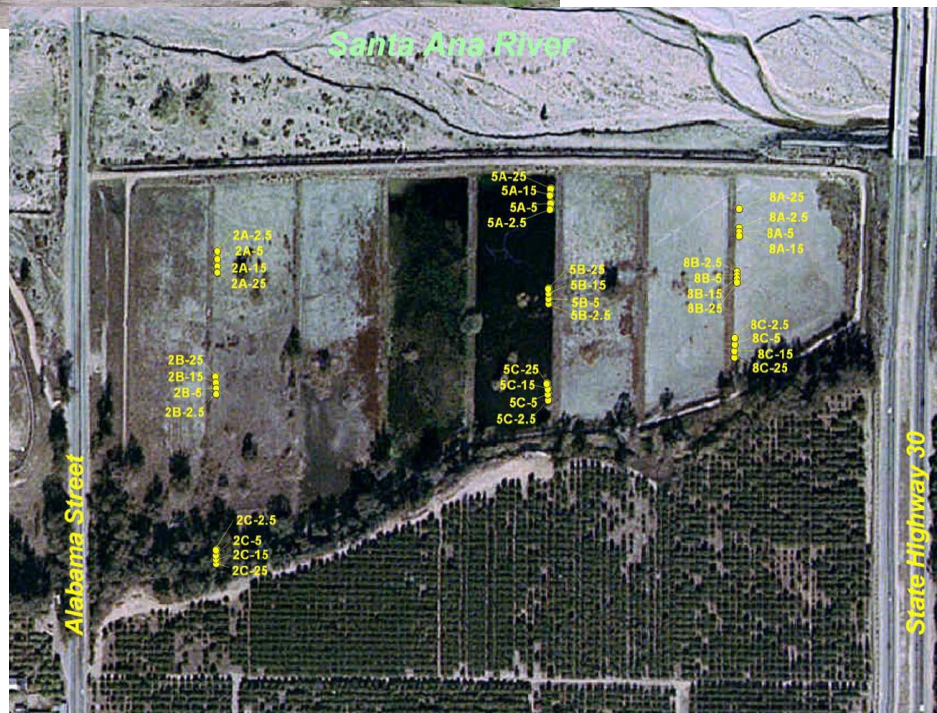

1993 to 2012 AWQ Recomputation
1999 to 2018 AWQ Recomputation
Riverside-A GMZ
(Nitrate)
Santa Ana River Reach 4
Rialto WWTP
Colton Landfill
RIX
Explanation
Statistic
Average
Well With Ambient NO3-N Statistic
Well Without Ambient NO3-N Statistic (Average Only)
Contour of Equal NO3-N Concentration
NO3-N Concentration
< 1.0 mg/L
10 mg/L
> 20 mg/L
Note: Grid cell size is 400 x 400 meters
Rivers and Streams
WWTP Discharge Locations
Geology
Consolidated Bedrock
DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,

Bunker Hill–B GMZ

- TDS WQO = 330 mg/L, Current = 280 mg/L.
- Nitrate WQO = 7.3 mg/L, Current = 5.8 mg/L.
- Using the AWQ data exploration tool, determined there were water quality anomalies in portions of the Bunker Hill-B GMZ.
- Possible legacy contamination.
- Proponents of the Sterling Project are proposing to recharge tertiary effluent in the Redlands Ponds.



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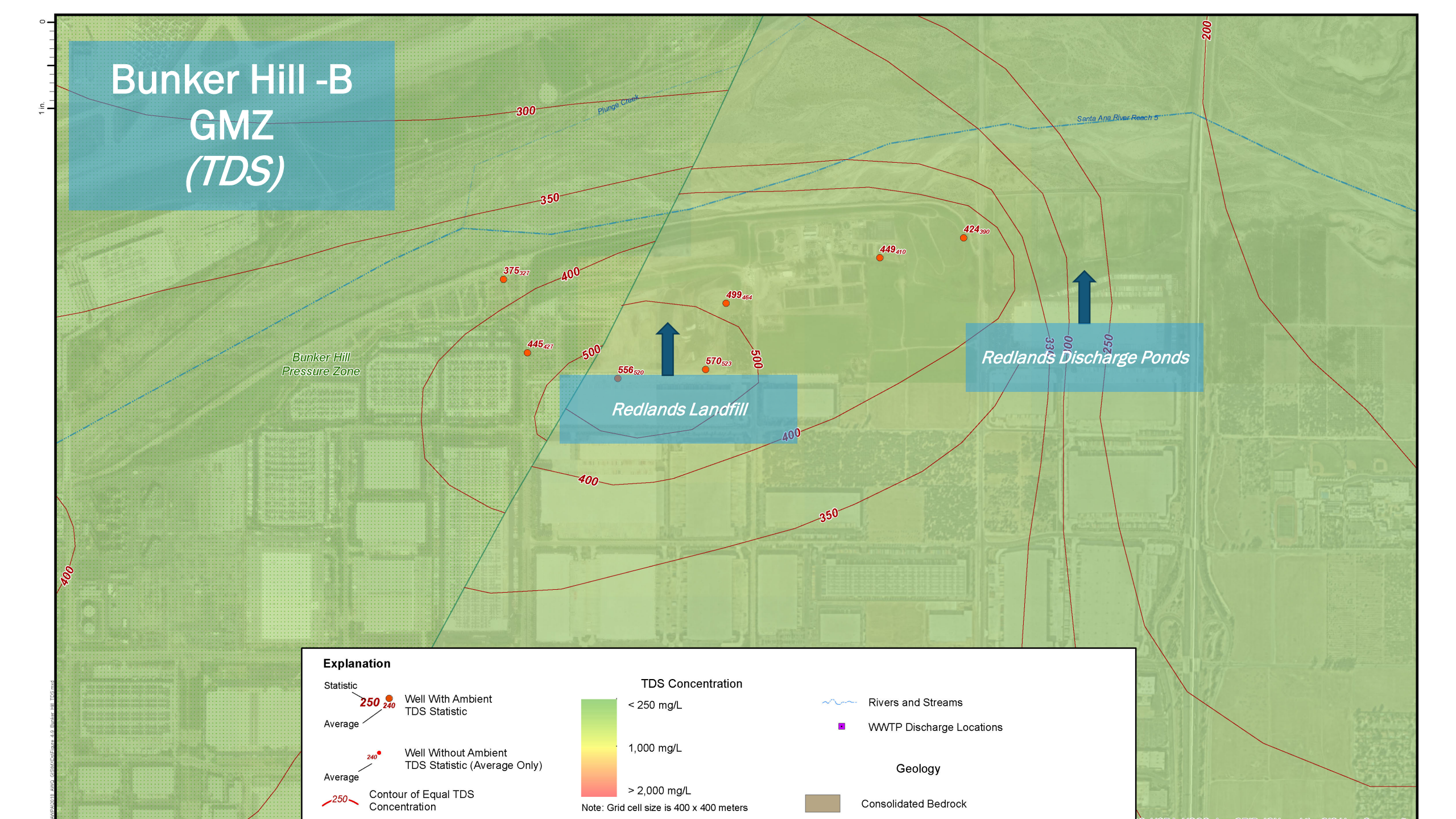
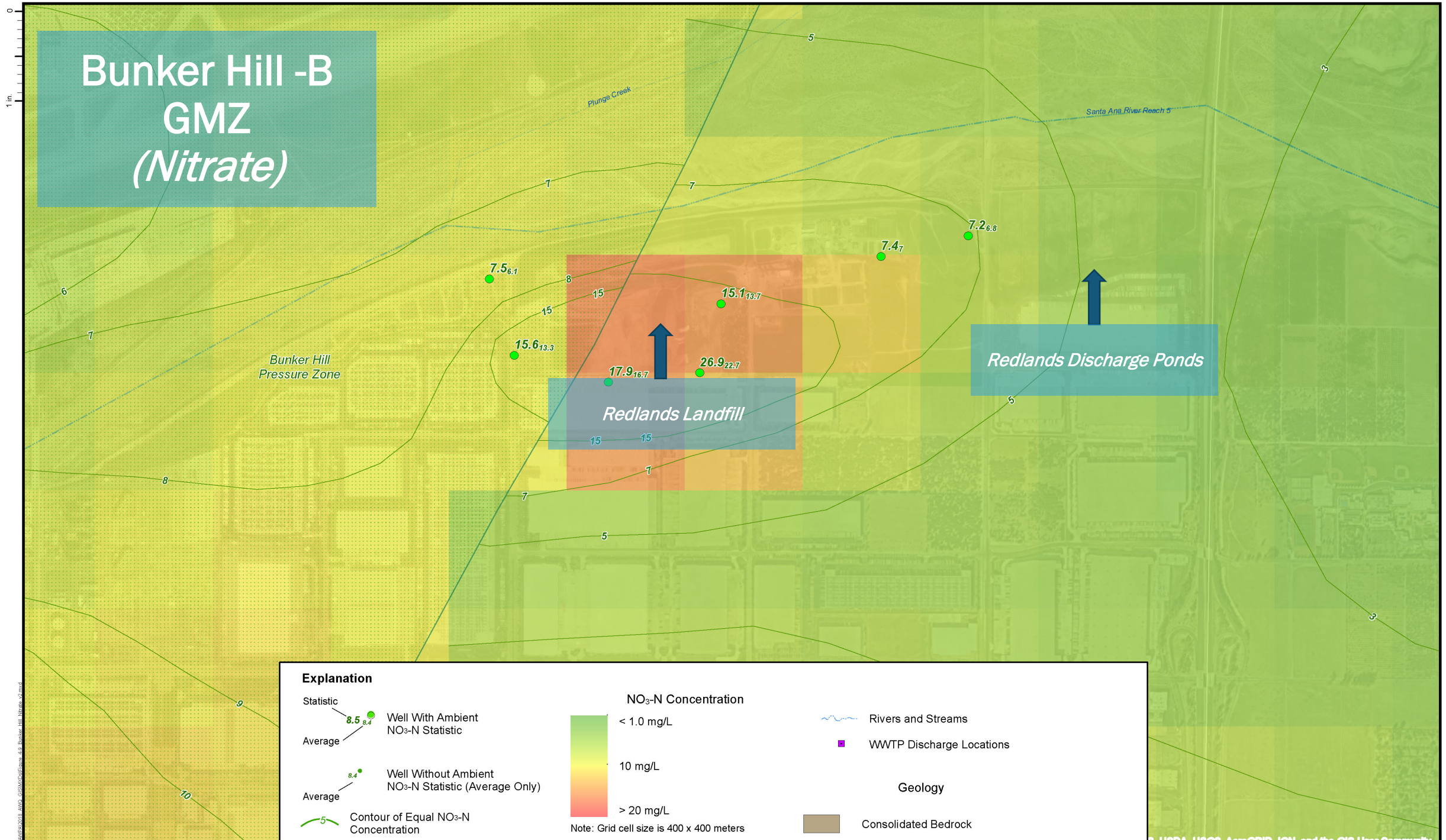
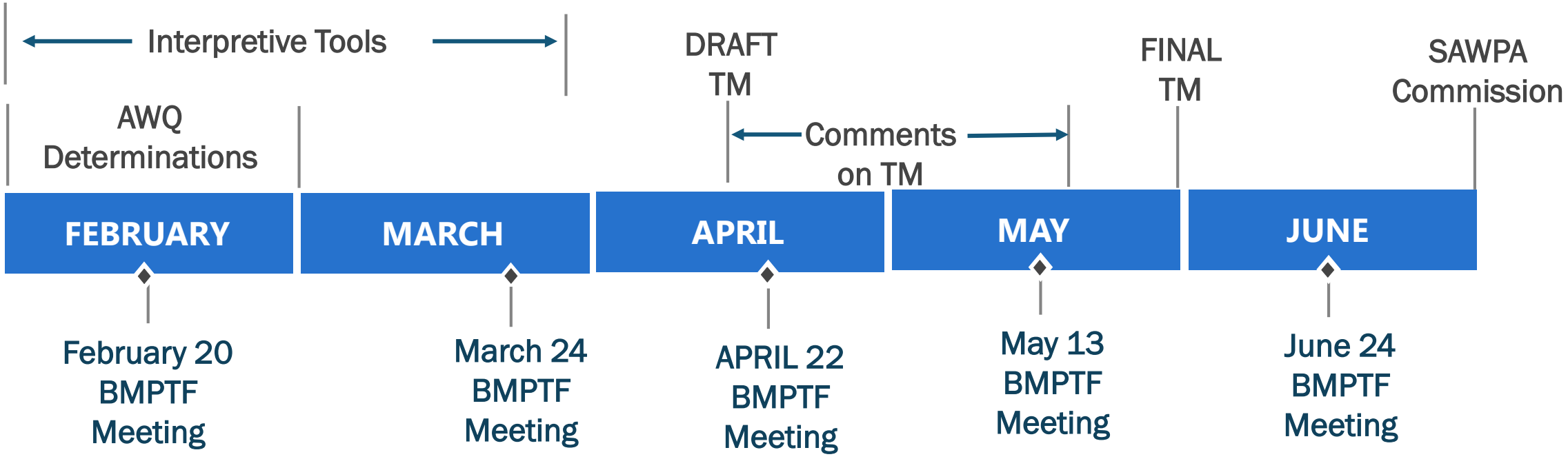

Bunker Hill -B GMZ (TDS)
Plunge Creek
Santa Ana River Reach 5
Bunker Hill Pressure Zone
Redlands Landfill
Redlands Discharge Ponds
300
350
400
500
200
250
375 327
445 427
499 464
556 520
570 523
449 410
424 390
Explanation
Statistic
250 240
Average
Well With Ambient TDS Statistic
240
Average
Well Without Ambient TDS Statistic (Average Only)
250
Contour of Equal TDS Concentration
TDS Concentration
< 250 mg/L
1,000 mg/L
> 2,000 mg/L
Note: Grid cell size is 400 x 400 meters
Rivers and Streams
WWTP Discharge Locations
Geology
Consolidated Bedrock


Bunker Hill -B GMZ (Nitrate)
Plunge Creek
Santa Ana River Reach 5
Bunker Hill Pressure Zone
Redlands Landfill
Redlands Discharge Ponds
7.5 6.1
15.1 13.7
7.4 7
7.2 6.8
15.6 13.3
17.9 16.7
26.9 22.7
Explanation
Statistic
8.5 8.4
Average
Well With Ambient NO3-N Statistic
8.4
Average
Well Without Ambient NO3-N Statistic (Average Only)
5
Contour of Equal NO3-N Concentration
NO3-N Concentration
< 1.0 mg/L
10 mg/L
> 20 mg/L
Note: Grid cell size is 400 x 400 meters
Rivers and Streams
WWTP Discharge Locations
Geology
Consolidated Bedrock

Near-Term Schedule



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