

Technical Memorandum
Update of the Physical Characterization of
Groundwater Management Zones
Santa Ana River Watershed

Prepared for **Santa Ana Watershed Project Authority**
Basin Monitoring Program Task Force
Under contract to CDM Smith

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Technical Memorandum

Update of the Physical Characterization of Groundwater Management Zones Santa Ana River Watershed

1. Introduction

The physical models of the groundwater management zones (GMZs) that are used to calculate the ambient water quality (AWQ) were developed in the Phase 2A TIN/TDS Study published in July 2000 (WEI, 2000). The Basin Plan (RWQCB, 2016) states that:

The determination of current ambient quality shall be accomplished using methodology consistent with that employed by the Nitrogen/TDS Task Force (20-year running averages) to develop the TDS and nitrogen water quality objectives included in this Basin Plan.

Therefore, to be consistent with the methodology established by the Nitrogen/TDS Task Force, the physical model of the GMZs used in the objective-setting period (1956 to 1973) and every subsequent triannual calculation, including the 1996 to 2015 time period, should be the same. However, since July 2000, hundreds of wells have been drilled, groundwater models have been developed and updated, and new hydrogeologic studies have been performed in the GMZs throughout the Santa Ana River Watershed, ultimately improving the understanding of aquifer properties and aquifer geometry of the GMZs. The Basin Monitoring Program Task (BMPTF) requested through the request for proposals (RFP) that the Chino Basin GMZs be evaluated with respect to the effect the physical model has on AWQ determinations.

2. Chino Basin GMZ Pilot Study for the Update of the Physical Model

The Chino Basin GMZ was used in a pilot study to evaluate the effects of the replacing the Existing AWQ Physical Model with an Updated Physical Model. The Chino Basin is one of the most complex basins in the Santa Ana River Watershed, and is divided into five antidegradation GMZs (Chino-1, Chino-2, Chino-3, Chino-4, and Chino-5). Appropriate and sufficient beneficial use protection/maximum benefit demonstrations were made by the Chino Basin Watermaster



(CBWM) and the Inland Empire Utilities Agency (IEUA) to warrant alternative “maximum benefit” objectives for the Chino-North GMZ, which groups together the Chino-1, Chino-2, and Chino-3 GMZs. Chino-South and Chino-East are equivalent to Chino-5 and Chino-4, respectively. These “maximum benefit” proposals include commitments by the agencies to implement specific projects and programs. The Chino-North GMZ contains three aquifers: shallow, middle, and deep.

The physical model currently used in the AWQ determinations is described in the TIN/TDS Phase 2A report (WEI, 2000), was developed by Montgomery Watson and Wildermuth (1994) and is referred to as the “Existing AWQ Physical Model” in this technical memorandum. CBWM has updated the hydrogeologic conceptual model of the Chino Groundwater Basin three times (2003, 2007, and 2013) since the Phase 2A report was published; the 2013 model is referred to as the “Updated Physical Model” in this technical memorandum. Significant changes between the physical models are described in detail in *2007 CBWM Groundwater Model Documentation and Evaluation of the Peace II Project Description* (WEI, 2007) and *2013 Chino Basin Groundwater Model Update and Recalculation of Safe Yield Pursuant to the Peace Agreement* (WEI, 2015a). New hydrogeologic data generated by the various CBWM monitoring programs, new wells drilled by the appropriative pool members, and regional geophysical data have led to the modification of the geometry of the bottom of aquifer and the hydrostratigraphy (layering). Modifications of note include the following:

- The Updated Physical Model has a different model domain than the Existing AWQ Physical Model, as shown in Figure 1.
- The presence of a bedrock fault that uplifted the crystalline bedrock of the basement complex in the eastern portion of the Chino-North GMZ (Chino-3 GMZ) relative to the sedimentary bedrock and water-bearing sediments in the western portion of the Chino-North GMZ (Chino-1 and Chino 2-GMZs).
- The bottom of the aquifer is now interpreted to be deeper in the western portion of the Chino-North GMZ, where several boreholes have been drilled to depths between 1,000 and 1,400 feet below ground surface (bgs) and did not penetrate crystalline



bedrock. Figure 2 shows the change in thickness resulting in different aquifer storage values throughout the Chino-North GMZ.

- Layer 1 is now interpreted to be thicker in the northern and eastern portions of the Chino Basin to take into account new data from boreholes and to avoid the computational issues with the model layer being unsaturated in the groundwater model.
- The specific yield values in the Existing AWQ Physical Model for each layer are homogeneous for each aquifer. The specific yield values for Layers 1, 2, and 3 are 0.15, 0.10, and 0.08, respectively. The specific yield in the Updated Physical Model is heterogeneous. Figure 3 shows specific yield values by grid cell and by layer for both the Existing AWQ Physical Model and the Updated Physical Model.

Groundwater quality point statistics for nitrate and total dissolved solids (TDS) for the 2015 current AWQ recomputation period were generated as outlined in Task 1d (Sections 2.3) of the 2017 AWQ Recomputation Technical Memorandum. For the AWQ computation using the Updated Physical Model, the point statistics were assigned new layer codes associated with the layers in the refined model; in other words, the hydrographic layering and aquifer properties of the Updated Physical Model were based on the *2013 Chino Basin Groundwater Model Update and Recalculation of Safe Yield Pursuant to the Peace Agreement* (WEI, 2015a). Groundwater quality (TDS and nitrate) was recontoured based on the new data. The cells included in the Existing AWQ Physical Model determination are based on the GMZ boundaries, and the AWQ determinations for the Updated Physical Model were based on the extent of the groundwater model domain (WEI, 2015a) and the extent of groundwater contours used by CBWM to calculate groundwater in storage in the 2014 State of the Basin Report (WEI, 2015b) as shown in Figure 1. The maps showing the TDS and nitrate contours for the Existing AWQ Physical Model and Updated Physical Model are located in Appendix A.

Table 1 shows the AWQ determinations for nitrate, TDS, and volume of water in storage, as well as the change between the Existing AWQ Physical Model and the Updated Physical Model. The most significant changes are in the nitrate AWQ determinations in Chino-North and Chino-South GMZs. The changes in nitrate concentrations are more pronounced than the changes in TDS concentrations, as the change in nitrate concentrations between Layer 1 and Layer 3 can



be over two orders of magnitude; some nitrate concentrations in Layer 1 are over 100 milligrams per liter (mg/L), while nitrate concentrations in Layer 3 are as low as 0.5 mg/L. The computed nitrate AWQ for Chino North using the Existing AWQ Physical Model is 10 mg/L, while the computed nitrate AWQ for Chino North using the Updated Physical Model is 7.0 mg/L. Groundwater storage in Chino-North GMZ is greater using the Updated Physical Model—9,140,000 acre-feet versus 5,870,000 acre-feet (a relative percent difference [RPD] of 44 percent). The difference in computed nitrate ambient quality is predominantly driven by the Chino-2 GMZ, where the computed nitrate difference is 10.7 mg/L to 5.2 mg/L.

2.1 Chino-North GMZ and Chino-1, Chino-2, and Chino-3 “Antidegradation” GMZs

The Chino-North GMZ is a three-layered system; nitrate and TDS concentrations are highest in the shallow layer (Layer 1), and are significantly lower in Layers 2 and 3. As discussed above, the groundwater in storage in the Chino-North GMZ increased by approximately 3,000,000 acre-feet, and 1,890,000 acre-feet from the deeper, cleaner Layer 3, which essentially dilutes the nitrate and TDS and lowers the computed AWQ concentrations. The computed AWQ concentrations change the most in Chino-2 GMZ for both nitrate and TDS, and drive the overall decrease in AWQ concentration for the Chino-North GMZ. Table 2 shows the volume of groundwater in storage by layer and by “antidegradation” GMZs and illustrates the shift in groundwater volume between layers. The drastic change in the AWQ nitrate in the Chino-2 GMZ is driven by the decrease in volume of about 120,000 acre-feet in poor-quality water (in Layer 1) and an increase of approximately 1,100,000 acre-feet in good-quality water (in Layer 3), resulting in an overall nitrate AWQ concentration difference of 10.7 mg/L compared with 5.2 mg/L.

2.2 Chino-South GMZ

The computed nitrate AWQ concentrations using the Existing AWQ Physical Model and the Updated Physical Model in Chino-South GMZ are 27.8 and 34.7 mg/L, respectively. The reason for the change in nitrate concentrations is the difference in the areas used in the calculation. Figure 1 shows the extent of active cells used in the Existing AWQ Physical Model and the Updated Physical Model. The area of the Chino-South GMZ that was excluded (gray cells) in



the Updated Physical Model resulted in a decrease of about 22,500 acre-feet of better-quality groundwater in storage. The result is an increase in AWQ concentrations.

2.3 Chino-East GMZ

The Existing AWQ Physical Model in the Chino–East GMZ does not provide an accurate representation of aquifer thickness in the cells adjacent to the Jurupa Mountains. For example, the modeled aquifer thickness in Pyrite Canyon—the location of the Stringfellow Superfund Site—ranges from about 200 to 500 feet where the bottom of aquifer has been observed to be approximately 50 feet (Tetra Tech, 2010). This area contains elevated TDS concentrations in the range of 7,000 to 8,000 mg/L, and has a significant impact on the TDS AWQ determinations of the Chino-East GMZ, as the GMZ is relatively shallow, unlike the Existing AWQ Physical Model. For example, if the cells in Pyrite Canyon (approximately 320 acres of a total area of 7,950 acres in Chino South) are removed from the 2015 current AWQ recomputation, the TDS AWQ decreases by 30 mg/L, from 840 to 810 mg/L. The Updated Physical Model does not include this area in the calculation, as it is located outside of the groundwater model domain.

References

- Montgomery Watson and M.J. Wildermuth (Montgomery Watson and Wildermuth). 1994. *Final Task 6 memorandum: Development of three dimensional groundwater model*. March 1994.
- Regional Water Quality Control Board, State of California, Santa Ana Region (RWQCB). 2016a. *Water quality control plan (Basin Plan) for the Santa Ana River Basin*. January 1995. Updated February 2016.
- Wildermuth Environmental, Inc. (WEI). 2000. *Technical memorandum: TIN/TDS Phase 2A, Tasks 1 through 5, TIN/TDS study of the Santa Ana Watershed*. July 2000.
- WEI. 2003. *Optimum Basin Management Program, Chino Basin Dry-Year Yield Program: Preliminary modeling report*. Prepared for the Chino Basin Watermaster.



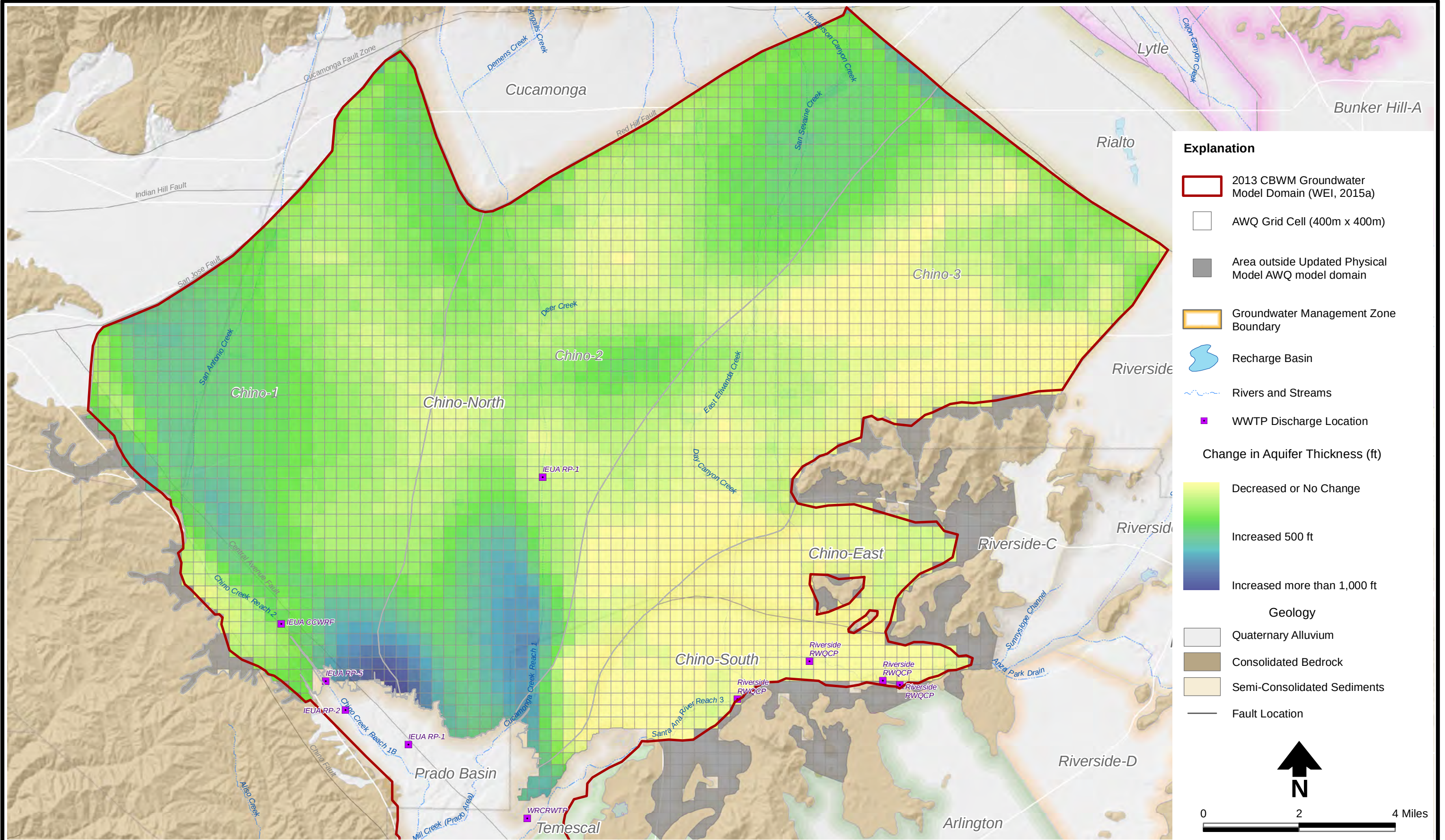
WEI. 2007. *2007 CBWM groundwater model documentation and evaluation of the Peace II project description.*

WEI. 2015a. *2013 Chino Basin groundwater model update and recalculation of safe yield pursuant to the Peace Agreement.*

WEI. 2015b. *Chino Basin Optimum Basin Management Program: 2014 state of the basin report.*

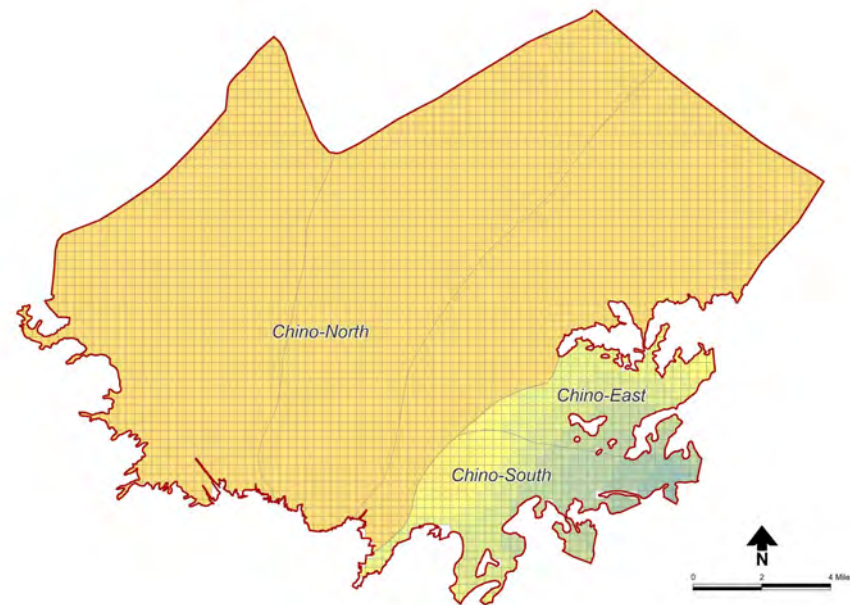
Figures

J:\PROJECTS\CA16.0087 SAWPA\AWQ\GIS\MXDS\REPORT FIGURE\TASK 1B TECH MEMO\FIGURE_2.CHINO_PILOT STUDY_THICKNESSCHANGE.MXD

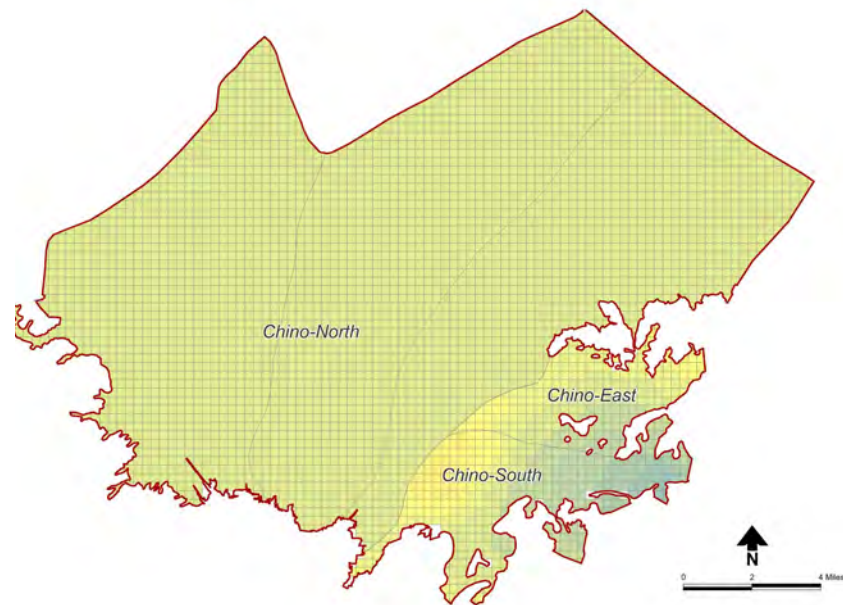


Source: SAWPA.net, January 2017

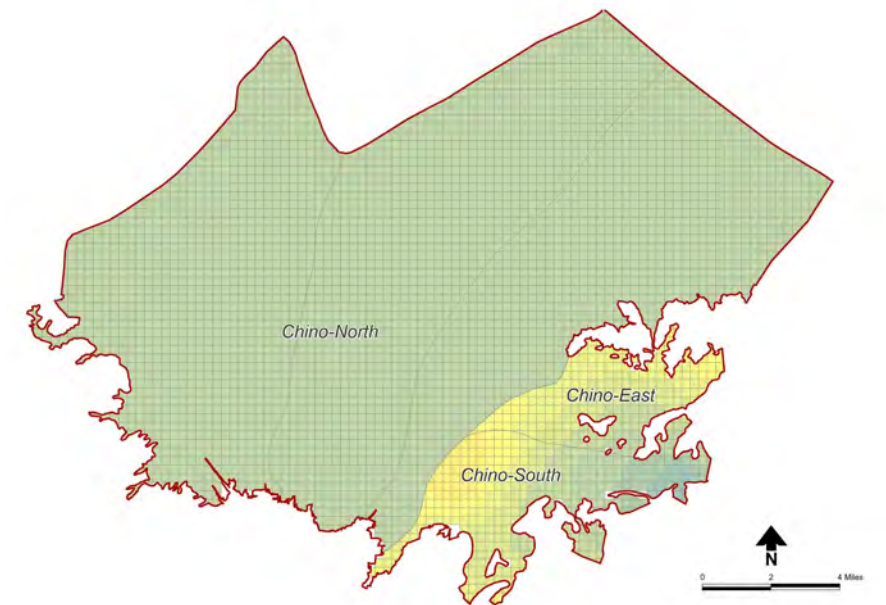
Figure 2



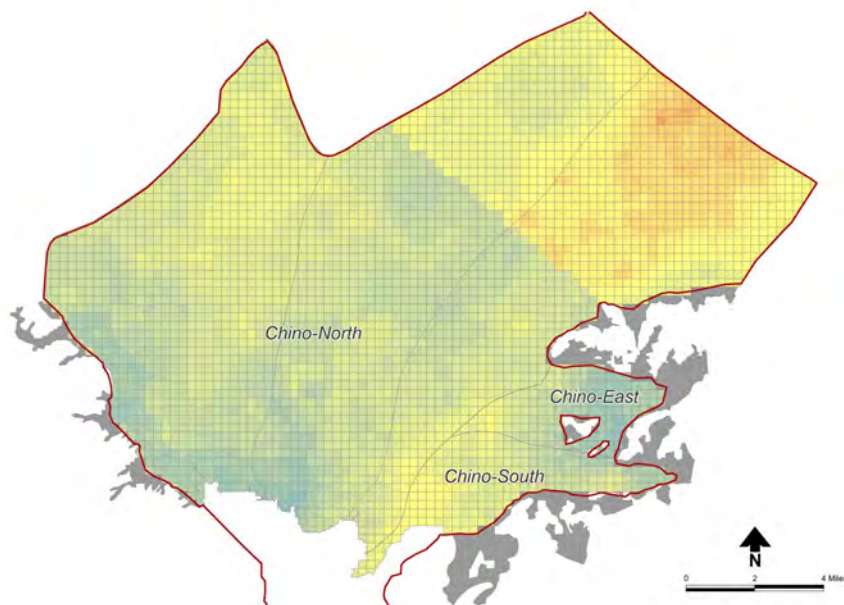
Existing AWQ Physical Model: Layer 1



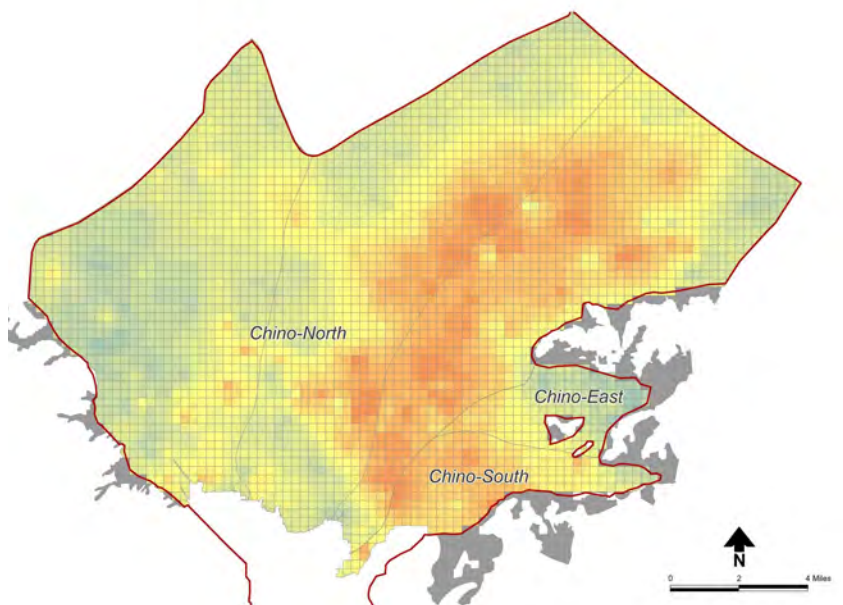
Existing AWQ Physical Model: Layer 2



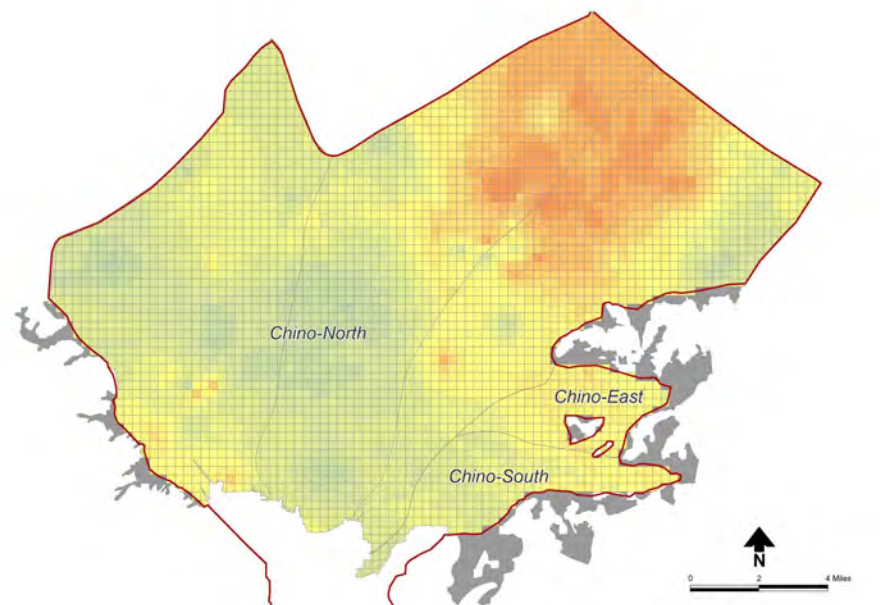
Existing AWQ Physical Model: Layer 3



Updated Physical Model: Layer 1



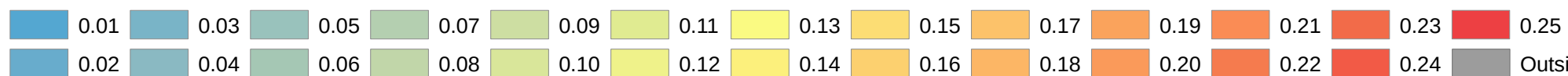
Updated Physical Model: Layer 2



Updated Physical Model: Layer 3

 Model Domain

Specific Yield



Tables



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Table 1. Comparison of 2015 AWQ Determinations Using the Existing Physical Model and the Updated Physical Model for the Chino Groundwater Management Zones

Groundwater Management Zone	Existing AWQ Physical Model			Updated Physical Model			Changes from Existing to Updated Physical Model		
	Nitrate Concentration (mg/L)	TDS Concentration (mg/L)	Volume (acre-feet)	Nitrate Concentration (mg/L)	TDS Concentration (mg/L)	Volume (acre-feet)	Nitrate Concentration (mg/L)	TDS Concentration (mg/L)	Volume (acre-feet)
Chino-1	10.5	350	2,100,000	8.4	300	3,130,000	-2.1	-50	1,030,000
Chino-2	10.9	380	2,500,000	5.2	280	3,690,000	-5.7	-100	1,190,000
Chino-3	8.9	320	1,270,000	8.1	310	2,320,000	-0.8	-10	1,050,000
Chino-North	10.3	360	5,870,000	7.0	290	9,140,000	-3.3	-70	3,270,000
Chino-South	27.8	940	190,000	34.7	970	160,000	6.9	30	-30,000
Chino-East	22.0	840	80,000	22.7	830	60,000	0.7	-10	-20,000

AWQ = Ambient water quality

mg/L = Milligrams per liter

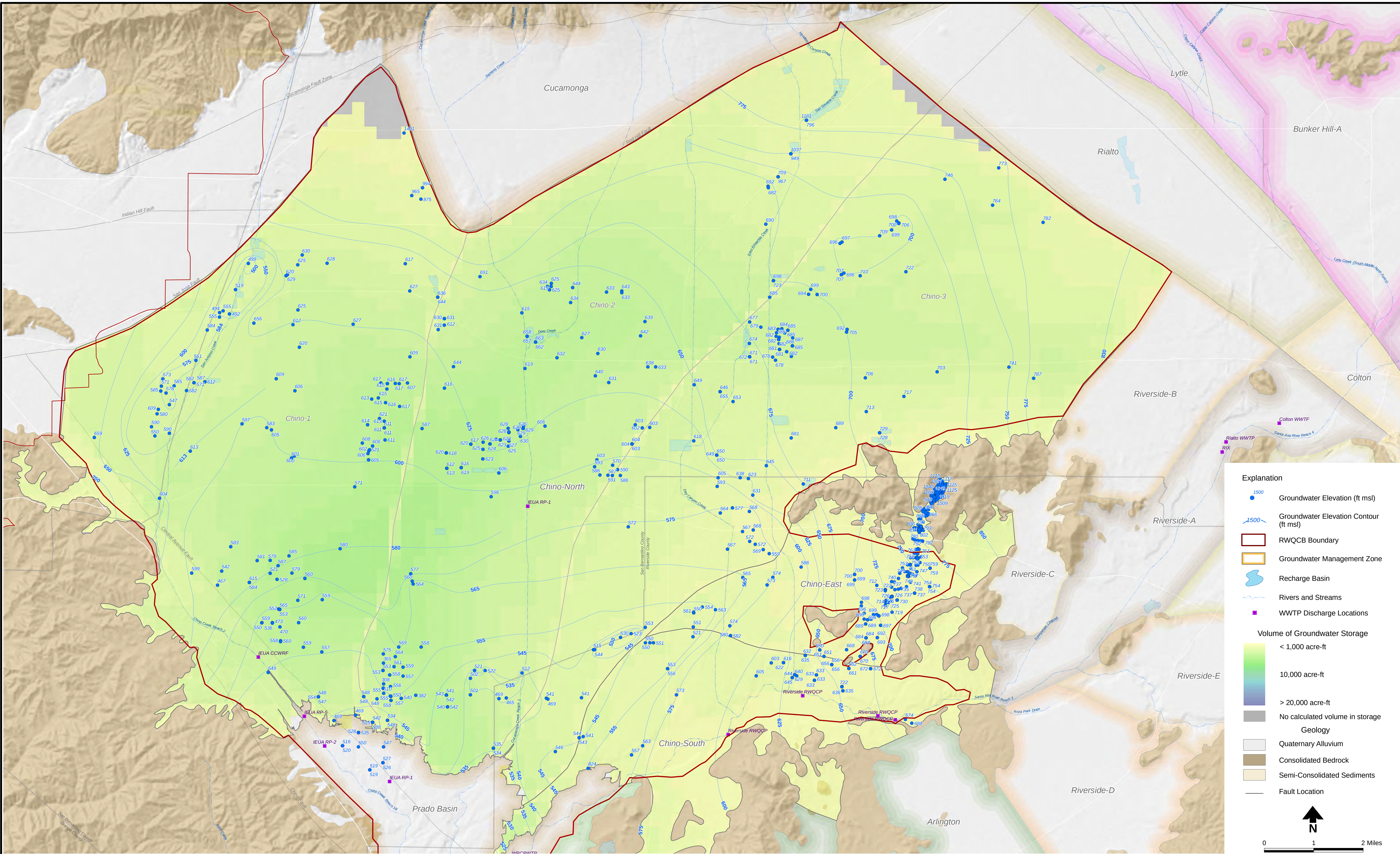
TDS = Total dissolved solids

Table 2. Comparison of Groundwater in Storage Between the Existing Physical Model and the Updated Physical Model for the Chino-North Groundwater Management Zone

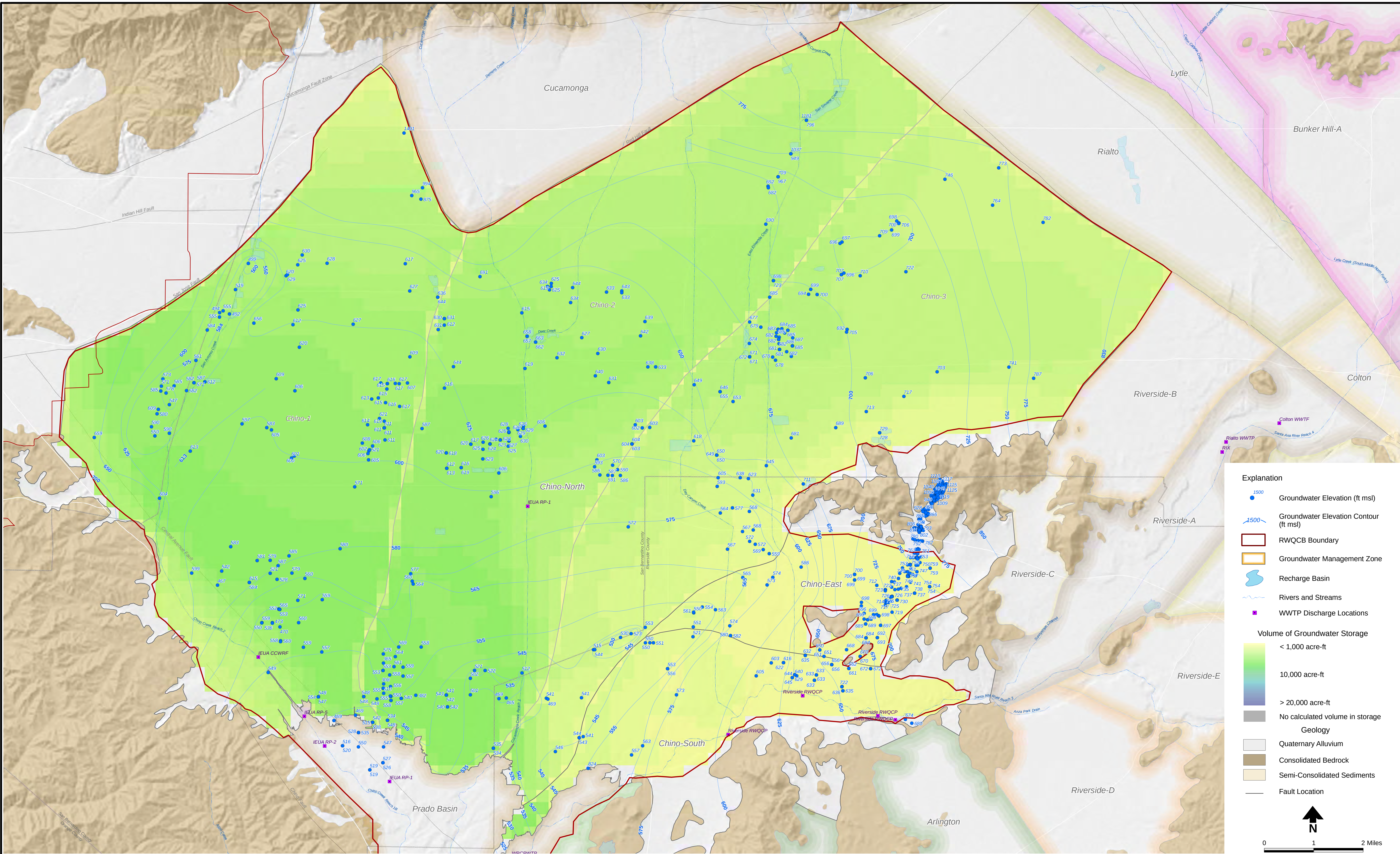
GMZ	Existing AWQ Physical Model Volume (acre-feet)			Updated Physical Model Volume (acre-feet)			Change in Volume from Existing to Updated Physical Model (acre-feet)		
	Layer 1	Layer 2	Layer 3	Layer 1	Layer 2	Layer 3	Layer 1	Layer 2	Layer 3
Chino-1	520,000	500,000	1,080,000	730,000	1,150,000	1,240,000	210,000	650,000	160,000
Chino-2	700,000	730,000	1,070,000	580,000	940,000	2,170,000	-120,000	210,000	1,100,000
Chino-3	80,000	520,000	680,000	680,000	330,000	1,310,000	600,000	-190,000	630,000
Chino-North	1,290,000	1,750,000	2,840,000	1,990,000	2,430,000	4,730,000	700,000	680,000	1,890,000

Appendix A

Chino Basin
Groundwater Management
Zone Maps



Source: SAWPA.net, January 2017



Explanation

- 1500 Groundwater Elevation (ft msl)
- 1500 Groundwater Elevation Contour (ft msl)
- RWQCB Boundary
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

Volume of Groundwater Storage

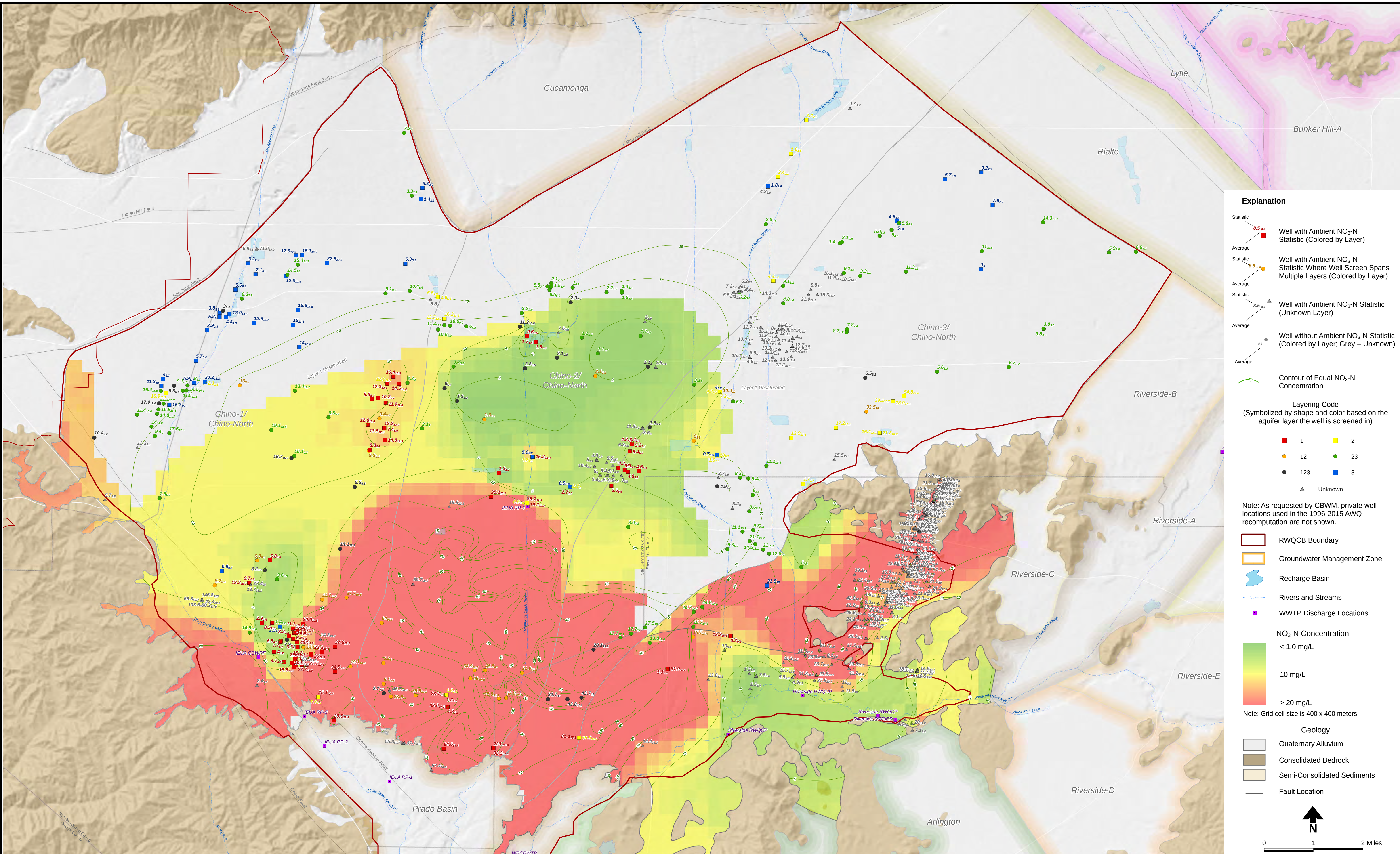
- < 1,000 acre-ft
- 10,000 acre-ft
- > 20,000 acre-ft
- No calculated volume in storage

Geology

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

0 1 2 Miles

Source: SAWPA.net, January 2017



Explanation

Statistic ■ 8.5 _{2,4} Well with Ambient NO₃-N Statistic (Colored by Layer)

Average ● 8.5 _{2,4} Well with Ambient NO₃-N Statistic Where Well Screen Spans Multiple Layers (Colored by Layer)

Statistic ▲ 8.5 _{2,4} Well with Ambient NO₃-N Statistic (Unknown Layer)

Average ● 8.4 Well without Ambient NO₃-N Statistic (Colored by Layer; Grey = Unknown)

Contour of Equal NO₃-N Concentration

Layering Code
(Symbolized by shape and color based on the aquifer layer the well is screened in)

■ 1	■ 2
● 12	● 23
● 123	■ 3
▲ Unknown	

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.

 RWQCB Boundary

 Groundwater Management Zone

 Recharge Basin

 Rivers and Streams

■ WWTP Discharge Locations

NO₃-N Concentration

 < 1.0 mg/L

 10 mg/L

 > 20 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

 Quaternary Alluvium

 Consolidated Bedrock

 Semi-Consolidated Sediments

 Fault Location

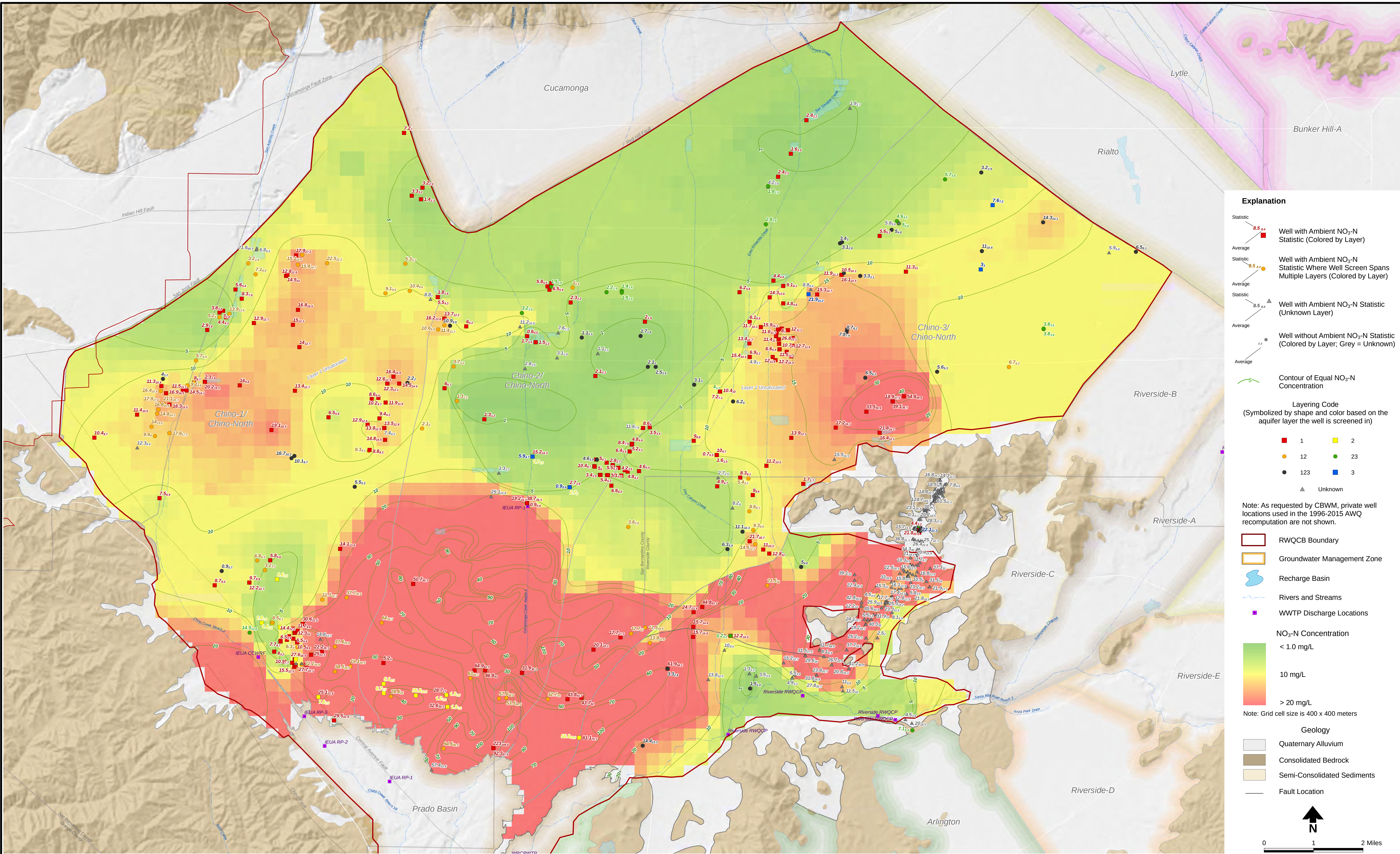
Scale

0 1 2 Miles

North Arrow

N

Source: SAWPA.net, January 2017



Explanation

Statistic Well with Ambient NO₃-N Statistic (Colored by Layer)

Average Well with Ambient NO₃-N Statistic Where Well Screen Spans Multiple Layers (Colored by Layer)

Statistic Well with Ambient NO₃-N Statistic (Unknown Layer)

Average Well without Ambient NO₃-N Statistic (Colored by Layer; Grey = Unknown)

Contour of Equal NO₃-N Concentration

Layering Code
(Symbolized by shape and color based on the aquifer layer the well is screened in)

1	2
12	23
123	3
Unknown	

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

NO₃-N Concentration

< 1.0 mg/L

10 mg/L

> 20 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

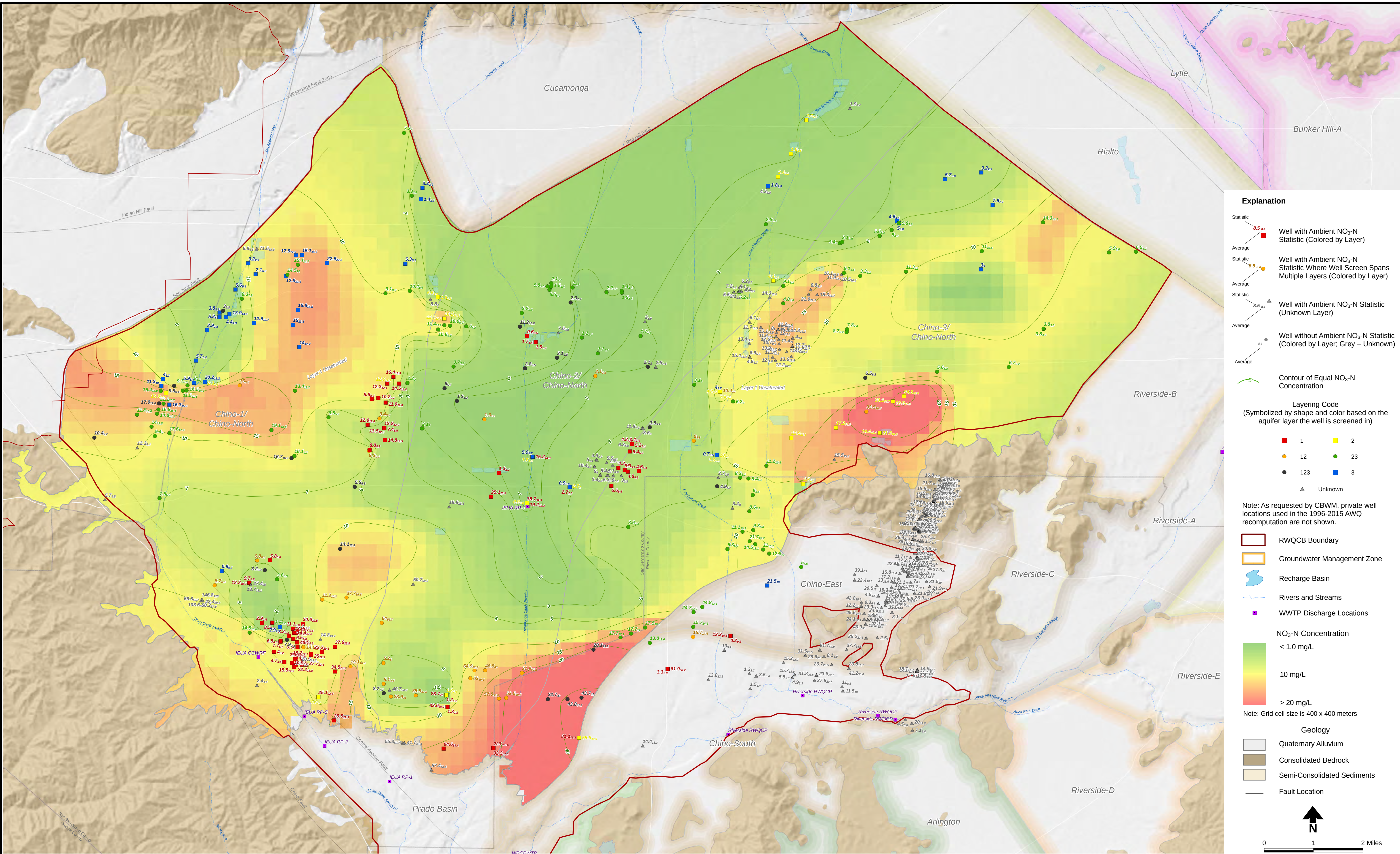
Semi-Consolidated Sediments

Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Explanation

Statistic

8.5

Average

Well with Ambient NO₃-N Statistic (Colored by Layer)

Statistic

8.5

Average

Well with Ambient NO₃-N Statistic Where Well Screen Spans Multiple Layers (Colored by Layer)

Statistic

8.5

Average

Well with Ambient NO₃-N Statistic (Unknown Layer)

Statistic

8.4

Average

Well without Ambient NO₃-N Statistic (Colored by Layer; Grey = Unknown)

5

Contour of Equal NO₃-N Concentration

Layering Code
(Symbolized by shape and color based on the aquifer layer the well is screened in)

1

2

12

23

123

3

Unknown

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

NO₃-N Concentration

< 1.0 mg/L

10 mg/L

> 20 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

Semi-Consolidated Sediments

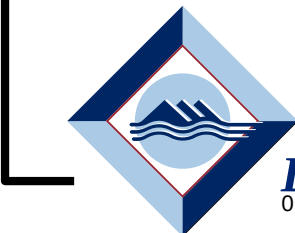
Fault Location

0

1

2 Miles

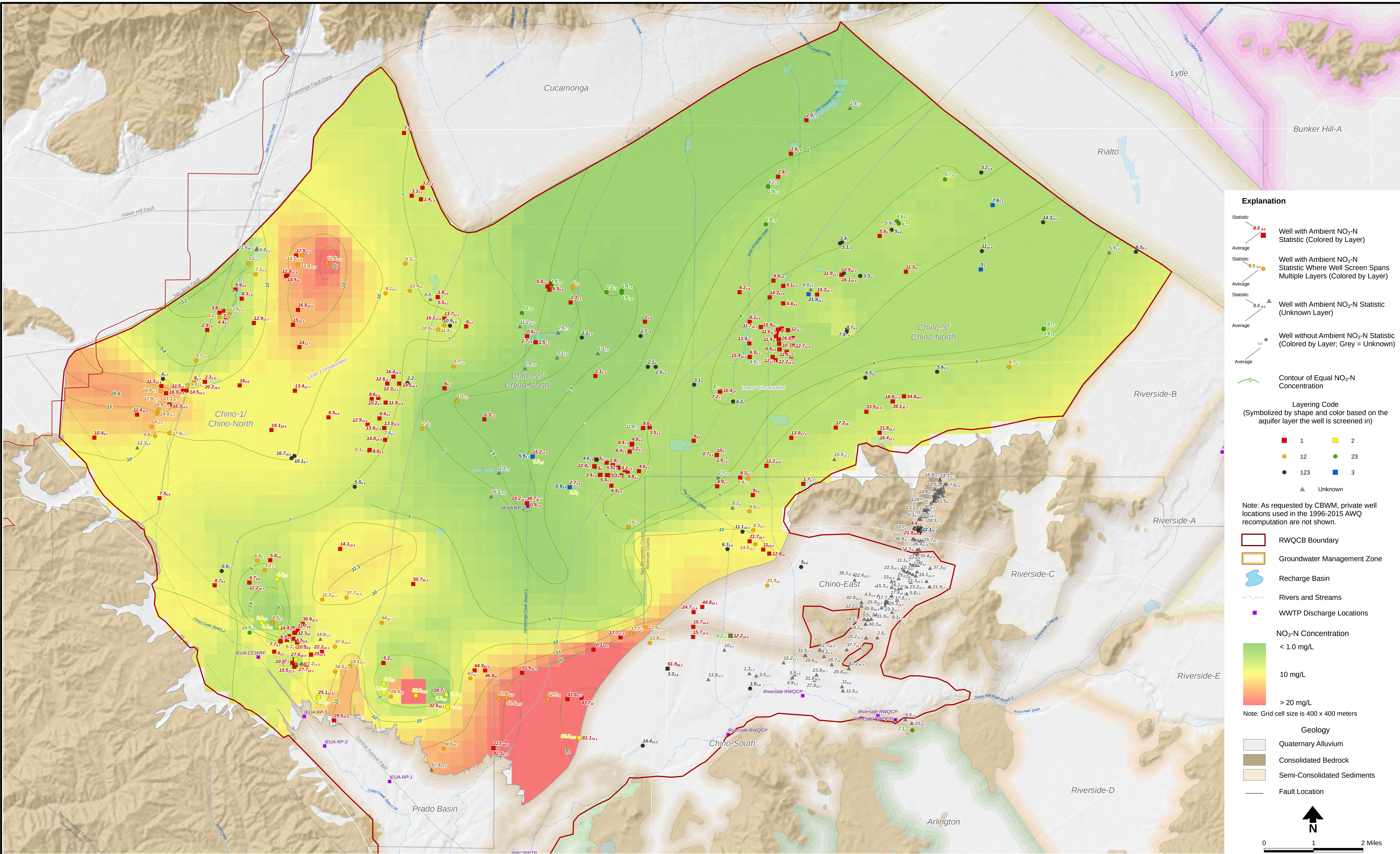
Source: SAWPA.net, January 2017



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 Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
NO₃-N Concentration and Contour Map Layer 2
Existing AWQPhysical Model
Figure A.3a



Explanation

Statistic Well with Ambient NO₃-N Statistic (Colored by Layer)

Average Well with Ambient NO₃-N Statistic Where Well Screen Spans Multiple Layers (Colored by Layer)

Statistic Well with Ambient NO₃-N Statistic (Unknown Layer)

Average Well without Ambient NO₃-N Statistic (Colored by Layer; Grey = Unknown)

Contour of Equal NO₃-N Concentration

Layering Code
(Symbolized by shape and color based on the aquifer layer the well is screened in)

1	2
12	23
123	3
Unknown	

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

NO₃-N Concentration

< 1.0 mg/L

10 mg/L

> 20 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

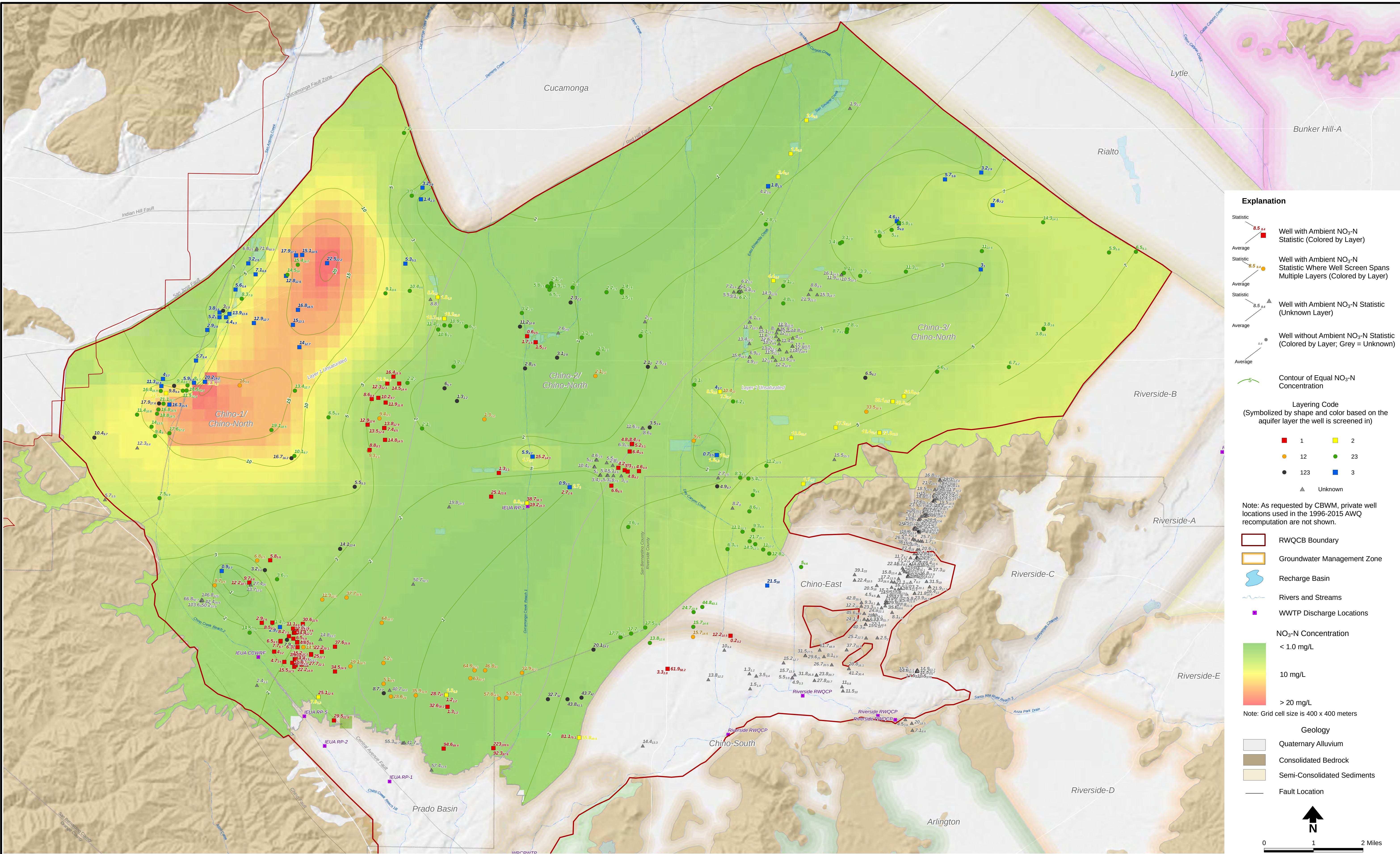
Consolidated Bedrock

Semi-Consolidated Sediments

Fault Location

N

0 1 2 Miles



Explanation

Statistic

Average

8.5

Well with Ambient NO₃-N Statistic (Colored by Layer)

Statistic

Average

8.5

Well with Ambient NO₃-N Statistic Where Well Screen Spans Multiple Layers (Colored by Layer)

Statistic

Average

8.5

Well with Ambient NO₃-N Statistic (Unknown Layer)

Statistic

Average

8.4

Well without Ambient NO₃-N Statistic (Colored by Layer; Grey = Unknown)

5

Contour of Equal NO₃-N Concentration

Layering Code
(Symbolized by shape and color based on the aquifer layer the well is screened in)

1

2

12

23

123

3

Unknown

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

NO₃-N Concentration

< 1.0 mg/L

10 mg/L

> 20 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

Semi-Consolidated Sediments

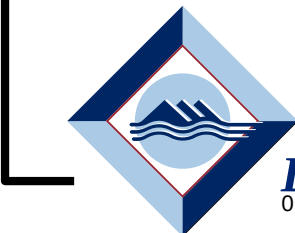
Fault Location

0

1

2 Miles

Source: SAWPA.net, January 2017



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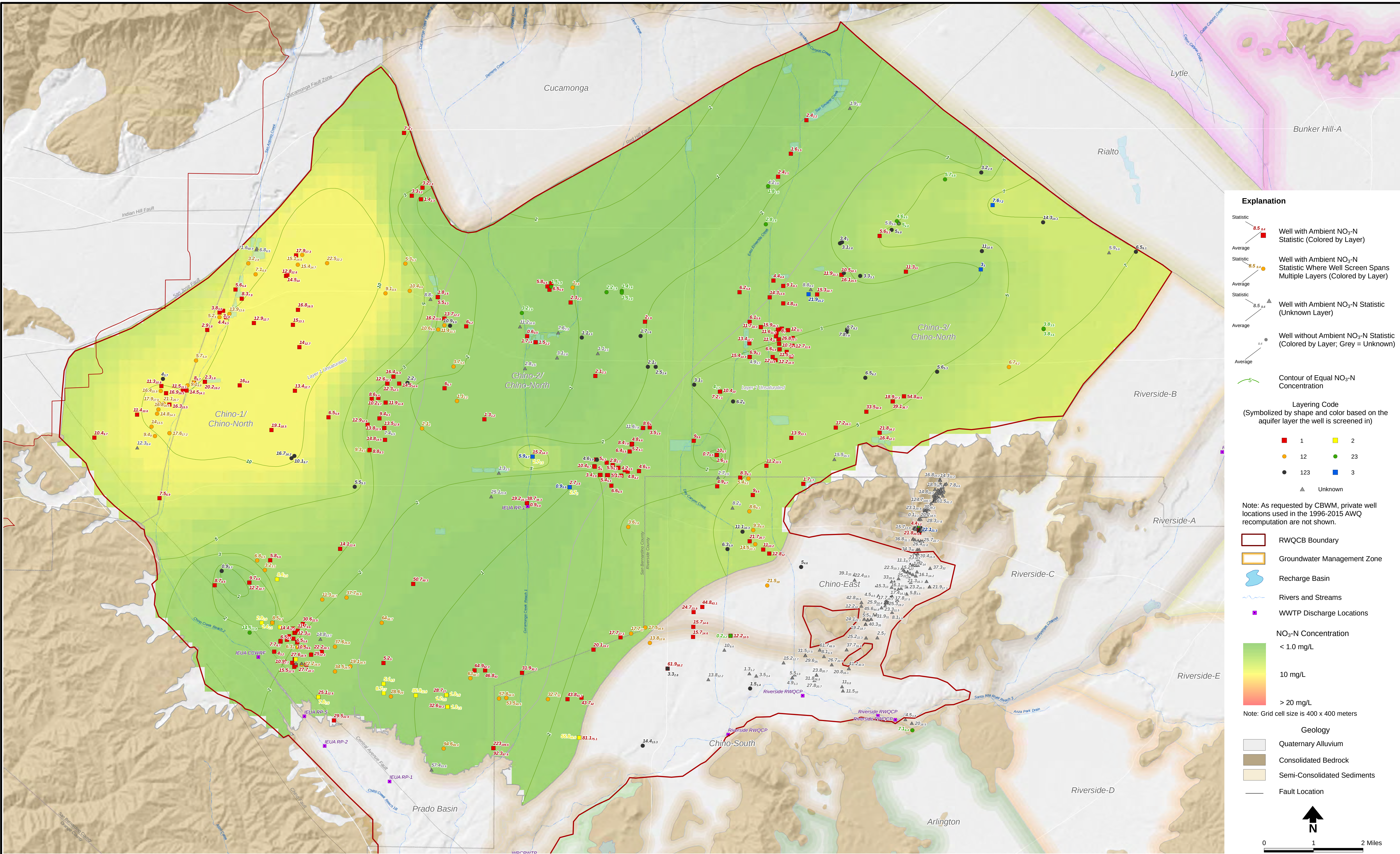
Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

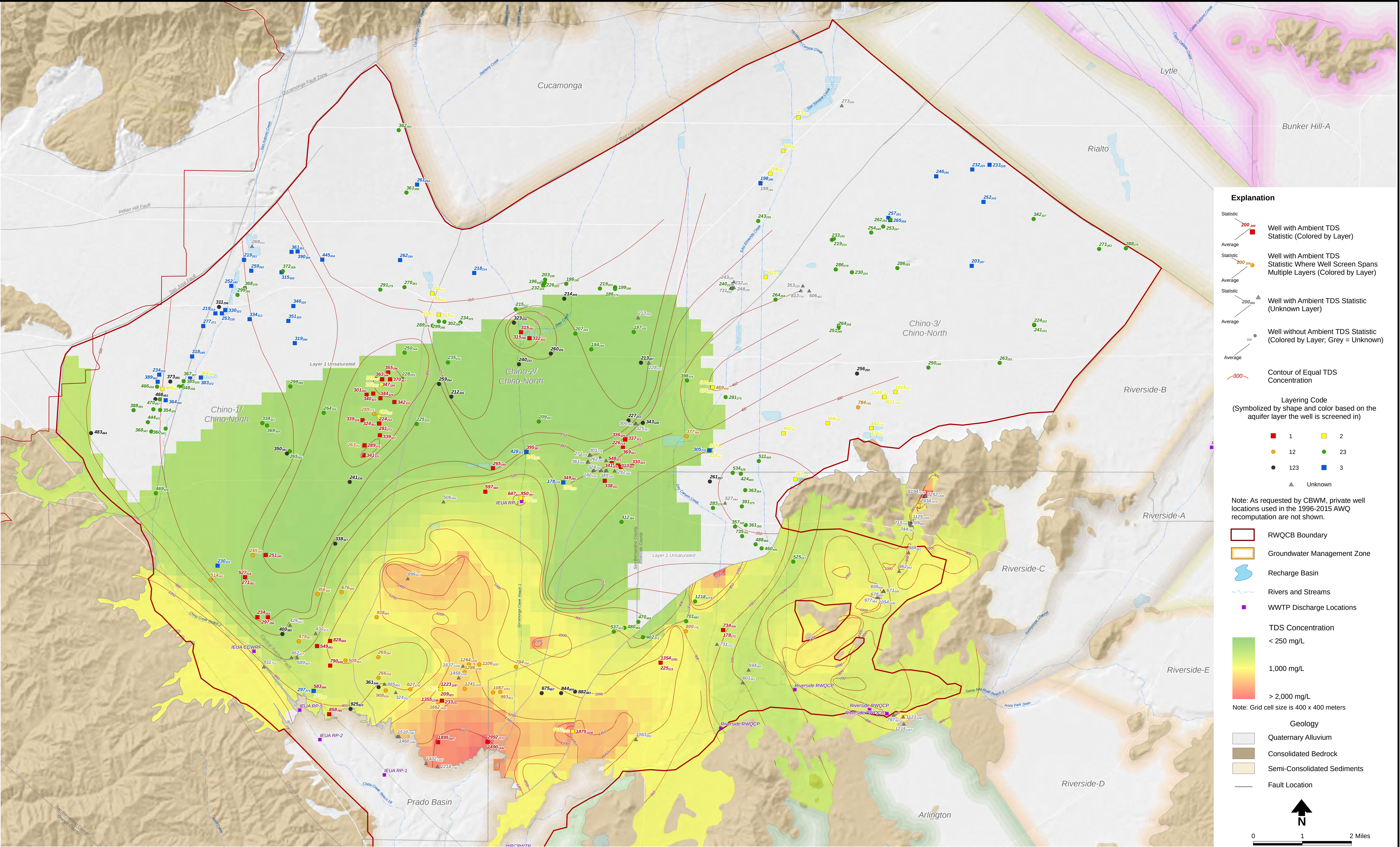
NO₃-N Concentration and Contour Map Layer 3

Existing AWQ Physical Model

FigureA.4a



Source: SAWPA.net, January 2017



Explanation

Statistic

Average

Statistic

Average

Statistic

Average

Statistic

Average

Well with Ambient TDS
Statistic (Colored by Layer)

Well with Ambient TDS
Statistic Where Well Screen Spans
Multiple Layers (Colored by Layer)

Well with Ambient TDS Statistic
(Unknown Layer)

Well without Ambient TDS Statistic
(Colored by Layer; Grey = Unknown)

Contour of Equal TDS
Concentration

Layering Code
(Symbolized by shape and color based on the
aquifer layer the well is screened in)

1

12

123

Unknown

2

23

3

Note: As requested by CBWM, private well
locations used in the 1996-2015 AWQ
recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

TDS Concentration

< 250 mg/L

1,000 mg/L

> 2,000 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

Semi-Consolidated Sediments

Fault Location

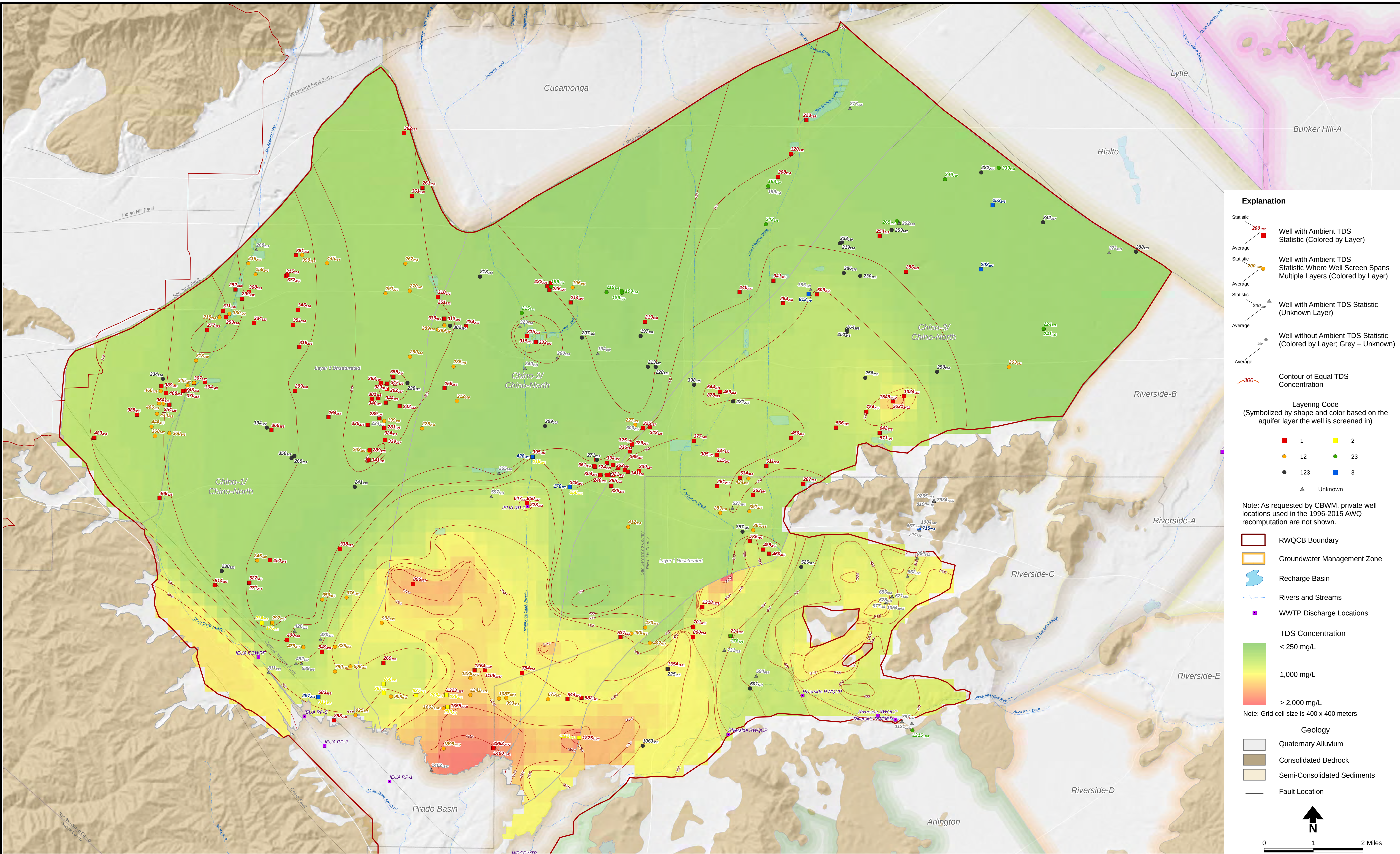
Source: SAWPA.net, January 2017

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration and Contour Map Layer 1
Existing AWQ Physical Model

Figure A.5a



Explanation

Statistic
Average

Well with Ambient TDS
Statistic (Colored by Layer)

Statistic
Average

Well with Ambient TDS
Statistic Where Well Screen Spans
Multiple Layers (Colored by Layer)

Statistic
Average

Well with Ambient TDS Statistic
(Unknown Layer)

Statistic
Average

Well without Ambient TDS Statistic
(Colored by Layer; Grey = Unknown)

Contour of Equal TDS
Concentration

Layering Code
(Symbolized by shape and color based on the
aquifer layer the well is screened in)

1	2
12	23
123	3
Unknown	

Note: As requested by CBWM, private well
locations used in the 1996-2015 AWQ
recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

TDS Concentration

< 250 mg/L

1,000 mg/L

> 2,000 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

Semi-Consolidated Sediments

Fault Location

0 1 2 Miles

Source: SAWPA.net, January 2017

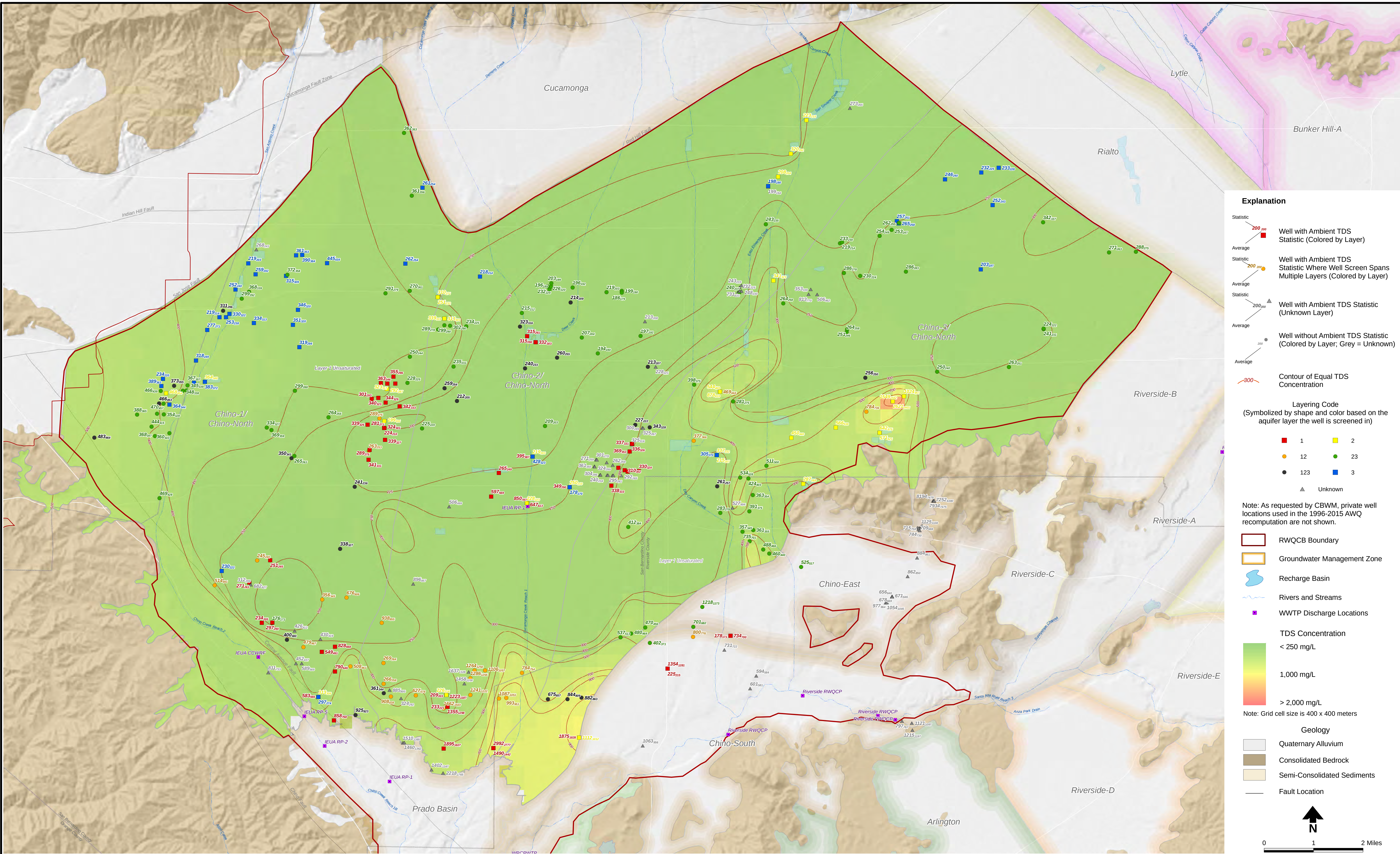


SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration and Contour Map Layer 1
Updated Physical Model

Figure A.5b



Explanation

Statistic 200₁₀₀ Well with Ambient TDS Statistic (Colored by Layer)

Average 200₂₀₀ Well with Ambient TDS Statistic Where Well Screen Spans Multiple Layers (Colored by Layer)

Statistic 200₂₀₀ Well with Ambient TDS Statistic (Unknown Layer)

Average 200 Well without Ambient TDS Statistic (Colored by Layer; Grey = Unknown)

300 Contour of Equal TDS Concentration

Layering Code
(Symbolized by shape and color based on the aquifer layer the well is screened in)

1	2
12	23
123	3
Unknown	

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.

RWQCB Boundary

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

TDS Concentration

< 250 mg/L

1,000 mg/L

> 2,000 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

Semi-Consolidated Sediments

Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017

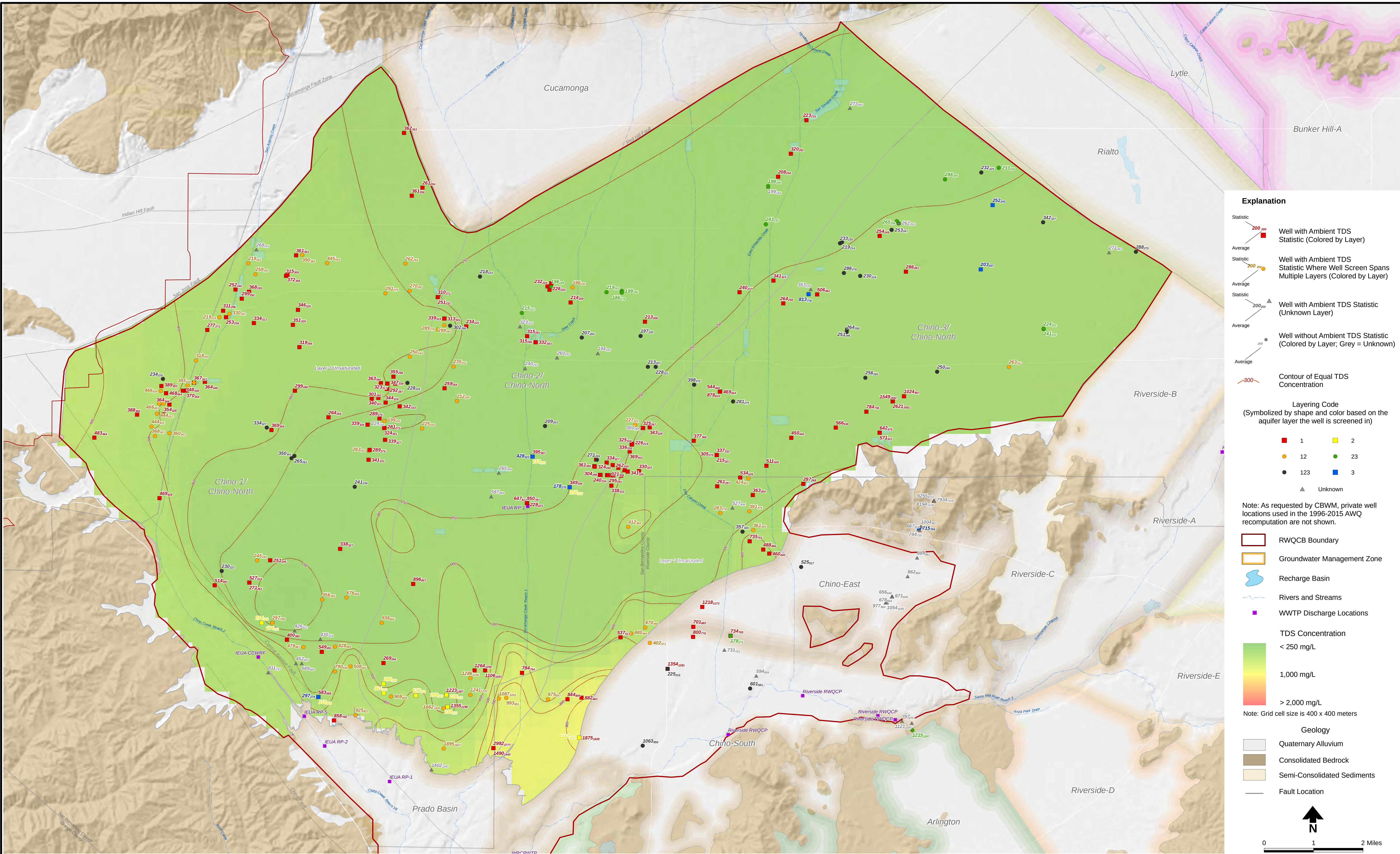
DBS&A
Daniel B. Stephens & Associates, Inc.
01/31/2017 CA.16.0087

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration and Contour Map Layer 2
Existing AWQ Physical Model

Figure A.6a



Source: SAWPA.net, January 2017

Appendix B

Comments and Responses to Draft Technical Memorandum Submitted July 31, 2017



**Response to Comments: Draft AWQ Technical Memorandum, July 31, 2017
Update the Physical Model of Groundwater Management Zones (Task 1b)
Page 1 of 4**

Comment No.	Section	Agency	Comment	Response to Comment
1	Section 6.3, p. 87	EMWD	<i>Improve Spatial Distribution of Modeling..."The GMZs in the upper Temescal Valley (Warm Springs Valley, Lee Lake, and Bedford)"</i> Temescal Valley has been done by EVMWD and EMWD through WEI and can be included in the future.	Noted.
2	Section 6.4, p. 88	SAWPA	Update the Physical Characterization of Management Zones. Based on your review of other groundwater management models under the Imported Water Recharge Agreement, is it possible to be more specific as which other management zones could benefit from updated physical models rather than the general statement that this could be applied to all of them.	Additional text has been added to the recommendations section regarding specific management zones that could benefit from an updated physical model. Further discussion among the task force is needed.
3	Section 6.4	Riverside Public Utility	I would like to see this section moved to a separate memo to the stakeholders, with the memo referenced in the final report. As a pilot study, this should be managed by the task force separate from our triennial reporting requirement.	Task 1b has been separated out of the AWQ Recomputation technical memorandum and is being submitted as this standalone document.
4	p. 78, 4th bullet	RWQCB	<i>"Layer 1 is now interpreted to be thicker in the northern and eastern portions of the Chino Basin to honor new data from boreholes and to avoid the model layer from being unsaturated."</i> Please clarify the text above. The wording implies that Layer 1 is saturated for modelling purposes. Is Layer 1 saturated in reality, or is this an artifact of model calibration?	The text has been modified to read "Layer 1 is now interpreted to be thicker in the northern and eastern portions of the Chino Basin to take into account new data from boreholes and to avoid the computational issues with the model layer being unsaturated in the groundwater model."



**Response to Comments: Draft AWQ Technical Memorandum, July 31, 2017
Update the Physical Model of Groundwater Management Zones (Task 1b)
Page 2 of 4**

Comment No.	Section	Agency	Comment	Response to Comment
5	p. 79, Section 5.1, second sentence	RWQCB	<i>"As discussed above, the groundwater in storage in the Chino-North GMZ increased by approximately 3,000,000 acre-feet, which essentially dilutes the nitrate and TDS and lowers the computed AWQ concentrations."</i> Please clarify this sentence to more accurately describe how the 3,000,000 acre-feet of additional water in storage is mostly located in the deeper, cleaner aquifer layers.	The text has been modified.
6	p. 88, Section 6.4	RWQCB	Consider adding a discussion on whether revisions to the physical model include revised boundaries based on model domains. Note that model domains typically do not extend to the management zone boundaries.	Comment noted. Need further discussion in the Task Force setting.
7	p. 88, Section 6.4, near the end of the first paragraph	RWQCB	In the sentence <i>"In order to make meaningful assimilative capacity determinations, historical ambient water quality (1954 to 1973) with new water quality objectives..."</i> Remove <i>"with new water quality objectives"</i>	The text has been modified.
8	p. 88, Section 6.4, bullet list	RWQCB	How many management zones have updated groundwater models (since 2000)?	Chino Basin has the most significant update to its physical model and was proposed by the BMPTF to be used as a pilot study. A preliminary estimate suggests that about half of the GMZs have updated physical models since the initial N/TDS report published in 2000.
9	Figure 5-1	RWQCB	Consider making the management zone boundaries clearer. In the text, discuss the differences in the existing grid and the updated model grid, and what the consequences are for the recomputation (dry cells, storage, etc.).	Comment noted. Specific examples are described in Sections 2.2 and Section 2.3.



**Response to Comments: Draft AWQ Technical Memorandum, July 31, 2017
Update the Physical Model of Groundwater Management Zones (Task 1b)
Page 3 of 4**

Comment No.	Section	Agency	Comment	Response to Comment
10	Section 5	IEUA	In the recent Basin Monitoring Program Task Force meeting there was mention that the Pilot UPM would be discussed further over the next several months. We believe that the following can provide some starting points for discussion. Updated Physical Model (see attached): • Recalculated volume for Chino-North is substantially higher using the UPM (9.1 MAF vs. previous 5.8 MAF) and warrants further detailed review • Report indicates that the volume gain was largely attributed to a deeper bottom-of-aquifer due to available boreholes information – Further details as to the borehole quantity, locations, depths, information, etc. would help explain this critical information – Additional discussion with the group regarding the recommended changes shown in the various figures in Section 5 (i.e., locations for increase in water level, model domain, layering, etc.) “Maximum benefit” objectives for the Chino-North were demonstrated by IEUA/CBWM and play an important role in our operational & planning efforts, and we are interested in understanding any potential impacts from the UPM effort.	Comment noted. Section 5 - Update the Physical Model of Groundwater Management Zones (Task 1b) has been moved to this separate technical memorandum.



**Response to Comments: Draft AWQ Technical Memorandum, July 31, 2017
Update the Physical Model of Groundwater Management Zones (Task 1b)
Page 4 of 4**

Comment No.	Section	Agency	Comment	Response to Comment
10 (cont.)	Section 5	IEUA	• Further discussion is needed on the potential increase of assimilative capacity for TDS based on preliminary UPM results (290 mg/L vs. previous 360 mg/L) • Need to consider potential impacts to individual management zones: Chino-North, Chino-South (w/ the pending Basin Plan Amendment), and Chino-East, as well as the larger Chino Basin Due to the significance of the UPM, and the need for further discussion and coordination with stakeholders, the Agency is requesting that the preliminary UPM effort be extracted from the AWQ Report, and not be included in the submission to the Regional Board in its current form. The Agency appreciates your understanding of the request, and looks forward to continuing discussion of the initial UPM results and next steps over the following several months.	Comment noted. Section 5 - Update the Physical Model of Groundwater Management Zones (Task 1b) has been moved to this separate technical memorandum.