October 15, 2014

Coachella Valley Salt and Nutrient Management Plan Stakeholder Meeting No. 3

DESERT WATER

WATER DISTRICT

Indio Water Authority
Your Water. Our Responsibility.

CITY OF COACHELLA
INCORPORATED 1946

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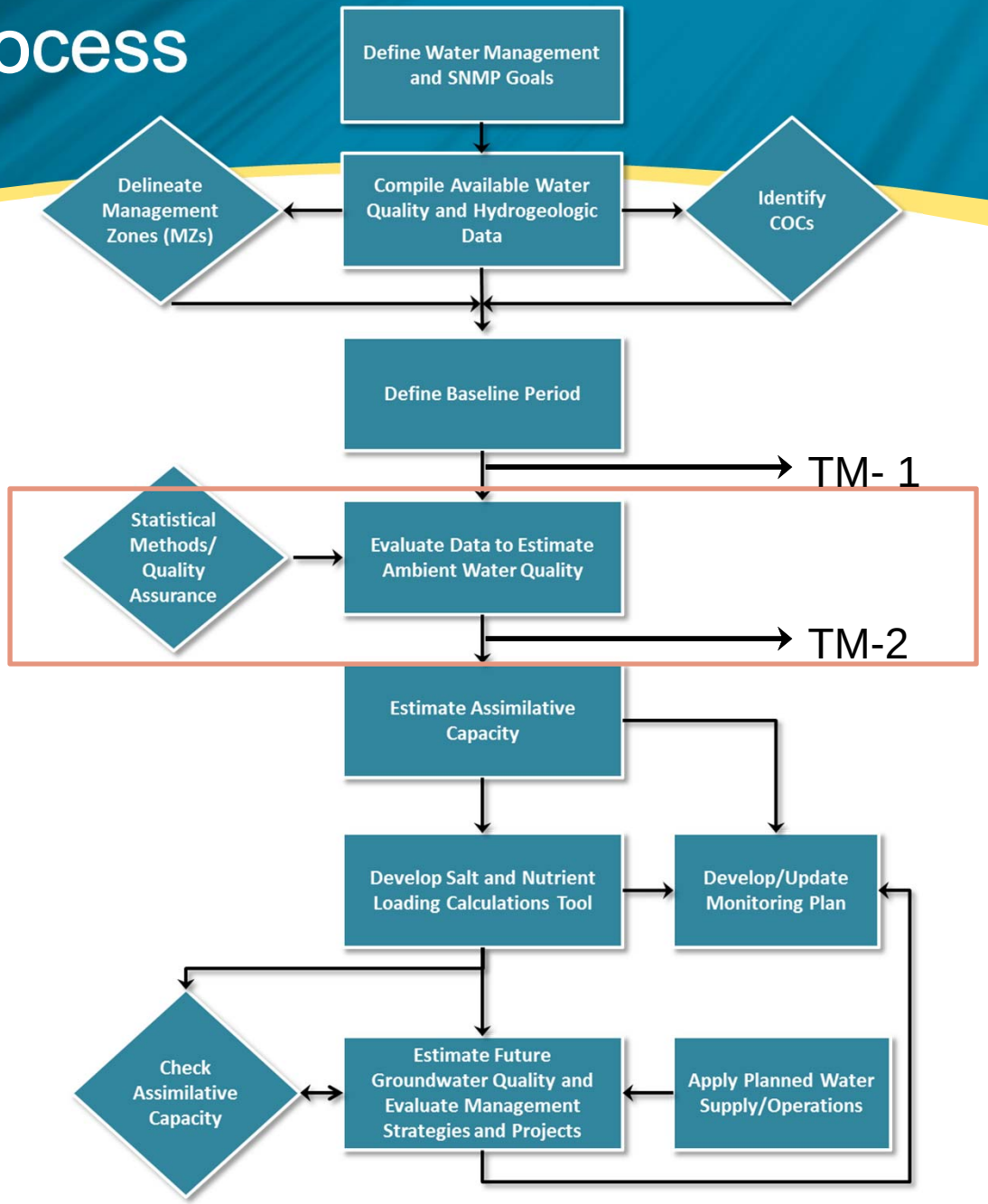
Agenda

- Introductions
- Review purpose
- Presentation (45 minutes)
- Stakeholder input and questions (30 minutes)

Today's Purpose

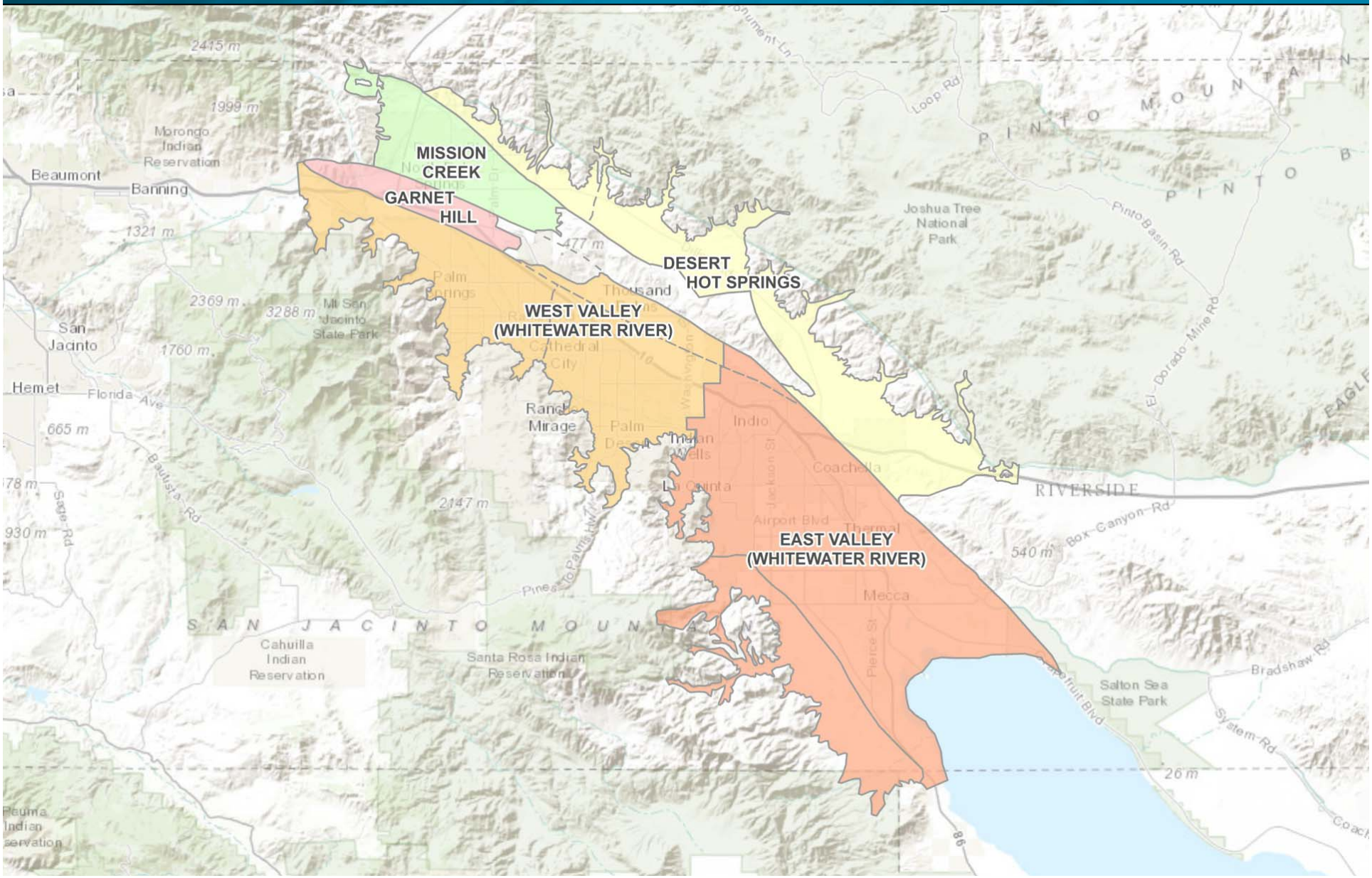
- Review the following:
  - Ambient Water Quality Methods
  - Results of the Ambient Water Quality Determination
  - Next Steps

SNMP Process



Ambient Water Quality Methods

Management Zones

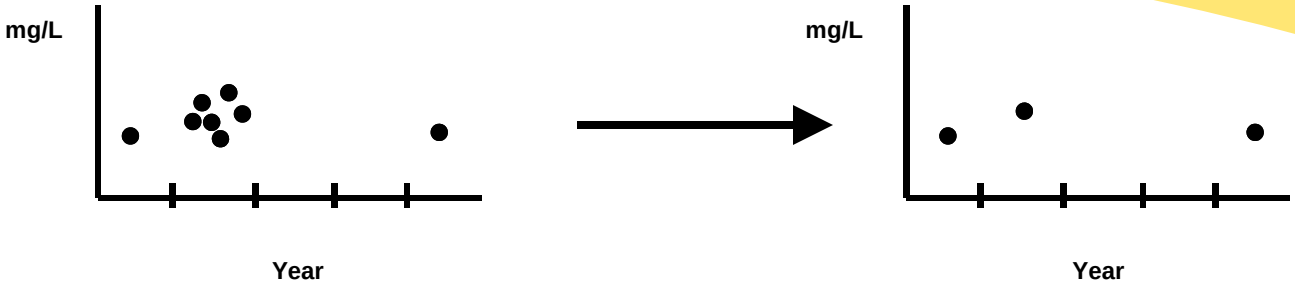


AWQ Approach

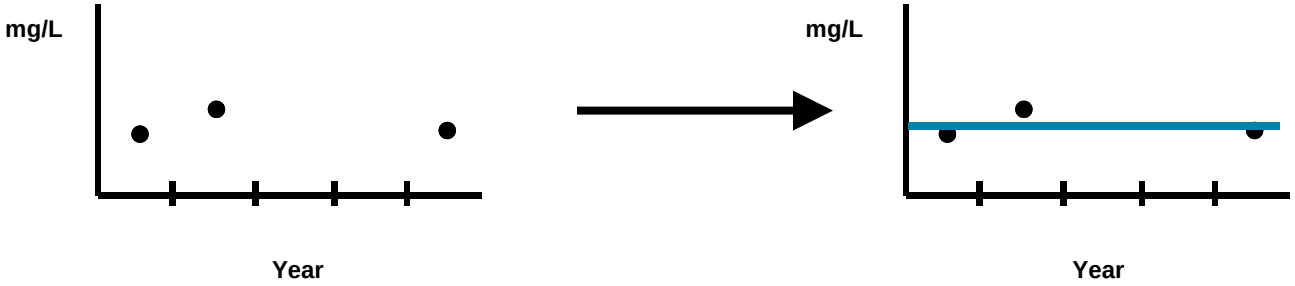
- Baseline Period
  - 1994 – 2013
  - Data availability and spatial distribution
- AWQ Calculation
  - Filtering:
    - Temporal filter
    - Spatial filter
  - Statistical description of AWQ
  - Volume-weighted AWQ determination (where applicable)

Temporal and Spatial Filtering

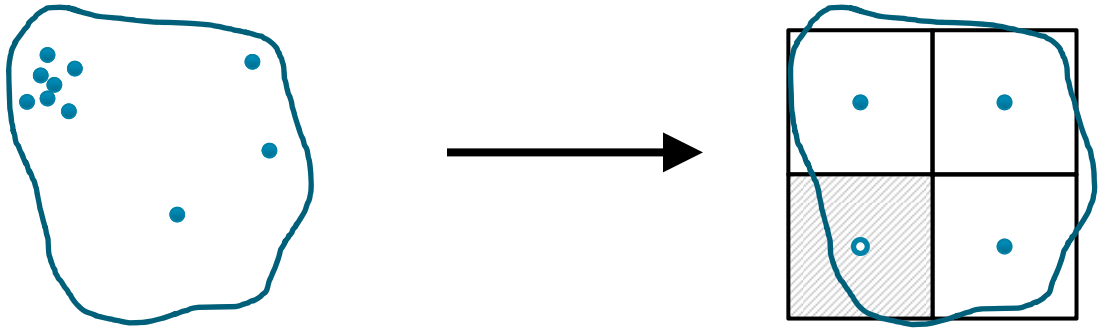
Temporal Filter 1:



Temporal Filter 2:



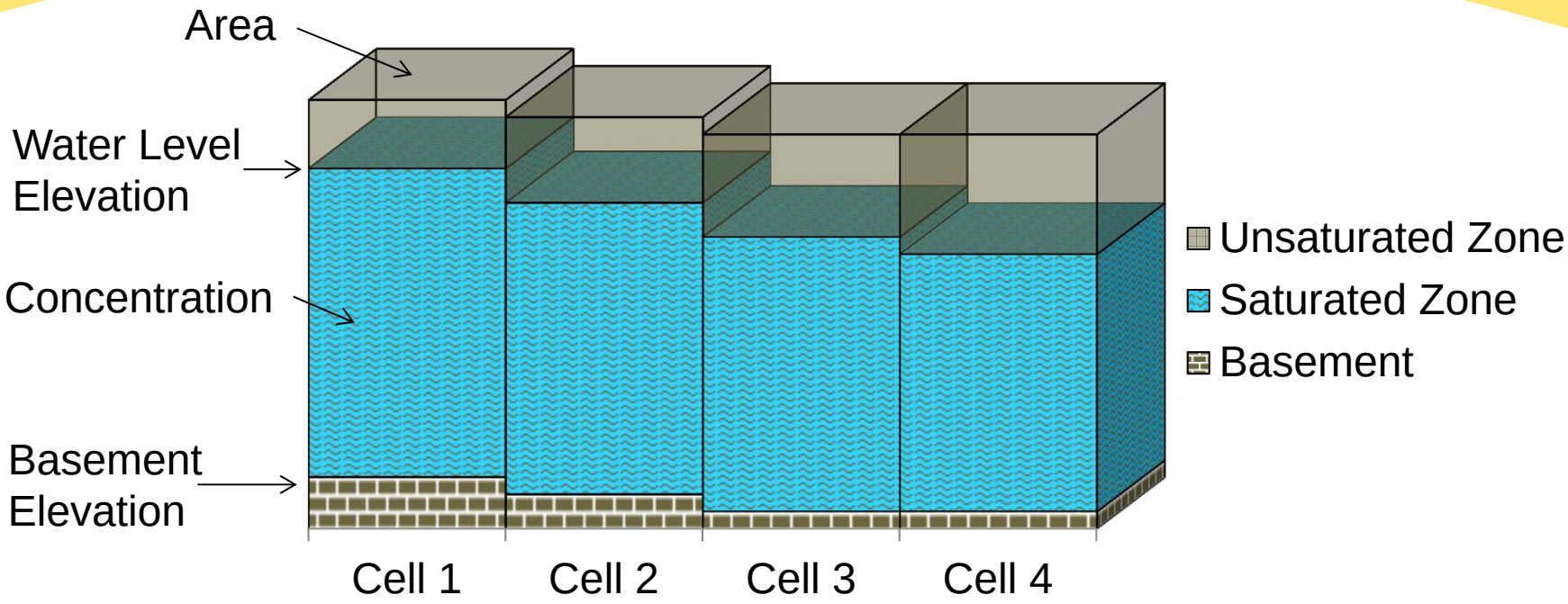
Spatial Filter:



Ambient Water Quality Methods

- **Statistical description of AWQ**
  - Big picture statistical summary
- **Volume-weighted AWQ determination**
  - Considers water in storage and distribution of data points
  - Requires: well-distributed data (vertical and horizontal), aquifer properties, information on screened depths
- **Both Methods**
  - Spatial and temporal filters are applied to eliminate weighting by wells or locations with high data frequency

Volume-weighted



$$\text{Volume}_T = \sum_{i=1}^{n} SY_i \times Area_i \times (Avg\ Water\ Level\ Elevation_i - Basement\ Elevation_i)$$

where i = Cell i

SY_i = Specific Yield of Cell I

Volume-Weighted Average Calculation

$$Concentration_{Avg} = \frac{1}{Volume_T} \sum_{i=1}^{n} Volume_i \times Concentration_i$$

Where:

$$Volume_i = SY_i \times Area_i \times (Avg\ Water\ Level\ Elevation_i - Basement\ Elevation_i)$$

SY_i = Specific Yield of Cell i

$Area_i$ = Area of Cell i

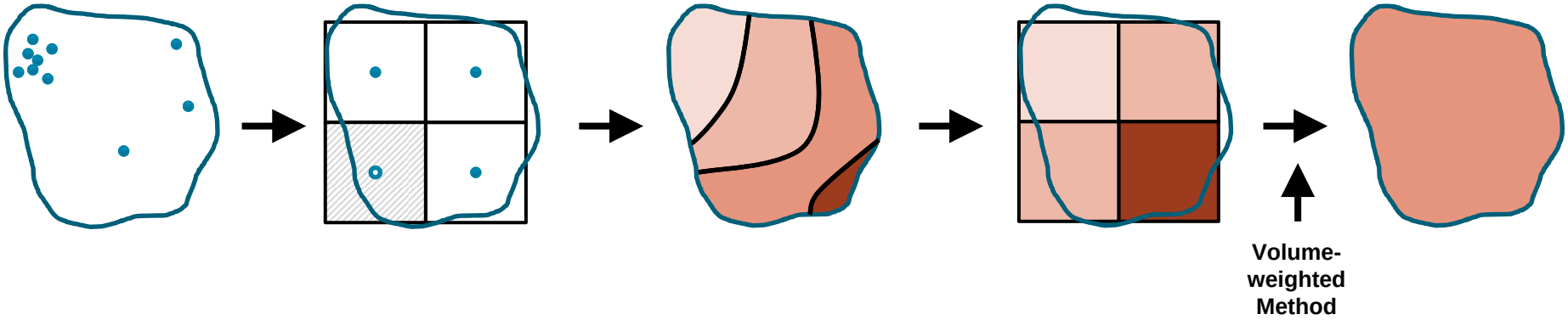
$Volume_T = \sum_{i=1}^{n} Volume_i$

$Concentration_i$ = Average Concentration in Cell i

Note: each cell is assigned a concentration, based on actual data or approximated

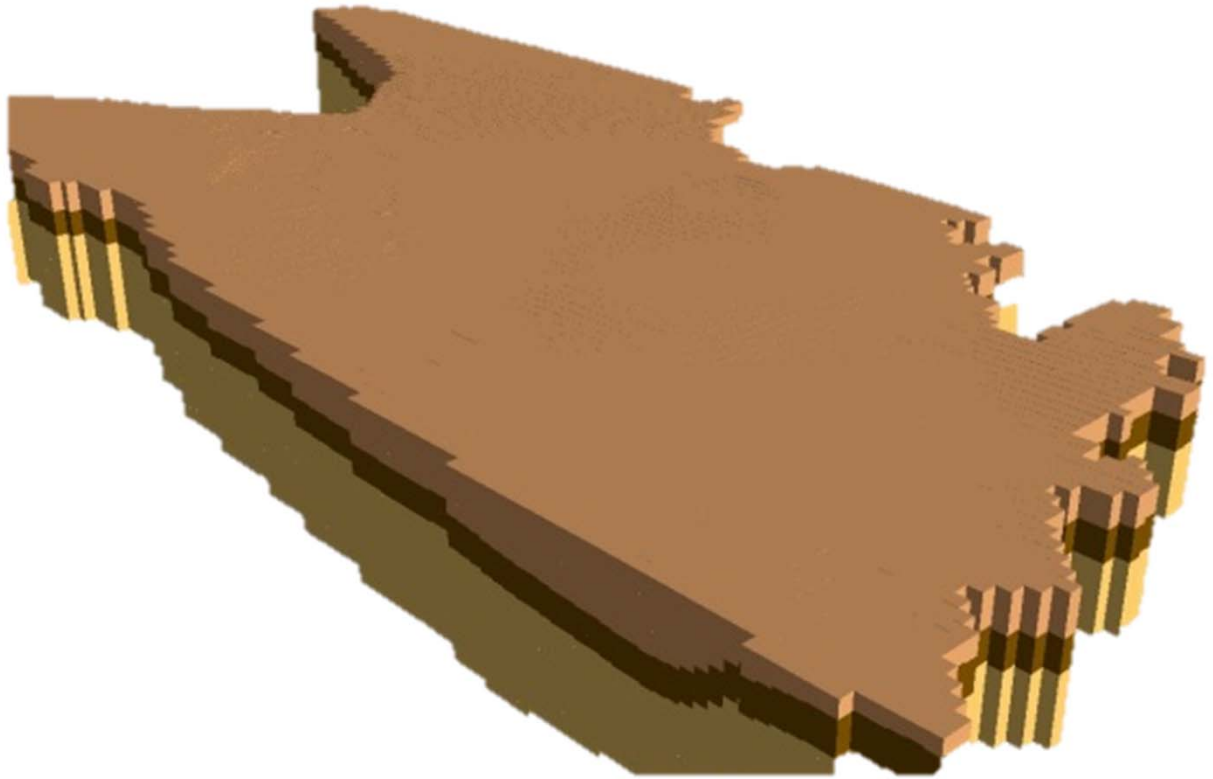
Contouring

- To get concentrations for all cells, the cell means are contoured:
  - Depending on the availability of data, model layers can be contoured separately to account for water quality variance with depth

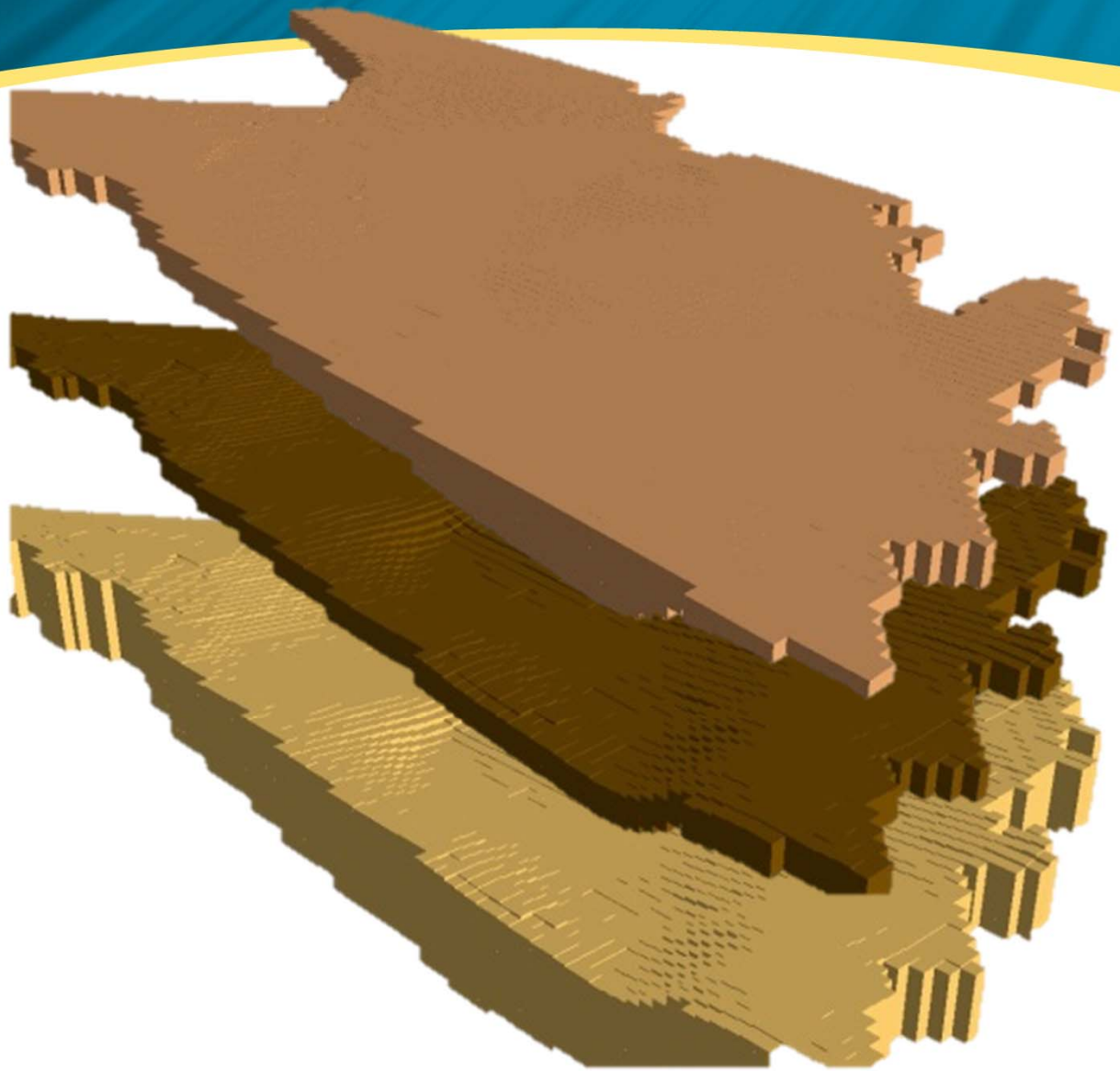


- The contours are used to approximate water quality for each cell
- Ambient water quality for a management zone is then calculated using the volume-weighted method – each cell's water quality contributes proportionally to the volume of water within it

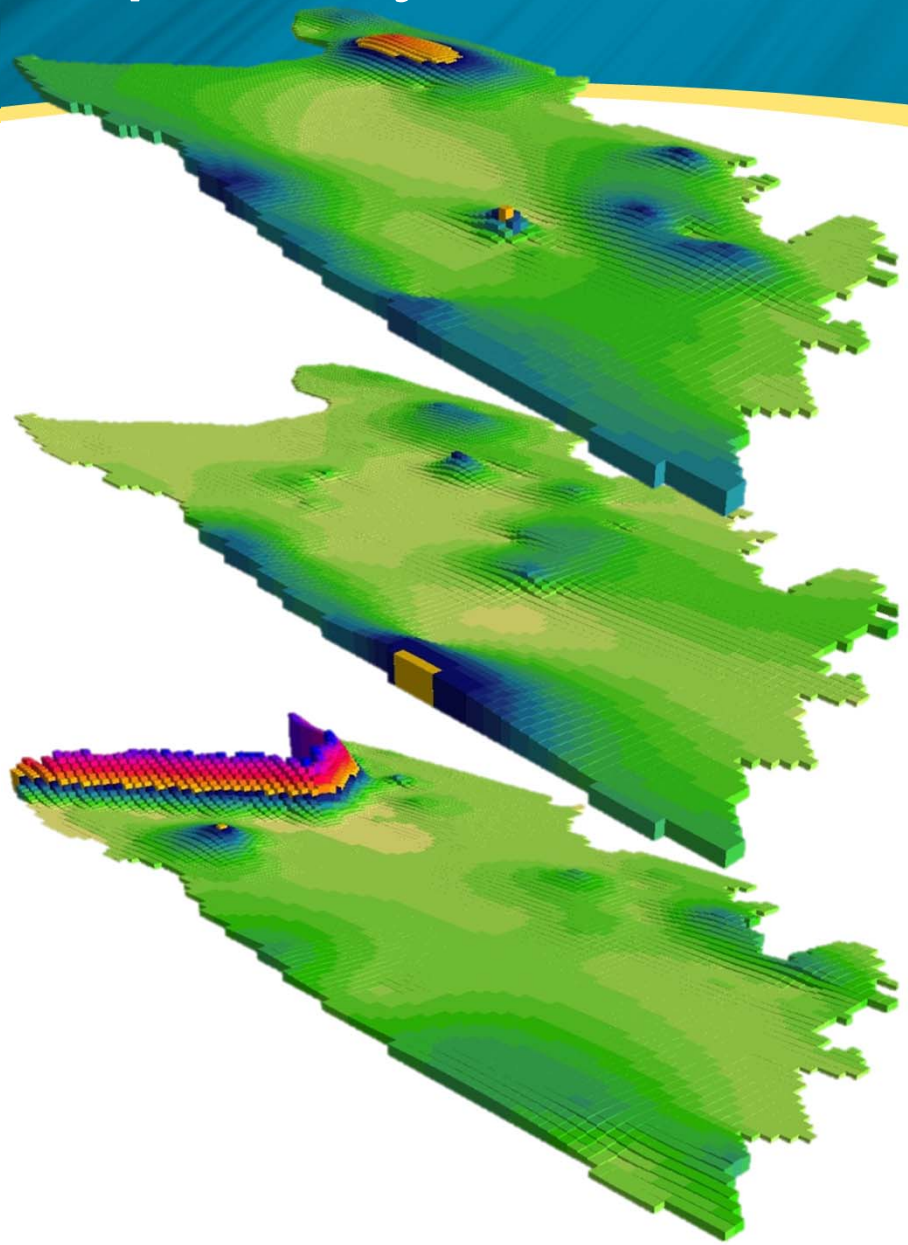
East Valley Aquifer System



East Valley Aquifer System



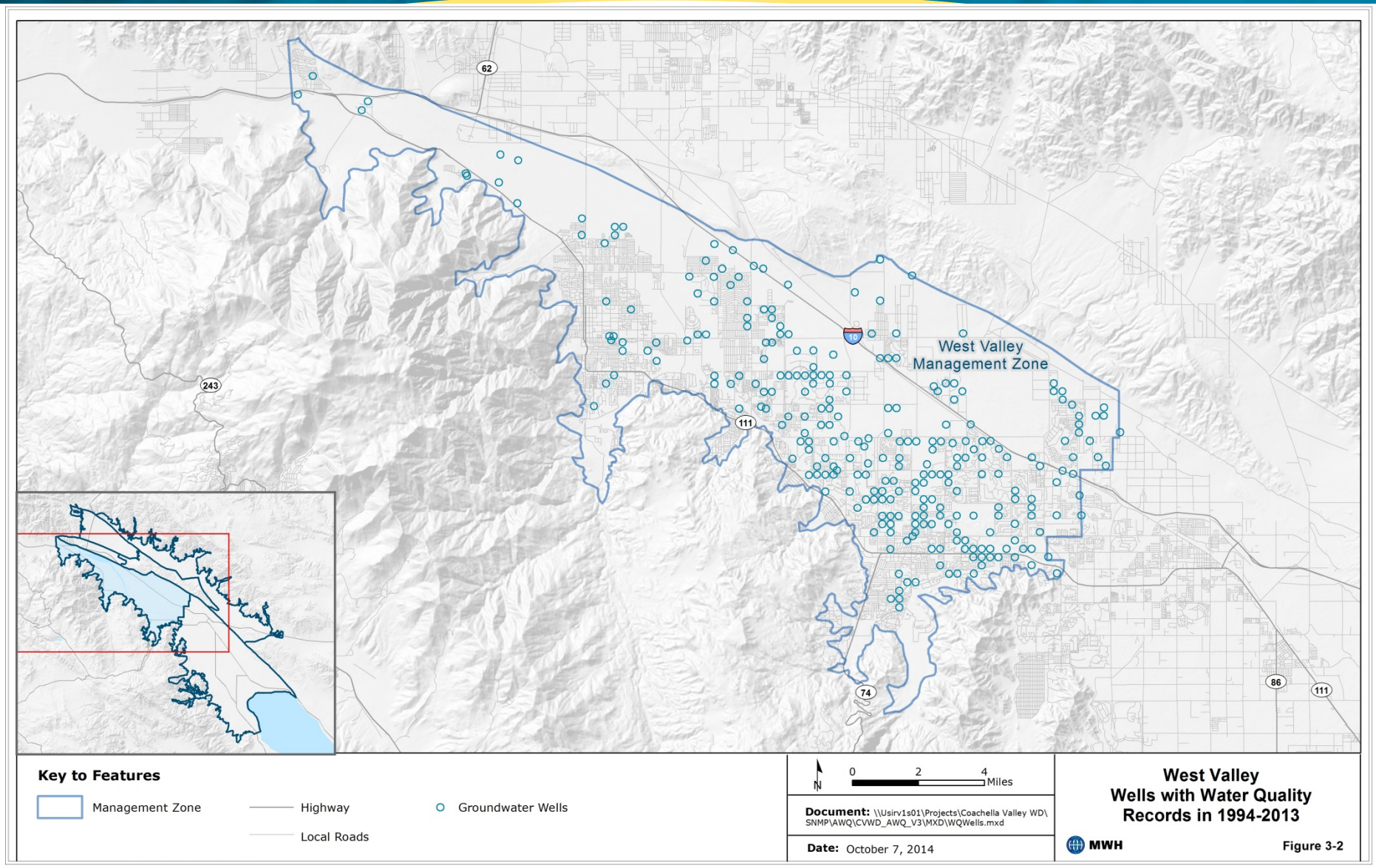
East Valley Aquifer System - Concentration



Ambient Water Quality Determination

West Valley Management Zone

West Valley MZ: Wells with Water Quality



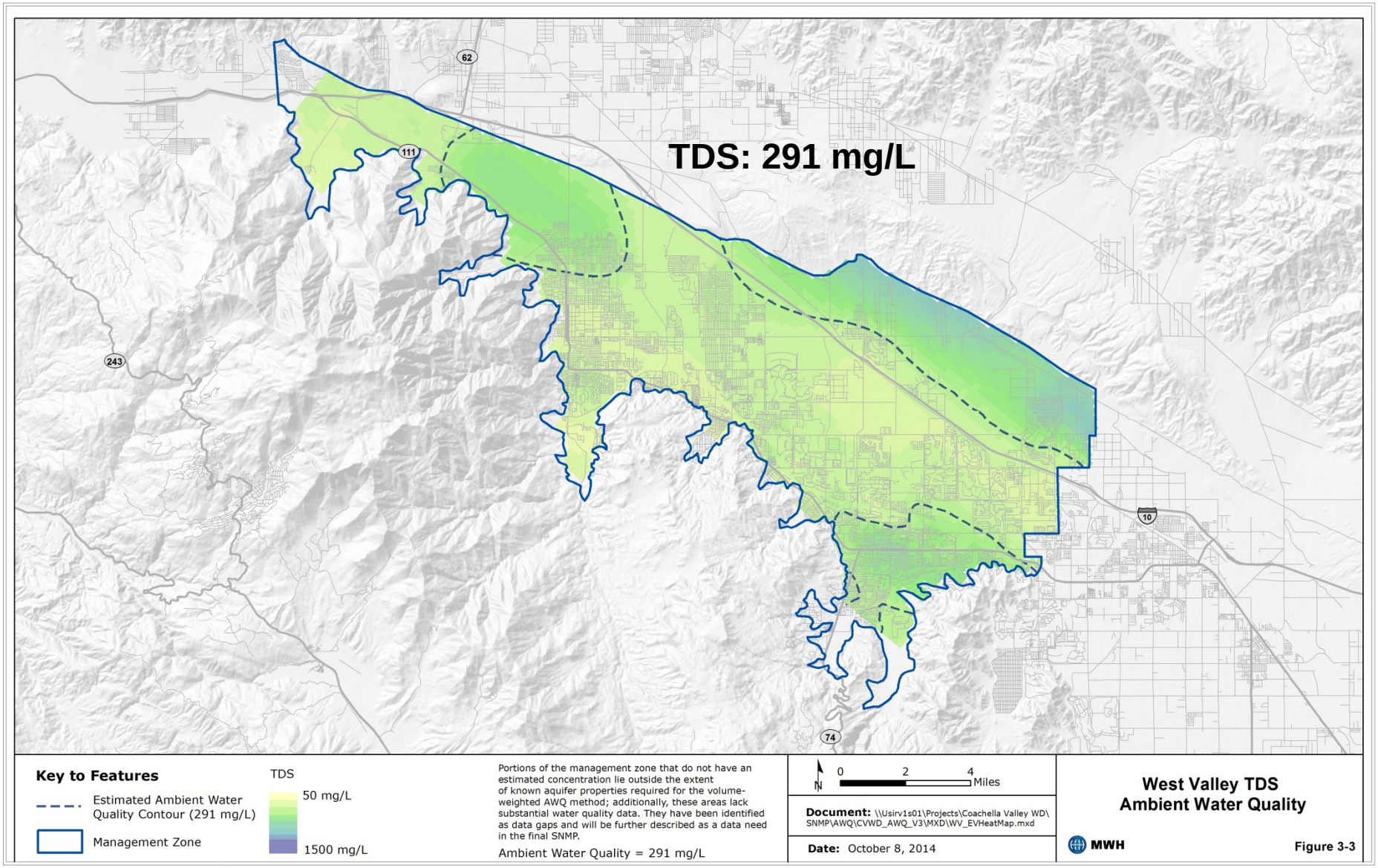
West Valley MZ: Unfiltered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	1,518	4,514
Mean	311	13.8
Median	251	5
Mode	200	2
Standard Deviation	155	15.2
Range	130 to 1,218	ND to 145
90% Confidence Interval for the Mean	304 to 319	13.3 to 14.2

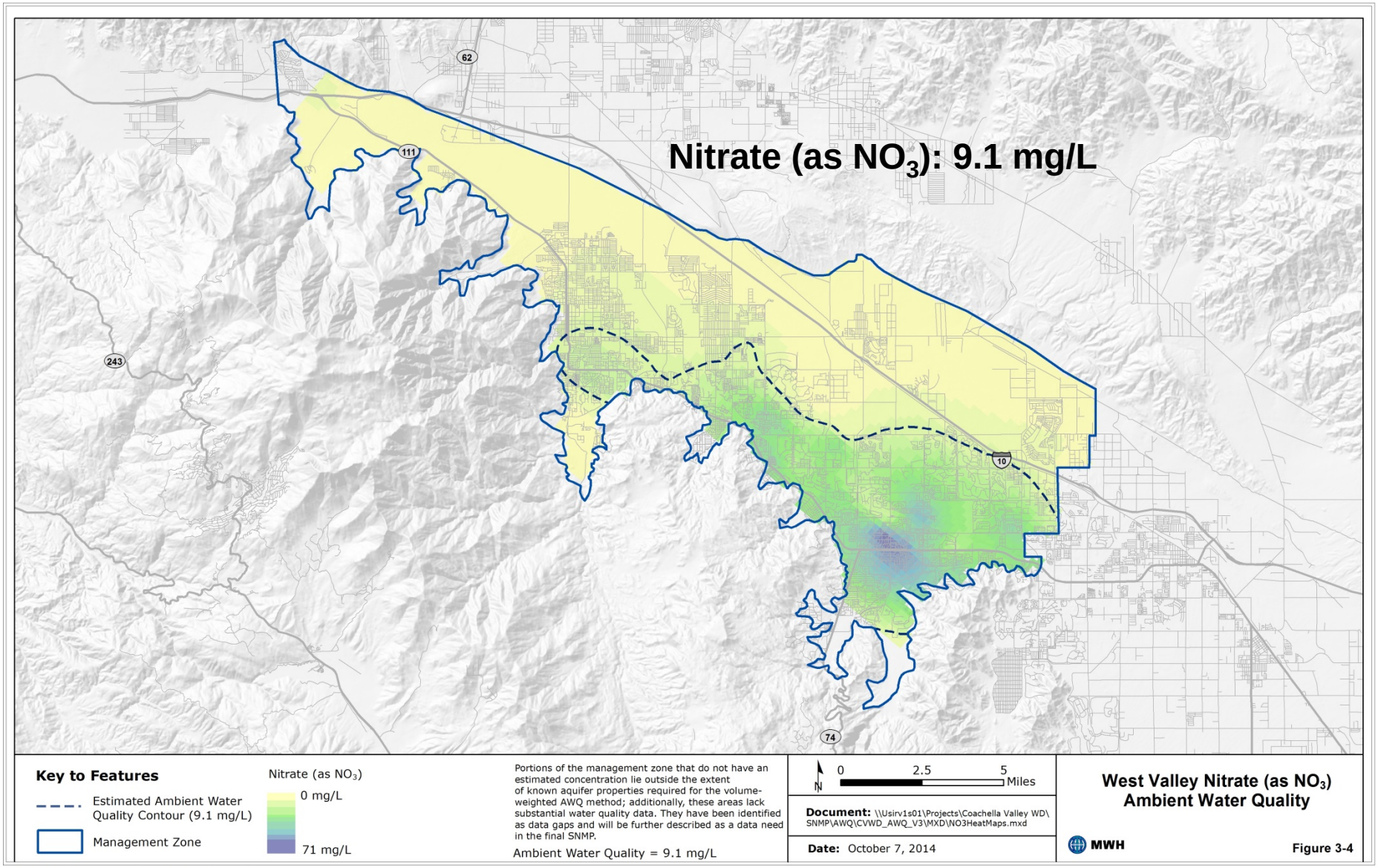
West Valley MZ: Filtered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	265	271
Mean	329	17.8
Median	252	4.5
Mode	210	3
Standard Deviation	196	25.9
Range	150 to 1,218	0.1 to 145
90% Confidence Interval for the Mean	305 to 352	14.7 to 20.9

West Valley MZ: Volume-weighted AWQ for TDS



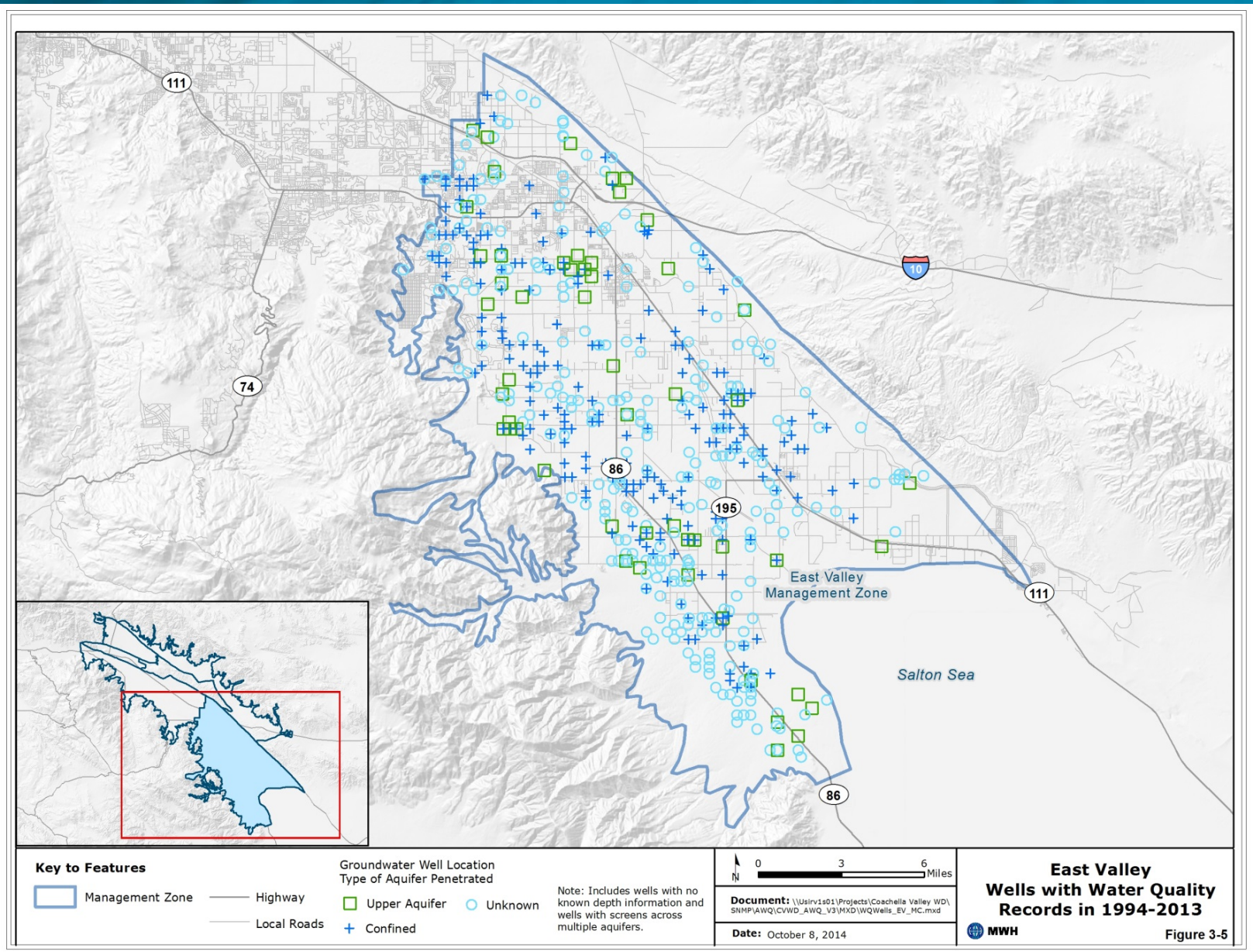
West Valley MZ: Volume-weighted AWQ for Nitrate (as NO_3)



Ambient Water Quality Determination

East Valley Management Zone

East Valley MZ: Wells with Water Quality



East Valley MZ: Unfiltered Data Statistics

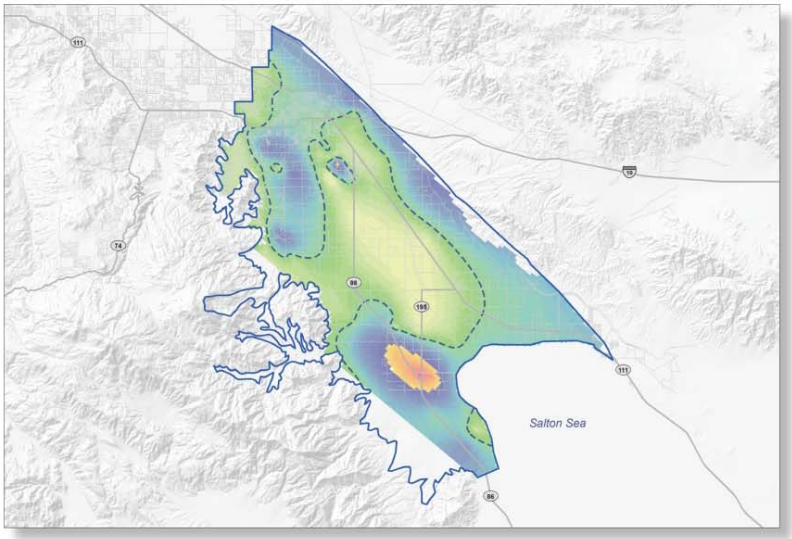
		Total Dissolved Solids (mg/L)			Nitrate as NO_3 (mg/L)		
Aquifer Zone		All	Upper	Lower	All	Upper	Lower
Descriptive Statistic	Count	2,875	743	1,218	3,980	734	1,789
	Mean	1,080	613	1,616	10	9.4	6.3
	Median	383	635	252	2.7	2	2
	Mode	180	800	150	ND	ND	ND
	Standard Deviation	2,381	309	3,538	18.1	26	12.1
	Range	1 to 19,500	1 to 2,320	19 to 19,500	ND to 260	ND to 260	ND to 221
	90% Confidence Interval for the Mean	993 to 1,167	590 to 635	1,417 to 1,815	9.4 to 10.5	7.5 to 11.2	5.7 to 6.9

East Valley MZ: Filtered Data Statistics

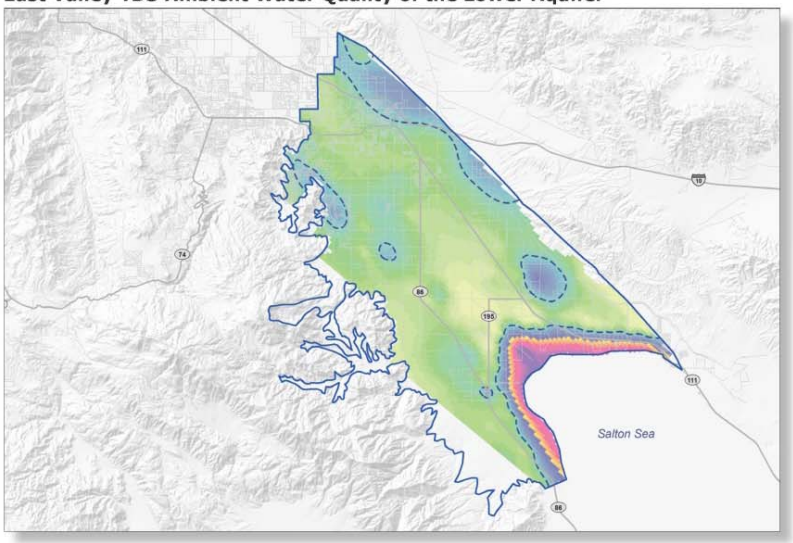
		Total Dissolved Solids (mg/L)			Nitrate as NO_3 (mg/L)		
Aquifer Zone		All	Upper	Lower	All	Upper	Lower
Descriptive Statistic	Count	477	53	222	487	53	224
	Mean	494	643	350	11.8	12.3	8.3
	Median	308	523	215	3	3.1	2.3
	Mode	160	665	160	ND	ND	ND
	Standard Deviation	444	484	391	19.6	21.9	16.9
	Range	1 to 3,520	1 to 2,210	19 to 4,582	ND to 178	ND to 90	ND to 152
	90% Confidence Interval for the Mean	454 to 534	510 to 776	298 to 401	10 to 13.5	6.3 to 18.4	6.1 to 10.6

East Valley MZ: Volume-weighted AWQ for TDS

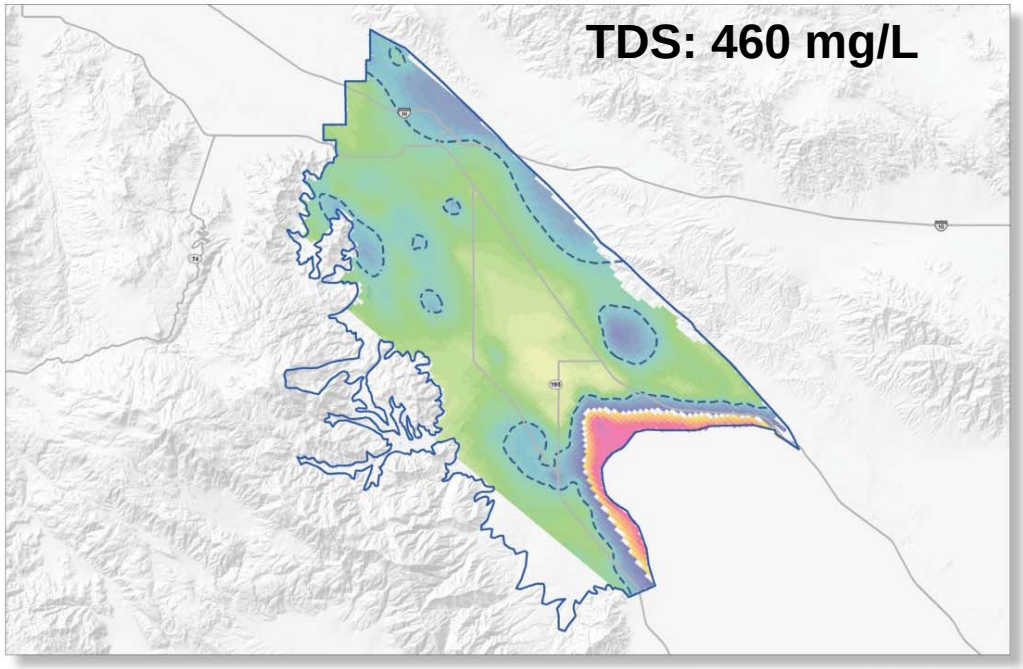
East Valley TDS Ambient Water Quality of the Upper Aquifer



East Valley TDS Ambient Water Quality of the Lower Aquifer



East Valley TDS Ambient Water Quality



Key to Features

Estimated Ambient Water Quality Contour (460 mg/L)

Management Zone

TDS

50 mg/L

1500 mg/L

1501 mg/L

3545 mg/L

Portions of the management zone that do not have an estimated concentration lie outside the extent of known aquifer properties required for the volume-weighted AWQ method; additionally, these areas lack substantial water quality data. They have been identified as data gaps and will be further described as a data need in the final SNMP.

Ambient Water Quality = 460 mg/L

N

Water quality concentration was contoured in three layers: the upper, unconfined system and two subdivisions of the lower, confined aquifer due to its thickness. TDS concentrations were assigned to each cell in each layer. Layers were then aggregated using the volume-weighted method to generate volume-weighted AWQ. Maps on this figure illustrate the TDS concentrations in the upper aquifer, the lower aquifer (an aggregate of the two subdivisions), and the total management zone (an aggregate of all three layers, or the two aquifer systems). The AWQ for TDS in the East Valley Management Zone is 460 mg/L.

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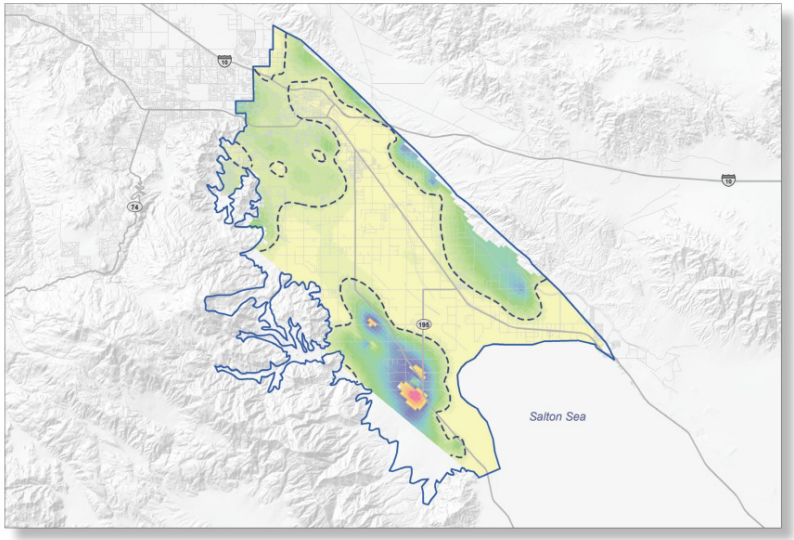
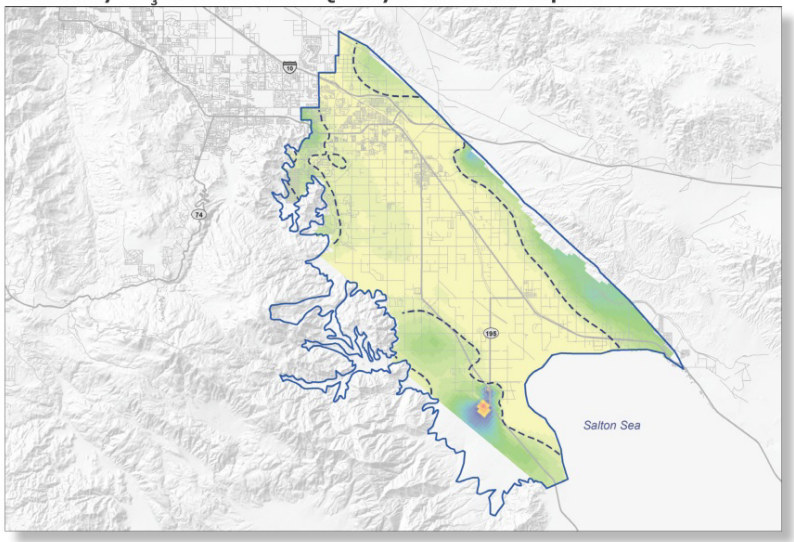
Figure 3-6
East Valley TDS Ambient Water Quality

East Valley MZ: Volume-weighted AWQ for Nitrate (as NO_3)

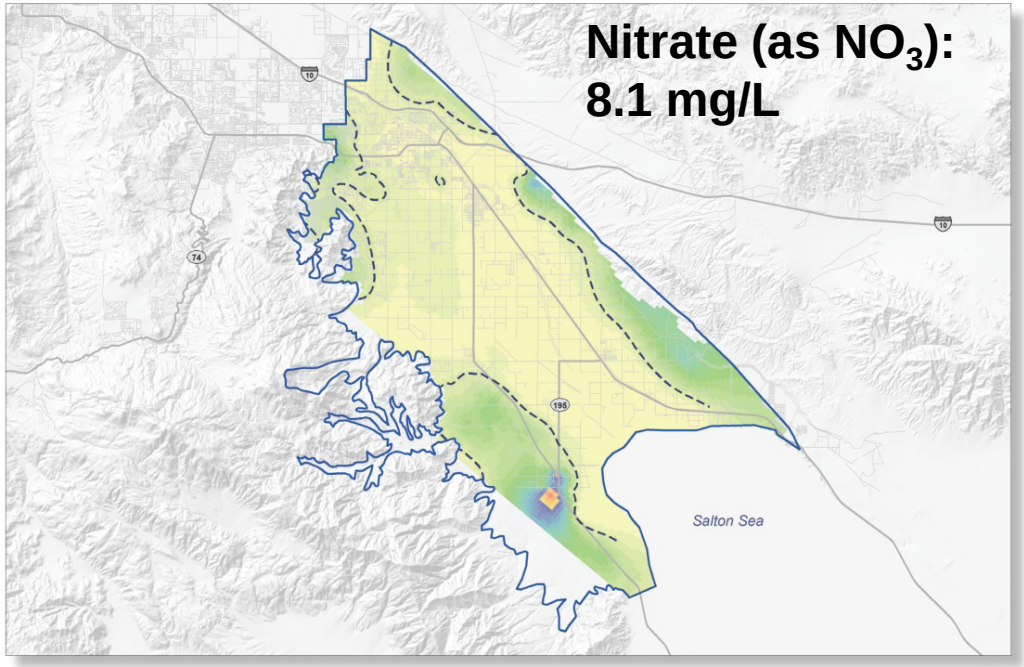
East Valley NO_3 Ambient Water Quality of the Upper Aquifer



East Valley NO_3 Ambient Water Quality of the Lower Aquifer



East Valley NO_3 Ambient Water Quality



Key to Features

- Estimated Ambient Water Quality Contour (8.1 mg/L)
- Management Zone

Nitrate (as NO_3)

0 mg/L – 71 mg/L

72 mg/L – 171 mg/L

Portions of the management zone that do not have an estimated concentration lie outside the extent of known aquifer properties required for the volume-weighted AWQ method; additionally, these areas lack substantial water quality data. They have been identified as data gaps and will be further described as a data need in the final SNMP.

Ambient Water Quality = 8.1 mg/L

N

Water quality concentration was contoured in three layers: the upper, unconfined system and two subdivisions of the lower, confined aquifer due to its thickness. Nitrate (as NO_3) concentrations were assigned to each cell in each layer. Layers were then aggregated using the volume-weighted method to generate volume-weighted AWQ. Maps on this figure illustrate the Nitrate (as NO_3) concentrations in the upper aquifer, the lower aquifer (an aggregate of the two subdivisions), and the total management zone (an aggregate of all three layers, or the two aquifer systems). The AWQ for Nitrate (as NO_3) in the East Valley Management Zone is 8.1 mg/L.

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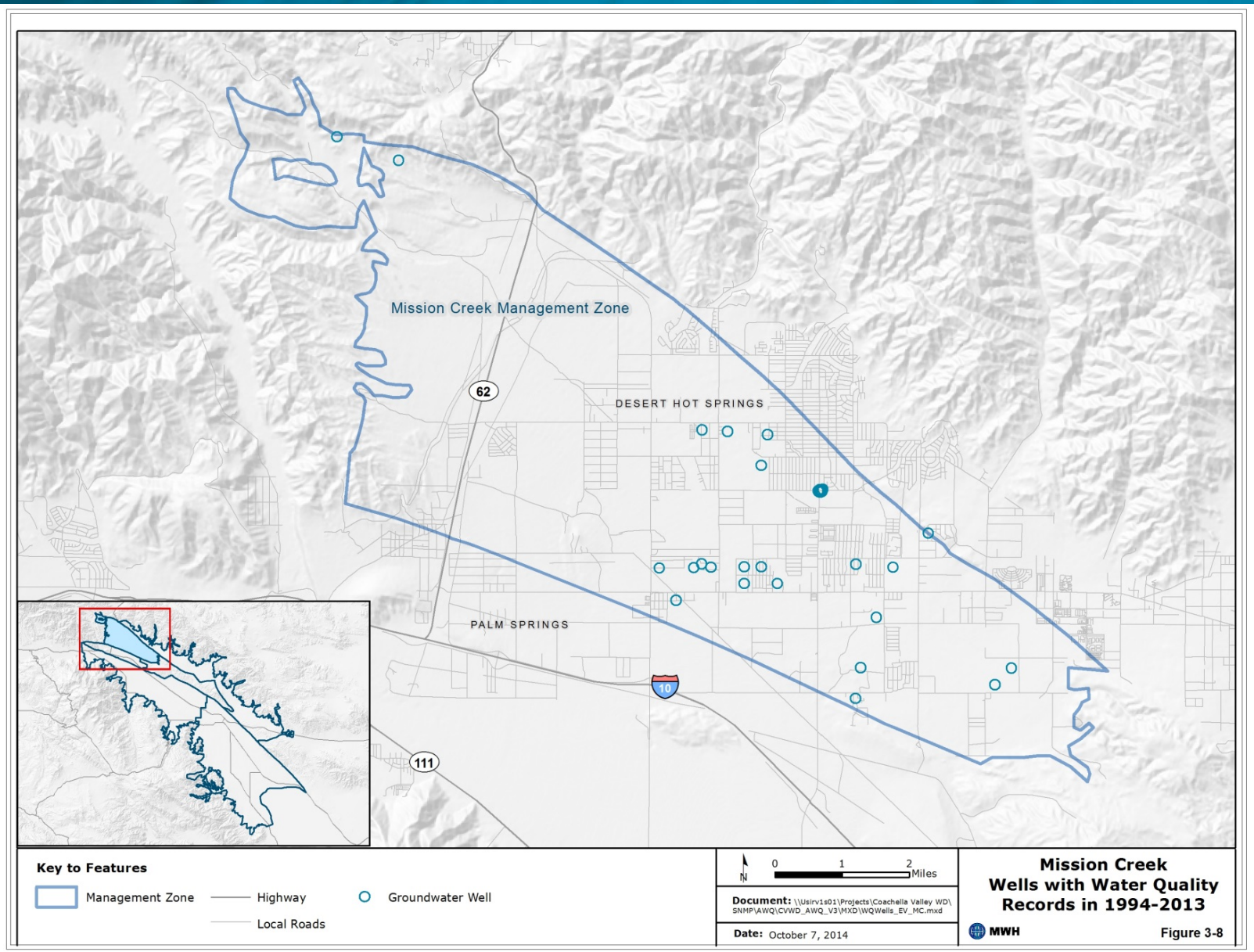
Figure 3-7
East Valley NO_3 Ambient Water Quality

Ambient Water Quality Determination

Mission Creek Management Zone

Mission Creek MZ: Wells with Water Quality



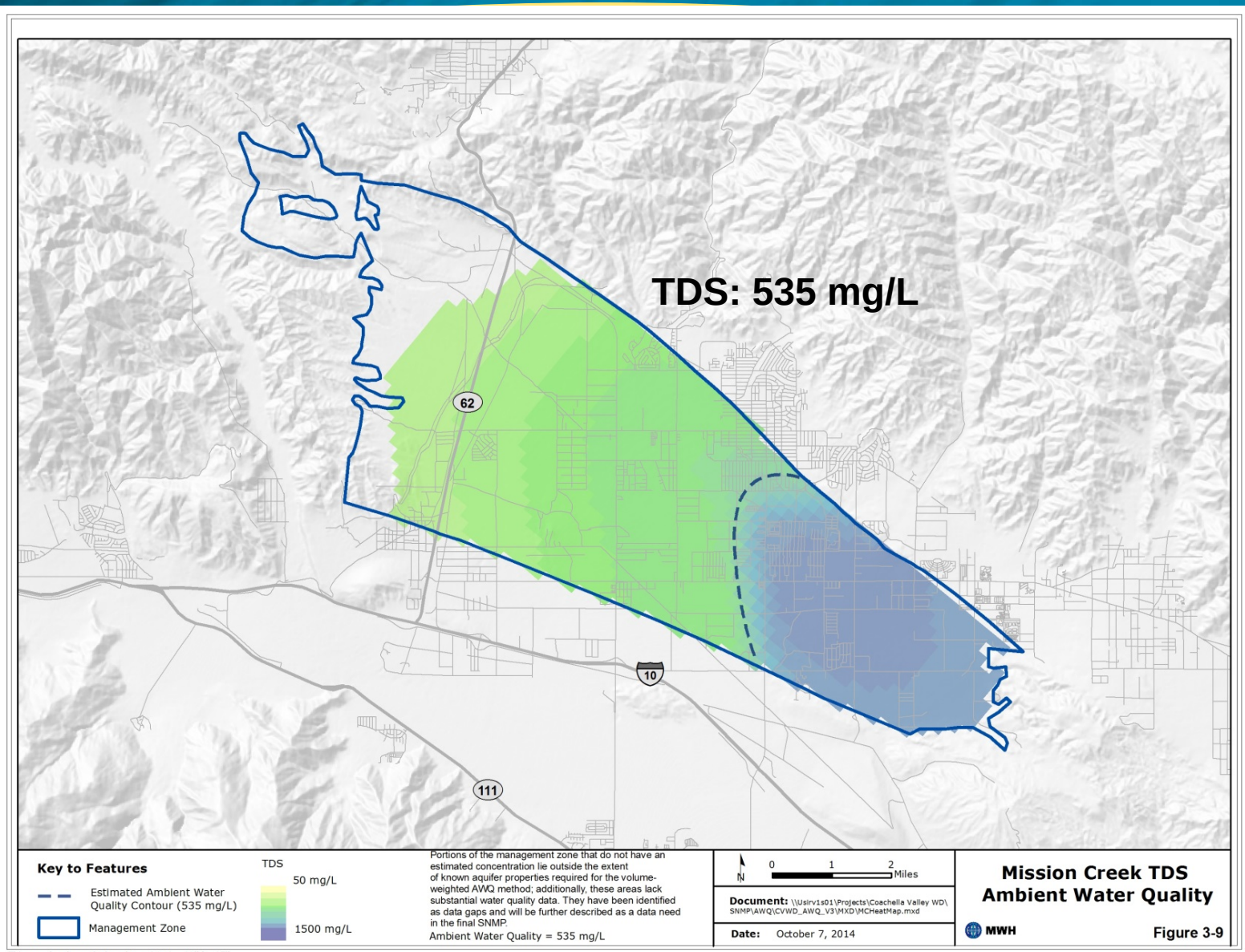
Mission Creek MZ: Unfiltered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	93	355
Mean	506	24.9
Median	446	5.4
Mode	430	ND
Standard Deviation	198	30.1
Range	270 to 1,100	ND to 86
90% Confidence Interval for the Mean	466 to 547	21.7 to 28

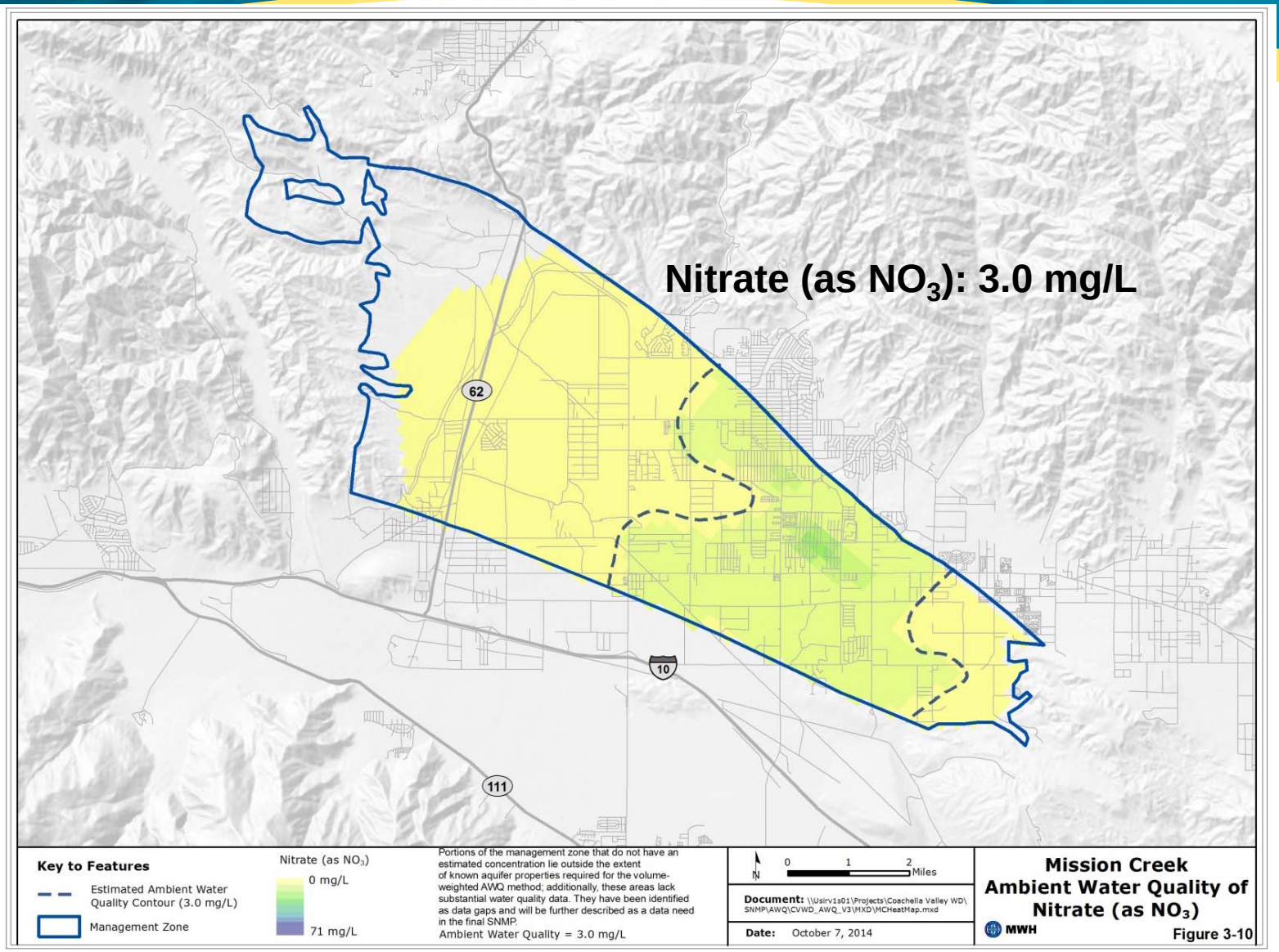
Mission Creek MZ: Filtered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	22	25
Mean	599	5.1
Median	492	4
Mode	-	3.6
Standard Deviation	240	6.1
Range	300 to 1,096	0.3 to 32.3
90% Confidence Interval for the Mean	493 to 706	2.5 to 7.6

Mission Creek MZ: Volume-weighted AWQ for TDS



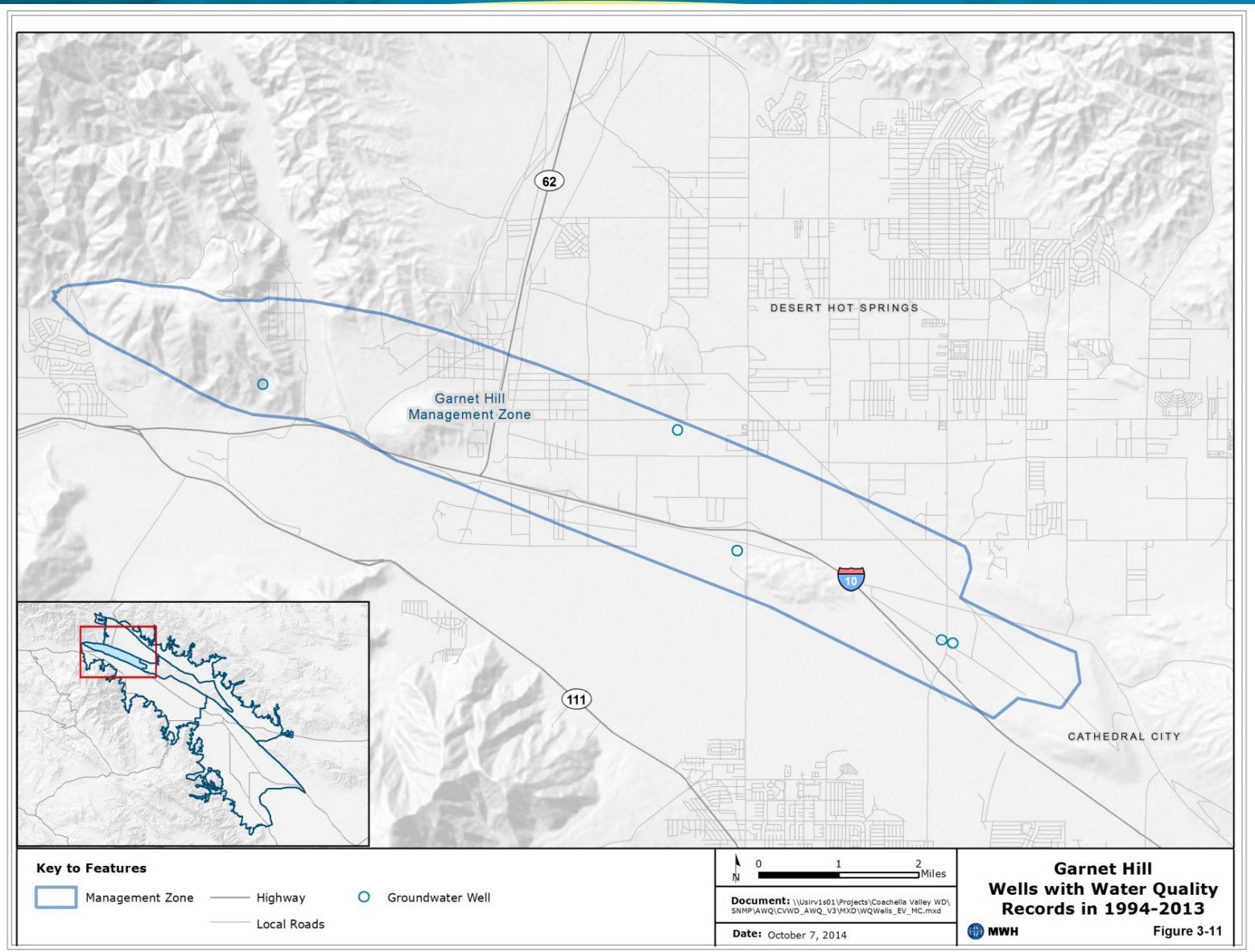
Mission Creek MZ: Volume-weighted AWQ for Nitrate (as NO_3)



Ambient Water Quality Determination

Garnet Hill Management Zone

Garnet Hill MZ: Wells with Water Quality



Garnet Hill MZ: Unfiltered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	19	18
Mean	274	3.5
Median	278	2.4
Mode	-	1.8
Standard Deviation	60	3.3
Range	156 to 390	ND to 14.3
90% Confidence Interval for the Mean	245 to 303	1.9 to 5.1

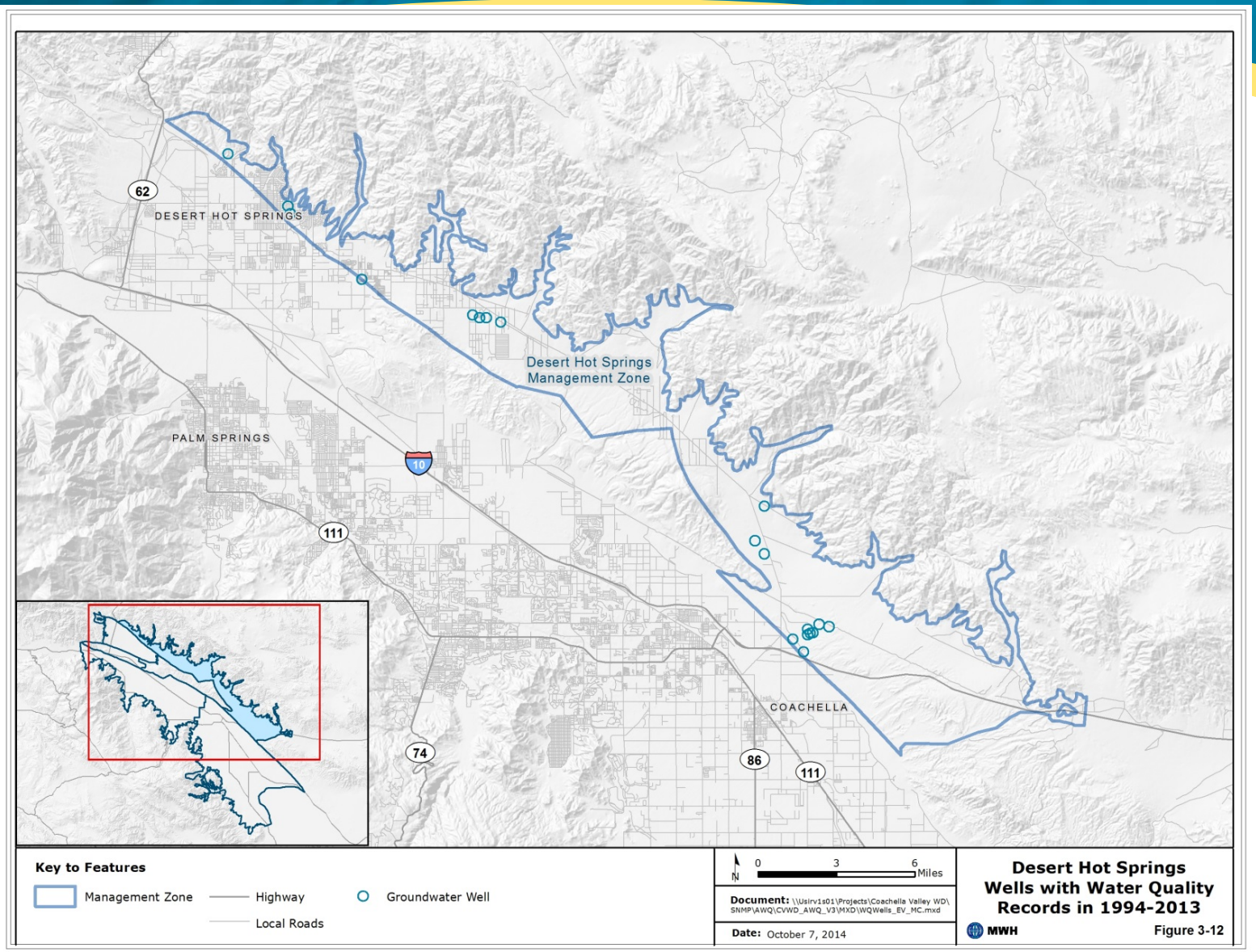
Garnet Hill MZ: Filtered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	4	4
Mean	231	2.2
Median	236	1.8
Mode	-	-
Standard Deviation	70	1.7
Range	156 to 295	0.6 to 4.5
90% Confidence Interval for the Mean	119 to 342	ND to 4.8

Ambient Water Quality Determination

Desert Hot Springs Management Zone

Desert Hot Springs MZ: Wells with Water Quality



Desert Hot Springs MZ: Unfiltered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	255	299
Mean	1,366	18.5
Median	1,400	11.7
Mode	1,700	6.3
Standard Deviation	443	16.8
Range	240 to 2,200	ND to 101
90% Confidence Interval for the Mean	1,311 to 1,420	16.5 to 20.4

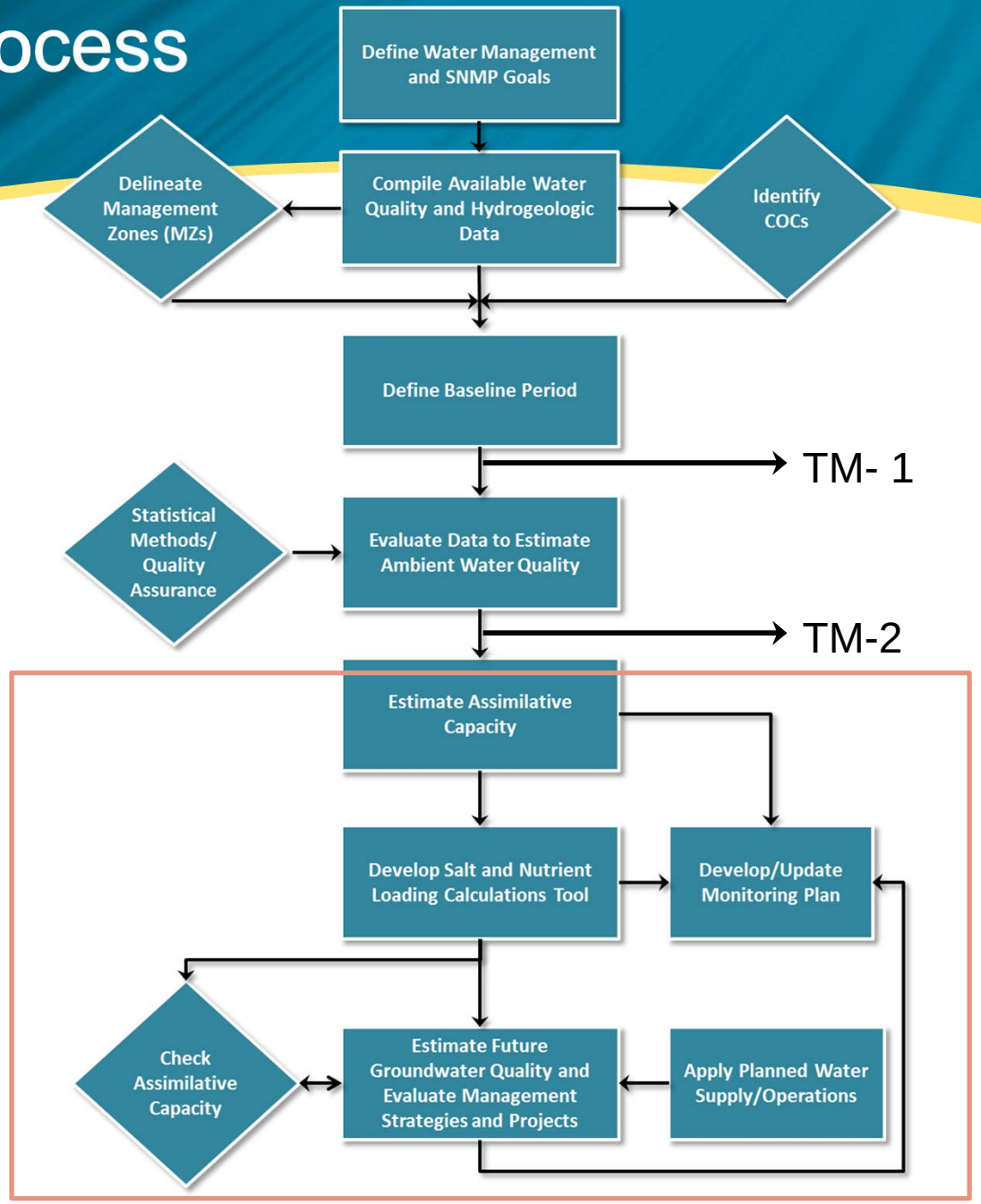
Desert Hot Springs MZ: Filtered Data Statistics

Descriptive Statistic	Total Dissolved Solids (mg/L)	Nitrate as NO_3 (mg/L)
Count	18	19
Mean	1,195	18.2
Median	1,190	10.1
Mode	-	-
Standard Deviation	483	24
Range	424 to 2,020	0.1 to 101
90% Confidence Interval for the Mean	954 to 1,435	6.6 to 29.7

Salt and Nutrient Planning

Alternative Development and Analysis

SNMP Process



Identify Water Management Goals and Potential Strategies

- Develop baseline projection of water quality
- Identify and develop salinity and nutrient management strategies
- Conduct assimilative capacity analysis
  - Identify alternative basin management
  - Compare baseline groundwater quality conditions with alternative basin management thresholds
  - Estimate basin assimilative capacity for each alternative management threshold

Conduct Anti-Degradation Analysis

- Assess developed water management strategies
- Determination of compliance with the State's Anti-Degradation Policy
- Determine if implementation may degrade or improve groundwater quality;
- Determine if the strategy is consistent with the maximum benefit to the people of the State.

Next Steps

- ~~Stakeholder comments by September 18~~
- ~~Complete AWQ Analysis~~
- Stakeholder Meeting No.3 – October 15
- TM-2 Comments Due October 29
- Complete TM-2
- Complete Salt/Nutrient Loading Tool
- Evaluate Assimilative Capacity
- Compile Projects and Develop Strategies
- Review Projects and Strategies
  - Stakeholder Meeting No.4 – January 7
- Complete SNMP