# CV-SALTS
# Consideration of Resolution to Extend Completion Date of Central Valley Salt and Nutrient Management Plan to 2016

# Agenda

## Basis of Resolution

- Recycled Water Policy
  - ✓ Requirements
  - ✓ Deadlines
- CV-SALTS
  - ✓ Progress to Date
    - Policy
    - Technical
  - ✓ Budget/Timeline

## Consideration of Resolution

# Recycled Water Policy
## (Resolution 2009-0011, as amended in Resolution 2013-0003)

**GOAL:** Increase recycled water use from municipal wastewater

**OBJECTIVE**: Establish criteria for permitting recycled water projects

**APPROACH**: Develop Salt and Nutrient Management Plans (SNMPs) which facilitate recycled water project permitting

# Recycled Water Policy

Includes requirement for SNMPs in **<u>all</u>** groundwater basins

- SNMP to include:
  - ✓ Salt/nutrient source identification
  - ✓ Fate/transport of analysis
  - ✓ Assimilative capacity/ loading estimates by basin/sub-basin
  - ✓ Water recycling & stormwater recharge/use goals & objectives
  - ✓ Implementation measures to manage salt and nutrient loadings on a sustainable basis
  - ✓ Basin/sub-basin Monitoring Plan
  - ✓ Constituents of emerging concern monitoring
  - ✓ Anti-degradation analysis (Resolution 68-16)

# Recycled Water Policy

## Timeline

**14 May 2014**: SNMP Submitted to Regional Water Board

- 2-yr extension ***if Regional Water Board finds substantial progress***

**Within 1-year**: Regional Water Board considers SNMP for adoption as a Basin Plan Amendment

***Becomes Basis for Future Salt/Nutrient Regulation***

# SNMP Status

- Locally Driven
- Funded thru IRWMP
- Approximately 25% on schedule
- Remaining evaluating time extension

**Central Valley utilizing unique approach:**

**CV-SALTS**

6 December 2013

Collaborative stakeholder process to develop a comprehensive Salt and Nitrate Management Plan (SNMP)

- Components will satisfy Recycled Water Policy requirements

**CV-SALTS Starting Point**

Identify Water Bodies — Surface Water, Ground Water

Designate Beneficial Uses — MUN, AGR

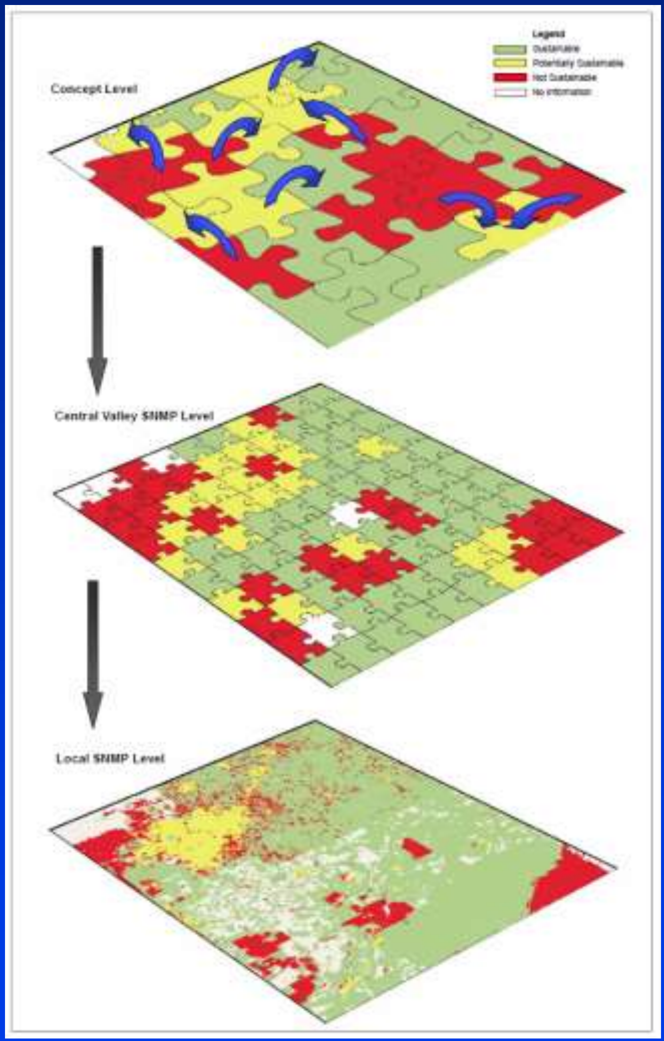
Establish Water Quality Objectives — Salinity, Nitrate

**Recycled Water Policy**

Implementation Requirements — Point Sources, Non-Point Sources

Monitoring and Assessment — Discharges, Receiving Waters

# Conceptual Model (Technical Approach) → Supports




Policy

↕

Central Valley SNMP
(Management Zones)

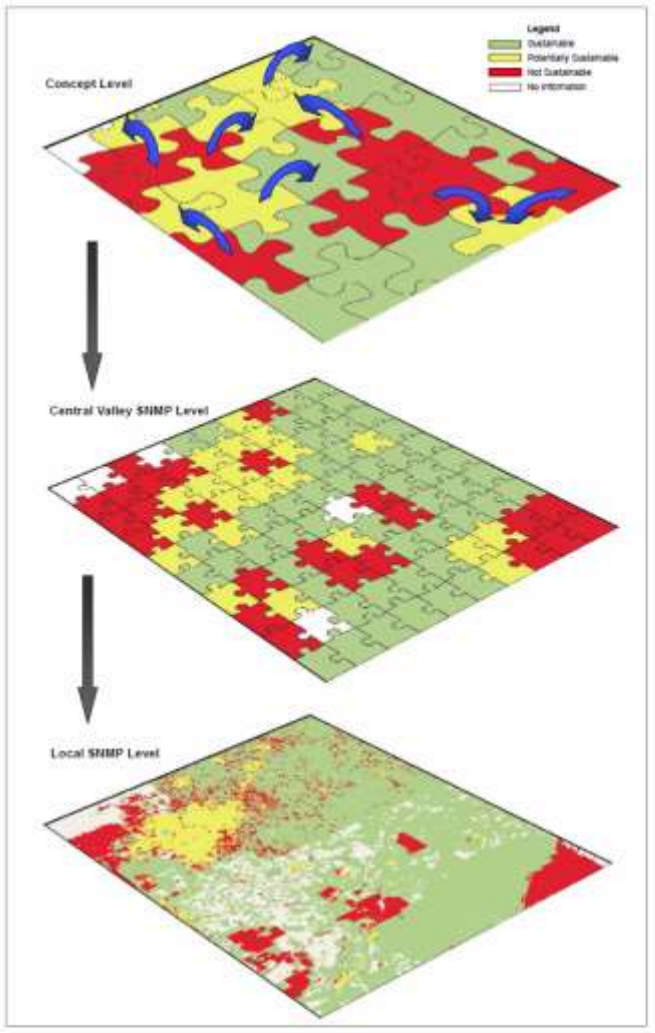
↕

Area Specific
(SNMPs; archetypes; prototypes)

# Policy Discussions

| Category | Completed | Ongoing |
|---|---|---|
| Water Bodies | | • Evaluate groundwater sub-basins or surface water sub-segments/categories to increase regulatory flexibility and facilitate Management Zone implementation |
| Standards (Beneficial Uses & Water Quality Objectives) | • Application of SMCLs to protect MUN<br>• Conceptual regulatory framework for protection of AGR use | • Complete decision tree for interpreting AGR narrative water quality objective<br>• Surface water and groundwater distinctions as related to protection of AGR use<br>• Appropriate application of Sources of Drinking Water Policy |
| Assessment | • Principles for calculating background water quality and assimilative capacity | • Refine based on technical findings<br>• Planning horizon |
| Implementation | • Developed Management Zone concept<br>• Discussed potential alternative compliance strategies | • Develop SNMP water recycling and stormwater recharge/use goals and objectives<br>• Maximum Benefit Guidance<br>• Drought considerations |

# Conceptual Model (Technical Approach) → Supports




Policy

↕

Central Valley SNMP
(Management Zones)

↕

Area Specific
(SNMPs; archetypes; prototypes)

# CV-SALTS Technical Project Activities

Richard Meyerhoff – CDM Smith
Vicki Kretsinger – Luhdorff & Scalmanini

Central Valley Water Board Meeting
December 6, 2013

CDM Smith

# Technical Presentation Overview

- Technical Projects Overview
  - Technical Project Relation to SNMP Requirements
- Conceptual Model Development
  - Initial Conceptual Model
  - Phase II Conceptual Model – Next Steps
- Strategic Salt Accumulation Land and Transport Study (SSALTS)
  - Phase 1 Salinity Characterization
  - Phases 2 and 3 Overview – Next Steps
- Developments in Agriculture Zone Mapping
- Closing – Coordinating Policy and Technical Activities

# SNMP Development – Technical Project Support

<table>
<tr><th colspan="2">Required SNMP Elements</th><th>Primary Technical Project Support</th></tr>
<tr><td rowspan="4">Salt and Nitrate Characterization</td><td>Source Identification</td><td rowspan="4">• Initial Conceptual Model (Complete)<br>• Phase II Conceptual Model (Complete in 2014)</td></tr>
<tr><td>Loading Estimates</td></tr>
<tr><td>Fate and Transport</td></tr>
<tr><td>Assimilative Capacity</td></tr>
<tr><td rowspan="2">Monitoring Plan</td><td>Salt, nutrients, constituents of concern</td><td rowspan="2">• Phase III Conceptual Model (Complete in 2015)</td></tr>
<tr><td>Constituents of emerging concern</td></tr>
<tr><td colspan="2">Antidegradation Analysis</td><td>• Phase II Conceptual Model – Develop background water quality calculation methods (Complete in 2014)<br>• Phase III Conceptual Model – Complete antidegradation analysis (Complete in 2015)</td></tr>
</table>

# SNMP Development – Technical Project Support

| Required SNMP Elements | Primary Technical Project Support |
| --- | --- |
| **Implementation Measures to Manage Salt/Nitrate Loading on a Sustainable Basis** | • Strategic Salt Accumulation Land and Transport Study (SSALTS) - (Phase 1 complete; complete Phases 2 & 3 in 2014)<br>• Post-SSALTS Implementation Planning (Complete in 2015) |
| **Water Recycling & Stormwater Recharge/Use Goals and Objectives** | *Policy Committee Activity* |
| **Salt & Nitrate Management Plan** | • Phase II Conceptual Model - Preliminary draft with completed technical elements (Complete in 2014)<br>• Refine SNMP as other projects completed, including SSALTS and Phase III Conceptual Model (Complete in 2016) |

| Technical Area | Primary Activities | SNMP Support | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| Conceptual Model Development | Initial Conceptual Model | • Source identification<br>• Assimilative capacity<br>• Loading estimates | | | | | Prepare Final SNMP |
| | Phase 2 | • Source and loading refinement<br>• Background water quality/ assimilative capacity calculation methods<br>• Management zone study | | | | | |
| | Phase 3 | • Antidegradation analysis<br>• Monitoring plan<br>• Economics analysis | | | | | |
| Data Development | GIS – Phase 2 | • Baseline database | | | | | |
| | Agriculture Zone Mapping | • AGR implementation tools | | | | | |
| Beneficial Use Studies | Tulare Lake Bed MUN Archetype | • MUN implementation tools | | | | | |
| | MUN Beneficial Use in Agriculturally Dominated Water Bodies Archetype | • MUN implementation tools | | | | | |
| Water Quality Objectives | Salinity-related Effects on Agricultural Irrigation Uses | • Evaluation of science behind establishment of salinity related objectives | | | | | |
| | Salinity Effects on MUN-related Uses of Water | | | | | | |
| | Stock Watering Study | | | | | | |
| | Aquatic Life Study | | | | | | |
| Implementation Planning | Strategic Salt Accumulation Land and Transport Study (SSALTS) | • SNMP implementation measures to manage salt on a sustainable basis | | | | | |
| | Post- SSALTS Implementation Planning | | | | | | |
| Lower San Joaquin River Committee | Technical Analyses (salt loading characterization, modeling) | • Coordination with CV-SALTS SNMP development activities to ensure consistency | | | | | |
| | Basin Planning Activities (WQOs, SED, economics, monitoring, implementation) | | | | | | |

# Technical Review Process

- Technical Advisory Committee – Meets monthly to discuss technical issues/provide comment on technical deliverables
- Project Committee – Designated ad hoc committee to provide more frequent/detailed reviews of selected technical products, e.g., Conceptual Model deliverables. Special thanks to:
  - Central Valley Regional Water Quality Board Staff - Clay Rodgers , Rob Busby and Jeanne Chilcott
  - CV-SALTS Participants – David Cory, Debbie Webster, Nigel Quinn and Roger Reynolds
  - Outside Volunteers – Thomas Harter (UC Davis) and Randy Hanson (USGS)

# CONCEPTUAL MODEL DEVELOPMENT

| Technical Area | Primary Activities | SNMP Support | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| **Conceptual Model Development** | Initial Conceptual Model | • Source identification<br>• Assimilative capacity<br>• Loading estimates | | | | | Prepare Final SNMP |
| | Phase 2 | • Source and loading refinement<br>• Background water quality/ assimilative capacity calculation methods<br>• Management zone study | | | | | |
| | Phase 3 | • Antidegradation analysis<br>• Monitoring plan<br>• Economics analysis | | | | | |
| **Data Development** | GIS – Phase 2 | • Baseline database | | | | | |
| | Agriculture Zone Mapping | • AGR implementation tools | | | | | |
| **Beneficial Use Studies** | Tulare Lake Bed MUN Archetype | • MUN implementation tools | | | | | |
| | MUN Beneficial Use in Agriculturally Dominated Water Bodies Archetype | • MUN implementation tools | | | | | |
| **Water Quality Objectives** | Salinity-related Effects on Agricultural Irrigation Uses | • Evaluation of science behind establishment of salinity related objectives | | | | | |
| | Salinity Effects on MUN-related Uses of Water | | | | | | |
| | Stock Watering Study | | | | | | |
| | Aquatic Life Study | | | | | | |
| **Implementation Planning** | Strategic Salt Accumulation Land and Transport Study (SSALTS) | • SNMP implementation measures to manage salt on a sustainable basis | | | | | |
| | Post- SSALTS Implementation Planning | | | | | | |
| **Lower San Joaquin River Committee** | Technical Analyses (salt loading characterization, modeling) | • Coordination with CV-SALTS SNMP development activities to ensure consistency | | | | | |
| | Basin Planning Activities (WQOs, SED, economics, monitoring, implementation) | | | | | | |

# CV-SALTS

# Initial Conceptual Model (ICM)

## Central Valley Water Board
## December 6, 2013

**Vicki Kretsinger Grabert, LSCE**

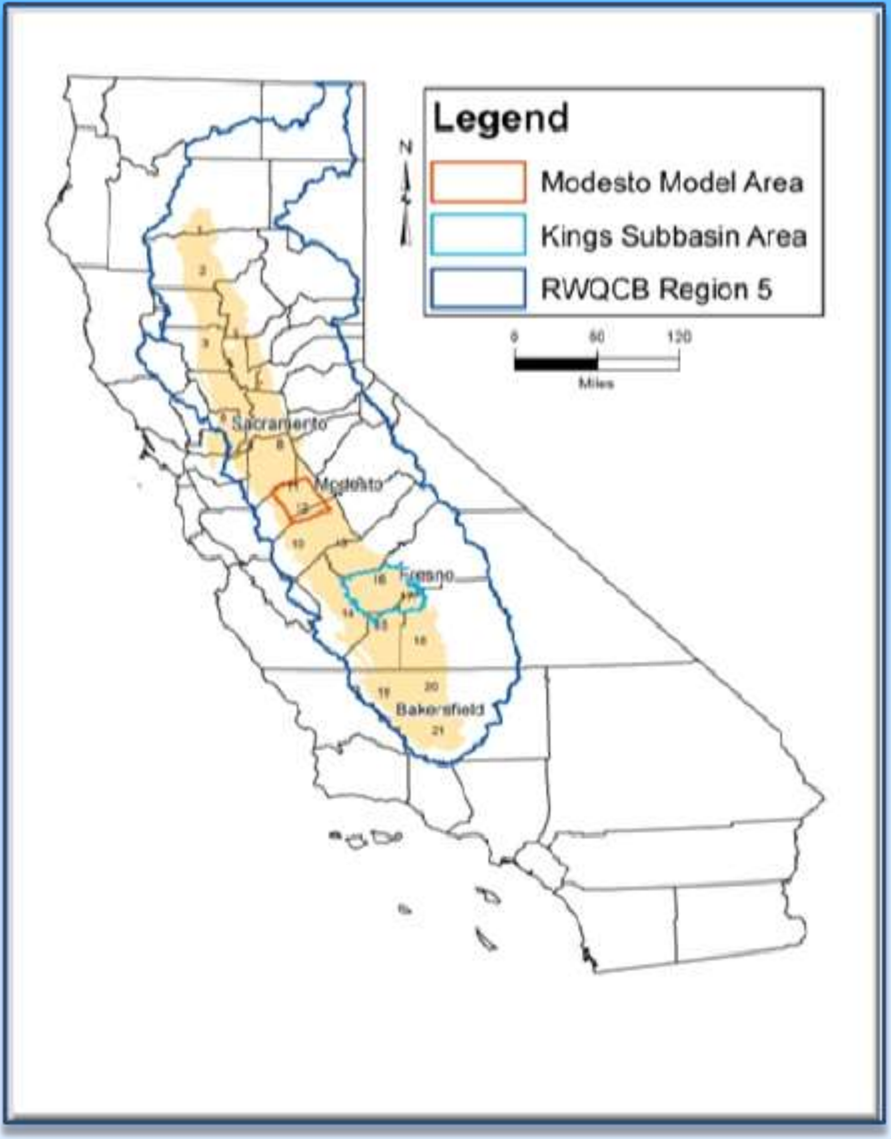
## Larry Walker Associates Team

LWA TEAM MEMBERS

1 - Larry Walker Associates
2 - Kennedy/Jenks
3 - Carollo Engineers
4 - PlanTierra
5 - Luhdorff and Scalmanini
6 - Systech Water Resources

# Presentation Outline

- Phases I and II
- Issue and Analysis Tools
- Central Valley-wide Analysis (Coarse Scale)
- Refined Scale Analysis (Modesto Area and Kings Subbasin)
- Transbasin Significance of Salt and $NO_3$
- Summary



# Conceptual Model Development – Phases I & II

| Key Elements | Phase I (ICM) | Phase II (Potential Tasks) |
|---|---|---|
| Ambient GW Quality | Coarse scale analysis (Initial Analysis Zones – IAZs); higher resolution in 2 focus areas | Develop final methodology; apply to example areas (higher resolution) |
| Assimilative Capacity (existing and projected) | Preliminary coarse scale analysis in IAZs; higher resolution in 2 focus areas | Develop final methodology; test on example areas (higher resolution) |
| Salt and Nitrate Transport | Coarse scale analysis | High resolution analysis (Archetype Area; existing vs. future scenarios) |
| Management Area | Default to IAZs (CVHM/DWR water balance regions) | Guidance for Management Zone Concept |
| SNMP (Local Development) | "Proof of concept" tools; flow & transport models for incorporation | Draft guidance for technical elements of local SNMPs |
| GW Monitoring | Preliminarily assess data gaps | Data distribution needs; inform Phase III |

# Issue: Salt and $NO_3$ Occurrence, Transport, and Management

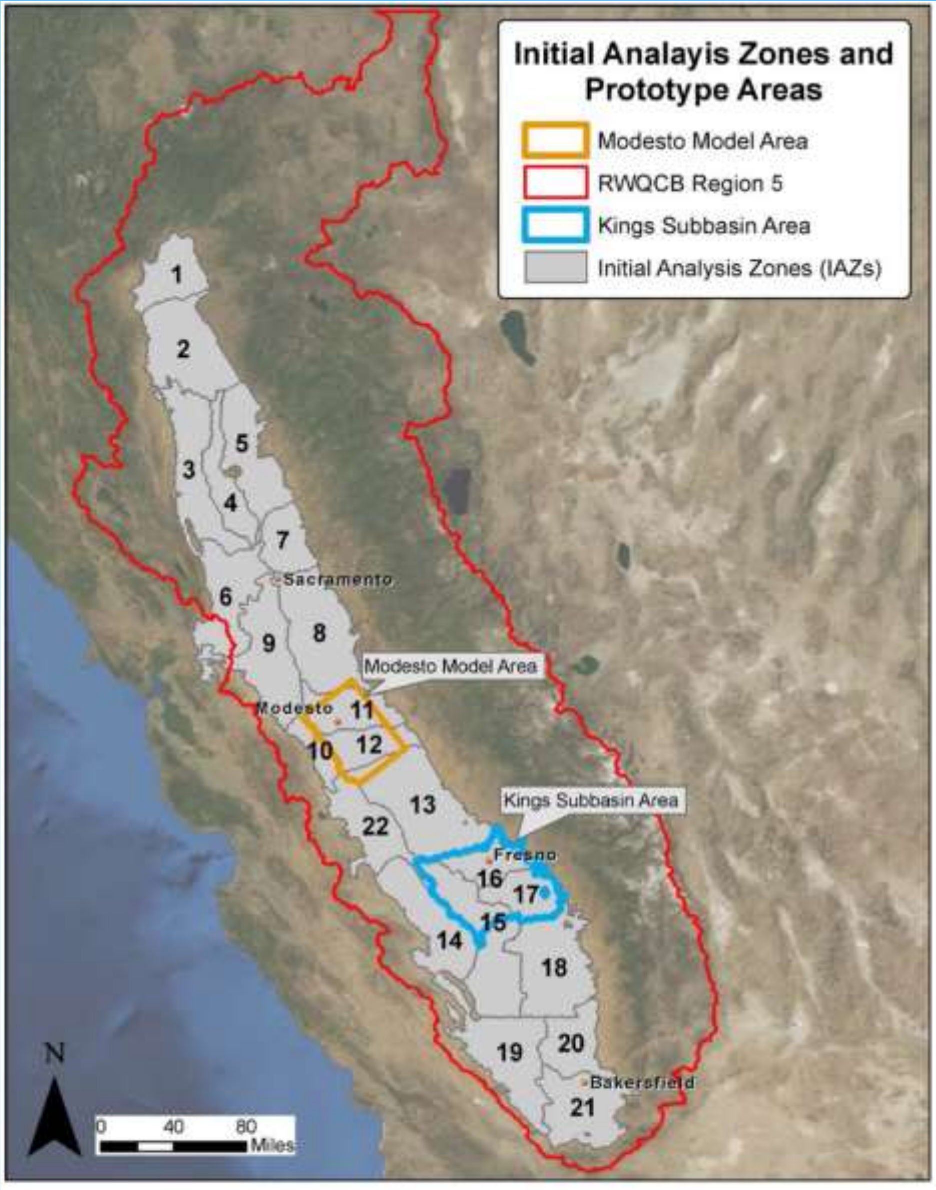
- Salt and $NO_3$ Accumulation
  - What is ambient WQ (current condition)?
  - Where are salt and $NO_3$ in balance/accumulating/depleting?
  - Where are priority areas?
  - What is potential assimilative capacity?

# Analysis Tools

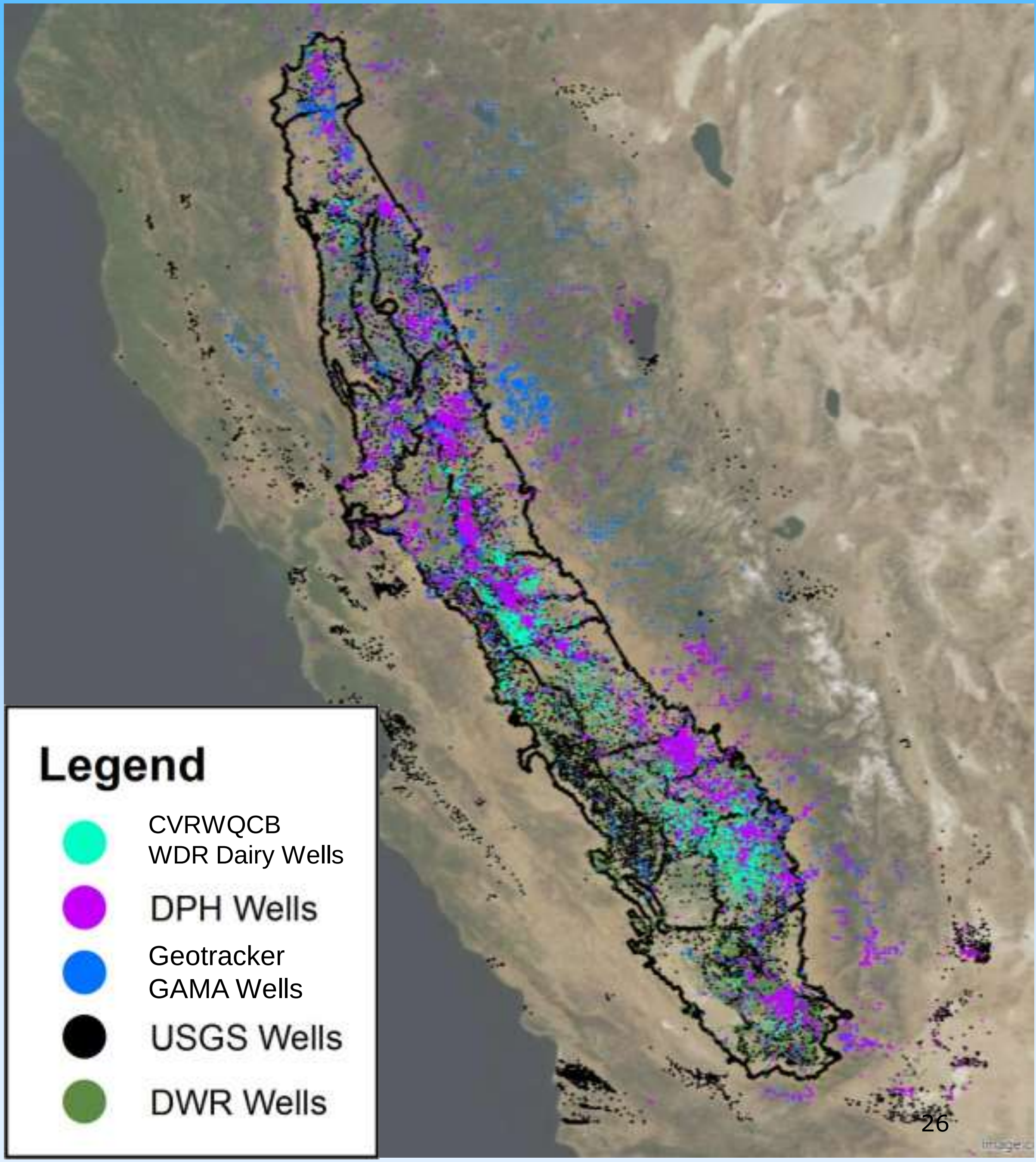
- Data
  - Hydrologic
  - Land Use
  - Coverage
  - Limitations
- Models
  - Central Valley: SW and GW; Salt and $NO_3$ Transport; Aggregate Scale; 20 Year Simulation
  - Stanislaus/Merced and Kings Subbasin: GW Flow and Salt and $NO_3$ Transport; Refined Grid

# Initial Analysis Zones and Prototype Areas

- 21 CVHM Subregions (Plus One Divided)
- ICM Task 6: 22 IAZs
- Existing WARMF Coverage
- Task 7 Prototype Areas
  - Modesto
  - Kings Subbasin



# Groundwater Quality Data: All Wells with Salt and Nitrate Data

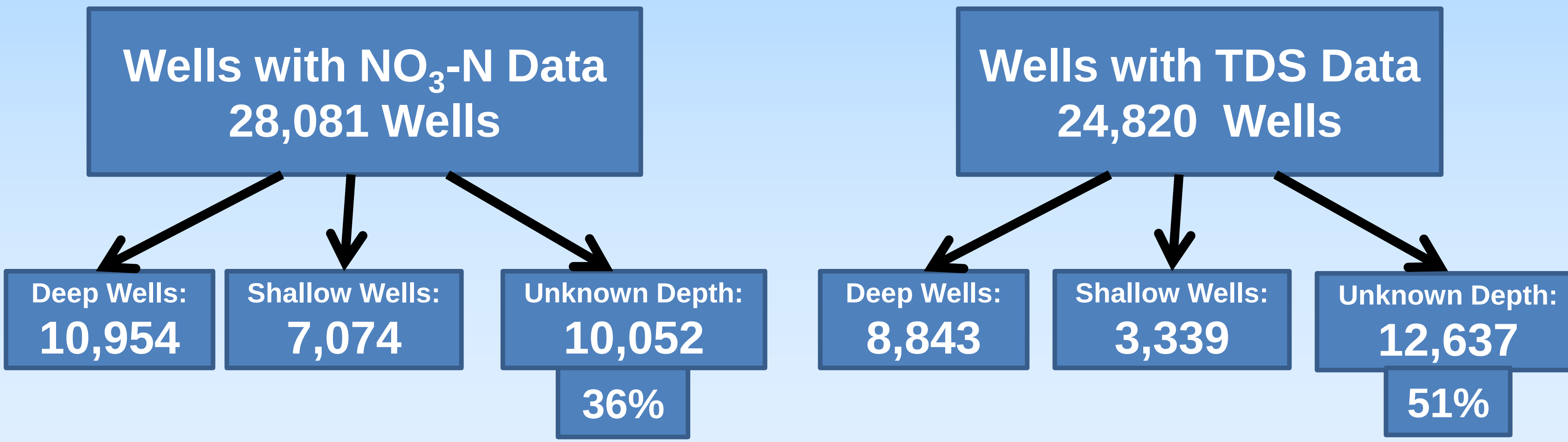



**Full dataset =**

- **50,478 wells**
- **33,305 wells in IAZs**

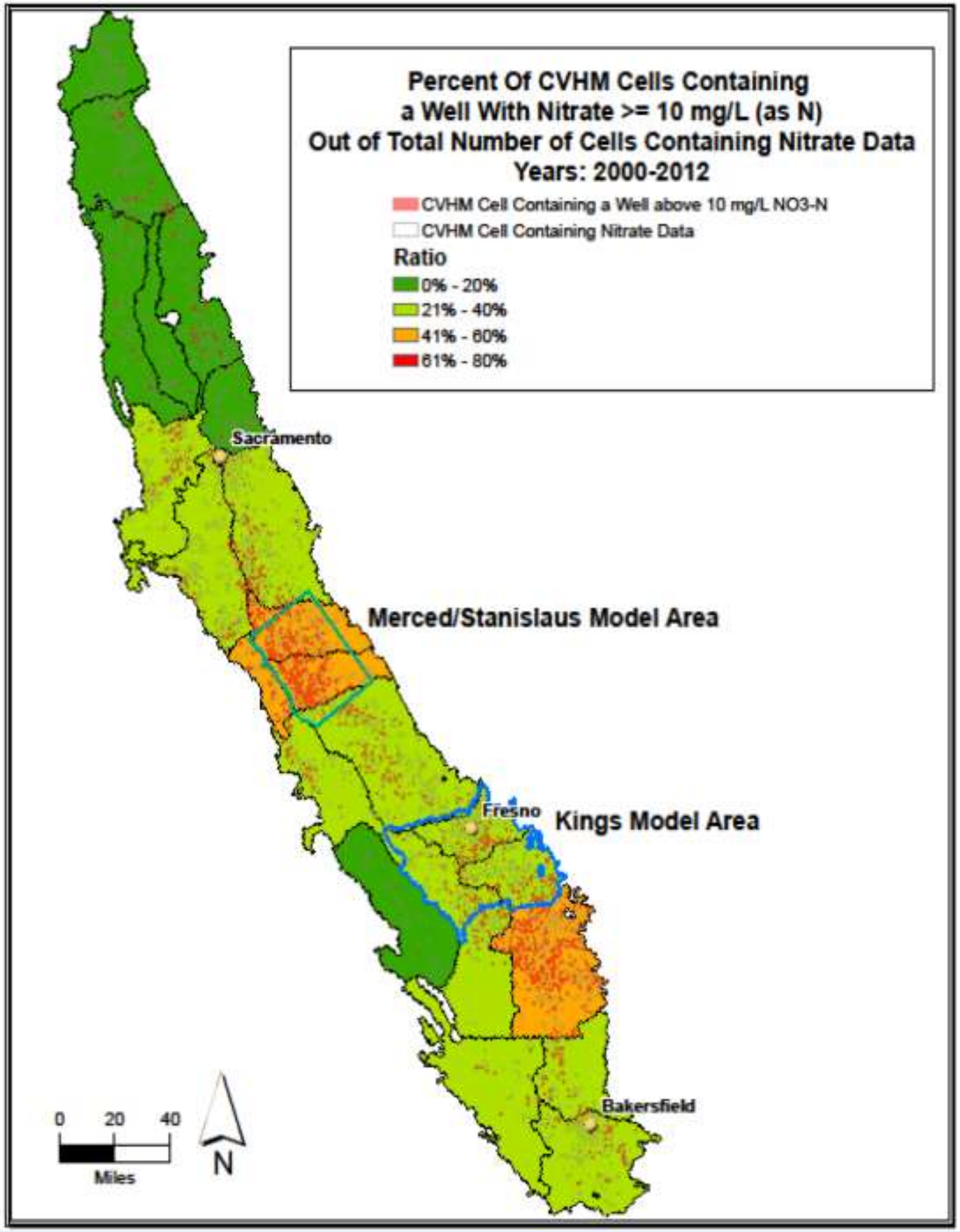
# Well Data Characterization

- Issues
  - Many wells do not have readily available construction information
  - Many wells not characterized with respect to their completion in the aquifer system



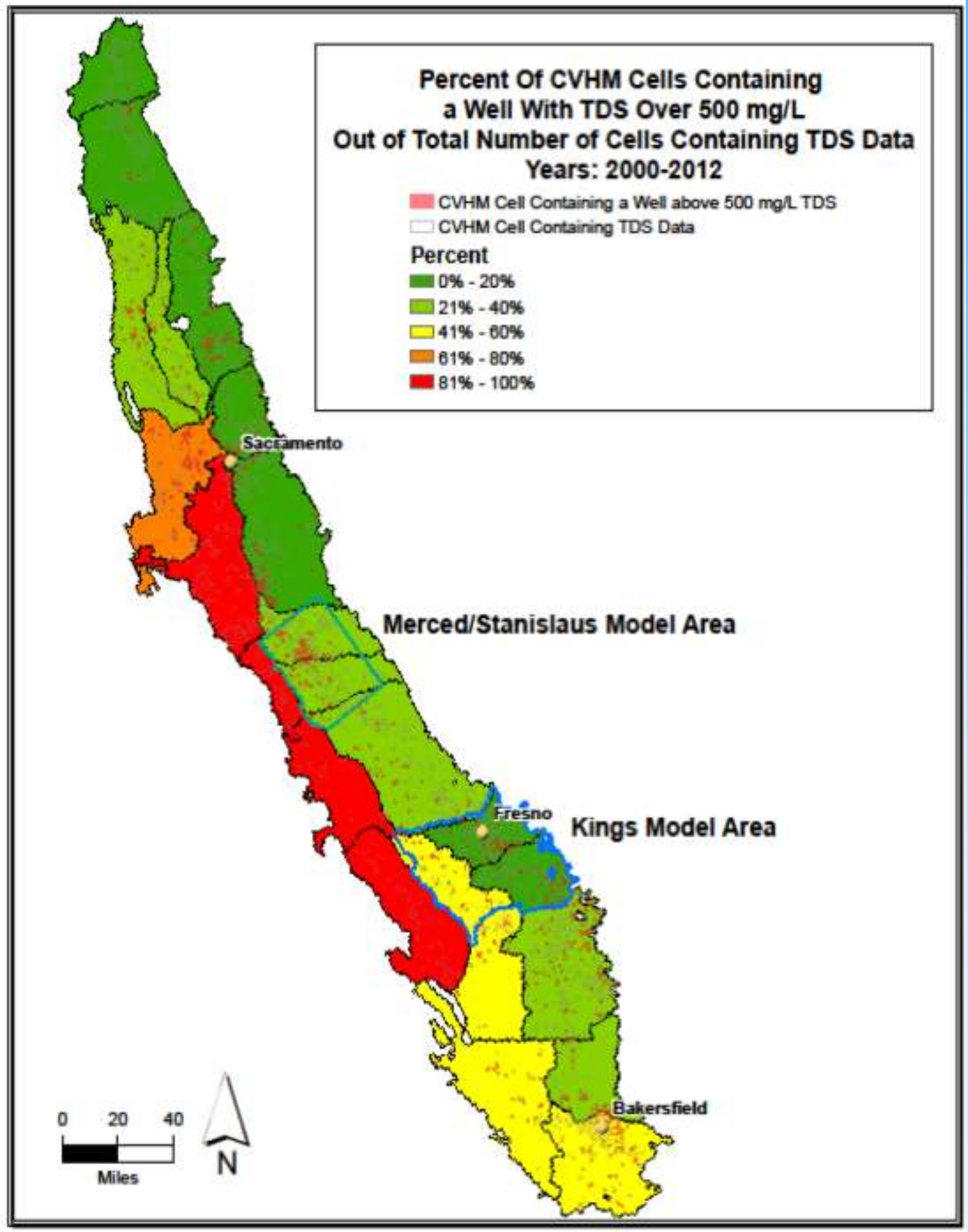
# Percent of CVHM Cells with a Well with $NO_3$-N > MCL

- Warmer colors represent greater % of wells in 1-mile$^2$ cells with $NO_3$-N > 10 mg/L



# Percent of CVHM Cells with a Well with TDS > 500 mg/L

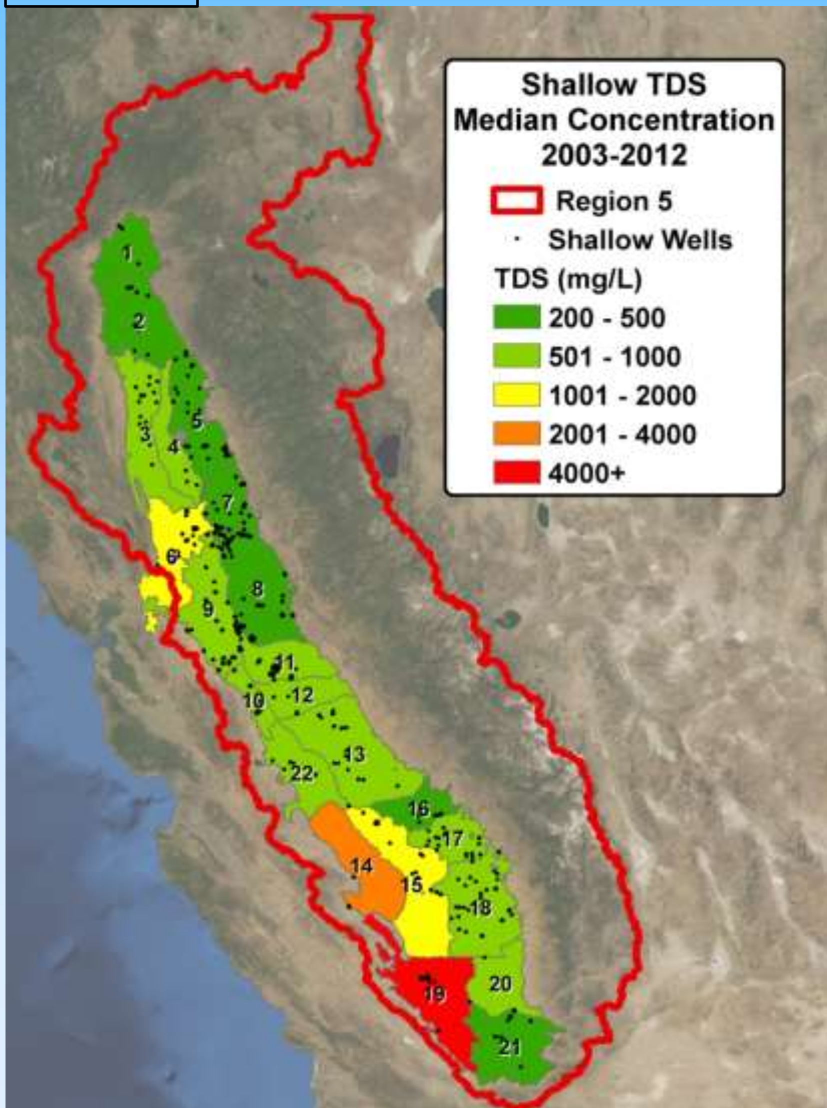
- Warmer colors represent greater % of wells in 1-mile$^2$ cells with TDS > 500 mg/L

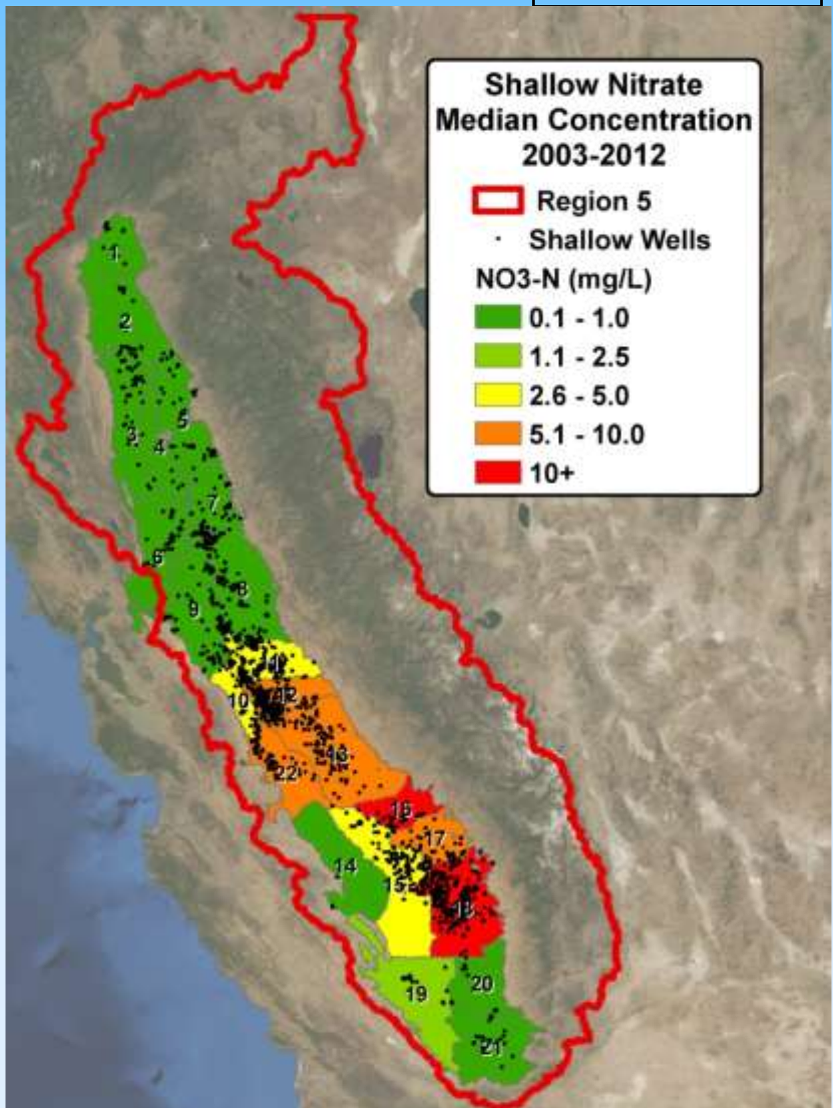


# Ambient Shallow GW Quality - Median CVHM Cell Concentration (Shallow Wells 2003-2012)

**TDS**

**$NO_3$-N**

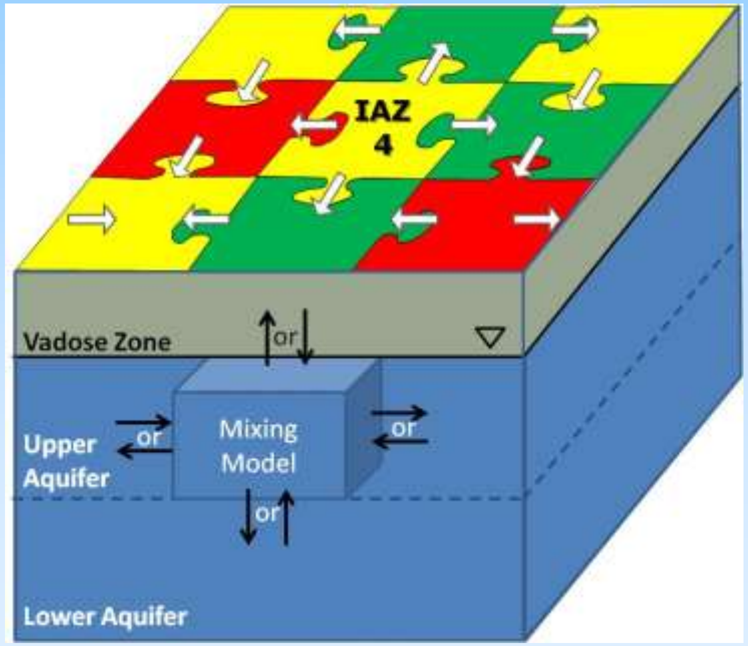


# Methodology

- **WARMF Output**
  - Watershed Analysis Risk Management Framework
  - Computes water balance and chemical mass balance, including chemical & physical processes and loading

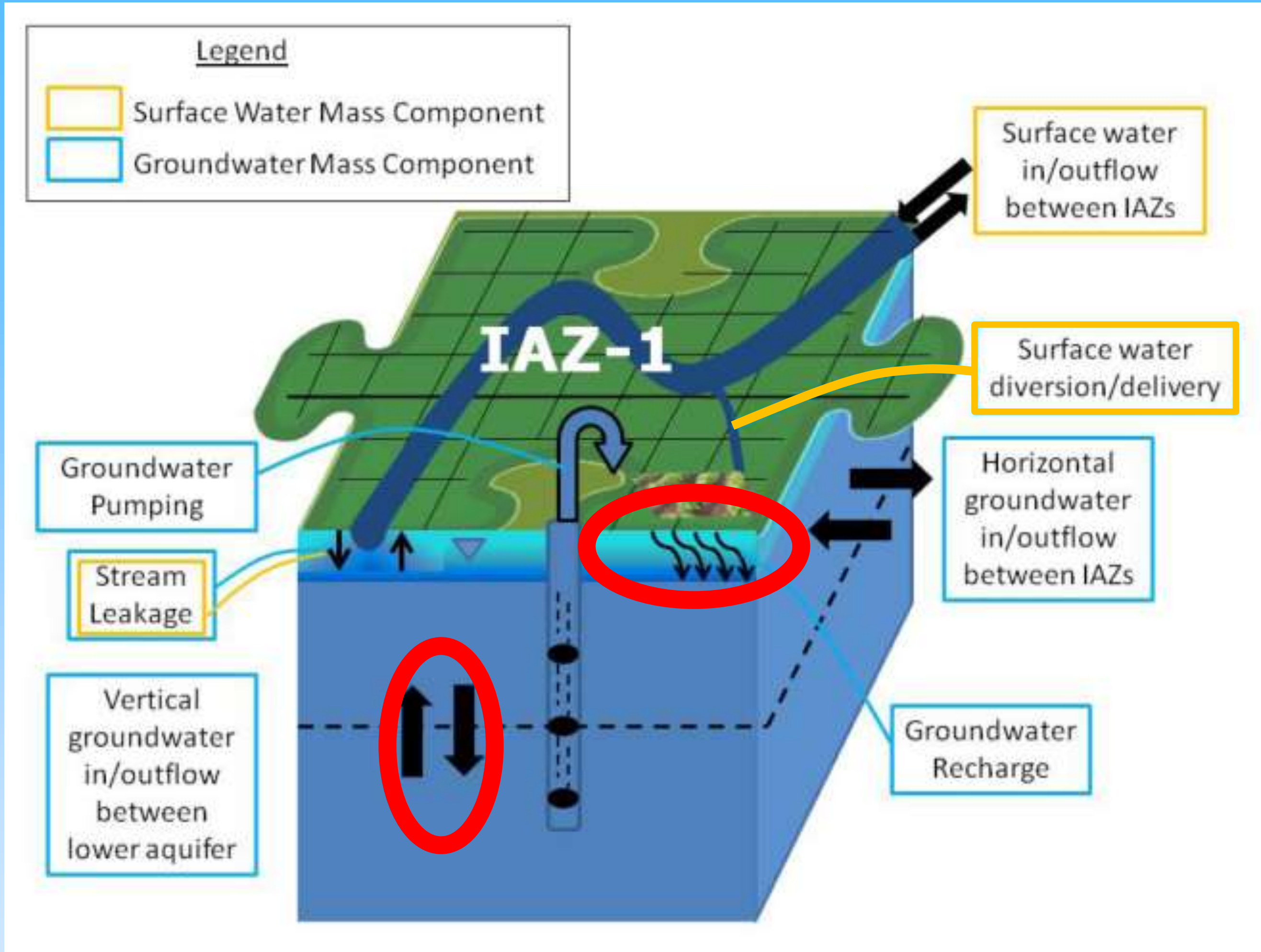
- **CVHM Output**
  - USGS Central Valley Hydrologic Model
  - Estimates water budget components (GW pumping, ag demands, SW deliveries, etc.)




**22 IAZs: All of Central Valley**

# ICM: Task 6 Aggregate Scale

**“Shallow” IAZ Volume:** 20-Yr Vertical Travel Time



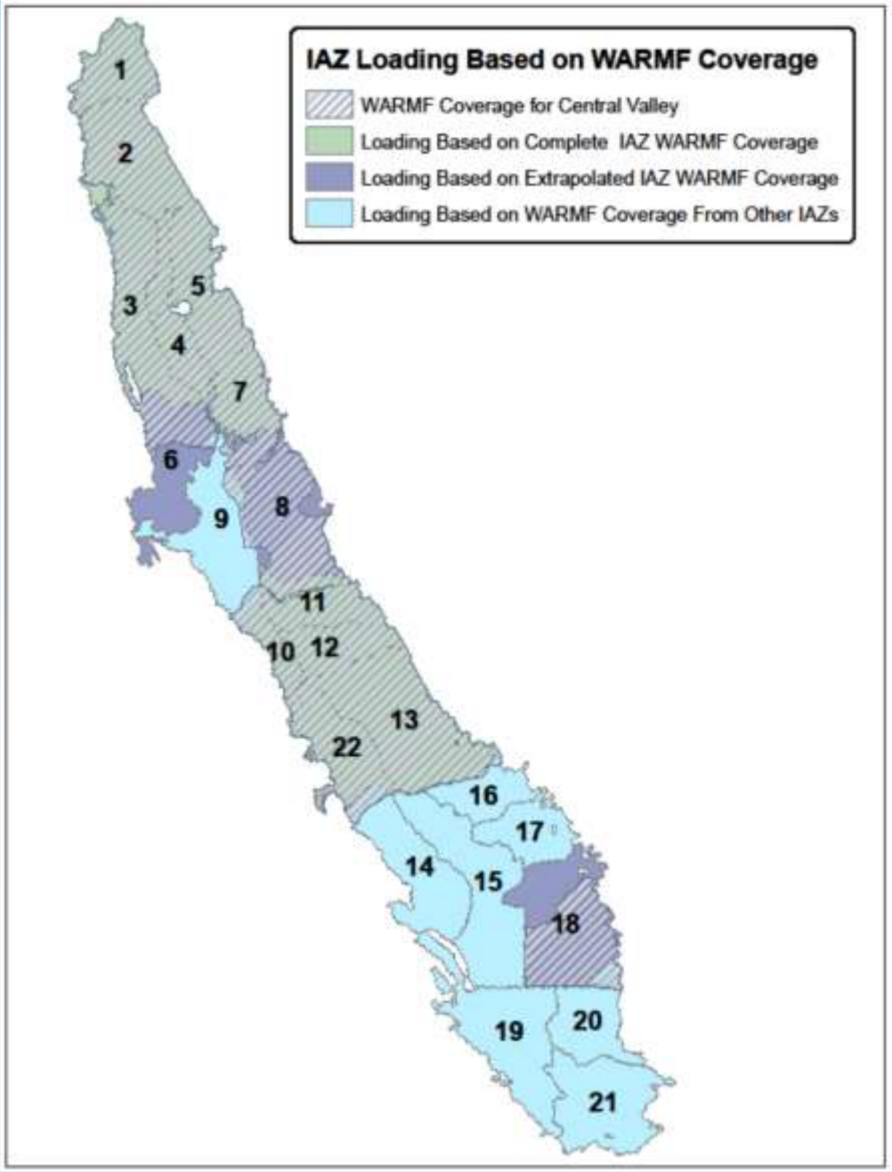

**Major Components of Mass Load Transfer:**

1) Recharge to Groundwater

2) Vertical Flow to Deeper Aquifer

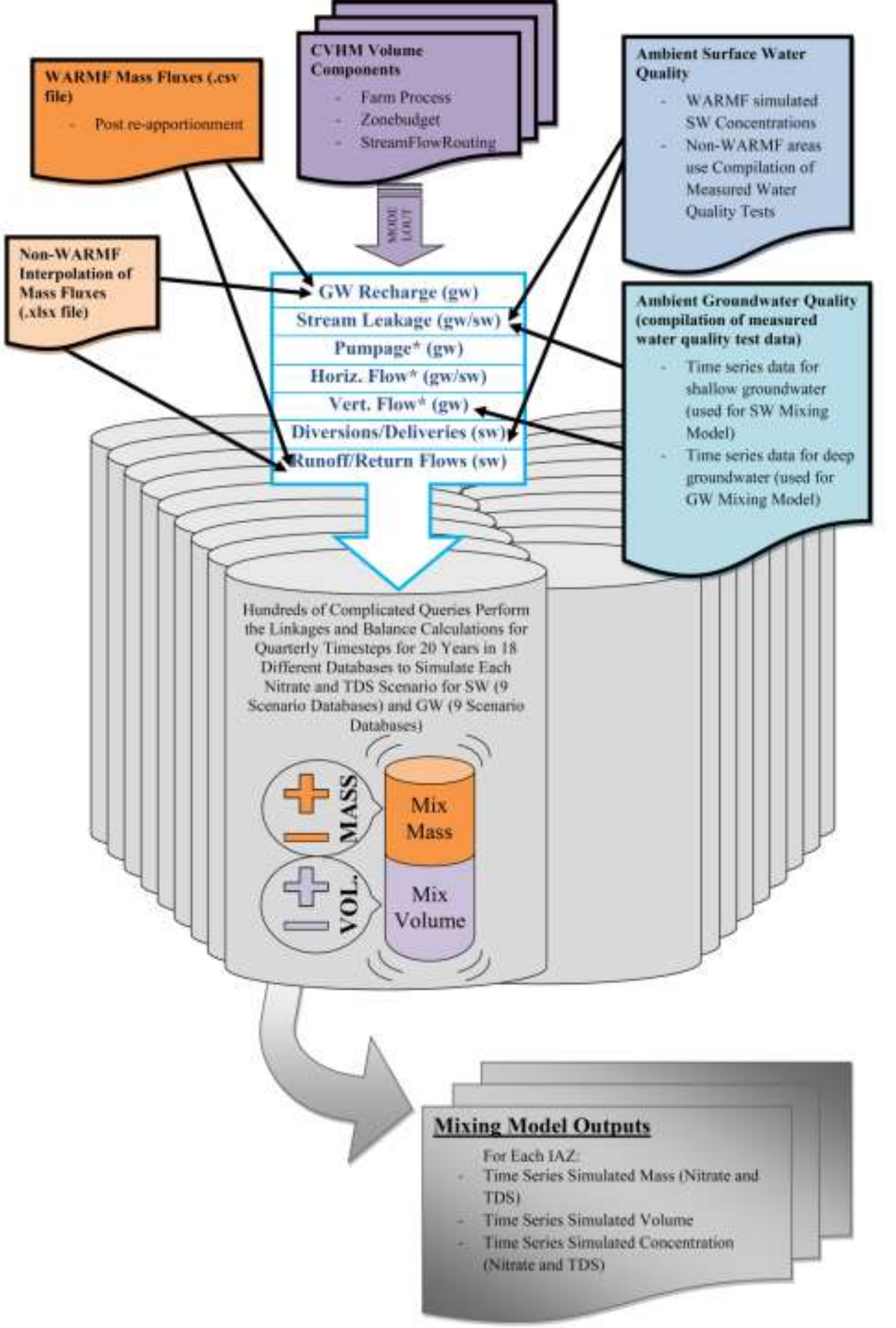
# $NO_3$ and Salt Loading Scenarios

- Developed From Original Loading Inputs
- 6 Nitrogen Scenarios
  - High, moderate, and low nitrogen use efficiency (NUE)
  - 90%, 75%, & 60% of low NUE
- 3 Salinity Scenarios
  - 50%, 100%, & 200% of original inputs



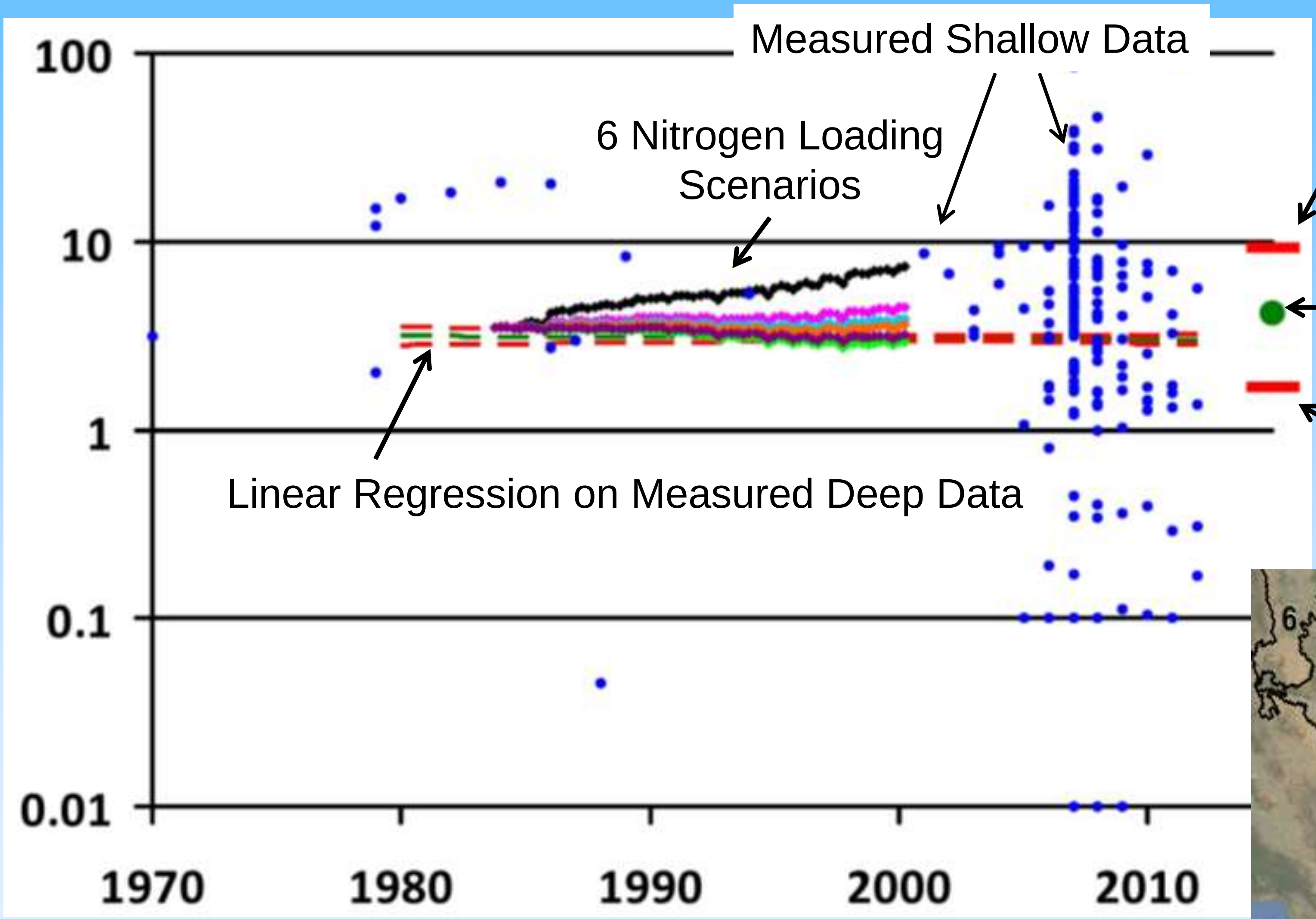
# Central Valley Database Mixing Model

- Hundreds of Complex Queries
- Quarterly Timesteps
- 20 Years
- 18 different databases for SW & GW scenarios
- Salt and $NO_3$-N

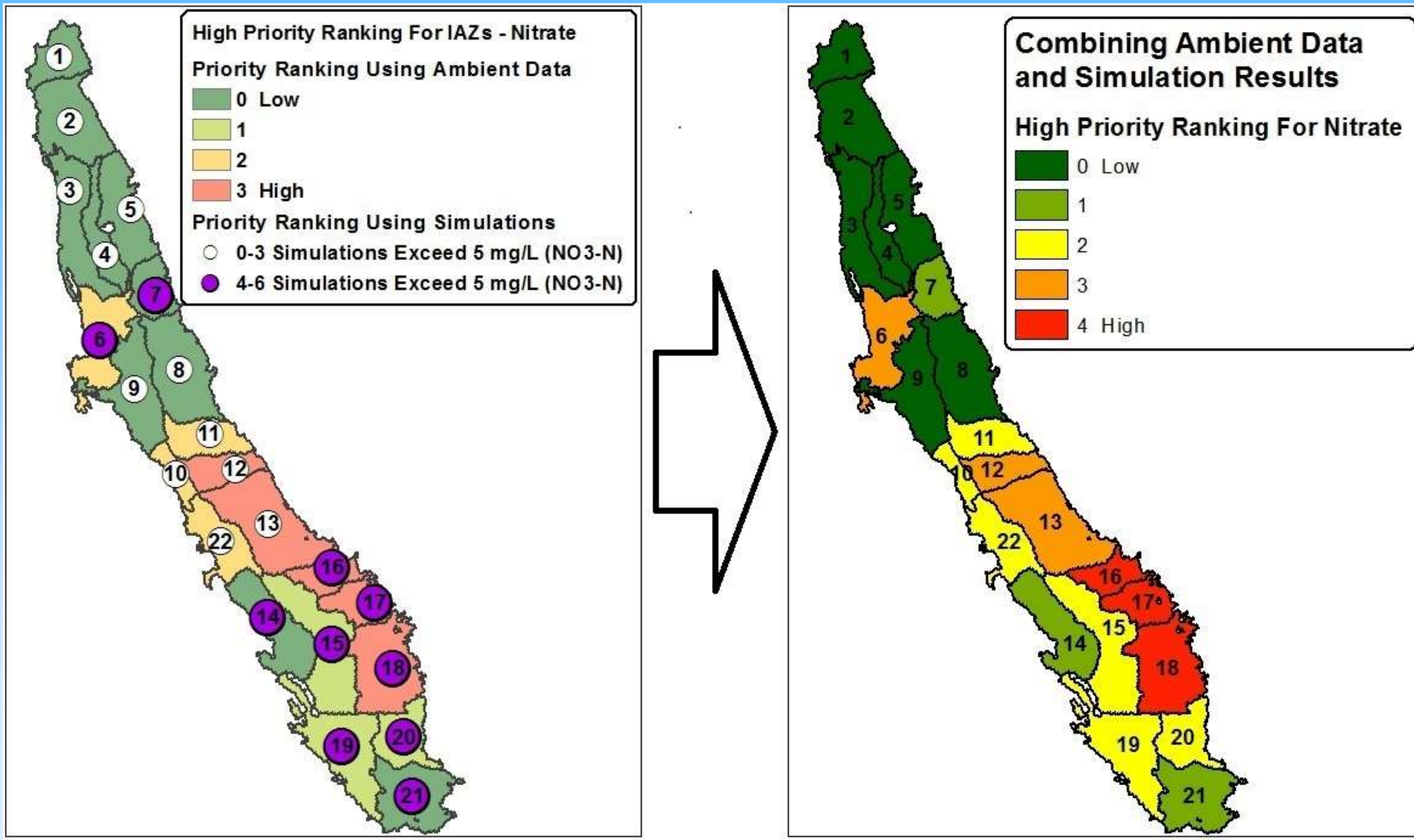


# Example Results – Modesto Area

## IAZ-11 $NO_3$-N

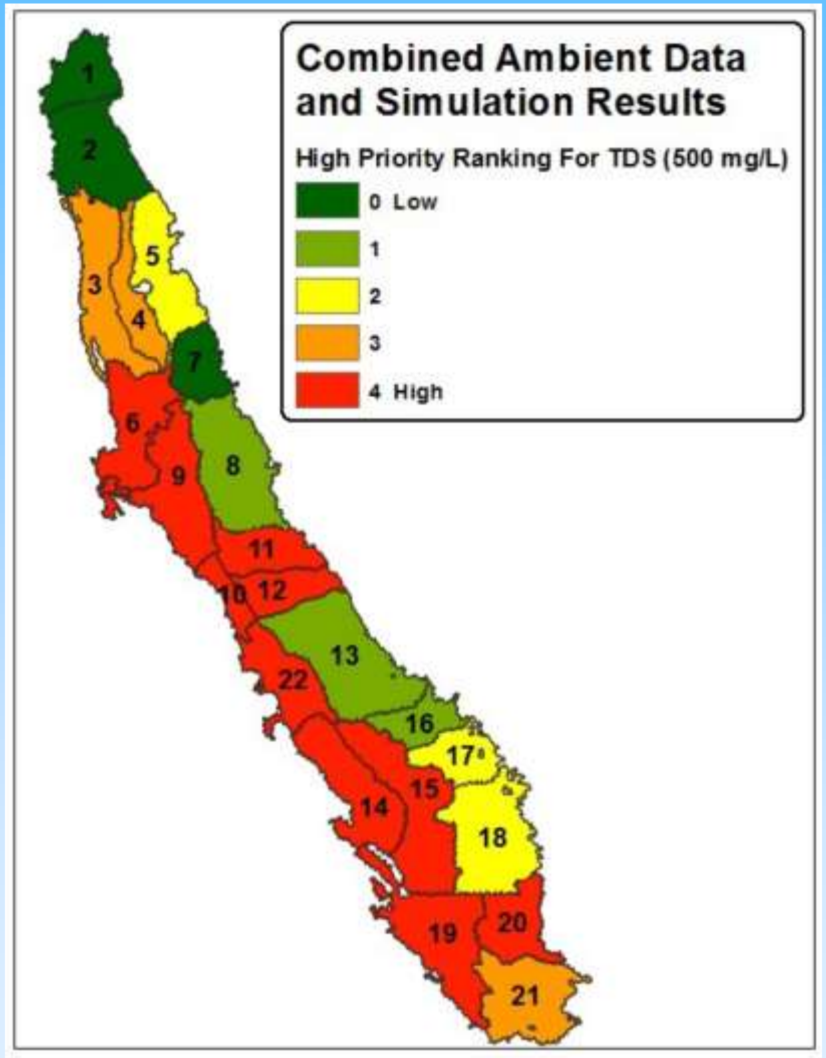


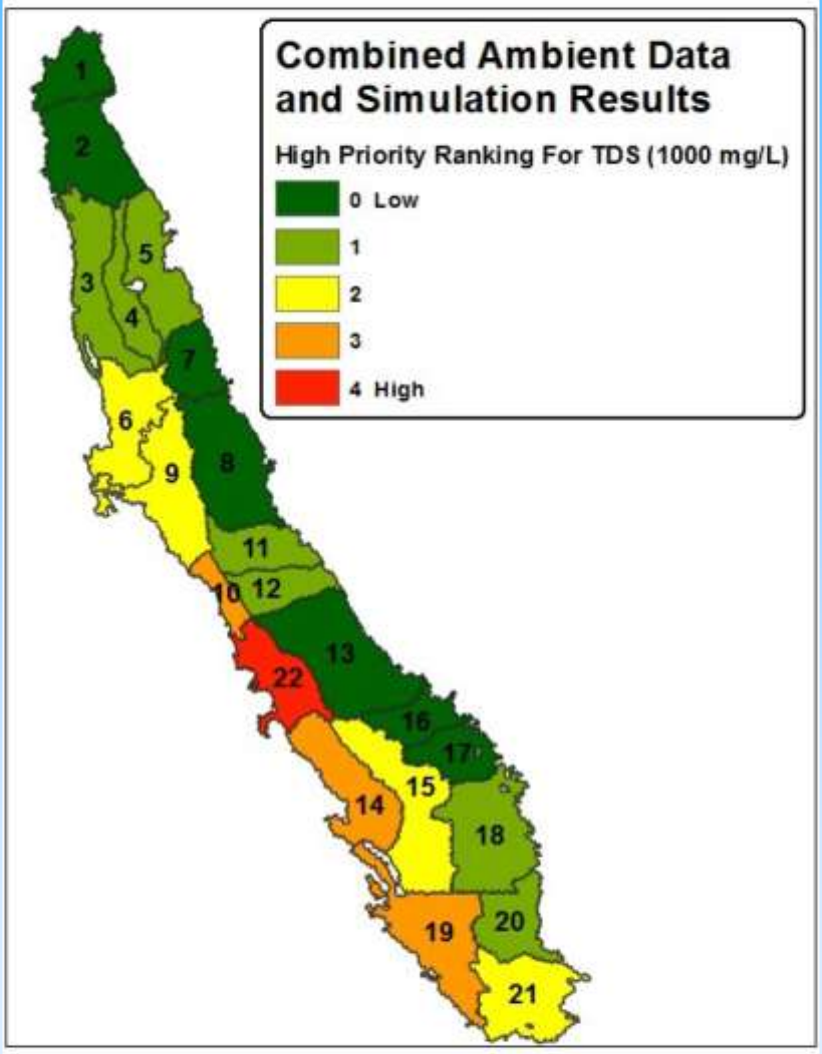

# IAZ Prioritization for $NO_3$-N (10 mg/L)




**3 IAZs exceed Ranking Criteria for $NO_3$-N**

# IAZ Prioritization for TDS (500 & 1000 mg/L)



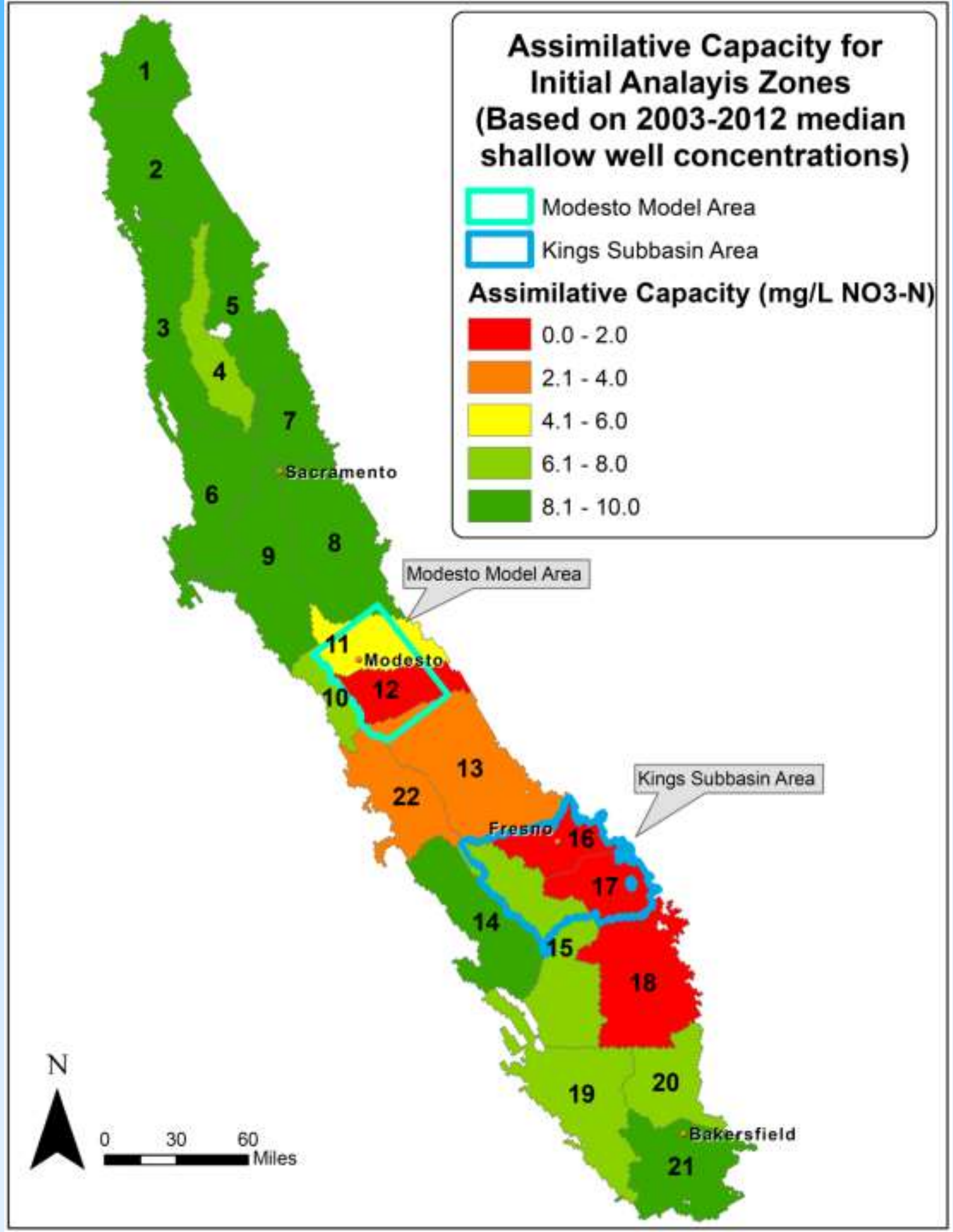

**Many IAZs exceed Ranking Criteria for TDS at 500 mg/L**

# Shallow Assimilative Capacity: $NO_3$-N (10 mg/L) And TDS at 500, 700 and 1000 mg/L

| | | Nitrate | | | TDS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ambient Data (mg/L NO3-N) | | Assimilative Capacity | Ambient Data (mg/L) | | Assimilative Capacity | | |
| | IAZ | Shallow Median (2003-2012) | Estimated Deep (2003) | 10 mg/L NO3-N Threshold | Shallow Median (2003-2012) | Estimated Deep (2003) | 500 mg/L Threshold | 700 mg/L Threshold | 1000 mg/L Threshold |
| Northern Central Valley | 1 | 0.1 | 0.8 | 9.9 | 370 | 158 | 130 | 330 | 630 |
| | 2 | 0.6 | 1.4 | 9.4 | 201 | 223 | 300 | 500 | 800 |
| | 3 | 0.9 | 1.5 | 9.1 | 583 | 381 | 0 | 117 | 417 |
| | 4 | 2.8 | 0.2 | 7.2 | 761 | 363 | 0 | 0 | 240 |
| | 5 | 0.4 | 0.9 | 9.6 | 329 | 281 | 171 | 371 | 671 |
| | 6 | 0.6 | 2.0 | 9.4 | 1060 | 461 | 0 | 0 | 0 |
| | 7 | 0.7 | 1.1 | 9.3 | 398 | 241 | 103 | 303 | 603 |
| Middle Central Valley | 8 | 1.2 | 1.1 | 8.8 | 438 | 226 | 62 | 262 | 562 |
| | 9 | 0.4 | 0.5 | 9.6 | 961 | 560 | 0 | 0 | 40 |
| | 10 | 2.7 | 4.2 | 7.3 | 842 | 911 | 0 | 0 | 159 |
| | 11 | 4.9 | 3.2 | 5.1 | 565 | 273 | 0 | 135 | 435 |
| | 12 | 10.4 | 3.0 | 0.0 | 825 | 267 | 0 | 0 | 175 |
| | 13 | 6.1 | 2.2 | 4.0 | 648 | 236 | 0 | 53 | 353 |
| | 22 | 7.4 | 1.9 | 2.6 | 1160 | 645 | 0 | 0 | 0 |
| Southern Central Valley | 14 | 0.4 | 1.0 | 9.6 | 3375 | 966 | 0 | 0 | 0 |
| | 15 | 3.0 | 0.4 | 7.0 | 1000 | 337 | 0 | 0 | 0 |
| | 16 | 11.1 | 3.1 | 0.0 | 575 | 218 | 0 | 125 | 425 |
| | 17 | 8.5 | 2.9 | 1.5 | 520 | 199 | 0 | 180 | 480 |
| | 18 | 10.7 | 3.0 | 0.0 | 598 | 213 | 0 | 102 | 402 |
| | 19 | 3.3 | 1.1 | 6.7 | 11300 | 397 | 0 | 0 | 0 |
| | 20 | 3.4 | 2.0 | 6.6 | 870 | 309 | 0 | 0 | 130 |
| | 21 | 0.2 | 1.5 | 9.8 | 335 | 262 | 165 | 365 | 665 |

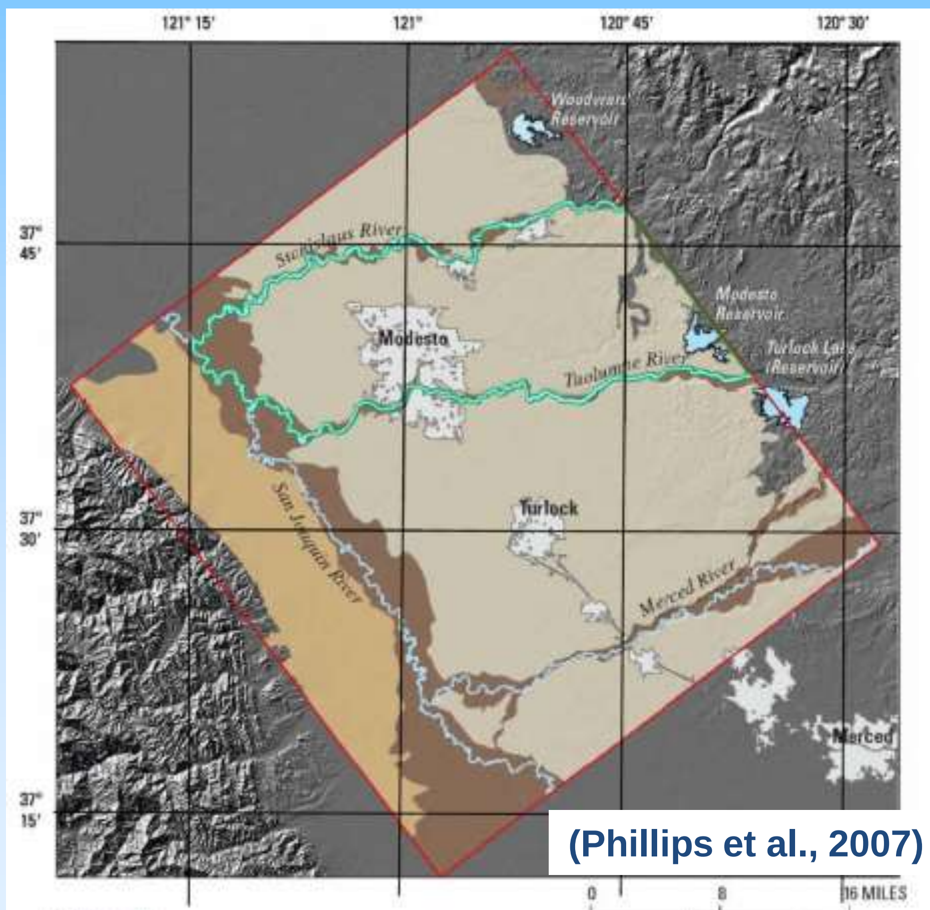
# Preliminary Assimilative Capacity: $NO_3$-N

- Relative to $NO_3$-N at 10 mg/L



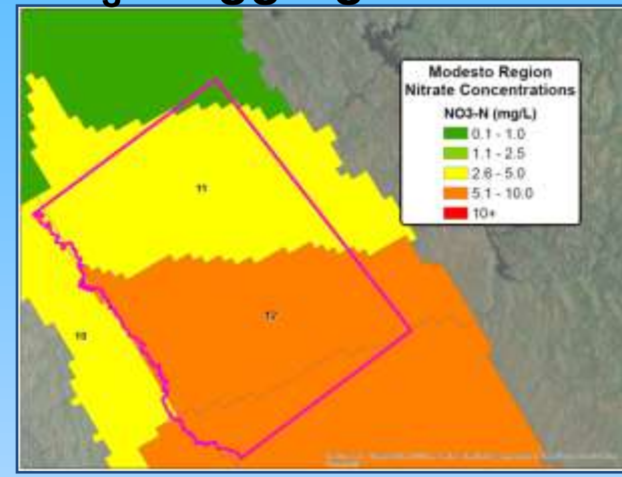
# USGS Modesto Regional Model

- ¼ $mi^2$ cell
- Local level prototype
- Utilize MODPATH-OBS

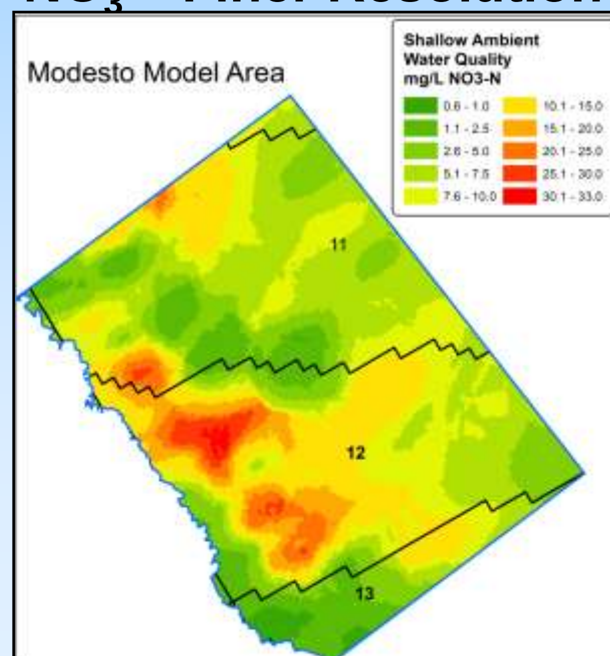



(Phillips et al., 2007)

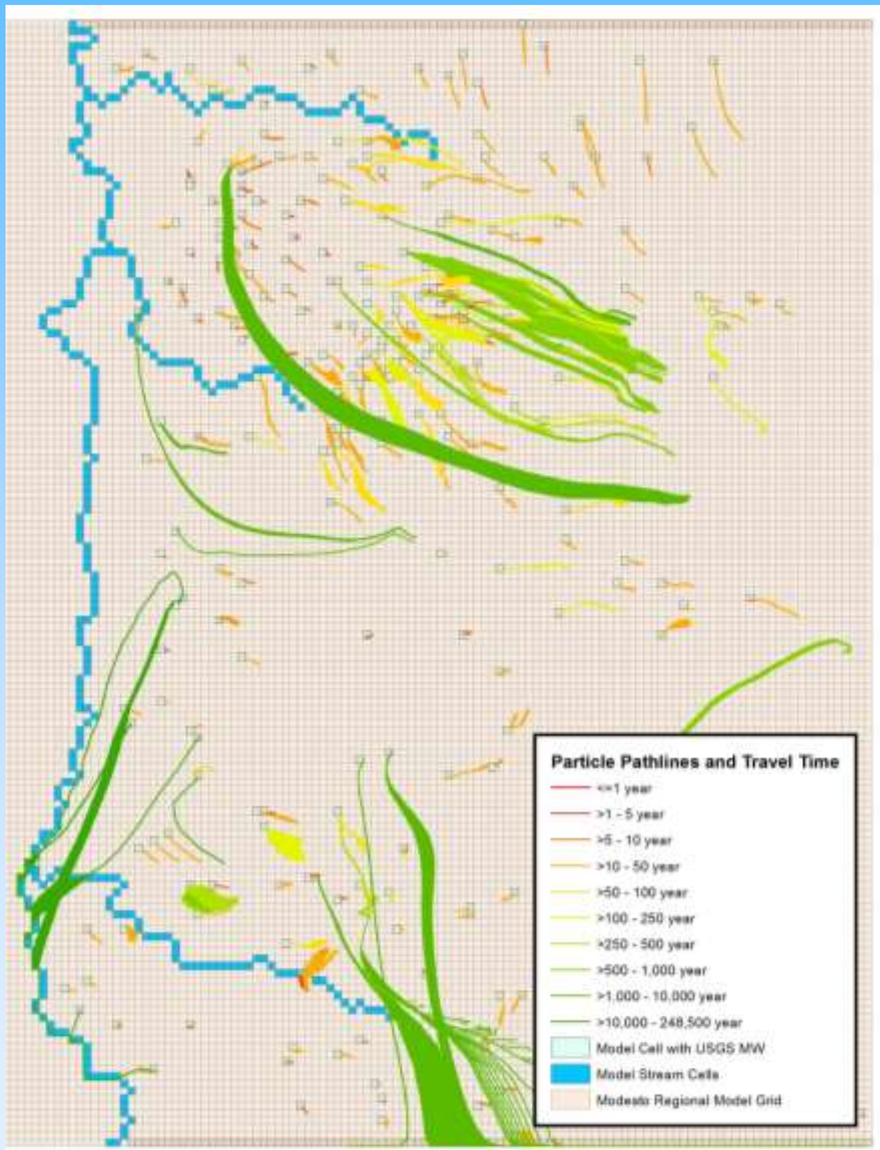
## $NO_3$ – Aggregate Scale



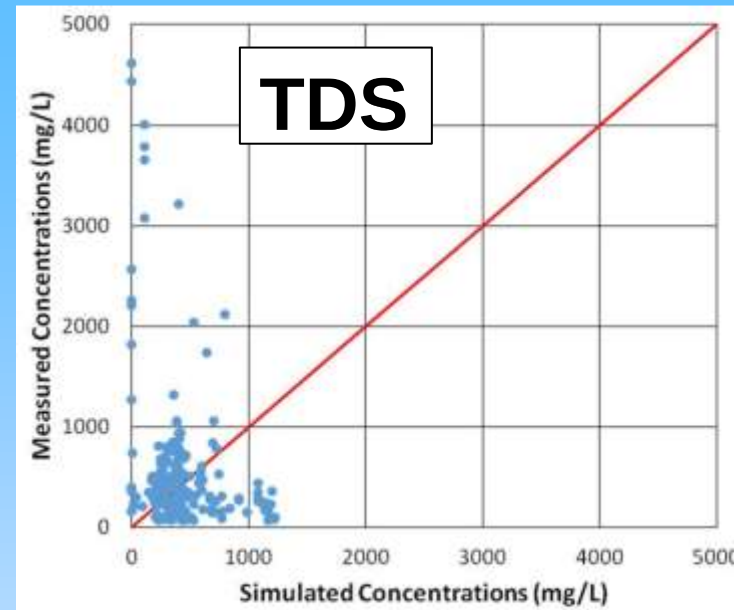

## $NO_3$ – Finer Resolution

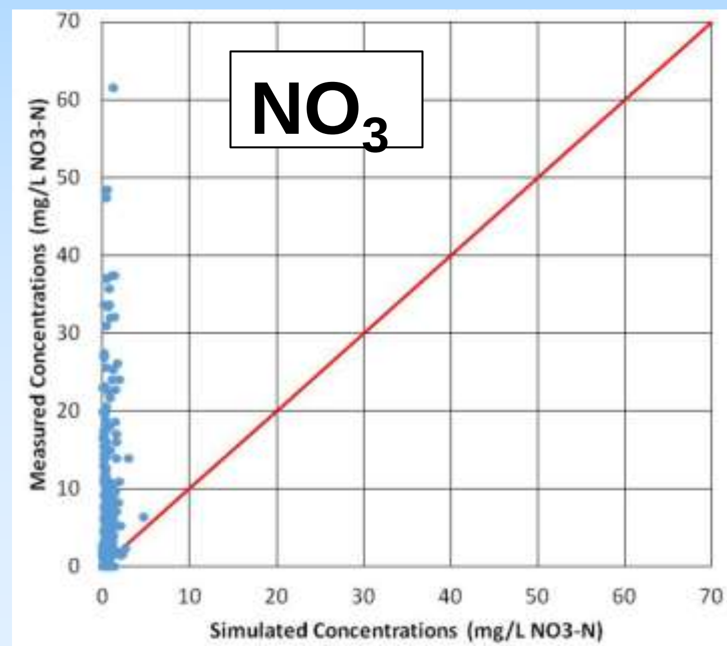


# Modesto Regional Model Simulation Results

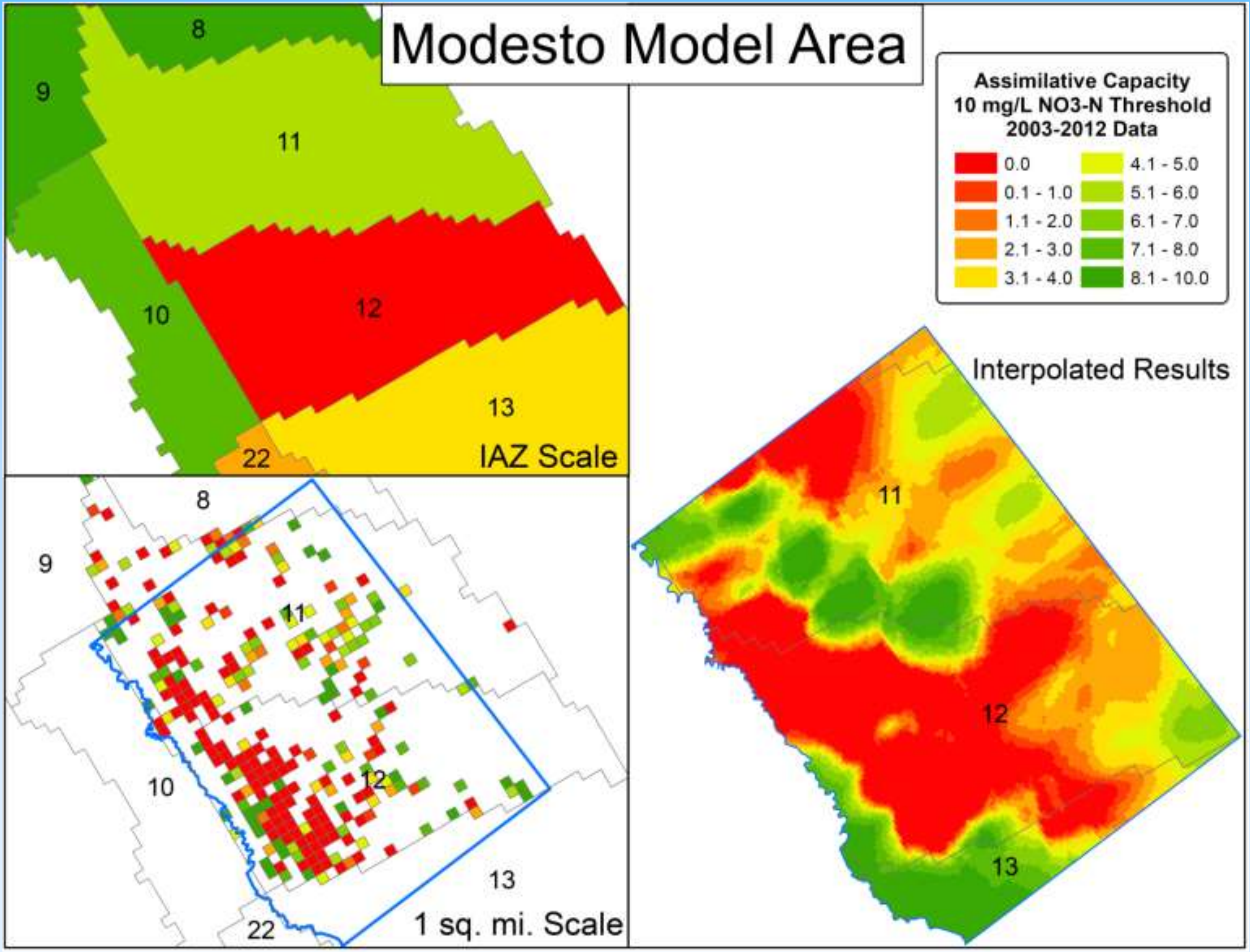



USGS Observation Wells

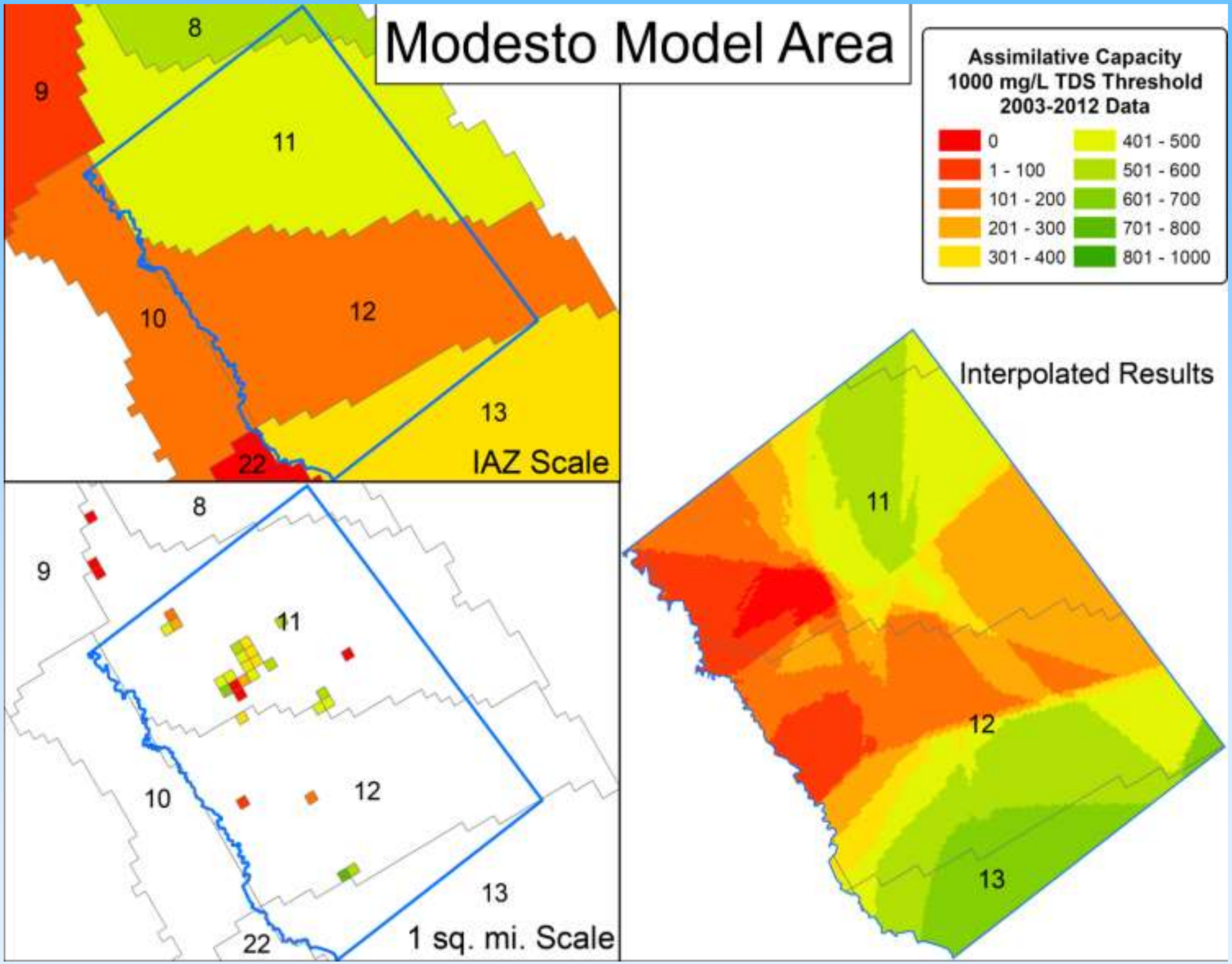


# Modesto Regional Model: Assimilative Capacity $NO_3$-N 10 mg/L

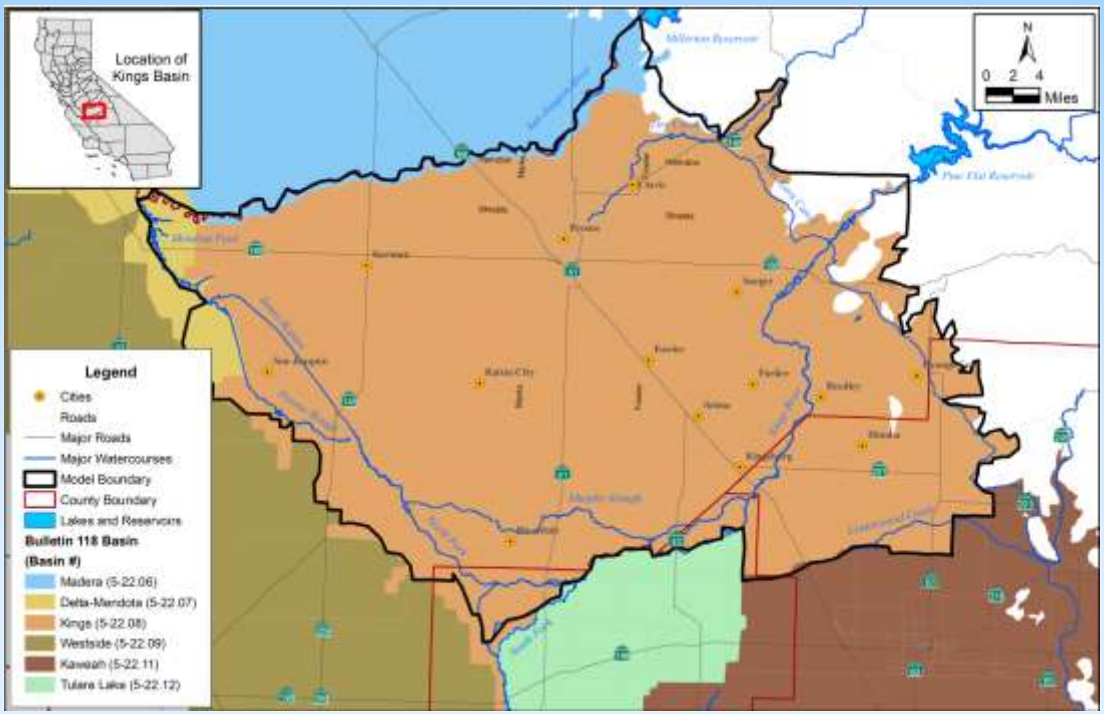


# Modesto Regional Model: Assimilative Capacity TDS 1000 mg/L

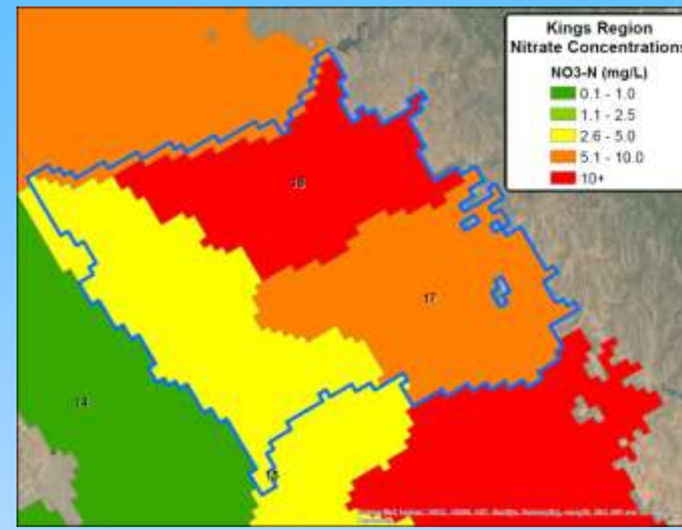


# Kings Subbasin

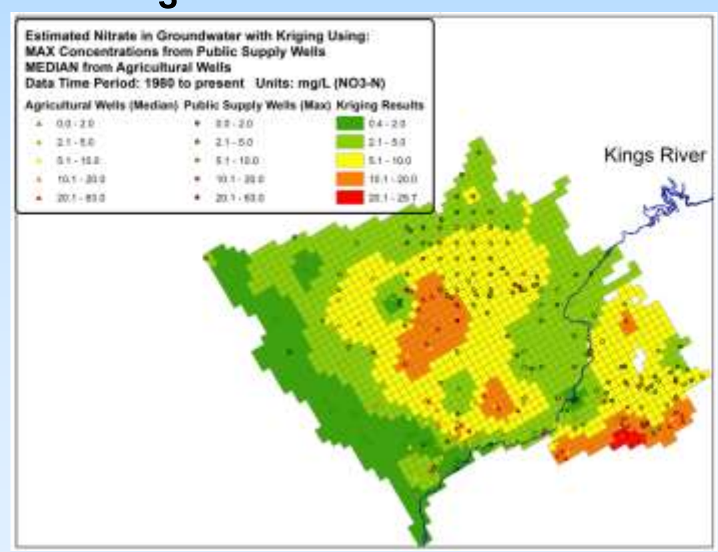
- CVHM (Subregions 16, 17, & part of 15); Similar to IGSM
- 1 $mi^2$ cell
- SNMP Master Plan Prototype; Proof of Concept
- GW Flow plus Salt & $NO_3$ Transport




**$NO_3$ – Aggregate Scale**



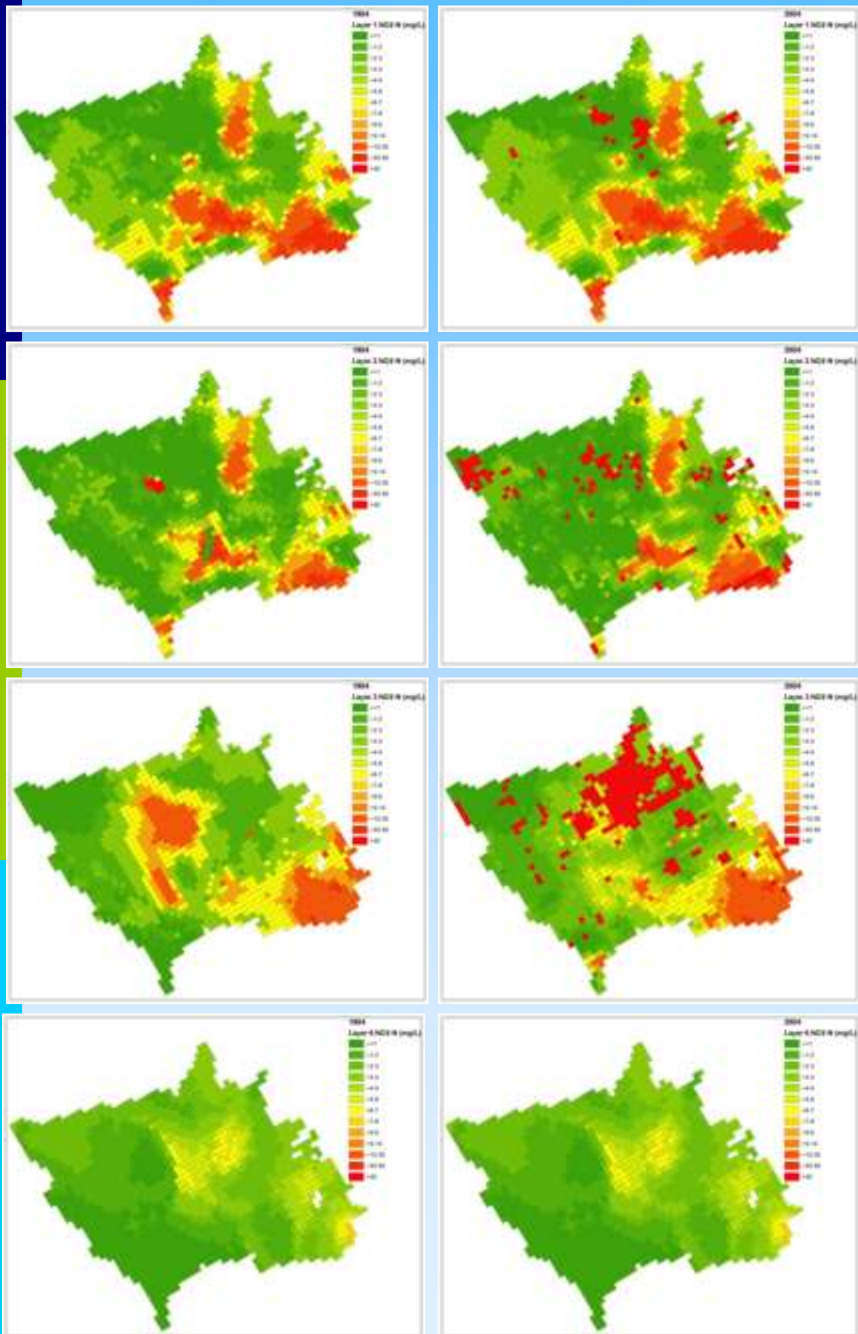

**$NO_3$ – Finer Resolution**




*Central Valley Water Board Meeting: 6 December 2013*

# 20-Yr Simulated GW Quality Changes (1984-2004)

1984 2004



Layer 1

Layer 2

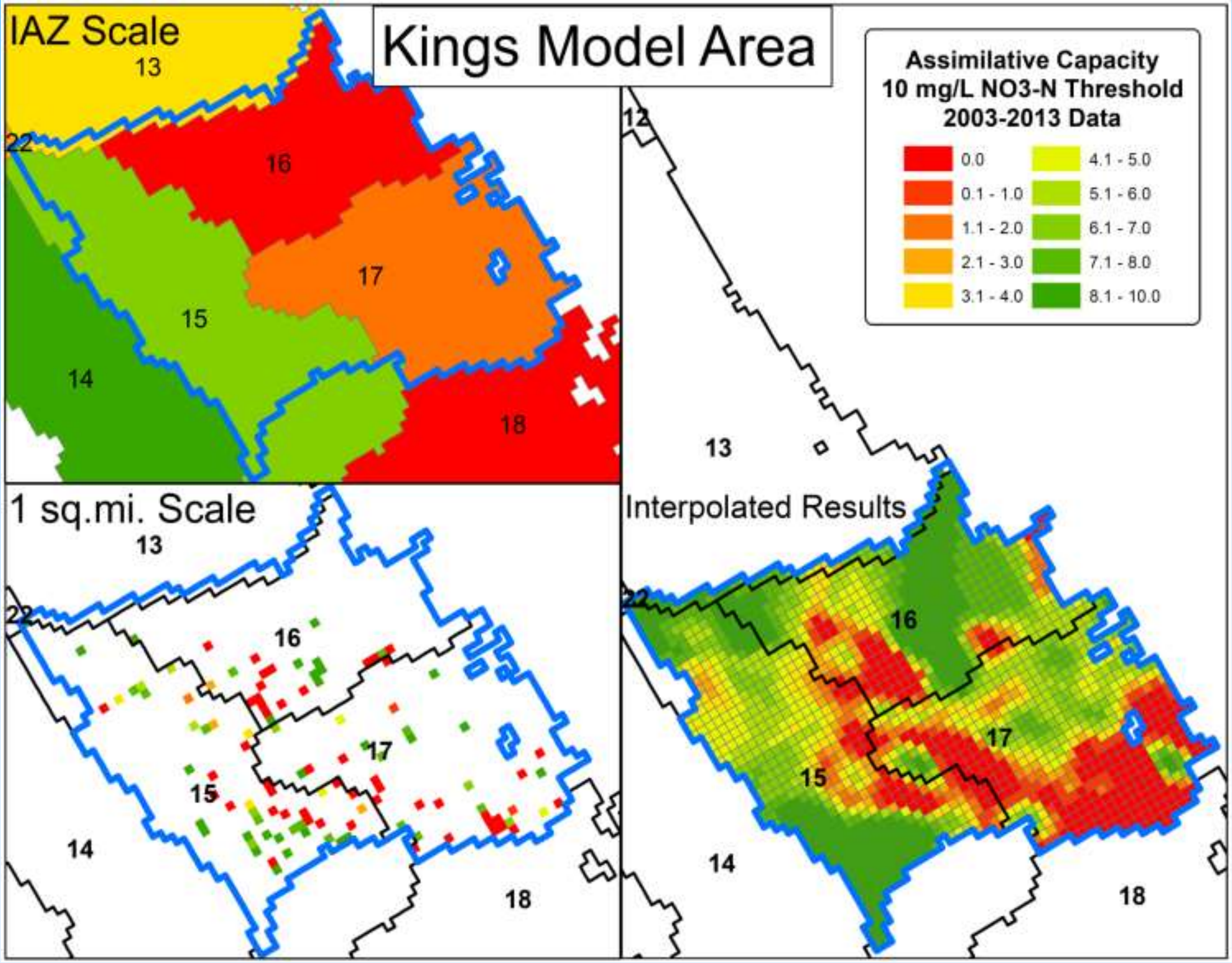
Layer 3

Layer 6

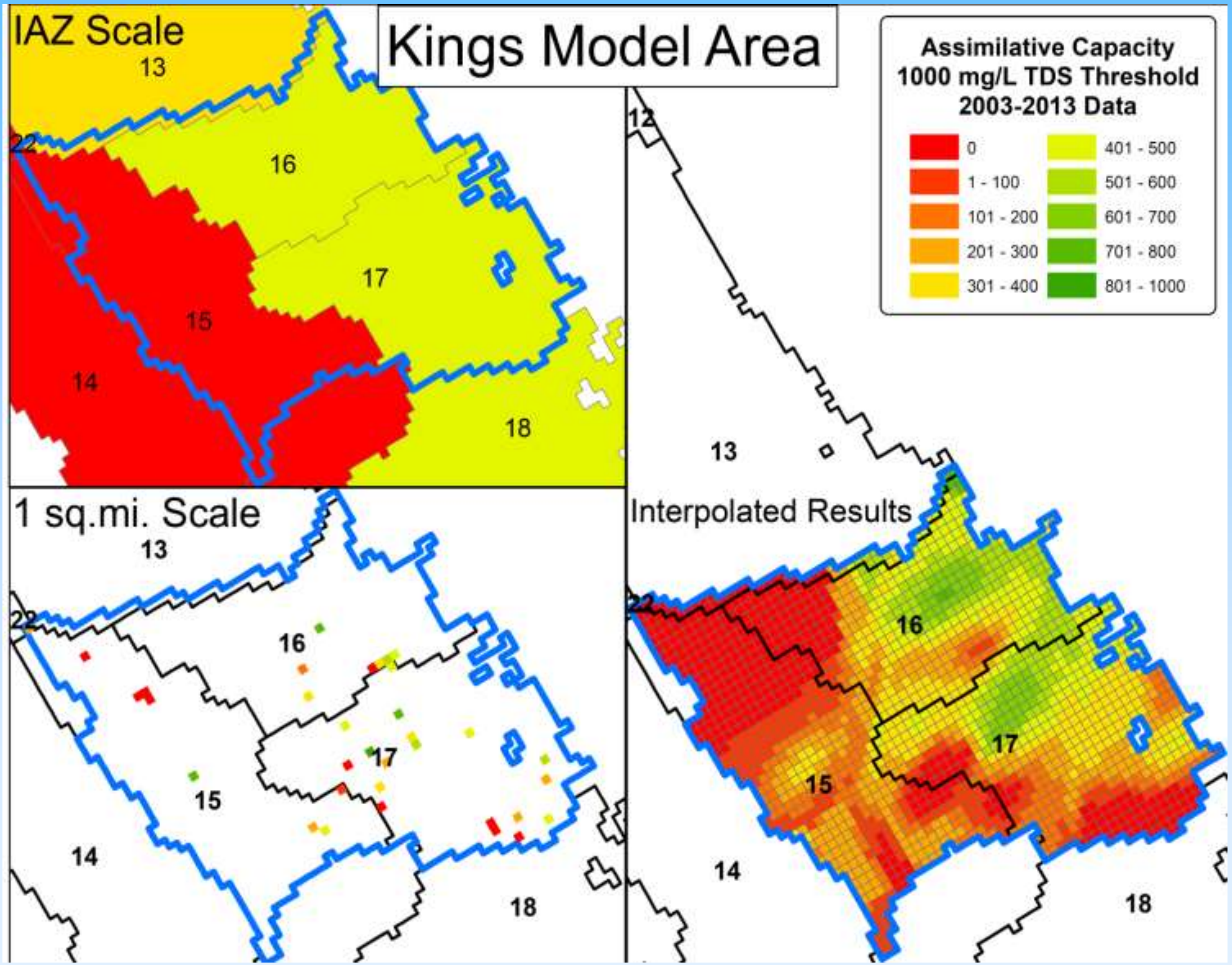
**Nitrate**
**(mg/L as N)**

- <=1
- >1-2
- >2-3
- >3-4
- >4-5
- >5-6
- >6-7
- >7-8
- >8-9
- >9-10
- >10-20
- >20-50
- >50

# Kings Subbasin Model: Assimilative Capacity $NO_3$-N 10 mg/L

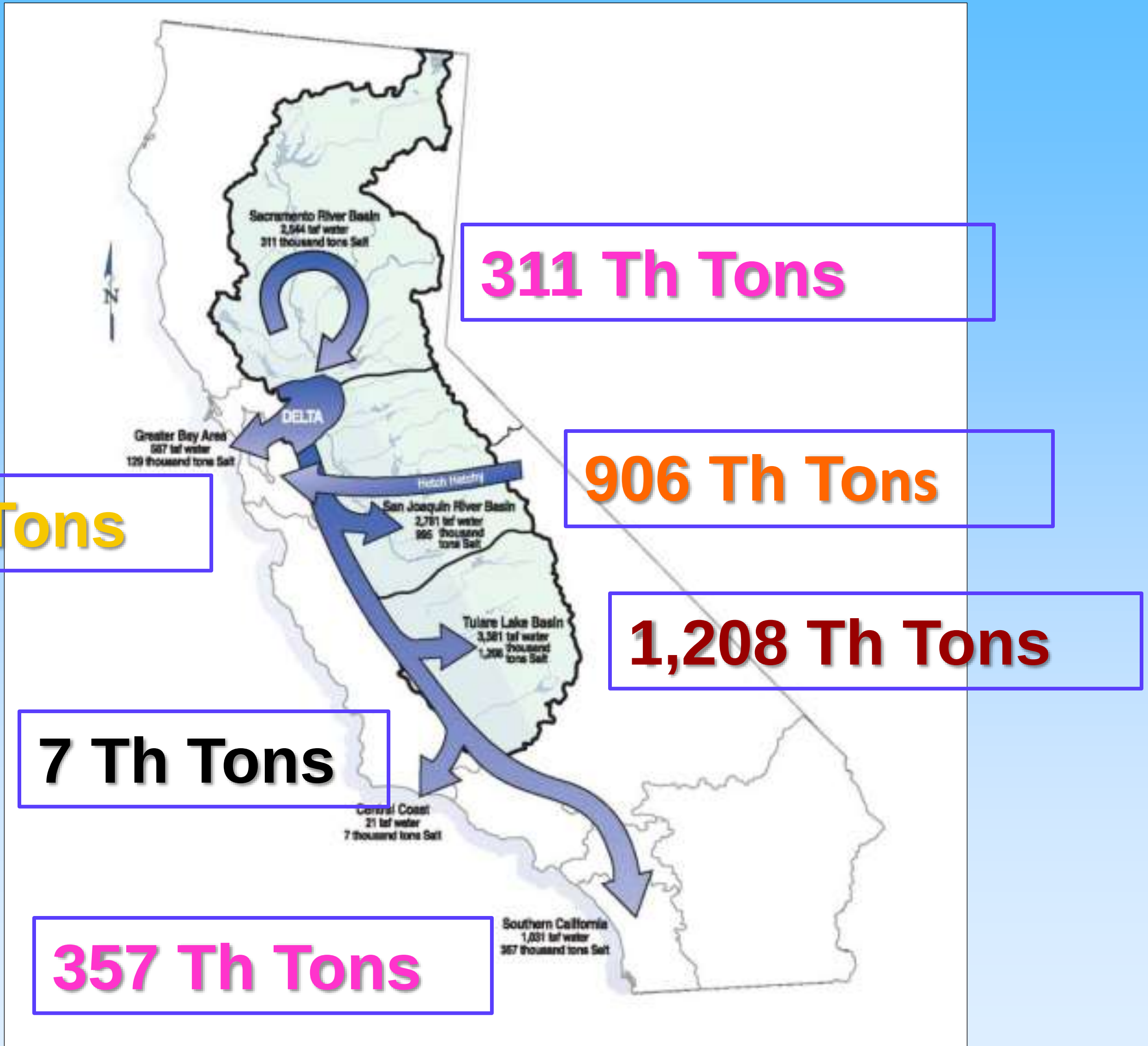


# Kings Subbasin Model: Assimilative Capacity TDS 1000 mg/L



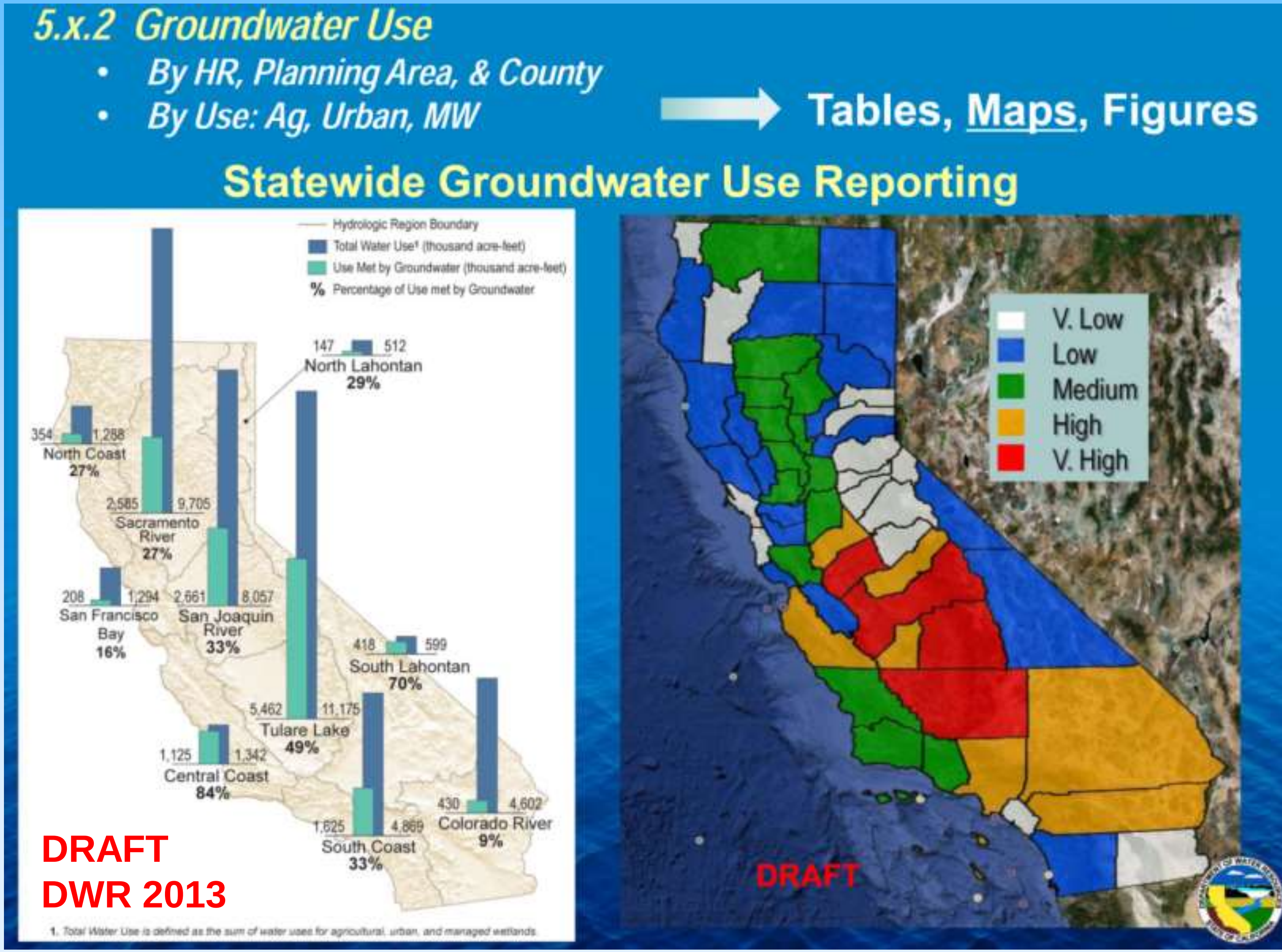
# Salt – Transbasin Transport Per Year

**SURFACE WATER salt transfer**




From DWR, Calif. Water Plan Update 2009

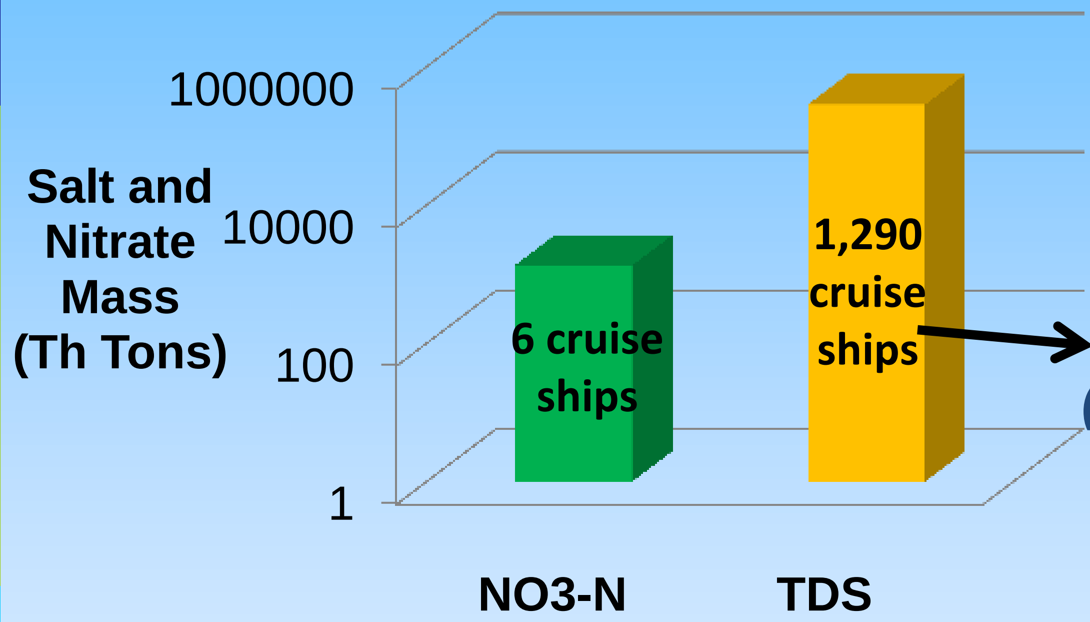
# DWR Water Plan Update 2013 - Draft GW Content on GW Use



# How Many Cruise Ships….

## Entire CV 20-Year Net Mass to Deeper Part of Aquifer System

- 1,335 ThT $NO_3$
- 283,823 ThT TDS
- $NO_3$ is ~.5% of TDS

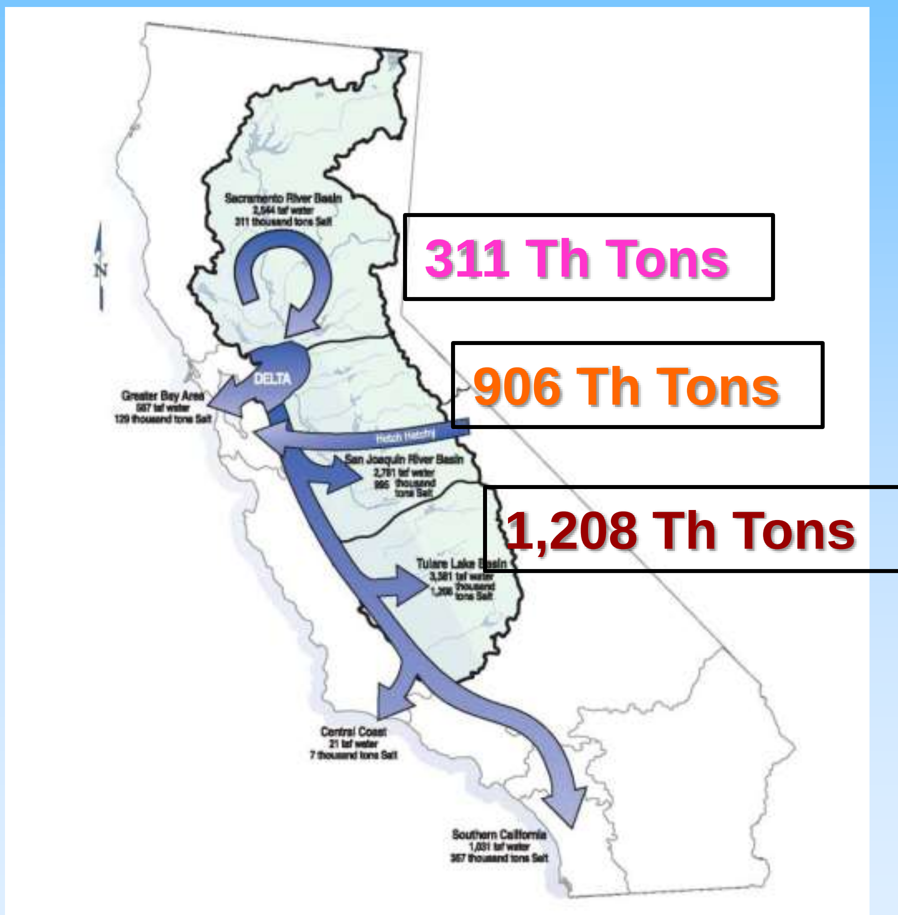



*The equivalent of 289 miles long of cruise ships*
*(~ Sacramento to Bakersfield)*

Includes:
1 - applied water (SW/GW)
2 - nutrients + amendments
3 - ambient shallow mass

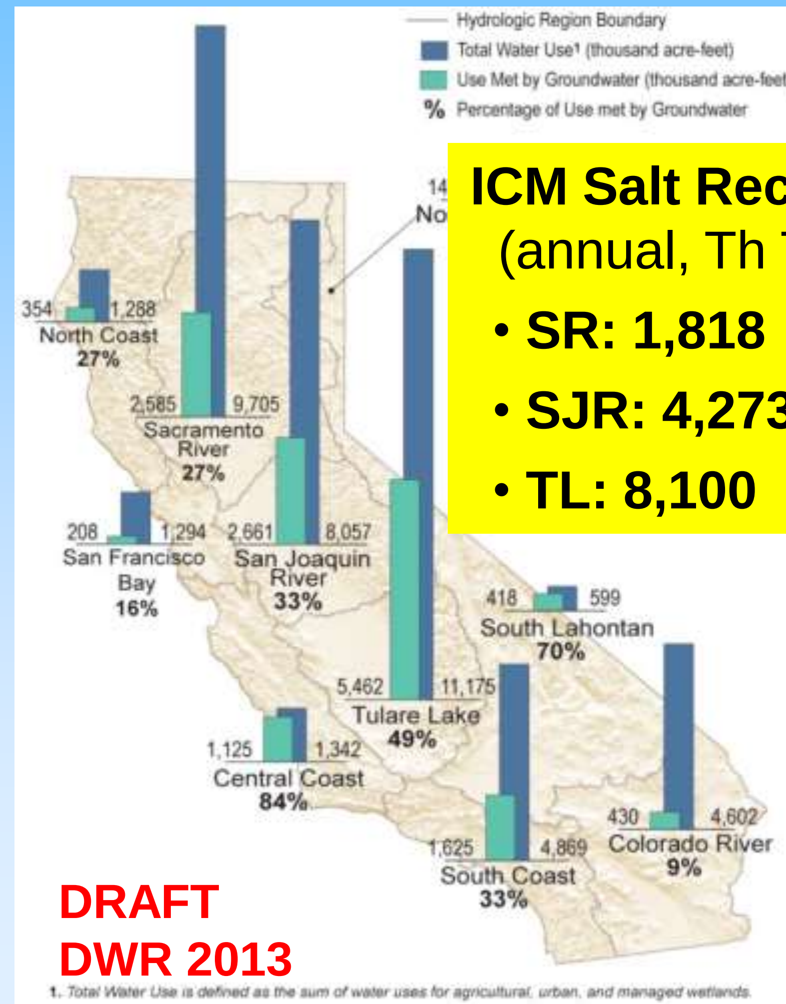
# Transbasin Significance of Salt

## Surface Water Transbasin Movement (annual)




From DWR, Calif. Water Plan Update 2009

## Annual GW Use & Deeper Aquifer Salt Recharge Mass




**ICM Salt Recharge**
(annual, Th Tons)

- **SR: 1,818**
- **SJR: 4,273**
- **TL: 8,100**

**DRAFT**
**DWR 2013**

# Lessons Learned from ICM – Part 1

- Groundwater Quality Data
  - Limited in some IAZs (spatial and temporal)
  - Well construction data usually not publicly accessible
  - Linkage relative to aquifer system usually hindered due to well data issue
  - ID high priority areas with *little to no* assimilative capacity
- Modeling Work: Fate of Salt and Nitrate
  - IAZ scale mixing model analysis good for low resolution determination
  - Salt and Nitrate Major Components = recharge to water table & vertical flow to deeper aquifer

# Lessons Learned from ICM – Part 2

- Smaller-Scale Analysis
  - Prototype Areas: Modesto and Kings
  - Uncertainty in estimated recharge concentrations
    - Proof-of-concept tools
    - Flow and transport models
  - More detailed fate and transport results
  - ***Finer scale of analysis needed to characterize ambient conditions and assimilative capacity***
- Benchmark Study entire Central Valley Floor
  - Includes SW loading, existing GW quality, surface mass loading (applied water, fertilizers and amendments)
  - Enormous masses of salt and nitrate are moving deeper and deeper over time (e.g., 1,290 cruise ships worth of salt over 20 years)

# Conceptual Model Development – Phases I & II

| Key Elements | Phase I (ICM) | Phase II (Potential Tasks) |
|---|---|---|
| Ambient GW Quality | Coarse scale analysis (Initial Analysis Zones – IAZs); higher resolution in 2 focus areas | Develop final methodology; apply to example areas (higher resolution) |
| Assimilative Capacity (existing and projected) | Preliminary coarse scale analysis in IAZs; higher resolution in 2 focus areas | Develop final methodology; test on example areas (higher resolution) |
| Salt and Nitrate Transport | Coarse scale analysis | High resolution analysis (Archetype Area; existing vs. future scenarios) |
| Management Area | Default to IAZs (CVHM/DWR water balance regions) | Guidance for Management Zone Concept |
| SNMP (Local Development) | "Proof of concept" tools; flow & transport models for incorporation | Draft guidance for technical elements of local SNMPs |
| GW Monitoring | Preliminarily assess data gaps | Data distribution needs; inform Phase III |

# Questions?

Photo Credits: Gary Pitzer, Water Education Foundation, Oct. 2009

# STRATEGIC SALT ACCUMULATION LAND AND TRANSPORT STUDY (SSALTS)

| Technical Area | Primary Activities | SNMP Support | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| **Conceptual Model Development** | Initial Conceptual Model | • Source identification<br>• Assimilative capacity<br>• Loading estimates | | | | | Prepare Final SNMP |
| | Phase 2 | • Source and loading refinement<br>• Background water quality/ assimilative capacity calculation methods<br>• Management zone study | | | | | |
| | Phase 3 | • Antidegradation analysis<br>• Monitoring plan<br>• Economics analysis | | | | | |
| **Data Development** | GIS – Phase 2 | • Baseline database | | | | | |
| | Agriculture Zone Mapping | • AGR implementation tools | | | | | |
| **Beneficial Use Studies** | Tulare Lake Bed MUN Archetype | • MUN implementation tools | | | | | |
| | MUN Beneficial Use in Agriculturally Dominated Water Bodies Archetype | • MUN implementation tools | | | | | |
| **Water Quality Objectives** | Salinity-related Effects on Agricultural Irrigation Uses | • Evaluation of science behind establishment of salinity related objectives | | | | | |
| | Salinity Effects on MUN-related Uses of Water | | | | | | |
| | Stock Watering Study | | | | | | |
| | Aquatic Life Study | | | | | | |
| **Implementation Planning** | Strategic Salt Accumulation Land and Transport Study (SSALTS) | • SNMP implementation measures to manage salt on a sustainable basis | | | | | |
| | Post- SSALTS Implementation Planning | | | | | | |
| **Lower San Joaquin River Committee** | Technical Analyses (salt loading characterization, modeling) | • Coordination with CV-SALTS SNMP development activities to ensure consistency | | | | | |
| | Basin Planning Activities (WQOs, SED, economics, monitoring, implementation) | | | | | | |

# SNMP Requirements Addressed by CV-SALTS

| Required SNMP Elements | Primary Technical Project Support |
|---|---|
| **Salt and Nitrate Characterization** - Source ID, Loading Estimates, Fate & Transport, Assimilative Capacity | • Conceptual Model Project |
| **Monitoring Plan** - Salt, nutrients, constituents of emerging concern | • Conceptual Model Project |
| **Antidegradation Analysis** | • Conceptual Model Project |
| **Implementation Measures to Manage Salt/Nitrate Loading on a Sustainable Basis** | • **SSALTS - Phase 1 complete; complete Phases 2 & 3 in 2014**<br>• Post-SSALTS Implementation Planning (Complete in 2015) |
| **Water Recycling & Stormwater Recharge/Use Goals and Objectives** | *Policy Committee Activity* |
| **Salt & Nitrate Management Plan** | • Conceptual Model Project<br>• Later Refinements |

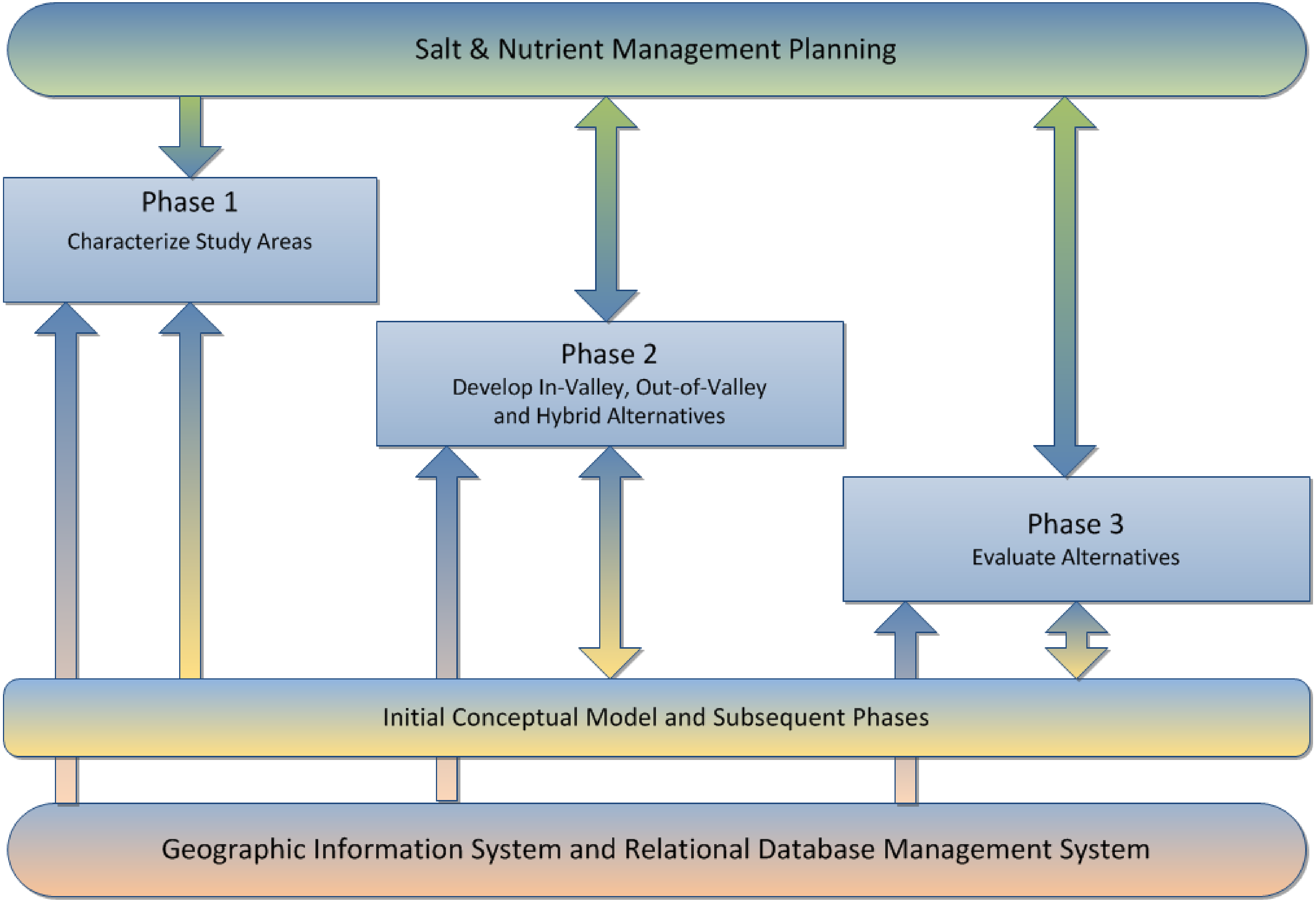
# SSALTS – How Do We Dispose of the Salt?

- SSALTS project focuses on sustainable salt management by evaluating the following general questions:
  - Given that salt accumulation is occurring, how is salt being managed now?
  - How will we dispose of salt in the future in a manner that is sustainable?
  - Once we identify the "how", what policy and regulatory actions are required to put the "how" into practice through implementation of the SNMP?

# SSALTS – Phased Project

- Phase 1 - Characterize Existing Salt Accumulation Study Areas
  - Identify representative Study Areas
  - Characterize study areas to establish baseline information
  - Perform screening-level analysis of sustainability
- Phase 2 - Develop Potential Long-term Salt Management Strategies
  - In-valley alternatives
  - Out-of-valley alternatives, and
  - Hybrid alternatives (combination of in-valley and out-of-valley)
- Phase 3 - Evaluate Potential Salt Disposal Implementation Alternatives
  - Develop and apply feasibility criteria (e.g., regulatory, institutional, economic, technological, etc.)
  - Identify and prioritize acceptable salt disposal alternatives for potential incorporation into Central Valley SNMP

# SSALTS Phases

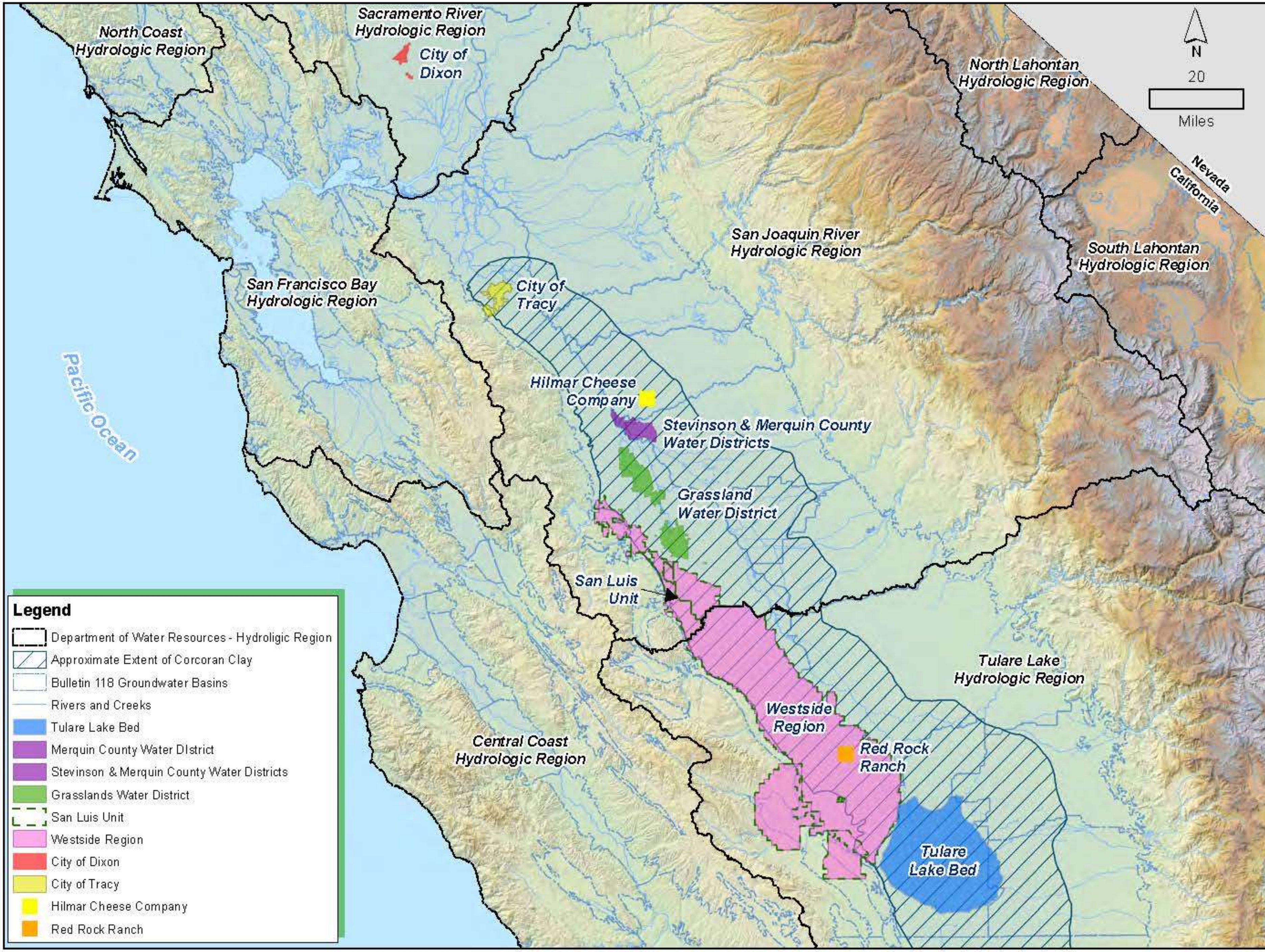


# Salt Management – Current Practices

- Phase 1 evaluated how salt is currently being managed in the Central Valley through the characterization of selected study areas
- Analysis focused on comparisons of existing disposal practices and an evaluation of the sustainability of these practices considering a number of planning factors
- Findings provide the foundation for development of alternatives in Phase 2 and analysis of these alternatives in Phase 3

# Phase 1 Study Areas

| Study Area | Central Valley Planning Area | Representative Area or Sector |
|---|---|---|
| City of Dixon | Sacramento River Basin | Municipal |
| City of Tracy | San Joaquin River Basin | Municipal |
| Hilmar Cheese | San Joaquin River Basin | Industrial |
| Industrial Food Processing Facilities | Central Valley | Industrial |
| Red Rocks Ranch | Tulare Lake Basin | Agriculture |
| Grassland Water District | San Joaquin River Basin | Agriculture |
| Stevinson Water District | San Joaquin River Basin | Agriculture |
| Tulare Lake Bed | Tulare Lake Basin | Agriculture |
| Westside Regional Drainage Plan | San Joaquin River Basin | Agriculture |
| San Luis Unit Ocean Disposal | San Joaquin River Basin | Agriculture |



North Coast Hydrologic Region
Sacramento River Hydrologic Region
City of Dixon
North Lahontan Hydrologic Region
N
20
Miles
Nevada
California
San Joaquin River Hydrologic Region
South Lahontan Hydrologic Region
San Francisco Bay Hydrologic Region
City of Tracy
Pacific Ocean
Hilmar Cheese Company
Stevinson & Merquin County Water Districts
Grassland Water District
San Luis Unit
Tulare Lake Hydrologic Region
Westside Region
Red Rock Ranch
Central Coast Hydrologic Region
Tulare Lake Bed
Legend
Department of Water Resources - Hydroligic Region
Approximate Extent of Corcoran Clay
Bulletin 118 Groundwater Basins
Rivers and Creeks
Tulare Lake Bed
Merquin County Water DIstrict
Stevinson & Merquin County Water Districts
Grasslands Water District
San Luis Unit
Westside Region
City of Dixon
City of Tracy
Hilmar Cheese Company
Red Rock Ranch

# Study Area Sustainability Analysis to Inform Subsequent Project Phases

- Seven factors considered in the Study Area sustainability analysis
- Factor scoring primarily qualitative
  - Relative scores more important than absolute scores – findings tell us what is or is not working
  - Reveals information regarding potential obstacles and opportunities for salt management
- Baseline information provides input to alternatives development
  - Consider differences across sectors (e.g., municipal, industrial, agriculture)
  - Consider potential regional differences – what may be sustainable in one geographic area may not be in another

# Sustainability Analysis Factors

| Factor | 4 - High | | 1 - Low |
|---|---|---|---|
| ***Implementability*** of the salt disposal method | Utilizes proven technologies and is readily implementable | | Salt disposal method is not working or utilizes unproven technologies |
| Salt ***capacity*** of the disposal method | Project's salt disposal load was not limited by the disposal method | | Salt disposal method has a capacity less than the salt disposal load |
| ***Regulatory*** challenges | Project is readily permittable and is able to meet current regulatory requirements | | Project faces considerable regulatory challenges - now or in the 50-year planning horizon |
| ***Institutional*** requirements | Bias toward fewer entities involved – unless part of a group with strong governance structure<br><br>Bias also given toward, in some cases, public sector project proponents with known or secure funding sources | | Group of small, underfunded individual stakeholders |

# Sustainability Analysis Factors (cont.)

| Factor | 4 - High | 1 - Low |
|---|---|---|
| Capital and operation and maintenance ***costs*** | Projects with lower anticipated costs | Projects with higher anticipated costs |
| Potential ***environmental*** issues | Little to no anticipated environmental issues | Reasonable potential for significant environmental issues to arise |
| ***Public acceptance*** | Reasonable public acceptance | Little to no public acceptance |

# SSALTS - Next Steps

- Phase 2 – Develop and Characterize Salt Disposal Alternatives – In-Valley, Out-of-Valley, Hybrid or Combination
  - Use knowledge gained in Phase 1
  - Eliminate potential alternatives not deemed feasible
  - Describe institutional, economic or regulatory considerations or barriers that could affect implementation
- Phase 3 – Evaluate Potential Salt Disposal Alternatives to Identify Acceptable Alternatives for Implementation
  - Develop feasibility evaluation criteria
  - Perform screening level feasibility analysis
  - Develop prioritized list of salt disposal alternatives to support SNMP development

# AGRICULTURAL ZONE MAPPING

| Technical Area | Primary Activities | SNMP Support | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| **Conceptual Model Development** | Initial Conceptual Model | • Source identification<br>• Assimilative capacity<br>• Loading estimates | | | | | |
| | Phase 2 | • Source and loading refinement<br>• Background water quality/ assimilative capacity calculation methods<br>• Management zone study | | | | | |
| | Phase 3 | • Antidegradation analysis<br>• Monitoring plan<br>• Economics analysis | | | | | |
| **Data Development** | GIS – Phase 2 | • Baseline database | | | | | |
| | Agriculture Zone Mapping | • AGR implementation tools | | | | | |
| **Beneficial Use Studies** | Tulare Lake Bed MUN Archetype | • MUN implementation tools | | | | | Prepare Final SNMP |
| | MUN Beneficial Use in Agriculturally Dominated Water Bodies Archetype | • MUN implementation tools | | | | | |
| **Water Quality Objectives** | Salinity-related Effects on Agricultural Irrigation Uses | • Evaluation of science behind establishment of salinity related objectives | | | | | |
| | Salinity Effects on MUN-related Uses of Water | | | | | | |
| | Stock Watering Study | | | | | | |
| | Aquatic Life Study | | | | | | |
| **Implementation Planning** | Strategic Salt Accumulation Land and Transport Study (SSALTS) | • SNMP implementation measures to manage salt on a sustainable basis | | | | | |
| | Post- SSALTS Implementation Planning | | | | | | |
| **Lower San Joaquin River Committee** | Technical Analyses (salt loading characterization, modeling) | • Coordination with CV-SALTS SNMP development activities to ensure consistency | | | | | |
| | Basin Planning Activities (WQOs, SED, economics, monitoring, implementation) | | | | | | |

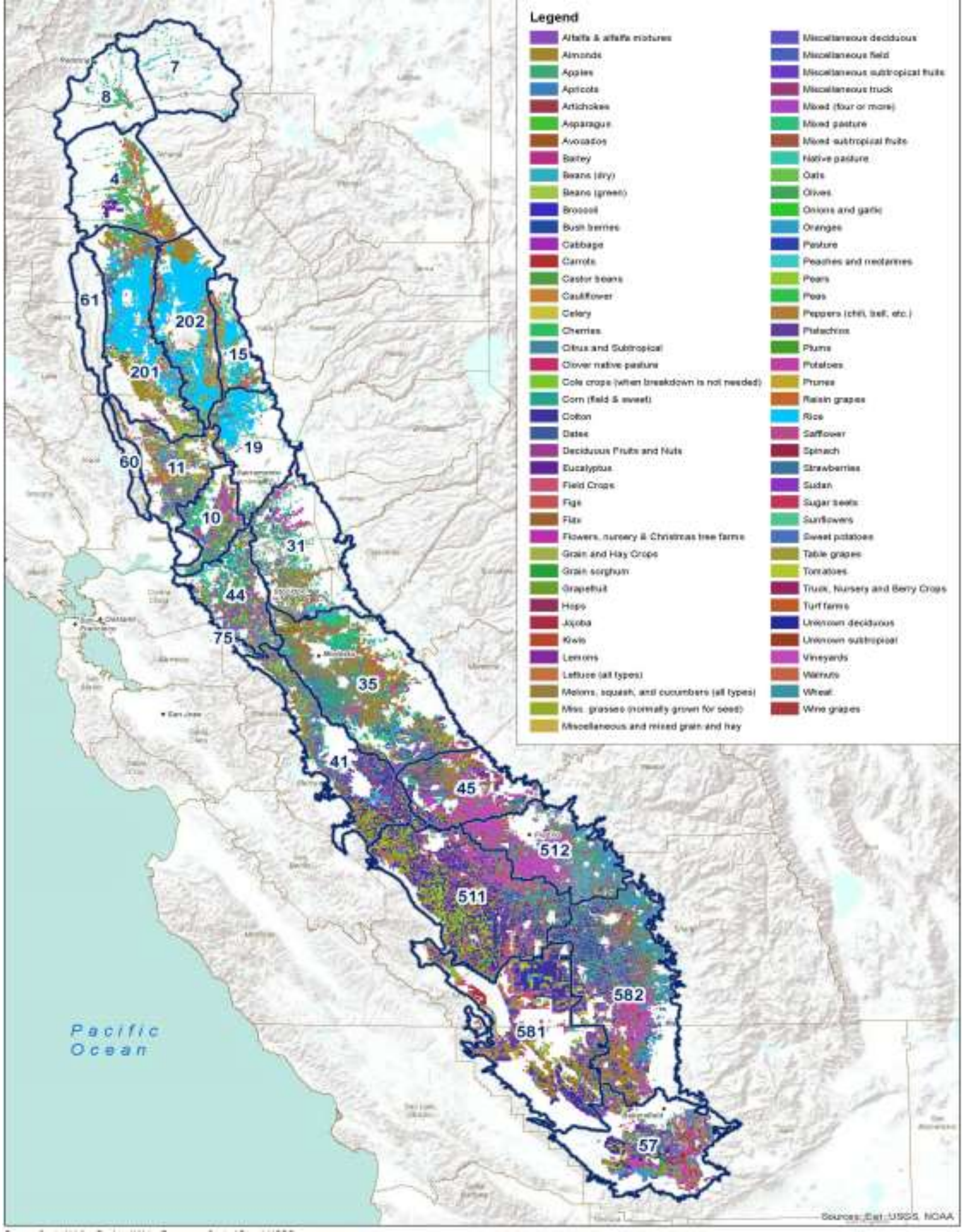
# Agricultural Zone Mapping Project

- Compiled additional GIS-related information to provide support to policy discussions regarding AGR protection (agricultural irrigation)
  - Crop cover and salt sensitivity
  - Irrigation sources
  - Climate
  - Soils
  - Applied water quality
  - Hydrography

- Currently evaluating use of compiled data to potentially delineate mapped areas based on crop salinity thresholds

# Agricultural Zone Mapping Project

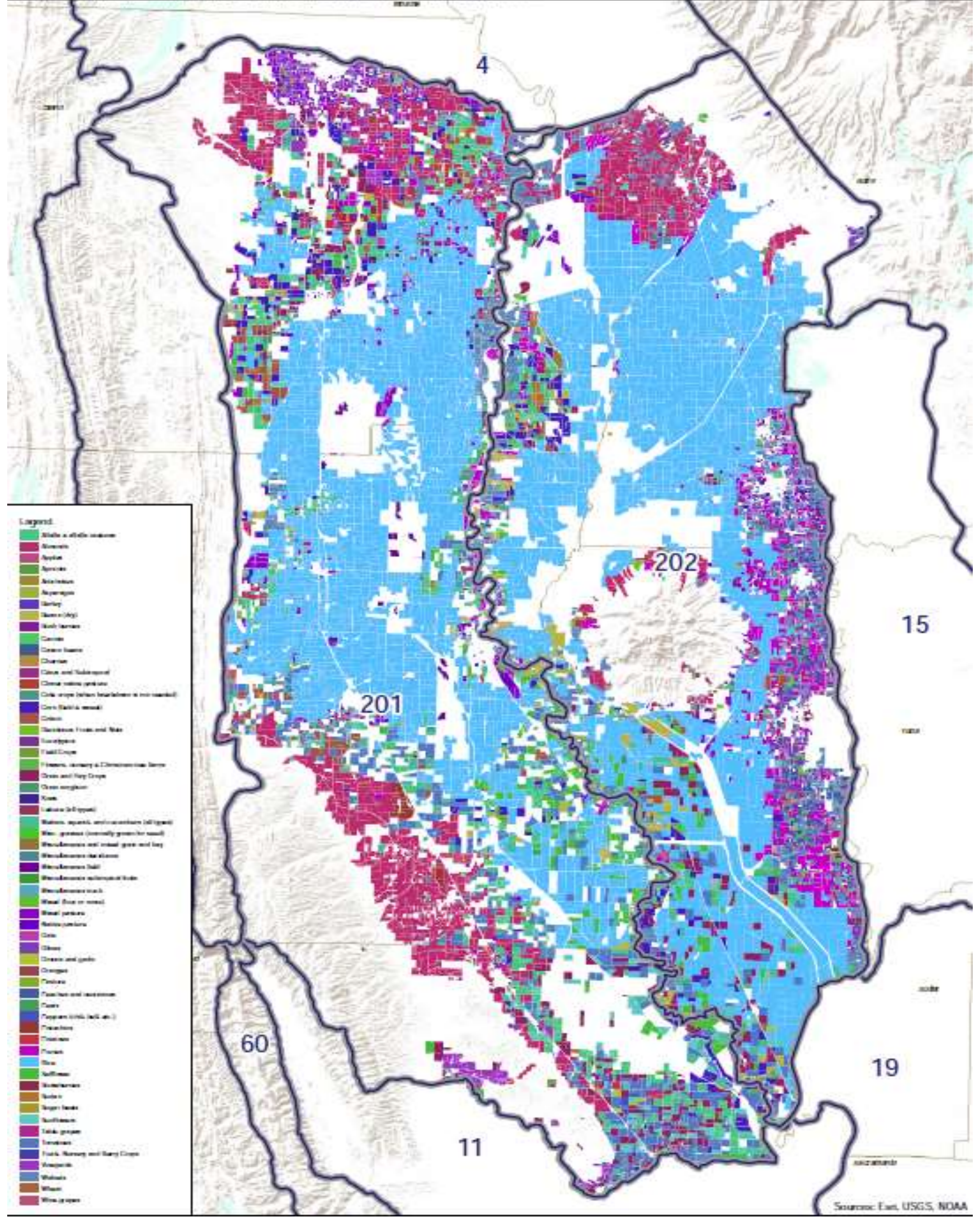
- Crop diversity in the Central Valley
- 81 categories of crops represented in this figure




*Central Valley Water Board Meeting: 6 December 2013*

# Agricultural Zone Mapping Project

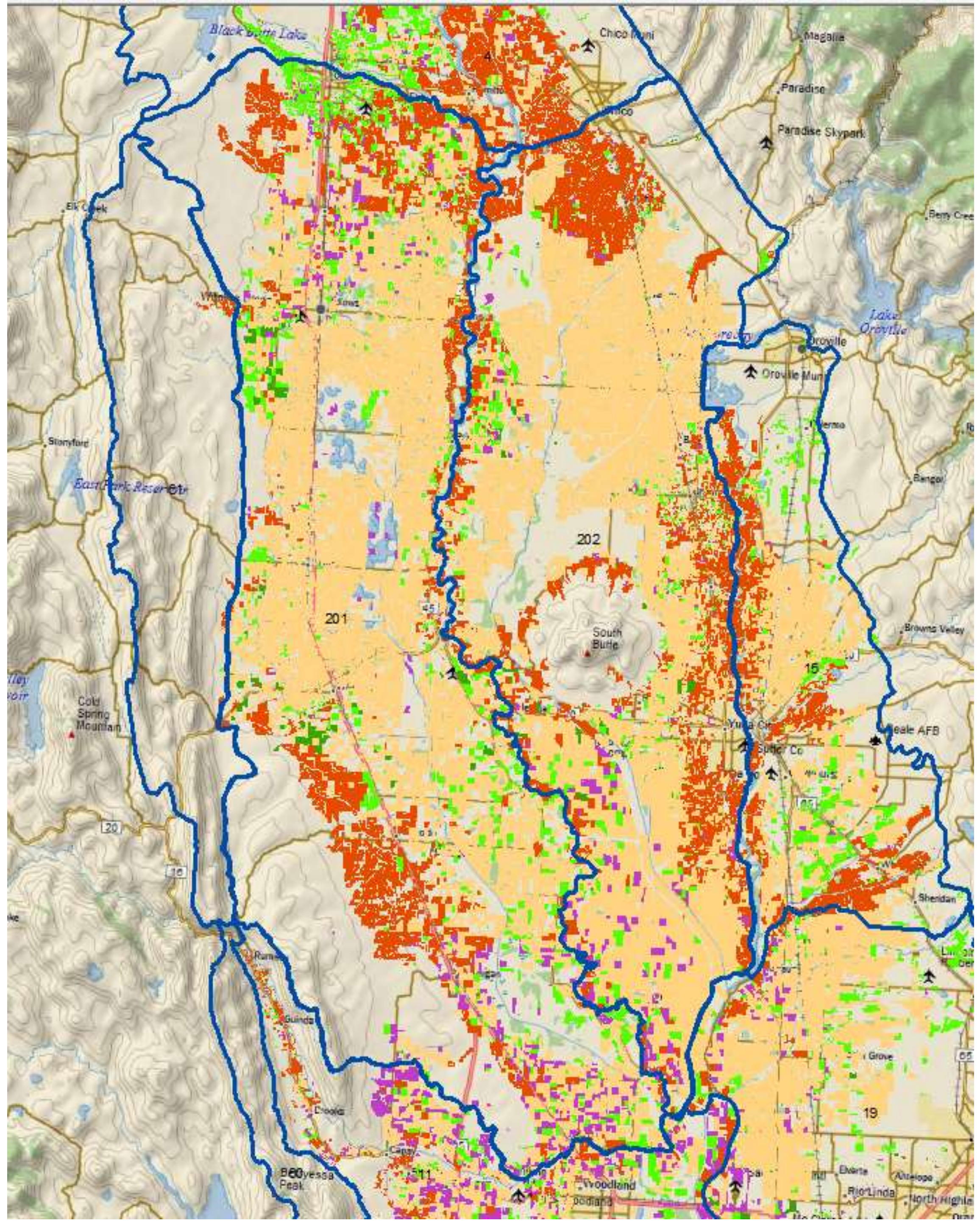
- Portion of Sacramento River Valley
- Dominated by Almonds, Walnuts and Rice



# Agricultural Zone Mapping Project

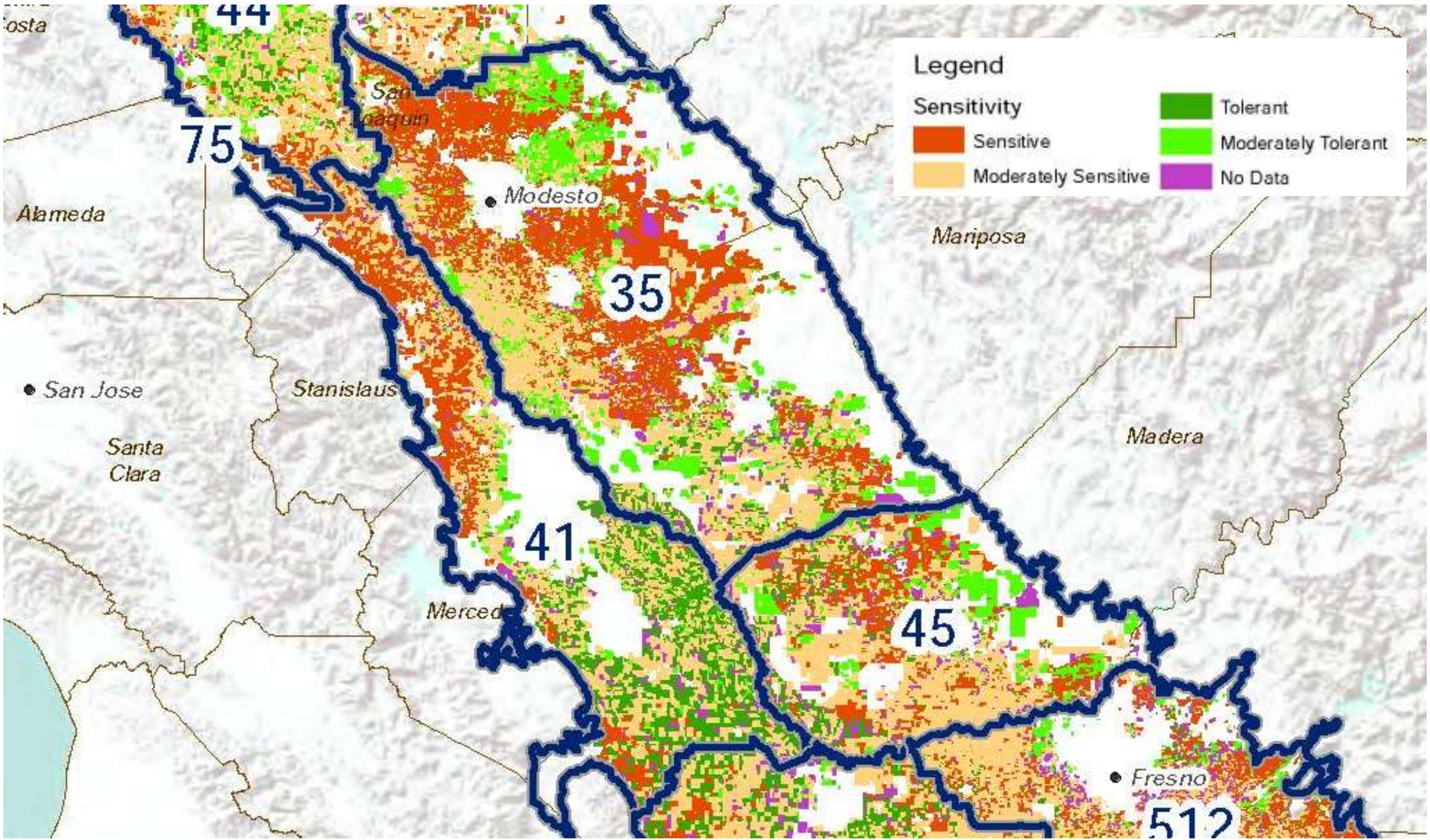
- Portion of Sacramento River Valley
- Crop sensitivity based on salt tolerance (literature)

Crop salinity tolerance classes (USDA, Ayers & Westcot, etc.)

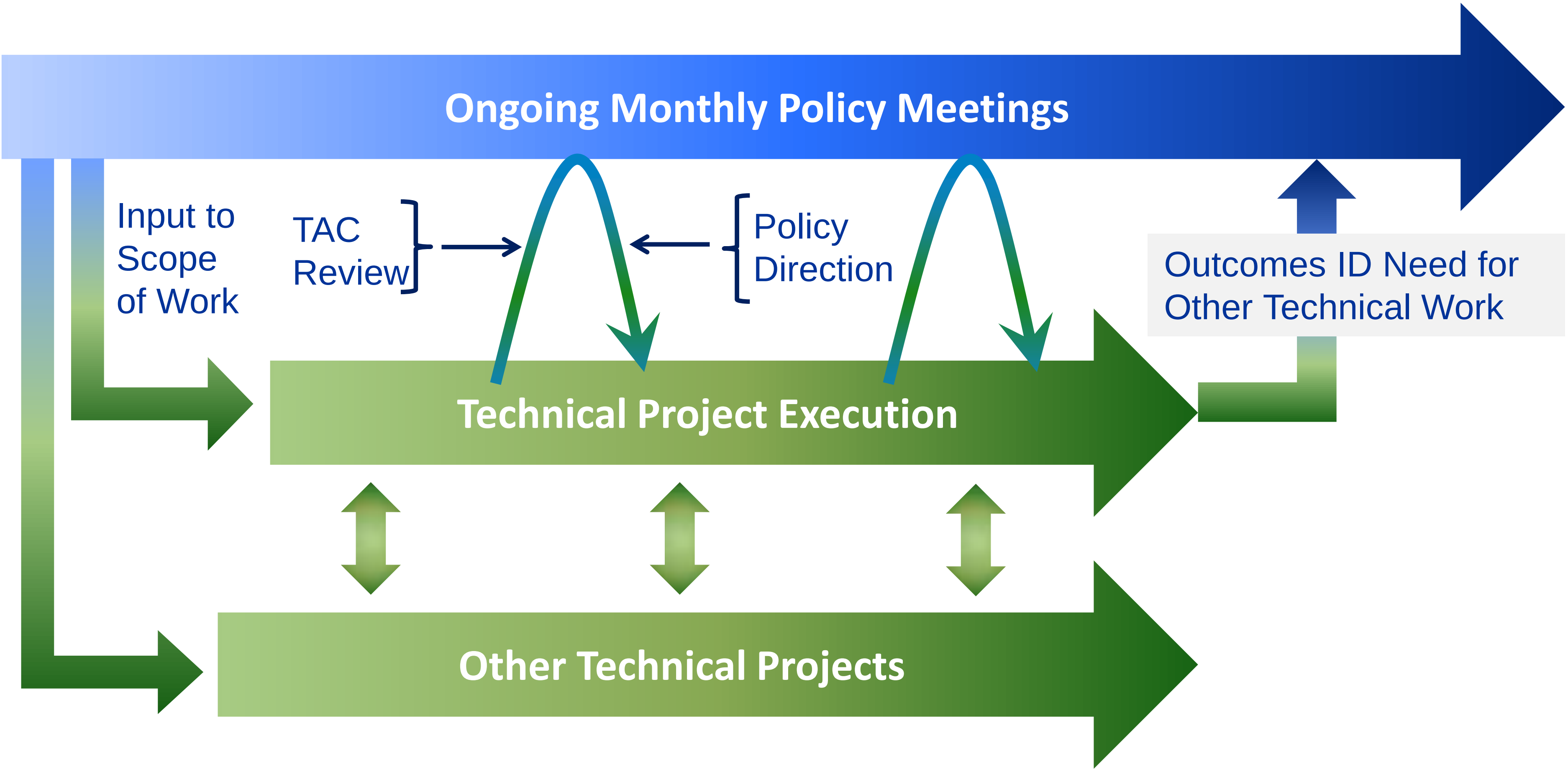
# Agricultural Zone Mapping Project

- Area in Central Valley between Modesto and Fresno
- Crop sensitivity based on salt tolerance (literature)

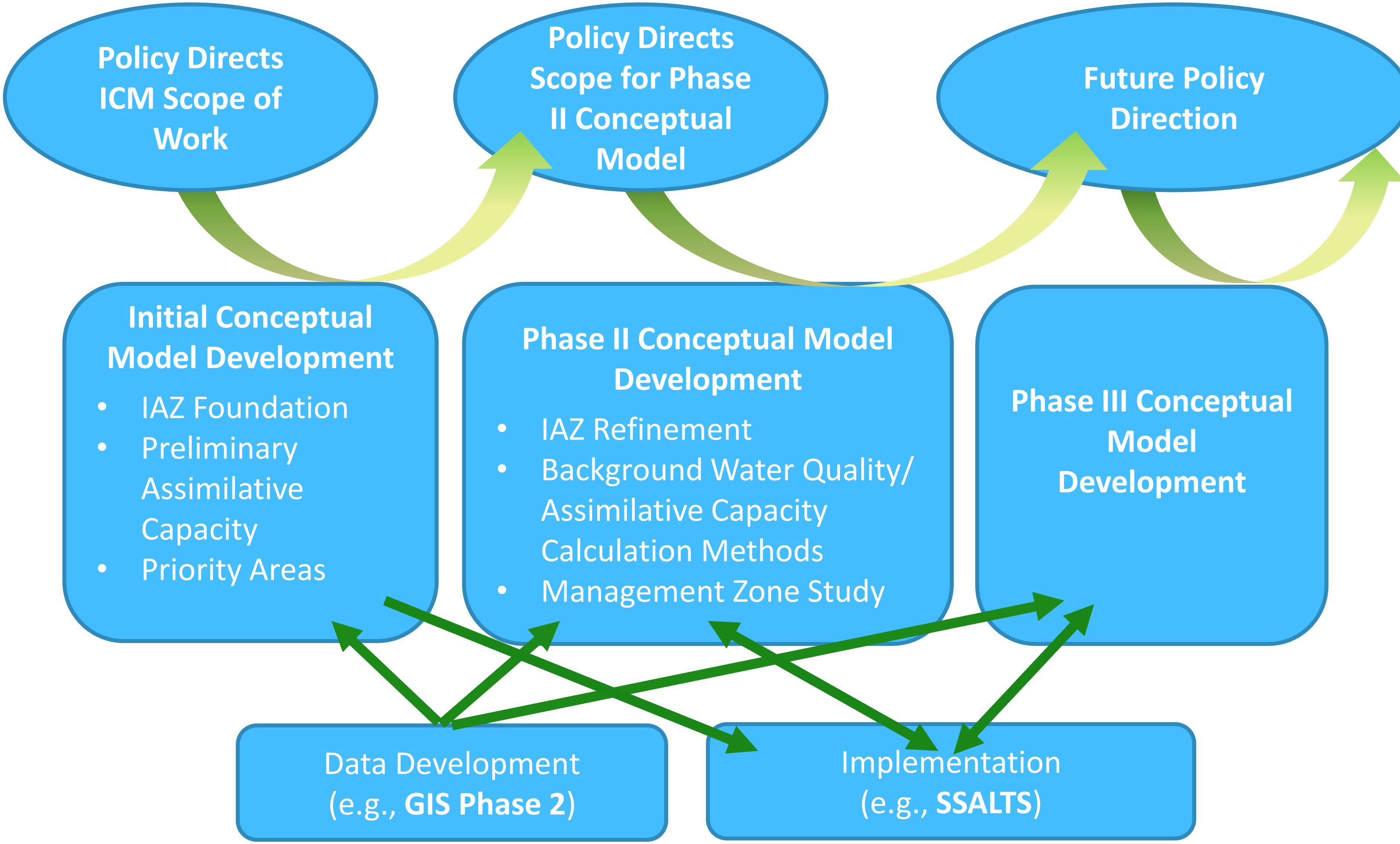


# TECHNICAL WRAP-UP

# Nexus Between Policy & Technical Work



# Policy & Technical Nexus in Action



| Technical Area | Primary Activities | SNMP Support | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| **Conceptual Model Development** | Initial Conceptual Model | • Source identification<br>• Assimilative capacity<br>• Loading estimates | | | | | Prepare Final SNMP |
| | Phase 2 | • Source and loading refinement<br>• Background water quality/ assimilative capacity calculation methods<br>• Management zone study | | | | | |
| | Phase 3 | • Antidegradation analysis<br>• Monitoring plan<br>• Economics analysis | | | | | |
| **Data Development** | GIS – Phase 2 | • Baseline database | | | | | |
| | Agriculture Zone Mapping | • AGR implementation tools | | | | | |
| **Beneficial Use Studies** | Tulare Lake Bed MUN Archetype | • MUN implementation tools | | | | | |
| | MUN Beneficial Use in Agriculturally Dominated Water Bodies Archetype | • MUN implementation tools | | | | | |
| **Water Quality Objectives** | Salinity-related Effects on Agricultural Irrigation Uses | • Evaluation of science behind establishment of salinity related objectives | | | | | |
| | Salinity Effects on MUN-related Uses of Water | | | | | | |
| | Stock Watering Study | | | | | | |
| | Aquatic Life Study | | | | | | |
| **Implementation Planning** | Strategic Salt Accumulation Land and Transport Study (SSALTS) | • SNMP implementation measures to manage salt on a sustainable basis | | | | | |
| | Post- SSALTS Implementation Planning | | | | | | |
| **Lower San Joaquin River Committee** | Technical Analyses (salt loading characterization, modeling) | • Coordination with CV-SALTS SNMP development activities to ensure consistency | | | | | |
| | Basin Planning Activities (WQOs, SED, economics, monitoring, implementation) | | | | | | |

Stakeholder Commitment

# BUDGET AND TIMELINE

# Central Valley Salinity Coalition Members

- California Cotton Growers and Ginners Association*
- California League of Food Processors*
- California Rice Commission*
- California Association of Sanitation Agen cies*
- Central Valley Clean Water Association*
- City of Davis*
- City of Manteca*
- City of Modesto*
- City of Stockton*
- City of Tracy*
- City of Vacaville*
- City of Fresno*
- County of San Joaquin*
- Dairy CARES /Western United Dairymen*
- Discovery Bay CSD
- East San Joaquin Water Quality Coalition*
- Pacific Water Quality Association
- Sacramento Regional County Sanitation District*
- San Joaquin River Group Authority*
- San Joaquin Valley Drainage Authority*
- South San Joaquin Water Quality Coalition*
- Stockton East Water District*
- The Wine Institute*
- Tulare Lake Drainage and Water Districts*
- Western Plant Health Association*
- Westlands Water District*

* Denotes Board Member

# Budget from Packet

## Amended Approved 7/9/13

| | 2012 Approved Workplan | Contracted Amount | Current Estimate | CAA Obligation | Projected Available Balance | Total Funding | CVSC Obligation | Stake holders & Grants |
|---|---|---|---|---|---|---|---|---|
| | | | | | $5,765,000 | | | |
| SJVDA Contracts Administrative Oversight* | $0 | $401,262 | $401,262 | $401,262 | $5,363,738 | $401,262 | | |
| **Program Management and Development** | | | | | $5,363,738 | $0 | | |
| Program Mgt/Facilitation thru 2/11 to 1/13 | $600,000 | $667,756 | $667,756 | $667,756 | $4,695,982 | $667,756 | | |
| Program Mgt. and Facilitation (3/13 to 3/16) | $600,000 | $600,000 | $600,000 | $0 | $4,695,982 | $600,000 | $600,000 | |
| Maintaining mtg minutes and website | $160,000 | | $110,000 | $80,000 | $4,615,982 | $110,000 | $30,000 | |
| Prior Implementation LWA Pilot Salt Study | | | $585,000 | | $4,615,982 | $585,000 | $585,000 | |
| Prior Implementation & future Outreach Efforts | $900,000 | | $50,000 | $50,000 | $4,565,982 | $50,000 | | |
| Basin Planning Support | $90,000 | $104,789 | $104,789 | $104,789 | $4,461,193 | $104,789 | | |
| **Policy Discussions on BU and WQO 2/13 -1/15** | $140,000 | $75,000 | $215,000 | $75,000 | $4,386,193 | $215,000 | $140,000 | |
| **Technical Project Management** | $500,000 | | $982,713 | $0 | $4,386,193 | $0 | | |
| EKI Technical Project Management (closed) | | $111,915 | $111,915 | $111,915 | $4,274,278 | $111,915 | | |
| LSJR Interim Committee Mgr. (thru 09/2012) | | $50,000 | $32,000 | $32,000 | $4,242,278 | $32,000 | | |
| CV-SALTS CDM Smith TPM thru 10/31/13 | | $296,098 | $296,098 | $296,098 | $3,946,180 | $296,098 | | |
| CV-SALTS CDM Smith TPM thru 10/31/15 ** | | | $264,000 | $0 | $3,946,180 | $264,000 | $264,000 | |
| LSJR Committee Manager* | | $213,085 | $278,700 | $278,700 | $3,667,480 | $278,700 | | |
| **Conceptual Model** | | | | | $3,667,480 | | | |
| --Phase I -approach, data, model (completed) | $200,000 | $473,918 | $495,918 | $495,918 | $3,171,562 | $495,918 | | |
| **Phase II ($575K)* Estimated cost and topics** | | | | | $3,171,562 | | | |
| --Prioritization & Refine Model from Phase 1 | $150,000 | $25,000 | $50,000 | $50,000 | $3,121,562 | $50,000 | | |
| --Potential Implementation Archetypes | $100,000 | | $150,000 | $150,000 | $2,971,562 | $150,000 | | |
| --Background WQ Assimilative Capacity | $100,000 | | $125,000 | $125,000 | $2,846,562 | $125,000 | | |
| --Effectiveness/Sustainability Demonstration | $150,000 | | $125,000 | $125,000 | $2,721,562 | $125,000 | | |
| --Prepare CV SNMP Element Documentation | $200,000 | | $125,000 | $125,000 | $2,596,562 | $125,000 | | |
| **Phase III ($500K)* Estimated cost and topics** | | | | | $2,596,562 | | | |
| -- Surveillance and Implementation §13242 | $100,000 | | $100,000 | $100,000 | $2,496,562 | $100,000 | | |
| --Conduct Economic Analysis | $300,000 | | $300,000 | $300,000 | $2,196,562 | $300,000 | | |
| --Perform Antidegradation Analysis | $125,000 | | $100,000 | $100,000 | $2,096,562 | $100,000 | | |
| **Technical Studies** | | | | | $2,096,562 | | | |
| BUOS Part I (completed) | $0 | $49,982 | $49,982 | $49,982 | $2,046,580 | $49,982 | | |
| BUOS Update with GIS Layers | $50,000 | $100,004 | $100,004 | $100,004 | $1,946,576 | $100,004 | | |
| Ag Water Quality Zoning Map | $100,000 | $120,000 | $240,000 | $120,000 | $1,826,576 | $240,000 | $55,000 | $65,000 |
| Stock Watering* | $29,000 | $29,000 | $29,000 | $0 | $1,826,576 | $29,000 | | $29,000 |
| Aquatic Life | | $31,500 | $31,500 | $31,500 | $1,795,076 | $31,500 | | |
| Groundwater Archetype (Tulare) | $600,000 | $100,000 | $300,000 | $100,000 | $1,695,076 | $300,000 | | $200,000 |
| MUN POTW Archetype | $1,000,000 | $300,000 | $300,000 | $110,000 | $1,585,076 | $300,000 | $75,000 | $115,000 |
| --Water Quality Testing Subtask completed * | | $45,099 | $45,099 | $45,099 | $1,539,977 | $45,099 | | *** |
| Lower San Joaquin River Salt & Boron WQO | $765,000 | $765,000 | $765,000 | $765,000 | $774,977 | $765,000 | | |
| **Implementation Planning** | | | | | $774,977 | | | |
| SSALTS Phase 1 | $335,000 | $345,000 | $345,000 | $345,000 | $429,977 | $345,000 | | |
| SSALTS & Implementation Planning/Refine MA | $350,000 | | $100,000 | $100,000 | $329,977 | $100,000 | | |
| Effective MP evaluation | $215,000 | | $348,377 | $0 | $329,977 | $348,377 | | $348,377 |
| Economically Disadvantaged Communities | $55,000 | | | | $329,977 | | | |
| **Documentation Basin Plan Amendment** | | | | | $329,977 | | | |
| CEQA Equivalent (SED) & Basin Plan Staff Report | $430,000 | | $400,000 | $300,000 | $29,977 | $400,000 | $100,000 | |
| Final SNMP Documentation and changes (16/17) | $75,000 | | $104,977 | $29,977 | $0 | $104,977 | $75,000 | |
| **Initial Implementation** (not shown here) | | | | | $0 | | | |
| **Potential Final Balance:** | **$8,419,000** | **$4,904,408** | **$8,446,377** | **$5,765,000** | **$0** | **$8,446,377** | **$1,924,000** | **$757,377** |

**Notes/Legend**

* *Scope/Cost Not Included in February 2012 workplan for this task*

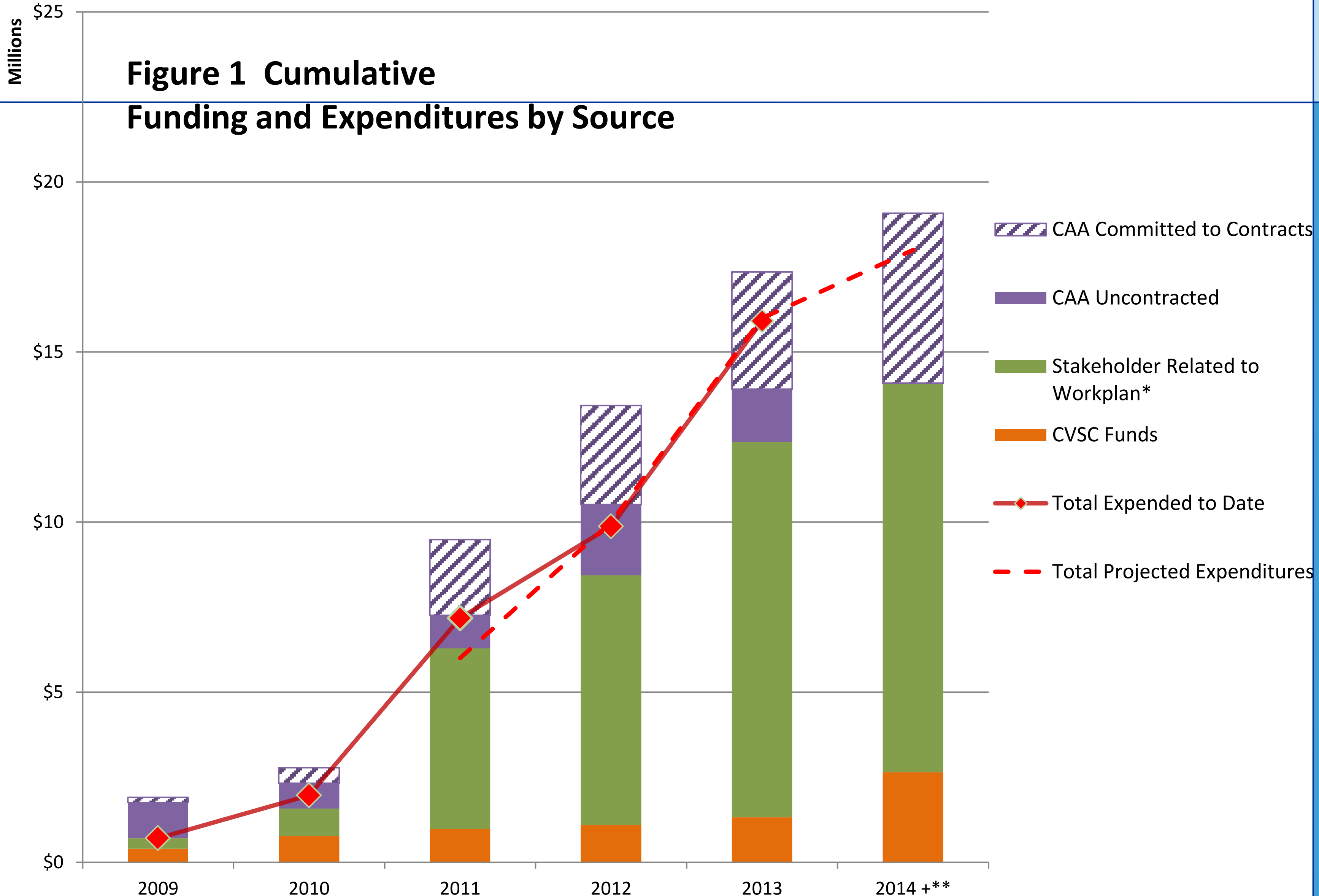
** *TPM paid by CVSC in 2014-15*

*** *Stakeholder funding from MUN POTW participants $60K and up to $55K from CVSC member direct contributions plus up to $75K CVSC contribution*

# Cost Share Summary

| Annual | Year | | | | | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 +** |
| CVSC Workplan | $398,719 | $362,530 | $220,000 | $116,896 | $220,000 | $1,326,297 |
| Stakeholder Direct Workplan | $0 | $0 | $73,000 | $384,744 | $834,000 | $144,000 |
| CAA Expended | $0 | $387,764 | $433,527 | $167,076 | $1,278,815 | |
| CAA Projected | | | | | | $2,732,818 |
| **Workplan Expended to Date** | **$398,719** | **$750,294** | **$726,527** | **$668,716** | **$2,332,815** | **$1,470,297** |
| | | | | | | |
| Stakeholder Related to Workplan* | $307,604 | $511,611 | $4,483,307 | $2,030,420 | $3,704,209 | $402,395 |
| | | | | | | |
| **Cumulative** | | | | | | |
| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014 +**** |
| CVSC Funds | $398,719 | $761,249 | $981,249 | $1,098,145 | $1,318,145 | $2,644,442 |
| Total Stakeholder Direct Workplan | $0 | $0 | $73,000 | $457,744 | $1,291,744 | $1,435,744 |
| Stakeholder Related to Workplan* | $307,604 | $819,215 | $5,302,522 | $7,332,942 | $11,037,151 | $11,439,546 |
| Total Stakeholder Expenditures | $706,323 | $1,580,464 | $6,356,771 | $8,888,831 | $13,647,040 | $15,519,732 |
| CAA Uncontracted | $1,054,070 | $745,294 | $976,766 | $2,083,852 | $937,131 | $0 |
| CAA Committed to Contracts | $145,930 | $454,706 | $2,223,224 | $2,916,148 | $4,062,869 | $5,000,000 |
| CAA Expended to Date | $0 | $387,764 | $821,291 | $1,383,608 | $2,285,436 | |
| Total Expended to Date | $706,323 | $1,968,228 | $7,178,062 | $10,272,439 | $15,932,476 | |
| Total Projected Expenditures | | | $7,000,000 | $10,000000 | $16,000,000 | **$20,000,000** |
| % Stakeholder Expended Funds | 100% | 80% | 89% | 87% | 86% | |

# Relative Contributions to Project Costs



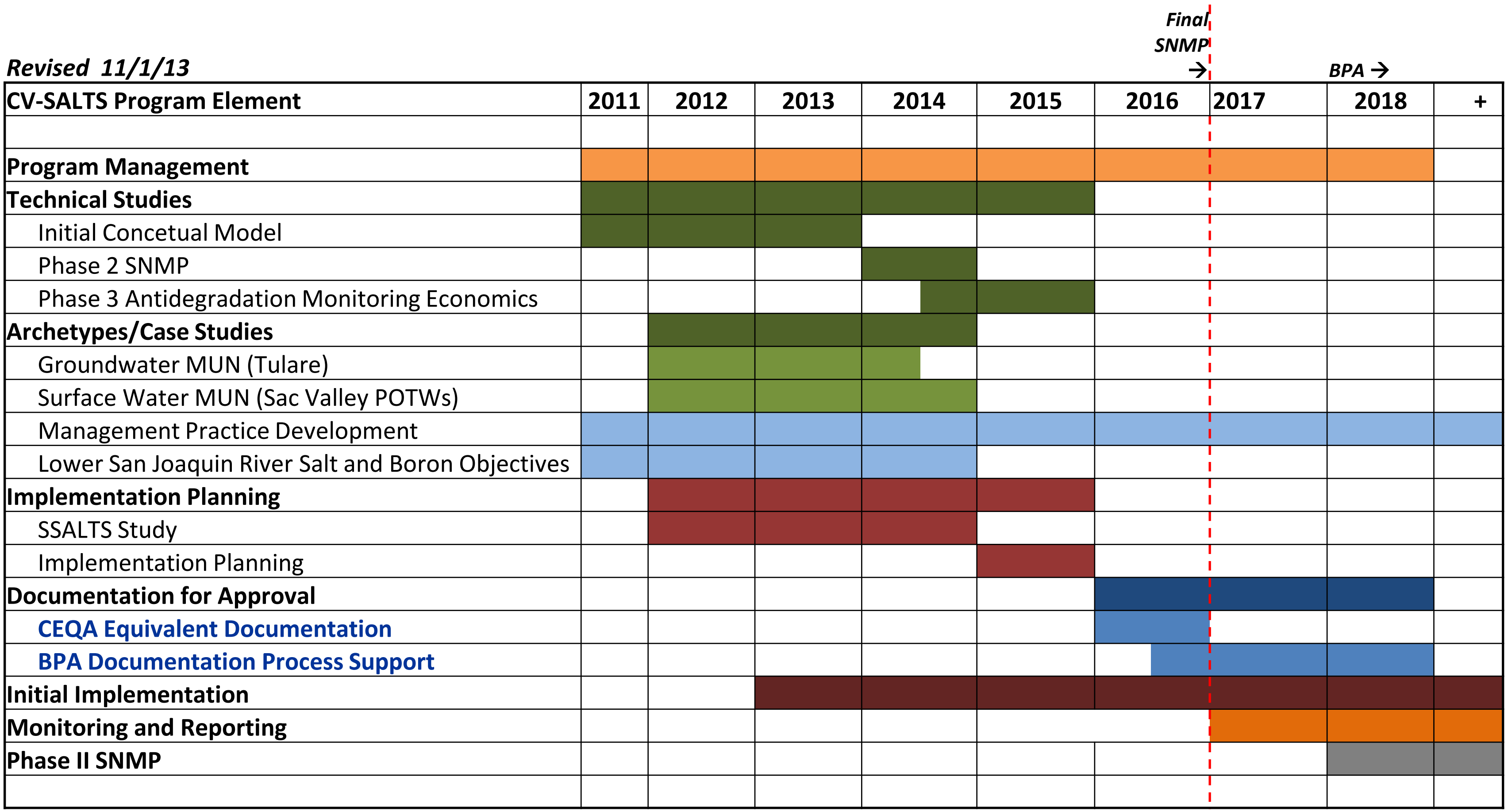
# <u>Anticipated Outcome</u>: Adoption of a CV-SNMP that Complies with SRWP

| Recycled Water Policy Elements | CV-SALTS |
|---|---|
| Water recycling and stormwater management goals/objectives | X |
| Conceptual model<br>-- Source/fate; assimilative capacity; etc. | X |
| Monitoring Plan | X |
| Antidegradation analysis | X |
| Implementation methods<br>-- Including templates for modifying Beneficial uses, water quality objectives, and developing area-specific SNMPs | X |
| Management activities | X |

# Anticipated Outcome: Ability to Fold in More Area-specific SNMPs, as needed

- Utilize Master CV-SNMP as default management approach
- Periodic updates to include area-specific SNMPs in the future
  - Utilize process templates from master plan
    - Area-specific SNMPs
    - Archetypes
    - Prototypes
- Facilitate ability to provide safe drinking water to communities already impacted by salt and nitrate

# Summarized CV-SALTS Workplan Schedule



# Staff Recommendation

Approve Resolution to Extend Completion Date of Central Valley Salt and Nitrate Management Plan to 2016, Based on Demonstration of Substantial Progress