California Regional Water Quality Control Board
Santa Ana Region

September 16, 2011

ITEM: **8**

SUBJECT: **Basin Monitoring Program Task Force: Determination of Groundwater Management Zone Ambient Quality**

The consultants will provide a detailed presentation at the meeting. The final report can be downloaded from the Regional Water Board web-site at: http://www.waterboards.ca.gov/santaana/water_issues/programs/basin_plan/docs/2009_AWQ_Final_Tech_Memo.pdf

Excerpts from the final report summarizing key findings are attached.

BASIN PLAN AMENDMENT
REQUIRED MONITORING AND ANALYSES

Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1990 to 2009

Final Technical Memorandum

Prepared for

Santa Ana Watershed Project Authority
Basin Monitoring Program Task Force

Prepared by

Wildermuth Environmental, Inc.

August 2011

1.1 Introduction and Background

In 1995, a Task Force was formed to provide oversight, supervision, and approval of a study to evaluate the impact of Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) on water resources in the Santa Ana Watershed. Members of the TIN/TDS Task Force (later renamed the Nitrogen/TDS Task Force) included:

- California Regional Water Quality Control Board, Santa Ana Region (RWQCB) – Advisory Member
- Chino Basin Water Conservation District (CBWCD)
- Chino Basin Watermaster (CBWM)
- City of Colton
- City of Corona
- City of Redlands
- City of Rialto
- City of Riverside
- City of San Bernardino
- Eastern Municipal Water District (EMWD)
- Elsinore Valley Municipal Water District (EVMWD)
- Inland Empire Utilities Agency (IEUA)
- Jurupa Community Services District (JCSD)
- Orange County Sanitation District (OCSD)
- Orange County Water District (OCWD)
- Riverside-Highland Water Company
- San Bernardino Valley Municipal Water District (SBVMWD)
- San Bernardino Valley Water Conservation District (SBVWCD)
- San Timoteo Watershed Management Authority (STWMA)
- Santa Ana Watershed Project Authority (SAWPA) – Task Force Administrator
- US Geological Survey (USGS) – Advisory Member
- West San Bernardino County Water District
- Yucaipa Valley Water District (YVWD)

Wildermuth Environmental, Inc. (WEI) was retained by the Nitrogen/TDS Task Force, through a contract administered by SAWPA, to conduct Phase 2A of the TIN/TDS Study (Task Order 1998-W020-1616-03). Phase 2A was comprised of the following tasks:

- Task 1: Develop Surface Water Translator for Meeting Groundwater Objectives that Accounts for Nitrogen Losses During Percolation
- Task 2: Develop New Compliance Metric and Monitoring Plan to Replace Current August-

Only Below Prado Metric

- Task 3: Develop Updated Boundary Maps for Groundwater Subbasins and New Management Zones
- Task 4: Estimate Regional TDS and Nitrogen Concentrations in Groundwater
- Task 5: Compute TDS and Nitrogen Objectives for New Groundwater Basins and Management Areas

These tasks were completed in July of 2000 and documented in *TIN/TDS Study – Phase 2A Final Technical Memorandum* (WEI, 2000a). The groundwater management zones delineated in this study, with subsequent revisions, were adopted in the January 22, 2004 Basin Plan Amendment (see Figure 1-1) and replaced the groundwater subbasins of the 1995 Basin Plan (RWQCB, 2004).

Table 1-1 and 1-2 display the ambient water quality determinations (for TDS and nitrate-nitrogen) for groundwater management zones that were generated during the Phase 2A study for the periods of 1954-1973 and 1978-1997. The ambient water quality determinations from the "historical" period (1954-1973) were used as the basis for the new water quality objectives in the 2004 Basin Plan Amendment (RWQCB, 2004). The ambient water quality determinations from the "current" period (1978-1997) were used to assess compliance with the new water quality objectives and to determine the magnitude of assimilative capacity, if it exists, within individual management zones.

If the current quality of a management zone is the same as or poorer than the water quality objectives, assimilative capacity does not exist. If the current quality is better than the water quality objectives, assimilative capacity exists. In the latter case, the difference between the objectives and current quality is the amount of assimilative capacity available.

Note that in Tables 1-1 and 1-2, a number of the water quality objectives have been raised to create assimilative capacity and, thus, encourage reclamation and the maximum beneficial use of state waters. These "maximum benefit" water quality objectives for management zones are contingent on the implementation of certain projects and programs by specific dischargers as part of their maximum benefit demonstrations. Also note that the Chino Basin management zones, as delineated in the *TIN/TDS Study – Phase 2A Final Technical Memorandum* (with revisions), have been further revised to accompany the maximum benefit water quality objectives.

As part of the agreement to adopt the 2004 Basin Plan Amendment, the affected parties have agreed to recompute ambient water quality for the individual management zones every three years. The determination of current ambient quality shall be accomplished using a methodology consistent with that employed by the Nitrogen/TDS Task Force (20-year running averages) to develop the TDS and nitrate-nitrogen water quality objectives included in the 2004 Basin Plan.

Specifically, the 2004 Basin Plan states:

> No later than (*6 months from effective date of this Basin Plan amendment*),

> Orange County Water District, Irvine Ranch Water District, Inland Empire Utilities Agency, Chino Basin Watermaster, City of Riverside, City of Corona, Elsinore Valley Municipal Water District, Eastern Municipal Water District, City of Colton, City of San Bernardino Municipal Water Department, City of Redlands, Jurupa Community Services District, Western Riverside County Regional Wastewater Authority , Lee Lake Water District, Yucaipa Valley Water District, City of Beaumont, the San Timoteo Watershed Management Authority and the City of Rialto shall submit to the Regional Board for approval, a proposed watershed-wide TDS and nitrogen monitoring program that will provide data necessary to review and update the TDS/nitrogen management plan. Data to be collected and analyzed shall address, at a minimum: (1) determination of current ambient quality in groundwater management zones; (2) determination of compliance with TDS and nitrate-nitrogen objectives for the management zones; (3) evaluation of assimilative capacity findings for groundwater management zones; and (4) assessment of the effects of recharge of surface water POTW discharges on the quality of affected groundwater management zones. 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. [Ref. 1] The determination of current ambient groundwater quality throughout the watershed must be reported by July 1, 2005, and, at a minimum, every three years thereafter.

The agencies referenced in the Basin Plan (above) formed the Basin Monitoring Program Task Force (BMPTF) to supervise and oversee the recomputation of ambient water quality, among other related tasks. The first recomputation of ambient water quality encompassed the period of 1984-2003 (reported by July 1, 2005). This recomputation of ambient water quality encompasses the period of 1990-2009 (reported by July 1, 2011). WEI was retained by the BMPTF to perform the current recomputation in June of 2010.

A draft technical memorandum was submitted to the BMPTF, the RWQCB, other affected public agencies, and interested parties for comment in June 2011. Once collected, these comments were addressed with revisions, where appropriate, and responses to the comments were composed and compiled as Appendix A.

This technical memorandum describes, in detail, the specific tasks involved in and the results derived from the recomputation of ambient water quality for all of the groundwater management zones listed in Tables 1-1 and 1-2 for the period of 1990 to 2009.

Section 3 – Ambient Water Quality Results for the Period 1990 to 2009

This section summarizes the results of the ambient water quality recomputation, provides limited interpretation of the results, and provides recommendations for future recomputation efforts.

3.1 Ambient TDS and Nitrate-N Concentrations for Management Zones (1990 to 2009)

The results of the recomputation of ambient TDS/nitrate-nitrogen concentrations for each management zone in the Santa Ana River Watershed for the period of 1990 to 2009 are presented in Tables 3-1 (TDS) and 3-2 (nitrate-nitrogen). Figures 3-1 and 3-2 show these results as map graphics.

3.2 Assimilative Capacity for TDS and Nitrate-N (2009)

The ambient water quality determinations from the "historical" period (1954-1973) were used as the basis for the new water quality objectives in the 2004 Basin Plan Amendment (RWQCB, 2004). The ambient water quality determinations from the current period (1990-2009) are used to assess compliance with the water quality objectives and to determine the magnitude of assimilative capacity, if it exists, within individual management zones.

If the current quality of a management zone is the same as or poorer than the water quality objectives, assimilative capacity does not exist. If the current quality is better than the water quality objectives, assimilative capacity exists. In the latter case, the difference between the objective and current quality is the magnitude of assimilative capacity. Where assimilative capacity exists, the RWQCB may, at its discretion, permit wastewater discharges containing TDS and/or nitrate-nitrogen at concentrations higher than the basin objective (RWQCB, 2004).

The magnitudes of assimilative capacity for TDS and nitrate-nitrogen at each management zone for the current period of recomputation are presented in Tables 3-1 and 3-2 and as map graphics in Figures 3-3 and 3-4. Note that in Tables 3-1 and 3-2, a number of the water quality objectives have been raised to create assimilative capacity and, thus, encourage reclamation and the maximum beneficial use of state waters (RWQCB, 2004). These "maximum benefit" water quality objectives for management zones are contingent on the implementation of certain projects and programs by specific dischargers as part of their maximum benefit demonstrations. The management zones with "maximum benefit" water quality objectives are Chino-North, Cucamonga, Yucaipa, San Timoteo, and Beaumont.

3.3 Trends in Ambient Water Quality Determinations at Management Zones

The ambient water quality of Santa Ana River Watershed management zones has been computed for four 20-year periods (1978-1997 [WEI, 2000a], 1984-2003 [WEI, 2005], 1987-2006 [WEI, 2008], and 1990-2009 [this technical memorandum]) since the initial computation of historical ambient water quality (1954-1973 [WEI 2000a]). The results of these computations are shown in Tables 3-1 and 3-2.

The changes in ambient TDS and nitrate-nitrogen since the last recomputation are shown in Table 3-3 and graphically displayed in Figures 3-5 and 3-6 for TDS and nitrate-nitrogen, respectively. An interpretive well analysis of trends in ambient water quality can be found in the *Interpretive Tools* section of this report (see Section 4).

Table 3-4 lists the number of wells with statistics in each management zone. Table 3-5 lists the management zones that could benefit from additional groundwater level and quality data and the water agencies that overlie them. Additional groundwater monitoring at appropriate locations and/or depths within the management zones listed in Table 3-5 will increase the number of wells with ambient water quality statistics, better constrain TDS and nitrate-nitrogen contouring, and ultimately make the management zones less susceptible to methodological factors that influence the computation of ambient water quality and mask actual trends in groundwater quality (see Section 4).

Table 3-1
Water Quality Objectives, Ambient Water Quality, and Assimilative Capacity for TDS

Groundwater Basin	Management Zone	Total Dissolved Solids (TDS)						
		Water Quality Objective (mg/L)	Historical Ambient[1] (mg/L)	1997 Ambient[2] (mg/L)	2003 Ambient[3] (mg/L)	2006 Ambient[4] (mg/L)	2009 Current Ambient[5] (mg/L)	Assimilative Capacity (mg/L)
San Bernardino Valley & Yucaipa/Beaumont Plains								
	Beaumont -- "max benefit"	330	233	290	260	260	280	**50**
	Beaumont -- "antideg"	230	233	290	260	260	280	-50
	Bunker Hill-A	310	313	350	320	330	340	-30
	Bunker Hill-B	330	332	260	280	280	270	**60**
	Lytle	260	264	240	230	230	240	**20**
	San Timoteo -- "max benefit"[6]	400	303	300	?	?	*420*	-20
	San Timoteo -- "antideg"	300	303	300	?	?	*420*	-120
	Yucaipa -- "max benefit"	370	319	330	310	310	320	**50**
	Yucaipa -- "antideg"	320	319	330	310	310	320	0
San Jacinto Basins								
	Canyon	230	234	220	420	370	420	-190
	Hemet-South	730	732	1030	850	920	910	-180
	Lakeview/Hemet-North	520	519	830	840	880	890	-370
	Menifee	1020	1021	3360	2220	2140	2050	-1030
	Perris-North	570	568	750	780	730	770	-200
	Perris-South	1260	1258	3190	2200	2600	2470	-1210
	San Jacinto-Lower	520	520	730	950	810	800	-280
	San Jacinto-Upper	320	321	370	370	350	350	-30
Chino, Rialto/Colton, & Riverside Basins								
	Chino-North -- "max benefit"	420	260	300	320	340	340	**80**
	Chino 1 -- "antideg"	280	280	310	330	340	340	-60
	Chino 2 -- "antideg"	250	250	300	340	360	360	-110
	Chino 3 -- "antideg"	260	260	280	280	310	320	-60
	Chino-East	730	733	760	620	650	770	-40
	Chino-South	680	676	720	790	940	980	-300
	Colton	410	407	430	430	450	430	-20
	Cucamonga -- "max benefit"	380	212	260	250	250	250	**130**
	Cucamonga -- "antideg"	210	212	260	250	250	250	-40
	Rialto	230	230	230	220	230	230	0
	Riverside-A	560	560	440	440	440	430	**130**
	Riverside-B	290	289	320	310	340	340	-50
	Riverside-C	680	684	760	750	740	740	-60
	Riverside-D	810	812	?	?	?	?	--
	Riverside-E	720	721	720	700	710	700	**20**
	Riverside-F	660	665	580	570	570	570	**90**
	Prado Basin	surface water objective applies	618	819				surface water objective applies
Elsinore/Temescal Valleys								
	Arlington	980	983	?	1020	960	1020	-40
	Bedford	?	?	?	740	?	?	--
	Coldwater	380	381	380	400	420	440	-60
	Elsinore	480	476	480	460	470	470	**10**
	Lee Lake	?	?	?	?	?	?	--
	Temescal	770	771	780	700	780	790	-20
	Warm Springs Valley	?	?	?	?	?	?	--
Orange County Basins								
	Irvine	910	908	910	880	920	910	0
	La Habra	?	?	?	?	?	?	--
	Orange County[7]	580	585	560	560	590	600	-20
	Santiago	?	?	?	?	?	?	--

? = Not enough data to estimate TDS concentrations; management zone is presumed to have no assimilative capacity. If assimilative capacity is demonstrated by an existing or proposed discharger, that discharge would be regulated accordingly.

[1] Data sampling period was 20 years (1954-1973) for historical ambient water quality computations.

[2] Data sampling period was 20 years (1978-1997) for current ambient water quality computations.

[3] Data sampling period was 20 years (1984-2003) for current ambient water quality computations.

[4] Data sampling period was 20 years (1987-2006) for current ambient water quality computations.

[5] Data sampling period was 20 years (1990-2009) for current ambient water quality computations.

[6] Current ambient water quality computations for the San Timoteo management zone were not made during this study. These values were published in *Preliminary Assessment of Assimilative Capacity in the San Timoteo Management Zone* (WEI, 2010), using a surrogate methodology.

[7] For the purposes of regulating discharges other than those associated with projects implemented within the Orange County Management Zone to facilitate remediation projects and/or to address legacy contamination, no assimilative capacity is assumed to exist.

For a detailed description of the methodologies employed to calculate ambient water quality, refer to Sections 4 & 5 of the Phase 2A Final Technical Memorandum (July, 2000).

Table 3-2
Water Quality Objectives, Ambient Water Quality, and Assimilative Capacity for Nitrate-Nitrogen

Groundwater Basin	Management Zone	Nitrate-Nitrogen (NO_3-N)						
		Water Quality Objective (mg/L)	Historical Ambient[1] (mg/L)	1997 Ambient[2] (mg/L)	2003 Ambient[3] (mg/L)	2006 Ambient[4] (mg/L)	2009 Current Ambient[5] (mg/L)	Assimilative Capacity (mg/L)
San Bernardino Valley & Yucaipa/Beaumont Plains								
	Beaumont -- "max benefit"	5.0	1.5	2.6	2.0	1.6	2.5	**2.5**
	Beaumont -- "antideg"	1.5	1.5	2.6	2.0	1.6	2.5	-1.0
	Bunker Hill-A	2.7	2.7	4.5	4.3	4.0	4.0	-1.3
	Bunker Hill-B	7.3	7.3	5.5	5.8	5.4	5.4	**1.9**
	Lytle	1.5	1.5	2.8	2.7	2.7	2.6	-1.1
	San Timoteo -- "max benefit"[6]	5.0	2.7	2.9	?	?	0.8	**4.2**
	San Timoteo -- "antideg"	2.7	2.7	2.9	?	?	0.8	**1.9**
	Yucaipa -- "max benefit"	5.0	4.2	5.2	5.4	5.3	6.2	-1.2
	Yucaipa -- "antideg"	4.2	4.2	5.2	5.8	5.3	6.2	-2.0
San Jacinto Basins								
	Canyon	2.5	2.5	1.6	2.1	1.9	2.7	-0.2
	Hemet-South	4.1	4.1	5.2	5.4	5.5	5.2	-1.1
	Lakeview/Hemet-North	1.8	1.8	2.7	3.4	2.7	2.6	-0.8
	Menifee	2.8	2.8	5.4	6.0	4.7	4.4	-1.6
	Perris-North	5.2	5.2	4.7	6.7	6.5	7.4	-2.2
	Perris-South	2.5	2.5	4.9	5.9	5.5	5.8	-3.3
	San Jacinto-Lower	1.0	1.0	1.9	1.8	1.2	1.1	-0.1
	San Jacinto-Upper	1.4	1.4	1.9	1.7	1.6	1.5	-0.1
Chino, Rialto/Colton, & Riverside Basins								
	Chino-North -- "max benefit"	5.0	3.7	7.4	8.7	9.7	9.5	-4.5
	Chino 1 -- "antideg"	5.0	5.0	8.4	8.9	9.3	9.1	-4.1
	Chino 2 -- "antideg"	2.9	2.9	7.2	9.5	10.7	10.3	-7.4
	Chino 3 -- "antideg"	3.5	3.5	6.3	6.8	8.2	8.4	-4.9
	Chino-East	10.0	13.3	29.1	9.6	12.7	15.7	-5.7
	Chino-South	4.2	4.2	8.8	15.3	25.7	26.8	-22.6
	Colton	2.7	2.7	2.9	2.9	2.9	2.8	-0.1
	Cucamonga -- "max benefit"	5.0	2.4	4.4	4.3	4.0	4.1	**0.9**
	Cucamonga -- "antideg"	2.4	2.4	4.4	4.3	4.0	4.1	-1.7
	Rialto	2.0	2.0	2.7	2.6	2.9	3.1	-1.1
	Riverside-A	6.2	6.2	4.4	4.9	4.9	5.2	**1.0**
	Riverside-B	7.6	7.6	8.0	7.8	8.3	8.4	-0.8
	Riverside-C	8.3	8.3	15.5	15.3	15.3	14.8	-6.5
	Riverside-D	10.0	19.5	?	?	?	?	--
	Riverside-E	10.0	13.3	14.8	15.4	15.3	15.2	-5.2
	Riverside-F	9.5	12.1	9.5	10.6	10.3	10.6	-1.1
	Prado Basin	surface water objective applies	4.3	22.0				surface water objective applies
Elsinore/Temescal Valleys								
	Arlington	10.0	25.5	?	26.0	20.4	18.1	-8.1
	Bedford	?	?	?	2.8	?	?	--
	Coldwater	1.5	1.5	2.6	2.4	2.6	2.8	-1.3
	Elsinore	1.0	1.0	2.6	2.4	2.4	2.2	-1.2
	Lee Lake	?	?	?	?	?	?	--
	Temescal	10.0	11.8	13.2	12.8	12.6	12.0	-2.0
	Warm Springs Valley	?	?	?	?	?	?	--
Orange County Basins								
	Irvine	5.9	5.9	7.4	6.5	6.5	6.7	-0.8
	La Habra	?	?	?	?	?	?	--
	Orange County	3.4	3.4	3.4	3.1	3.0	3.0	**0.4**
	Santiago	?	?	?	?	?	?	--

? = Not enough data to estimate Nitrate-N concentrations; management zone is presumed to have no assimilative capacity. If assimilative capacity is demonstrated by an existing or proposed discharger, that discharge would be regulated accordingly.

[1] Data sampling period was 20 years (1954-1973) for historical ambient water quality computations.

[2] Data sampling period was 20 years (1978-1997) for current ambient water quality computations.

[3] Data sampling period was 20 years (1984-2003) for current ambient water quality computations.

[4] Data sampling period was 20 years (1987-2006) for current ambient water quality computations.

[5] Data sampling period was 20 years (1990-2009) for current ambient water quality computations.

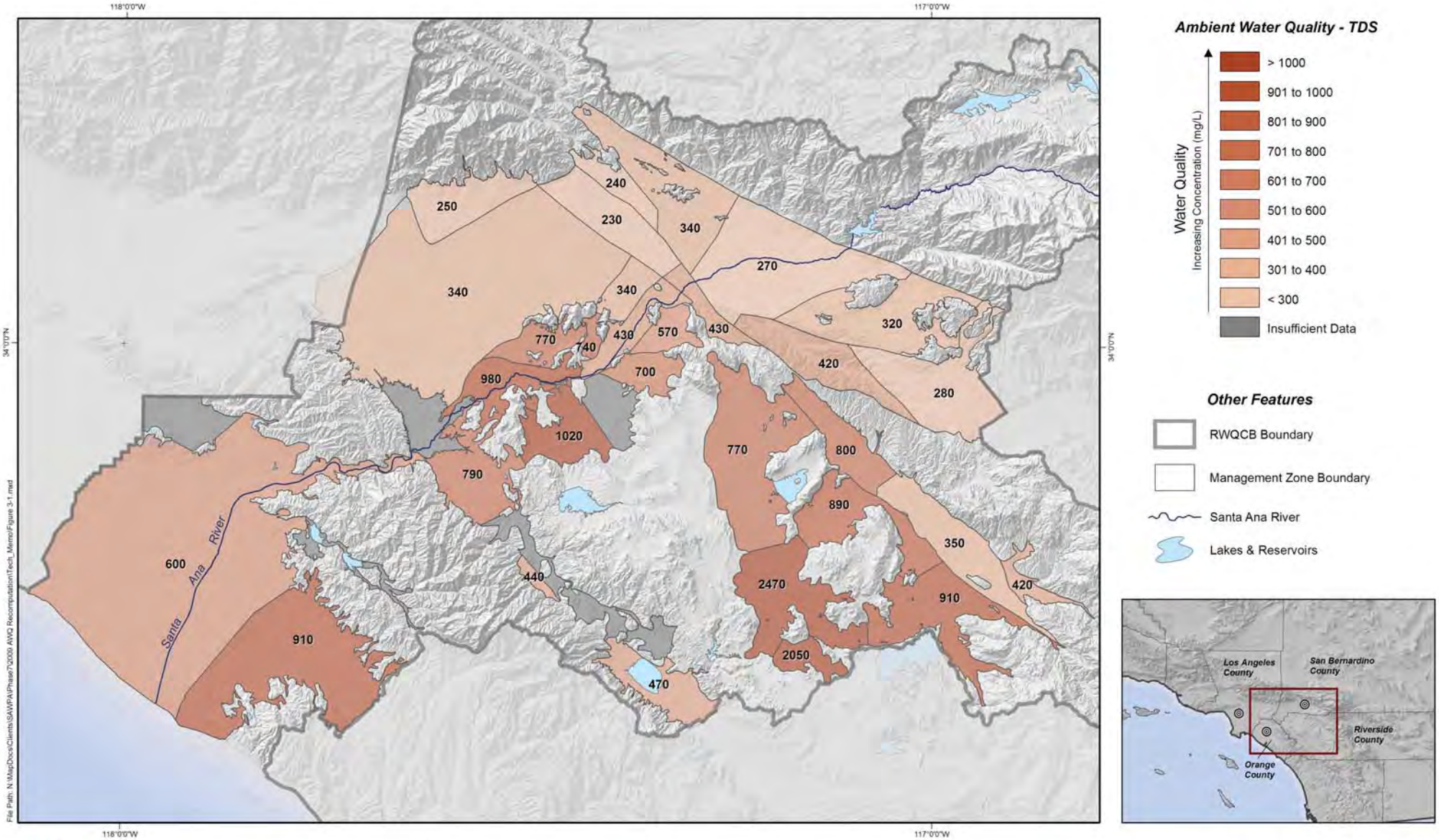
[6] Current ambient water quality computations for the San Timoteo management zone were not made during this study. These values were published in *Preliminary Assessment of Assimilative Capacity in the San Timoteo Management Zone* (WEI, 2010) using a surrogate methodology.

For a detailed description of the methodologies employed to calculate ambient water quality, refer to Sections 4 & 5 of the Phase 2A Final Technical Memorandum (July, 2000).

This table reflects all revisions requested and approved by the TIN/TDS Task Force since the original publication of Table 5-1 in the Phase 2A Final Technical Memorandum (July, 2000).

Table 3-3
Change in Ambient Water Quality by Management Zone

Management Zone	Change in Ambient Water Quality (2006 to 2009)	
	TDS *mg/L*	Nitrate-N *mg/L*
Arlington	60	-2.3
Beaumont	20	0.9
Bedford	--	--
Bunker Hill-A	10	0.0
Bunker Hill-B	-10	0.0
Canyon	50	0.8
Chino 1	0	-0.2
Chino 2	0	-0.4
Chino 3	10	0.2
Chino-East	120	3.0
Chino-North	0	-0.2
Chino-South	40	1.1
Coldwater	20	0.2
Colton	-20	-0.1
Cucamonga	0	0.1
Elsinore	0	-0.2
Hemet-South	-10	-0.3
Irvine	-10	0.2
La Habra	--	--
Lakeview/Hemet-North	10	-0.1
Lee Lake	--	--
Lytle	10	-0.1
Menifee	-90	-0.3
Orange County	10	0.0
Perris-North	40	0.9
Perris-South	-130	0.3
Prado Basin	--	--
Rialto	0	0.2
Riverside-A	-10	0.3
Riverside-B	0	0.1
Riverside-C	0	-0.5
Riverside-D	--	--
Riverside-E	-10	-0.1
Riverside-F	0	0.3
San Jacinto-Lower	-10	-0.1
San Jacinto-Upper	0	-0.1
San Timoteo	--	--
Santiago	--	--
Temescal	10	-0.6
Warm Springs Valley	--	--
Yucaipa	10	0.9



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Date: 20110831
File: Figure 3-1

0 5 10 15 Miles
0 5 10 15 20 25 KM

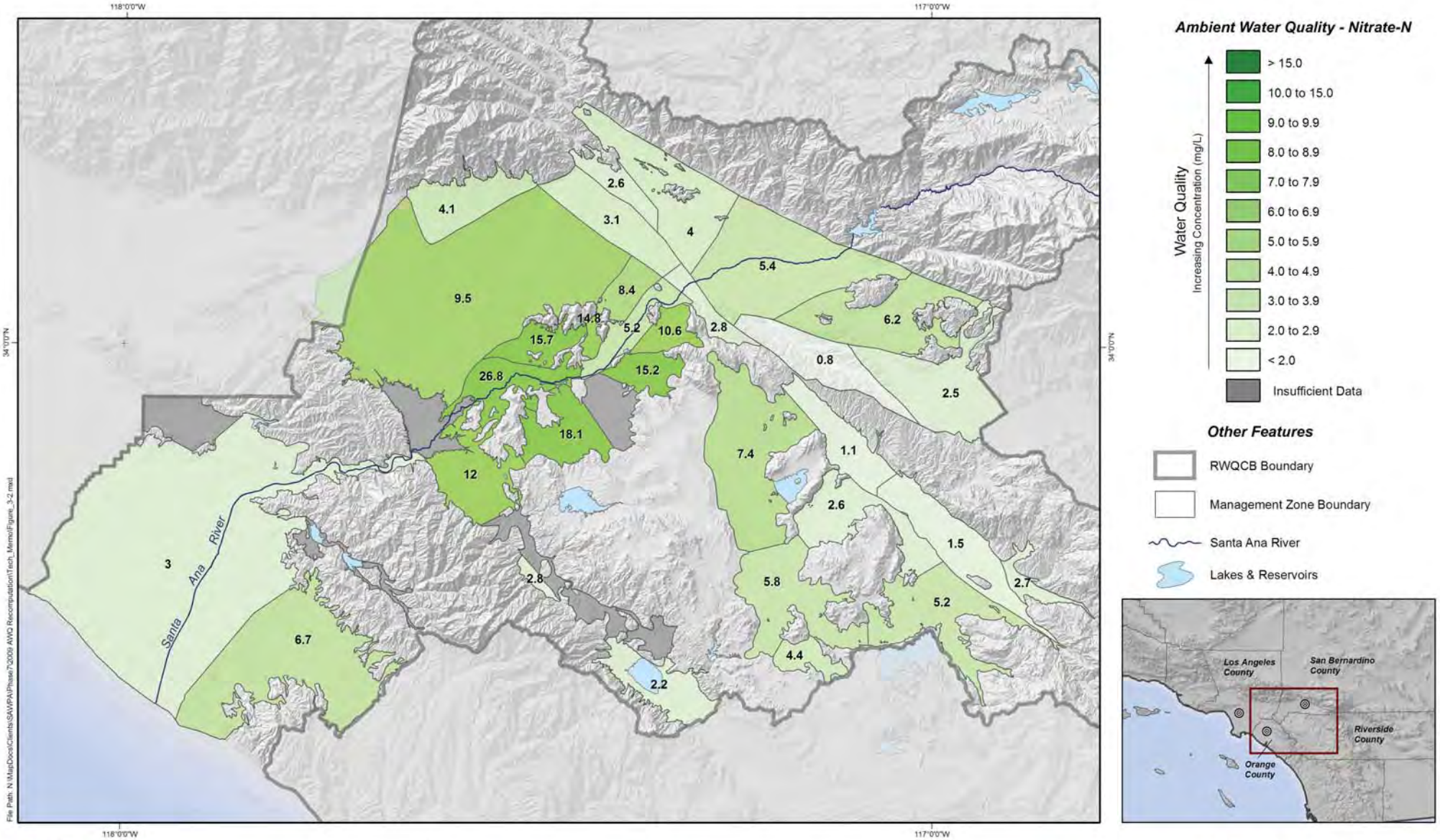
Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1990 to 2009

Ambient Water Quality - TDS

Santa Ana Watershed - 1990-2009

Figure 3-1



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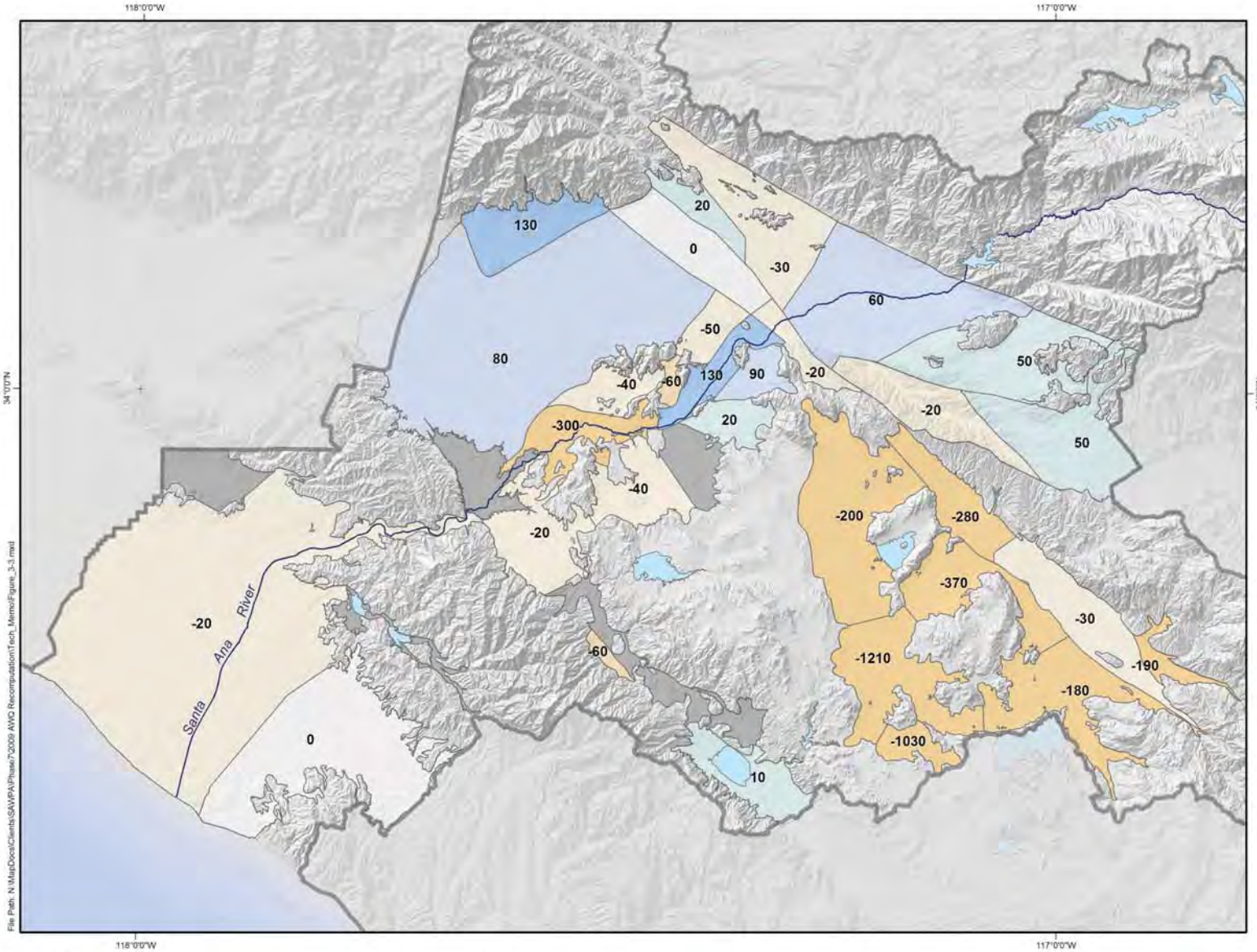
Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1990 to 2009

Ambient Water Quality - Nitrate-N

Santa Ana Watershed - 1990-2009

Figure 3-2



Assimilative Capacity for TDS

- < -100 mg/L
- -51 to -100
- -1 to -50
- 0
- 1 to 50
- 51 to 100
- >100
- Insufficient Data

Note: A negative value means that the current ambient quality is worse than the water quality objective, and no assimilative capacity exists for that management zone.

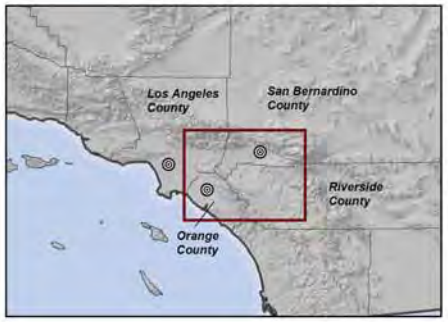
A positive value means that the current ambient quality is better than the water quality objective, and assimilative capacity exists for that management zone.

Each management zone in this figure is symbolized and labeled by the difference between the current ambient water quality and the water quality objective.

Where assimilative capacity exists, the RWQCB may, at its discretion, permit wastewater discharges containing TDS and/or nitrate-nitrogen at concentrations higher than the basin objective.

Other Features

- RWQCB Boundary
- Management Zone Boundary
- Santa Ana River
- Lakes & Reservoirs



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Date: 20110725
File: Figure_3-3

0 5 10 15 Miles
0 5 10 15 20 25 KM

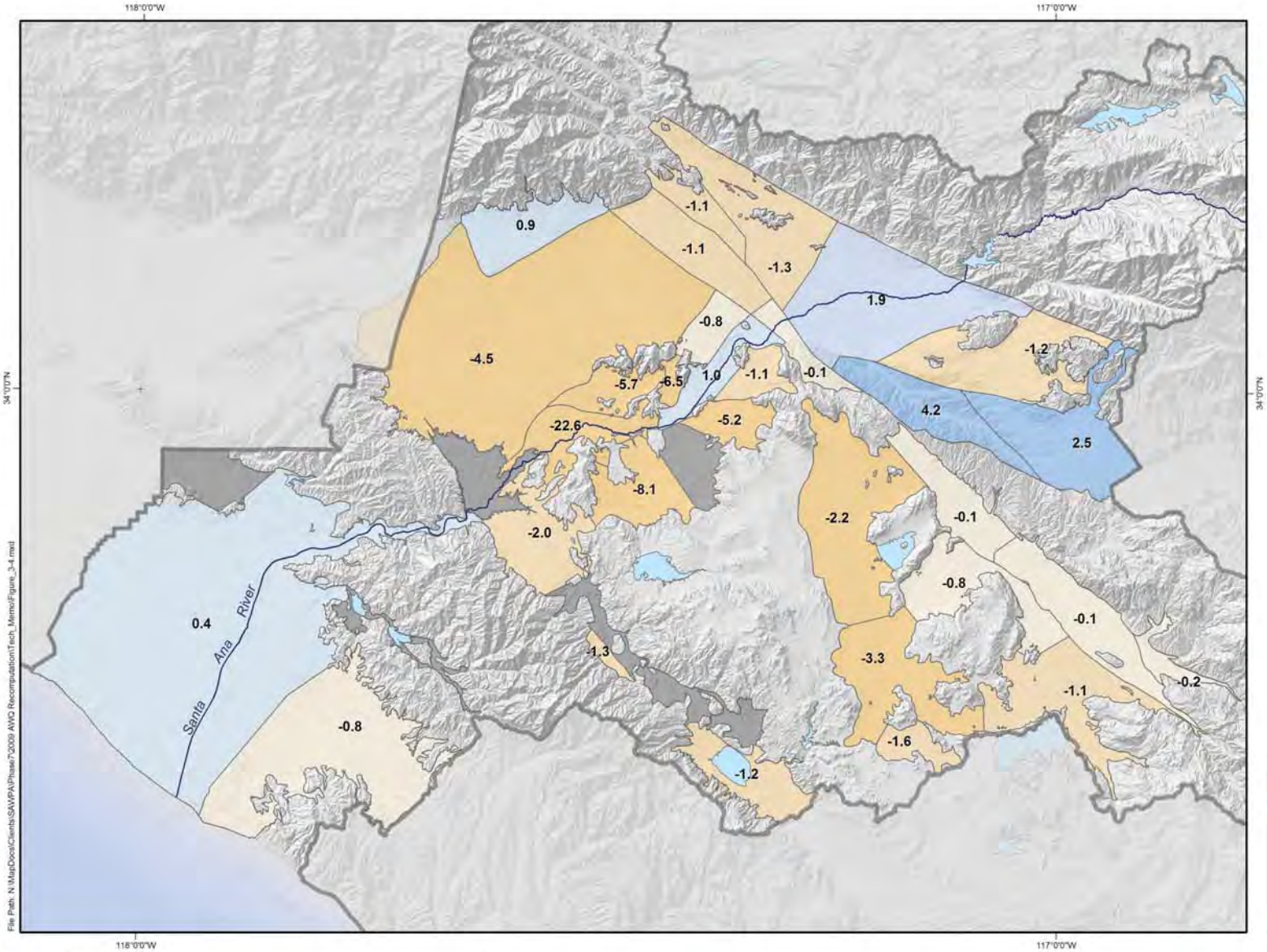
Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1990 to 2009

Assimilative Capacity for TDS

Santa Ana Watershed - 1990-2009

Figure 3-3



Assimilative Capacity for Nitrate-N

- < -2 mg/L
- -1.1 to -2
- -0.1 to -1
- 0
- 0.1 to 1
- 1.1 to 2
- > 2
- Insufficient Data

Note: A negative value means that the current ambient quality is worse than the water quality objective, and no assimilative capacity exists for that management zone.

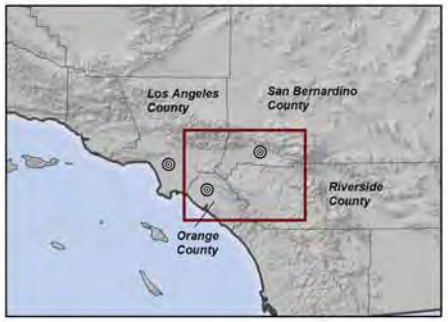
A positive value means that the current ambient quality is better than the water quality objective, and assimilative capacity exists for that management zone.

Each management zone in this figure is symbolized and labeled by the difference between the current ambient water quality and the water quality objective.

Where assimilative capacity exists, the RWQCB may, at its discretion, permit wastewater discharges containing TDS and/or nitrate-nitrogen at concentrations higher than the basin objective.

Other Features

- RWQCB Boundary
- Management Zone Boundary
- Santa Ana River
- Lakes & Reservoirs



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0 5 10 15 Miles
0 5 10 15 20 25 KM

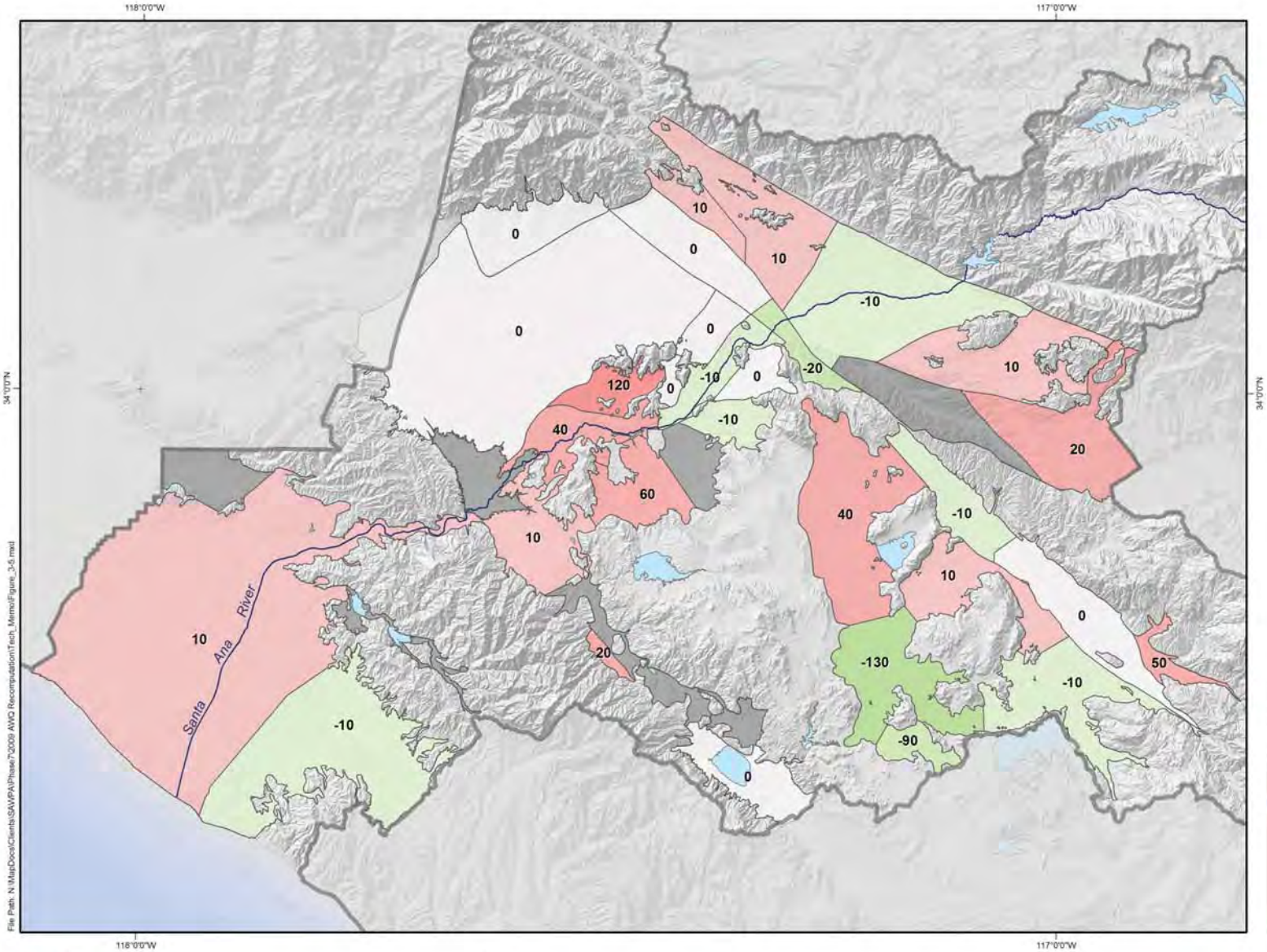
Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1990 to 2009

Assimilative Capacity for Nitrate-N

Santa Ana Watershed - 1990-2009

Figure 3-4



Change in Ambient TDS

Water Quality

Improving

- < -1000 mg/L
- -101 to -1000
- -11 to -100
- -1 to -10
- 0
- 1 to 10
- 11 to 100
- 101 to 1000
- > 1000

Degrading

Other Features

- RWQCB Boundary
- Insufficient Data
- Management Zone Boundary
- Santa Ana River
- Lakes & Reservoirs

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0 5 10 15 Miles
0 5 10 15 20 25 KM

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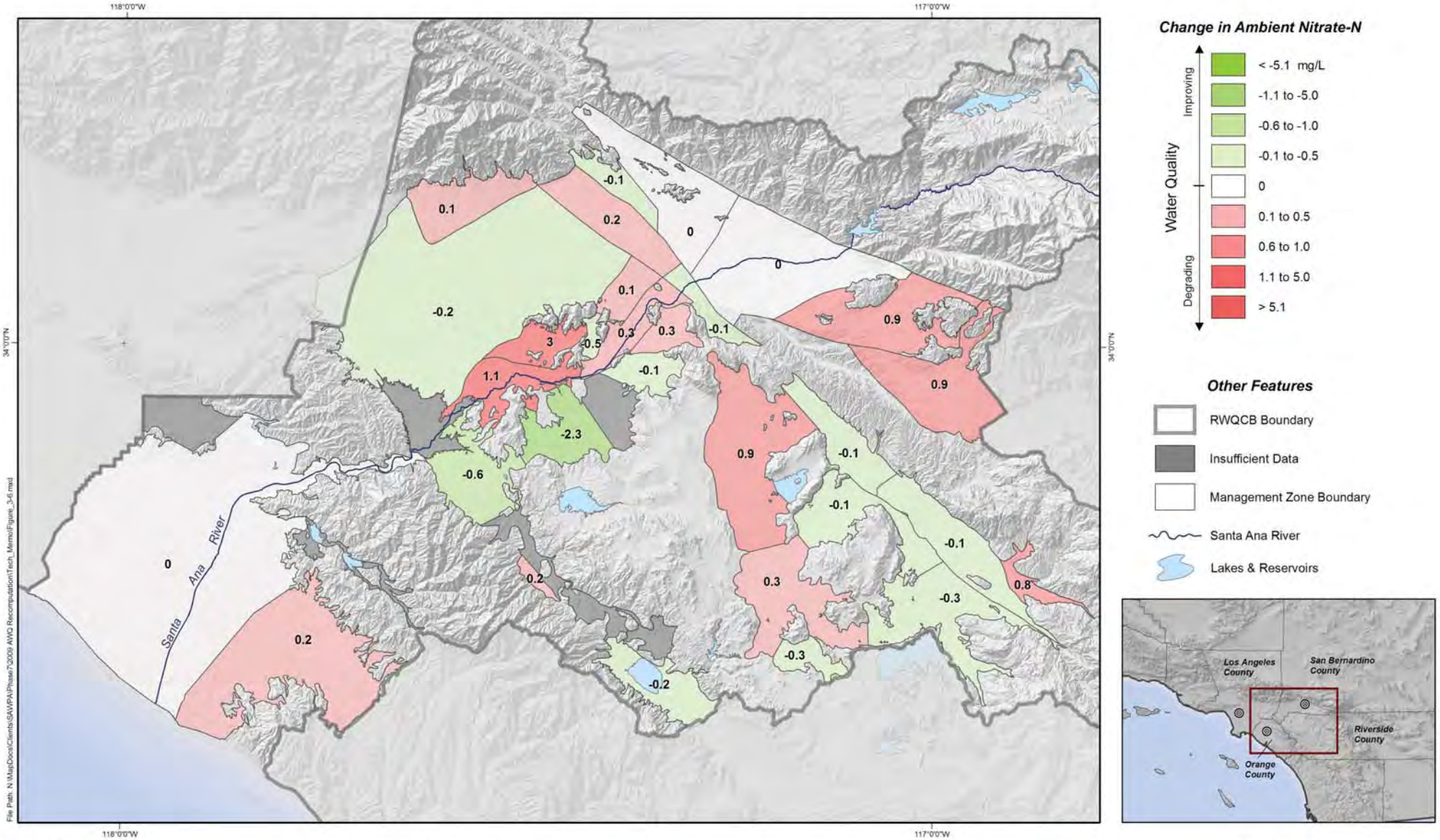
Recomputation of Ambient Water Quality for the Period 1990 to 2009

SAWPA

Change in Ambient TDS

Santa Ana Watershed - 2006 to 2009

Figure 3-5



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0 5 10 15 Miles
0 5 10 15 20 25 KM

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Recomputation of Ambient Water Quality for the Period 1990 to 2009

Change in Ambient Nitrate-N

Santa Ana Watershed - 2006 to 2009

Figure 3-6