

CV-SALTS Technical Approaches for Salt and Nitrate Characterization of Central Valley Groundwater

Vicki Kretsinger Grabert



**Luhdorff &
Scalmanini**
Consulting Engineers

January 18, 2019

Presentation at
State Water Resources Control Board
Drinking Water Needs Assessment
Workshop

CV-SALTS Stakeholder Led Initiative

- State and Federal Agencies
- Local Agencies
- Discharger Community
 - Agriculture
 - Industry
 - Wastewater treatment
- Environmental Justice and Disadvantaged Community Representatives



**12+ year effort
Policies/technical work
covering 40% of the State**

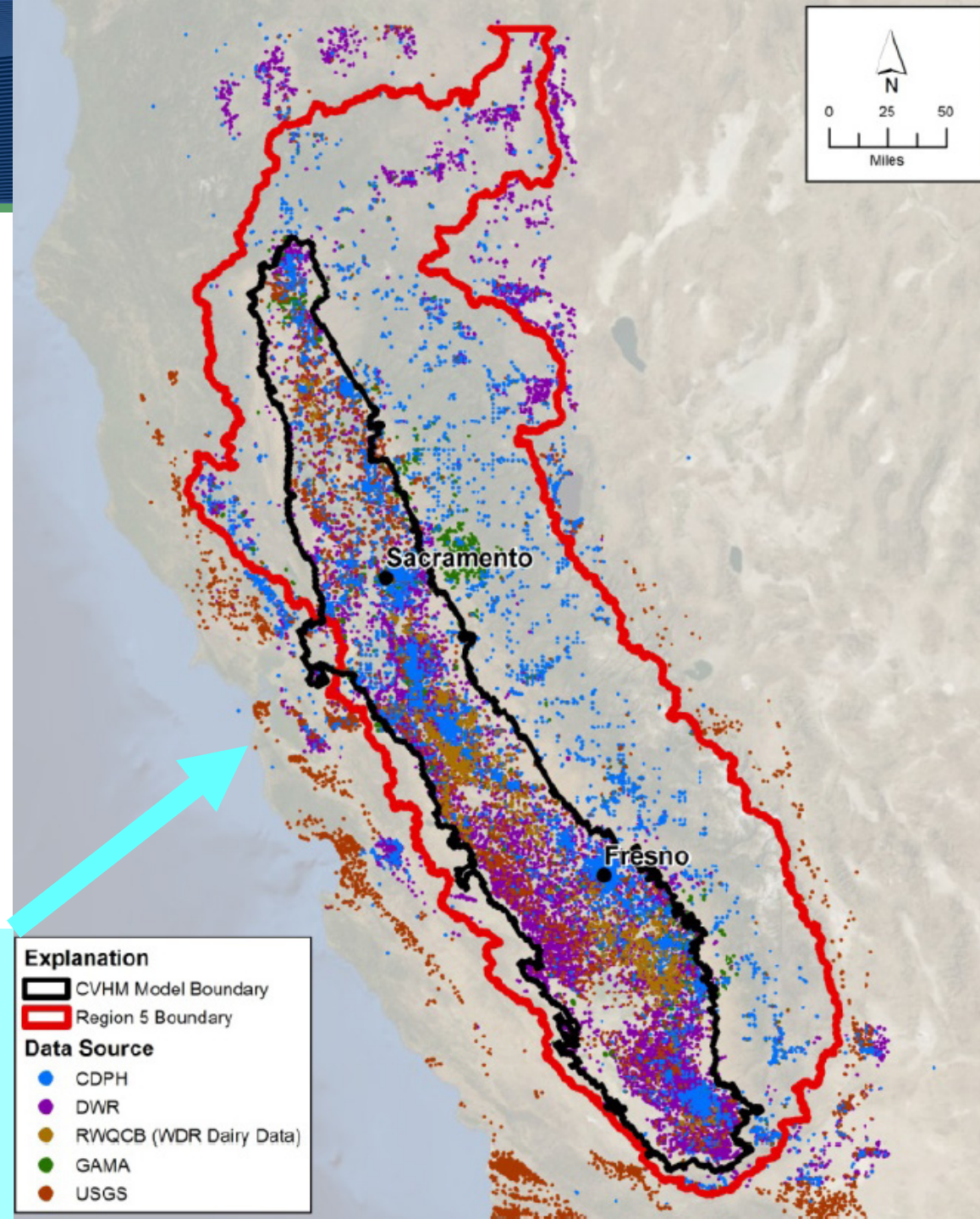
***Central Valley Salinity Alternatives
for Long-Term Sustainability***

Groundwater Quality

- Groundwater technical support to CV-SALTS since 2009; many reports
- Today: Focus on “High Resolution” report (2016; 3,168 pages mostly figures along with many tables)
- Analyses and mapping for Region 5 including Central Valley Floor
- Constituents: Nitrate and Salt (TDS)
- Mapping
 - Ambient Concentrations
 - Predicted Concentrations (based on actual/historical observations)
 - Trends

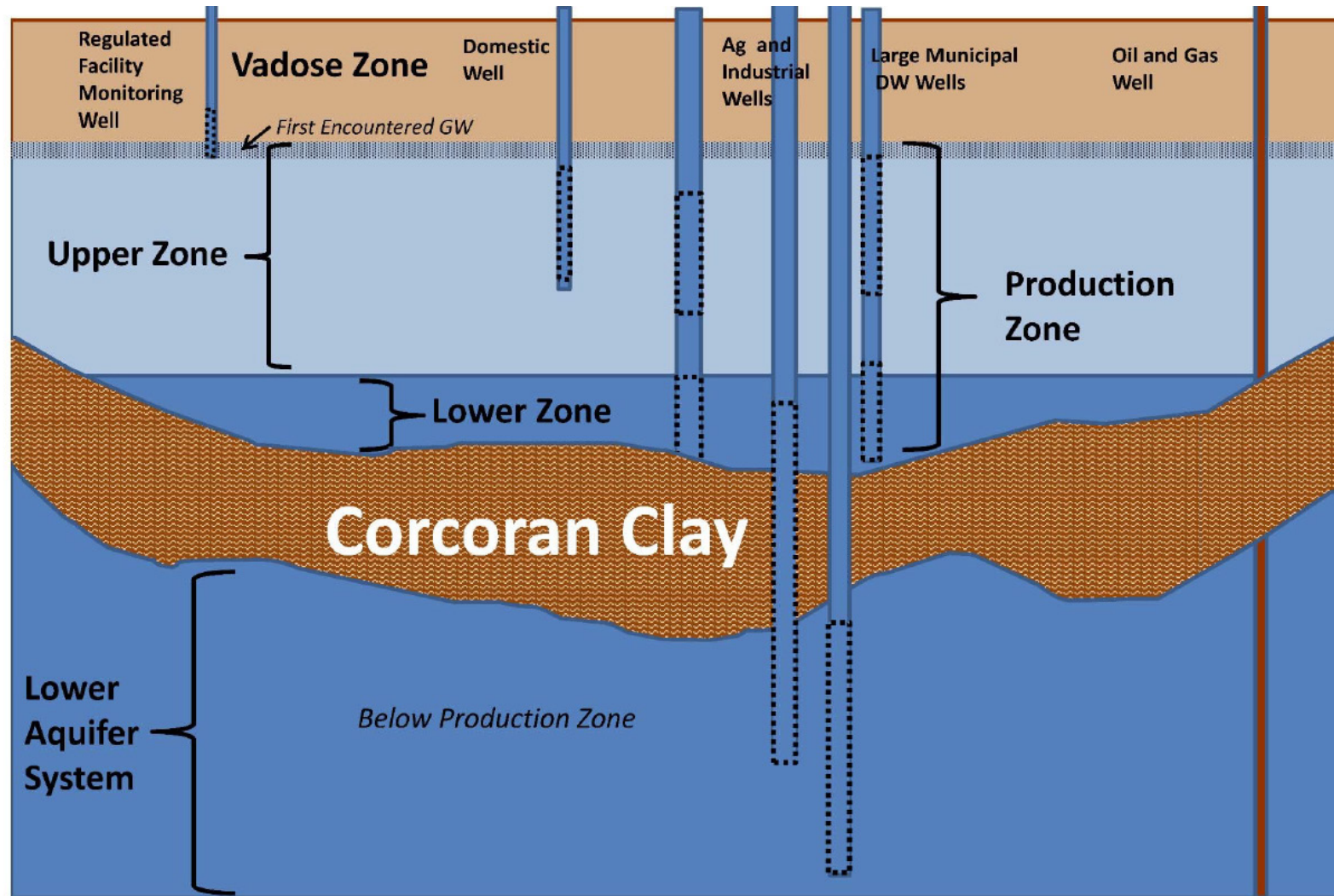
CV-SALTS: All Wells with Publicly Available Salt & Nitrate Data; 46,228 Wells

- Many without construction info



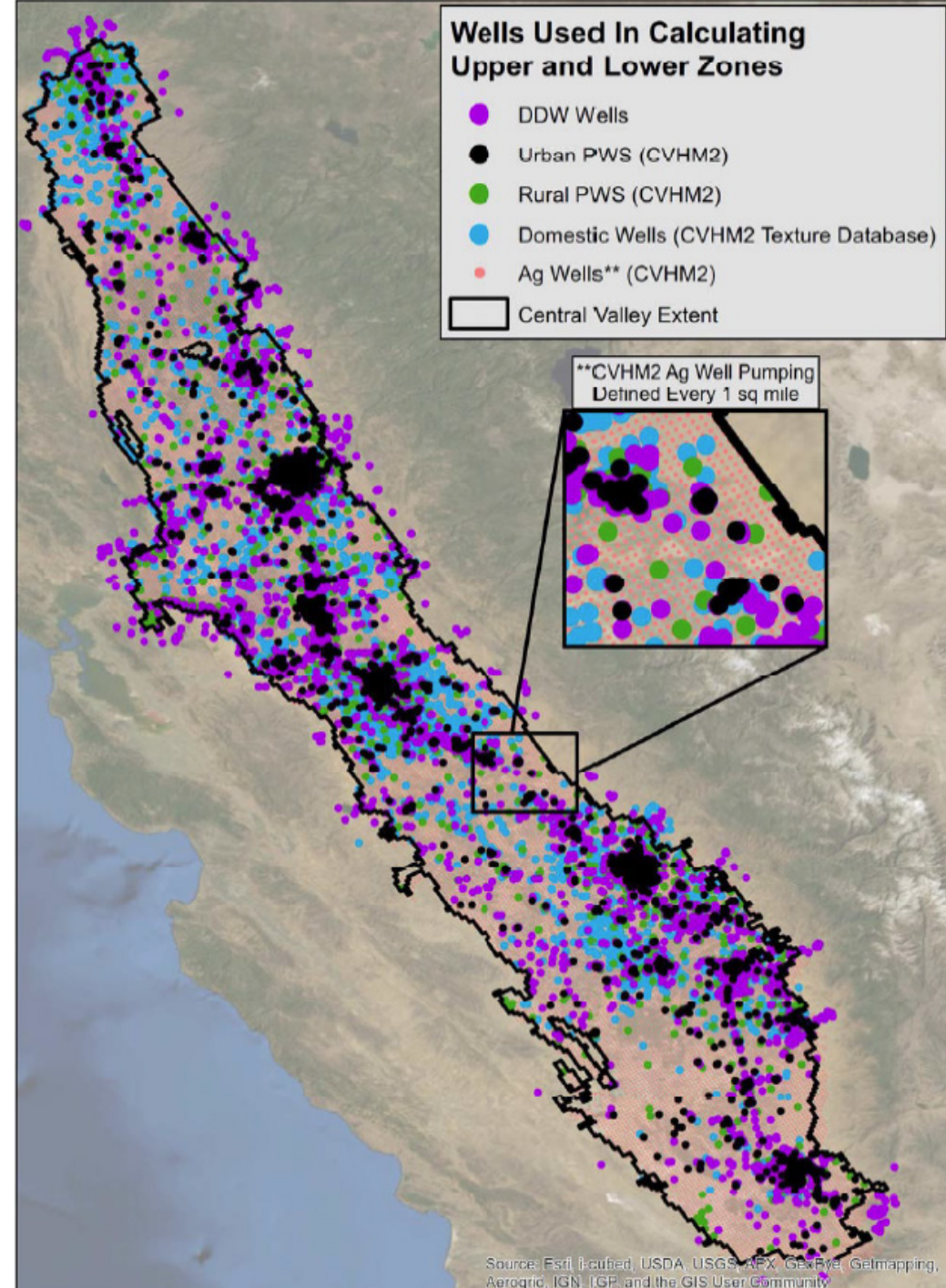
Depth to Bottom of Upper Groundwater Zone

- Organize GW Quality data (nitrate and TDS) relative to GW system
- Delineated with numerous datasets; focus on domestic well depths

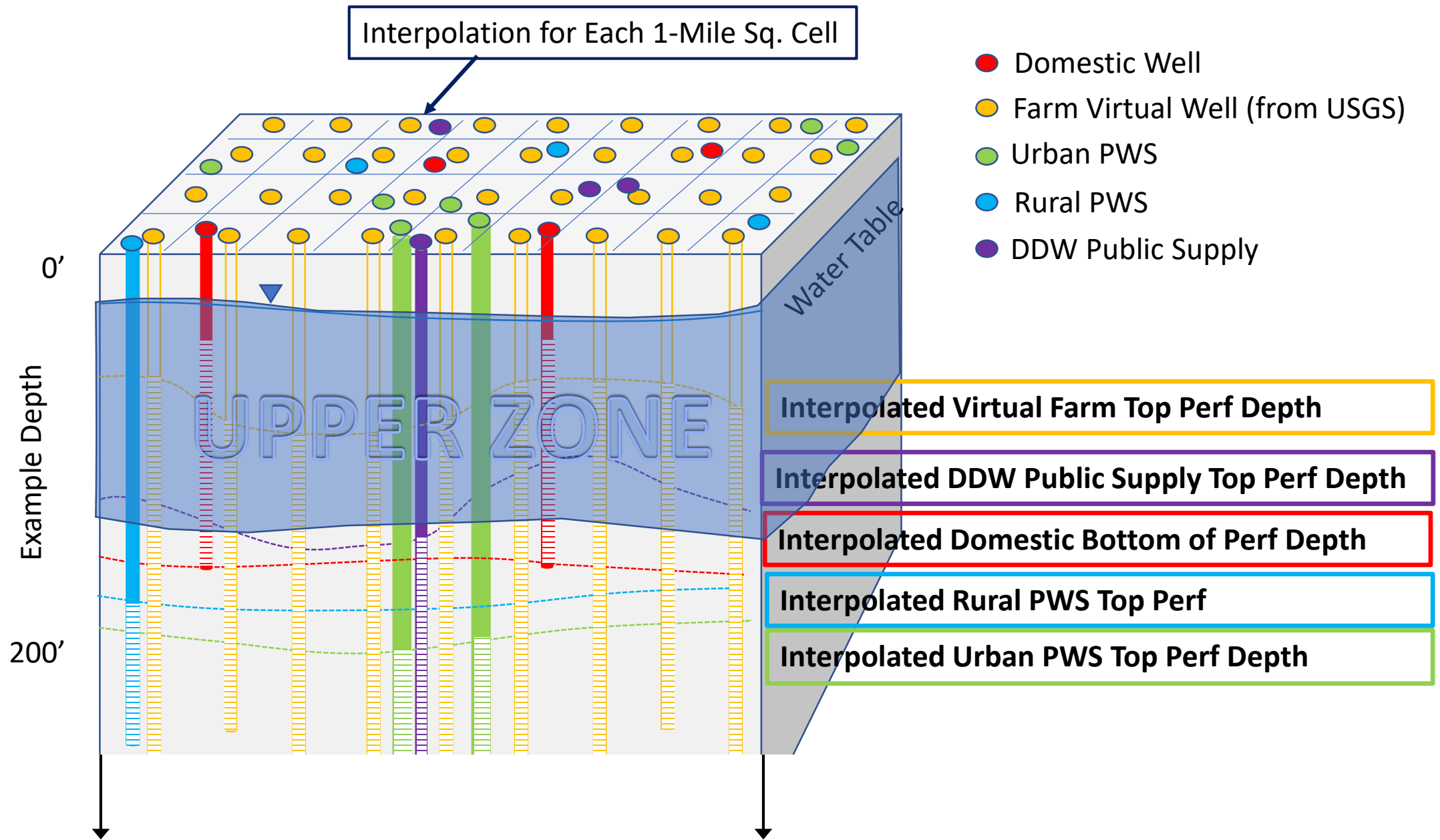


Upper Zone Calculation Datasets

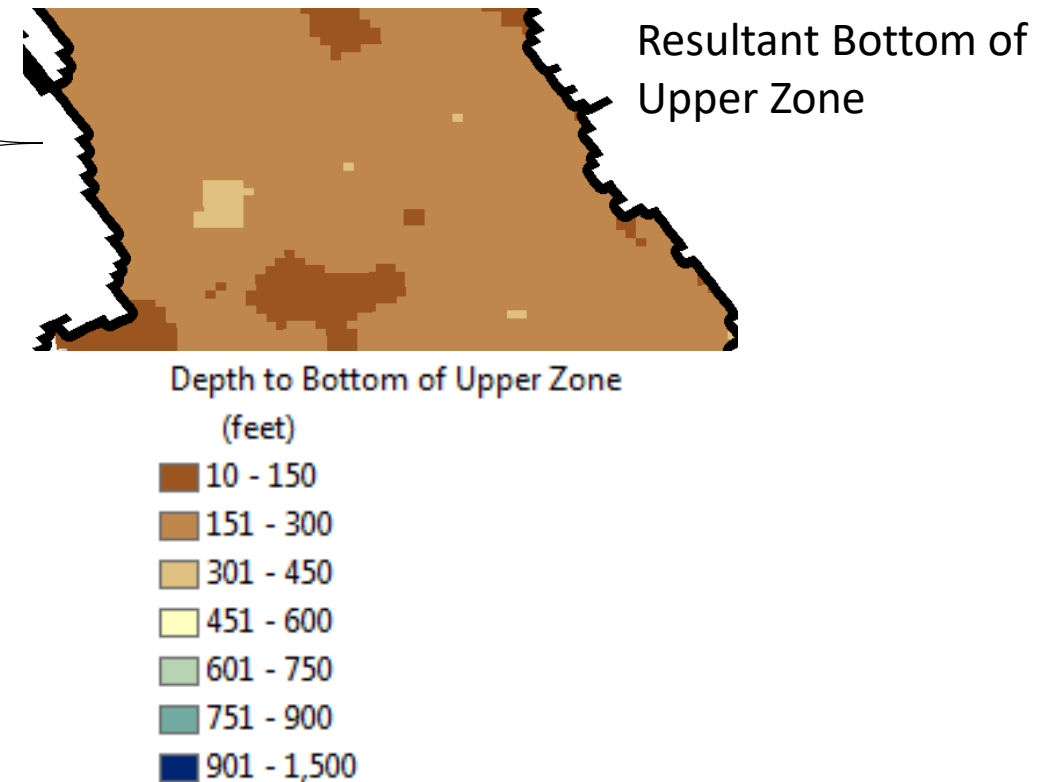
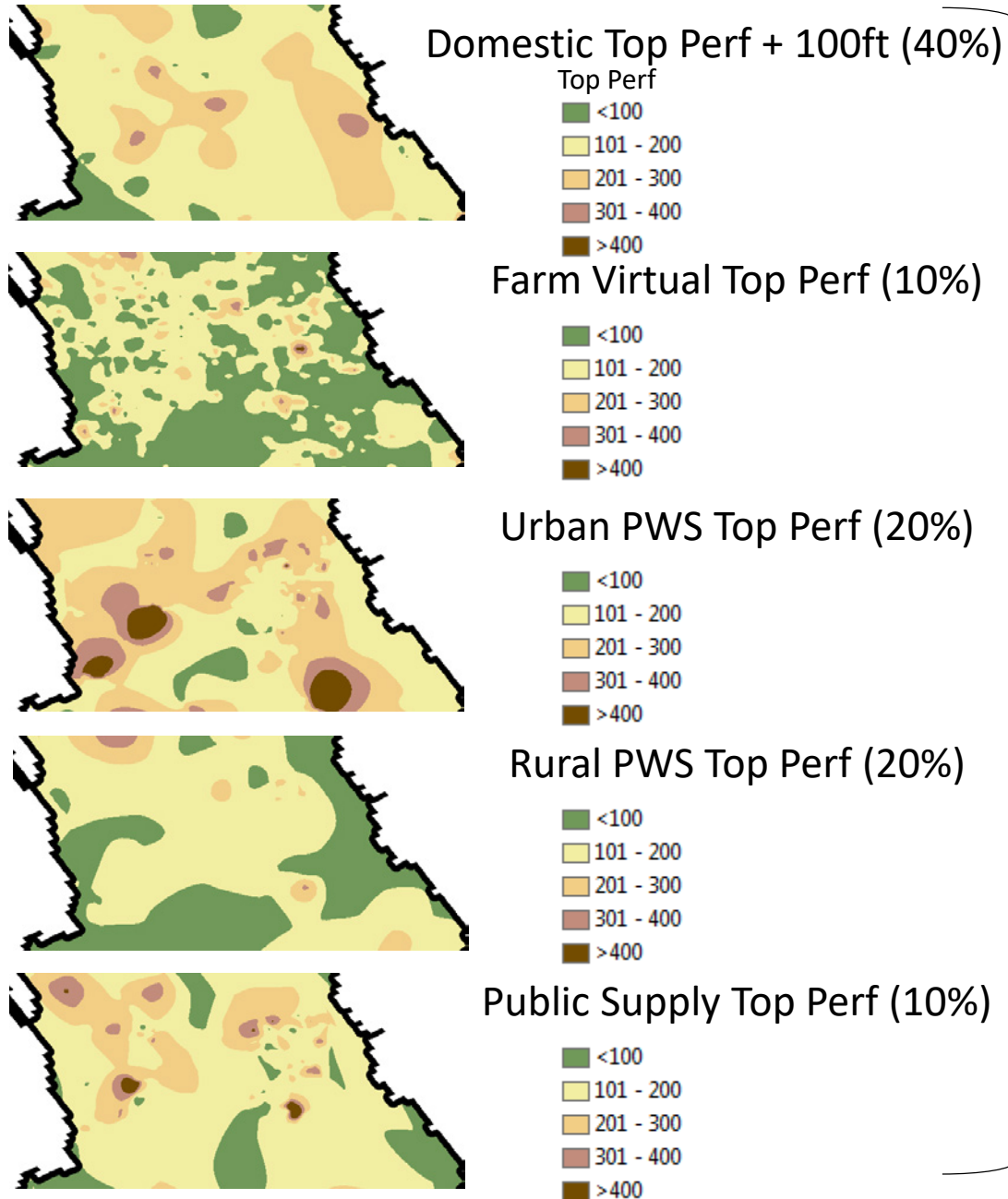
| Data Layer | Weights for Establishing Bottom of Upper Zone |
|------------------------------------|---|
| Domestic Wells Bottom Perforation | 40% |
| Farm Virtual Wells Top Perforation | 10% |
| Urban PWS Top Perforation | 20% |
| Rural PWS Top Perforation | 20% |
| DDW Systems Top Perforation | 10% |
| Total | 100% |



Upper Zone Conceptual Cartoon



Sacramento Example

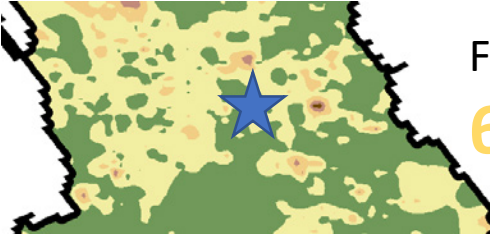


EXAMPLE CALCULATION: FOR EACH 1 MILE x 1 MILE CELL



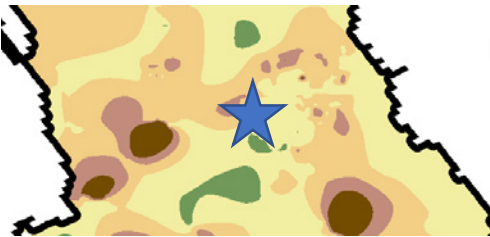
Domestic Top Perf + 100ft (40%)

289ft



Farm Virtual Top Perf (10%)

66ft



Urban PWS Top Perf (20%)

178ft



Rural PWS Top Perf (20%)

149ft



Public Supply Top Perf (10%)

146ft



Example
Cell Location

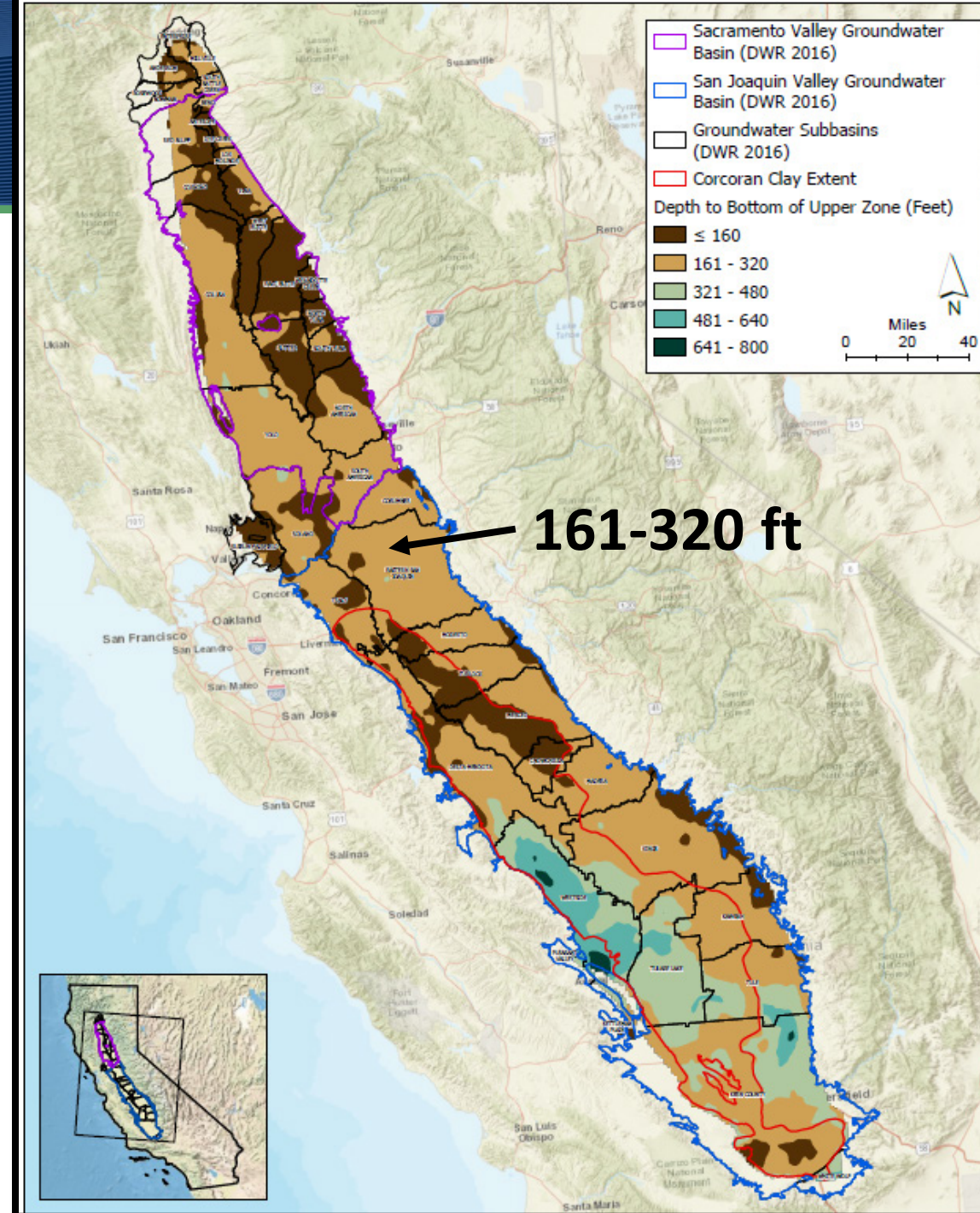
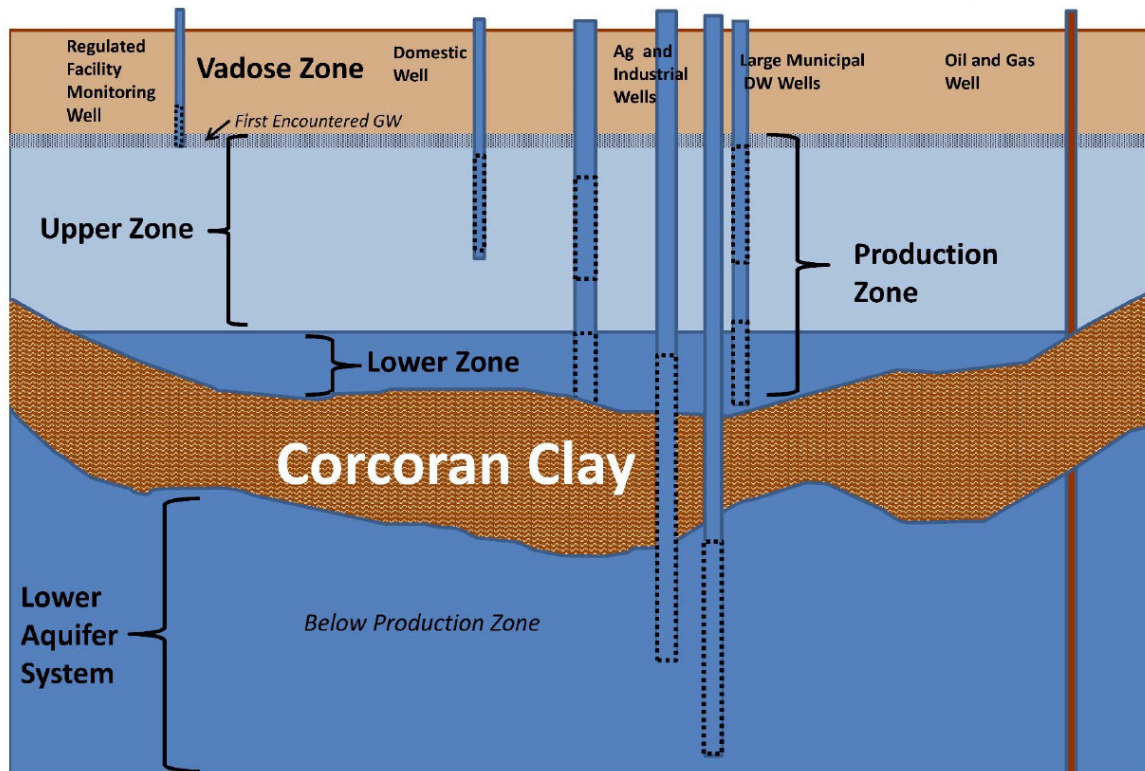


Resultant Bottom of
Upper Zone 208ft

$$(0.4 \times 289\text{ft}) + (0.1 \times 66\text{ft}) + (0.2 \times 178\text{ft}) + (0.2 \times 149\text{ft}) + (0.1 \times 146\text{ft}) = 208\text{ft}$$

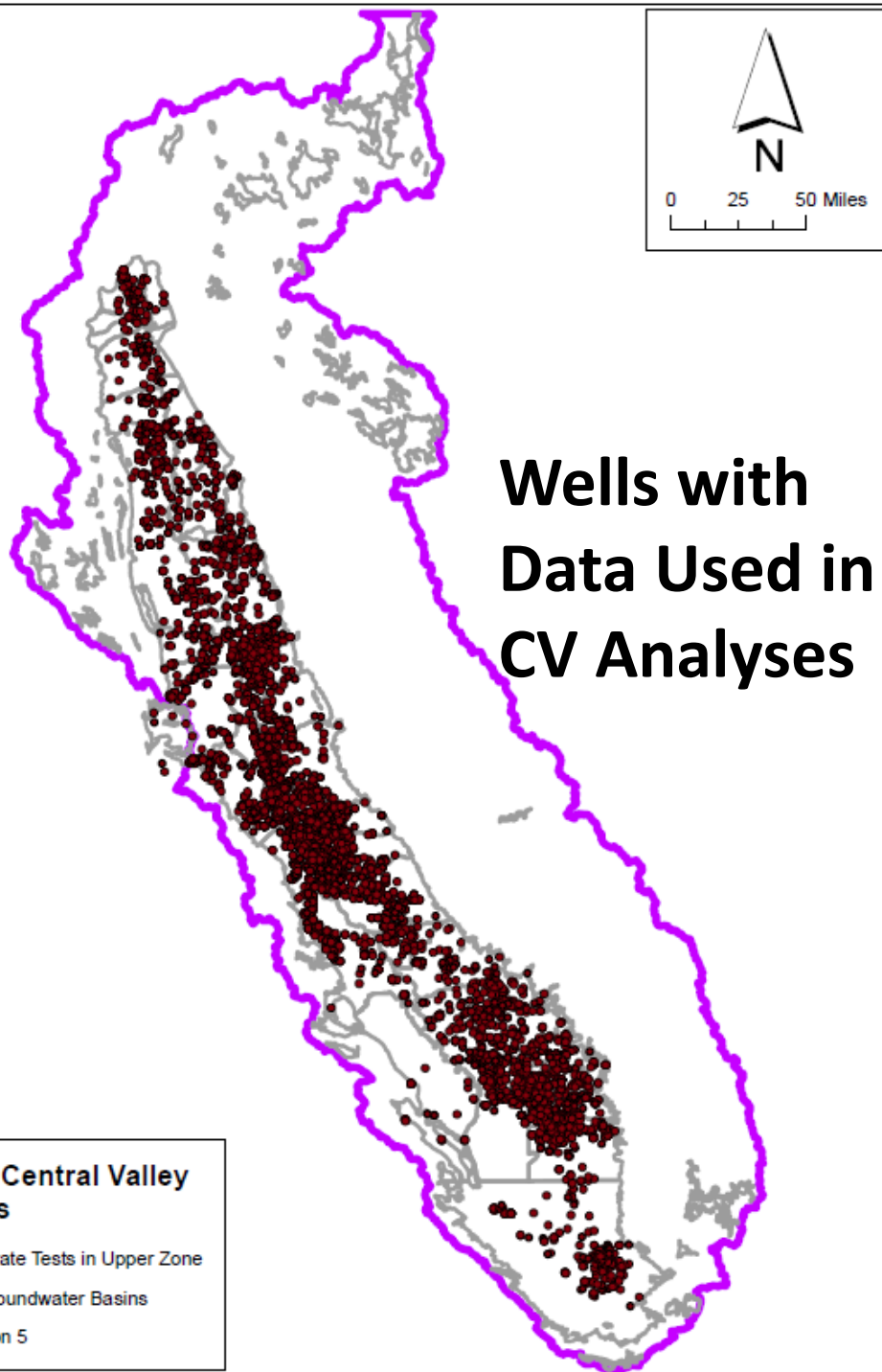
Depth to Bottom of Upper Groundwater Zone

- Results of data interpretation
- Depth variable across Central Valley; 1 sq. mile interpretation



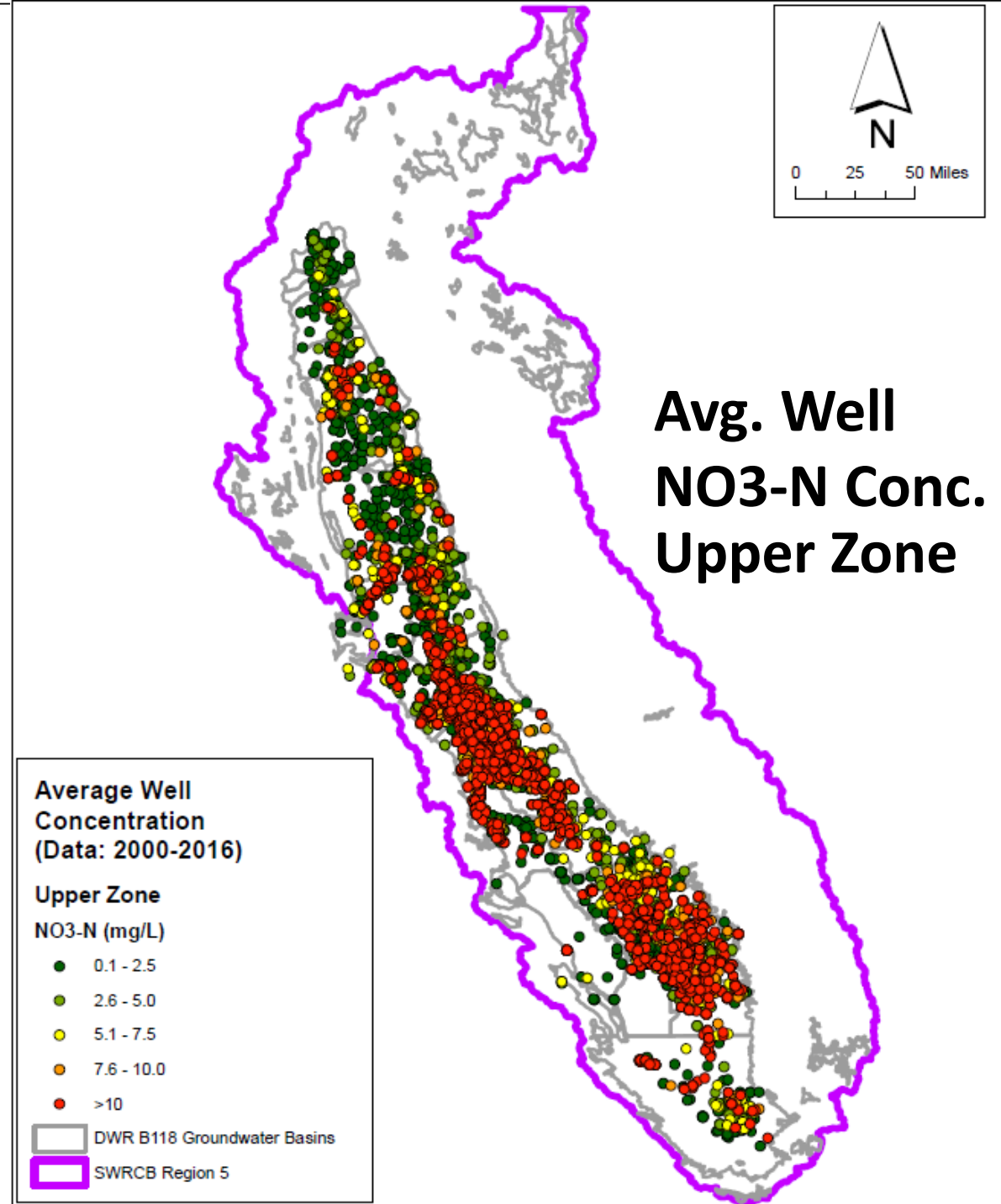


Characterization of Ambient Nitrate and Salt in Central Valley Groundwater



Wells Used in Central Valley Floor Analyses

- Wells With Nitrate Tests in Upper Zone
- DWR B118 Groundwater Basins
- SWRCB Region 5

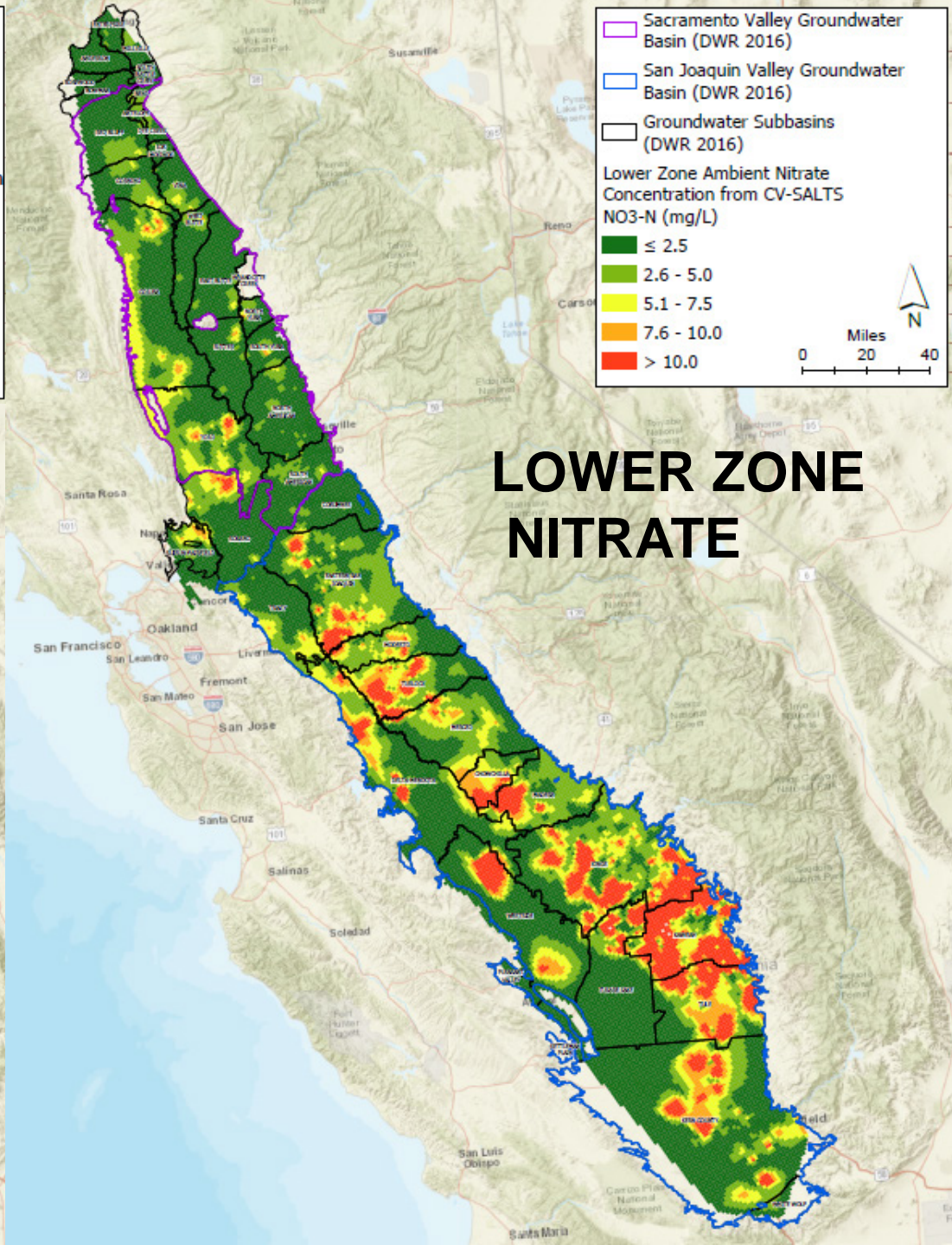
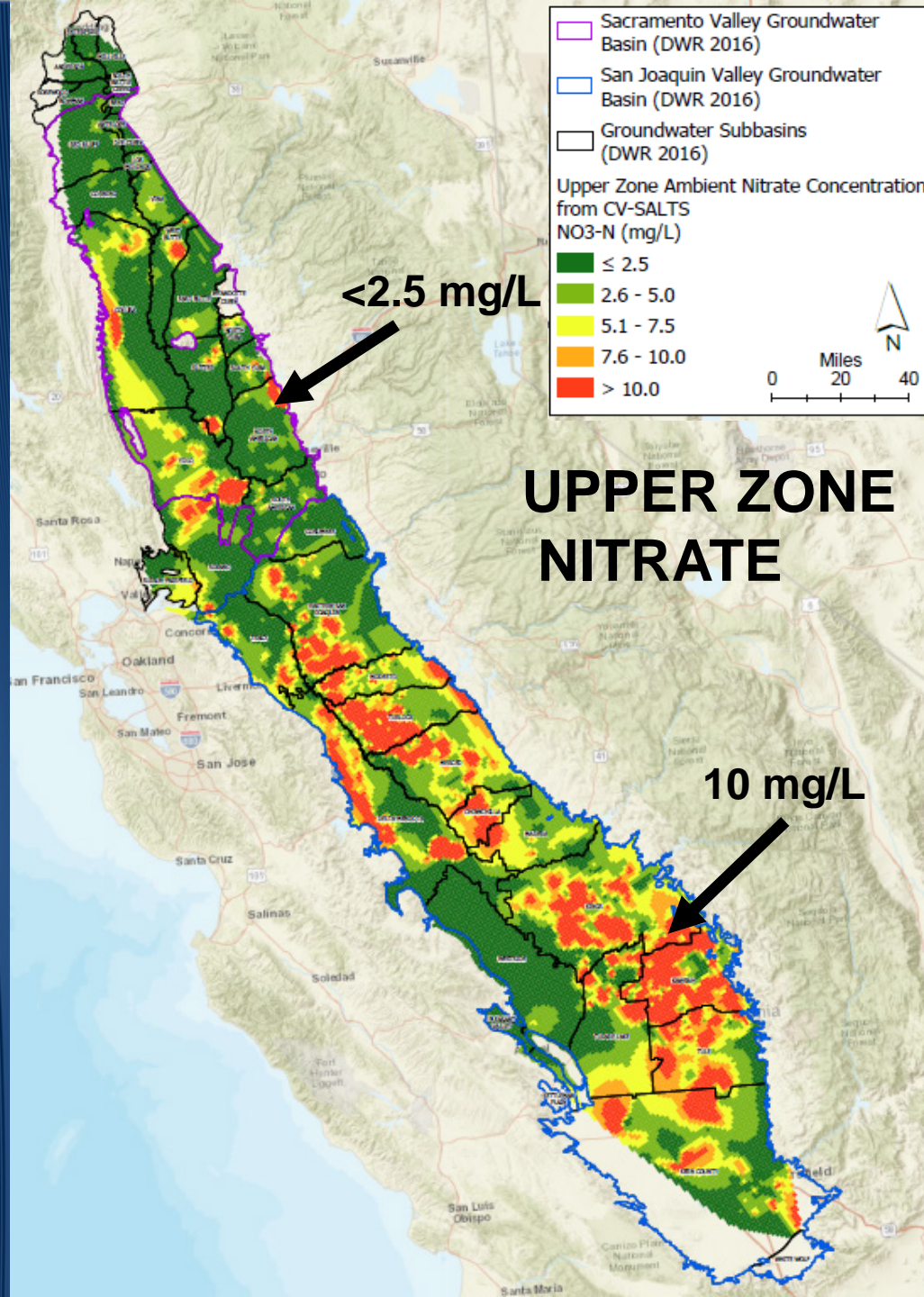


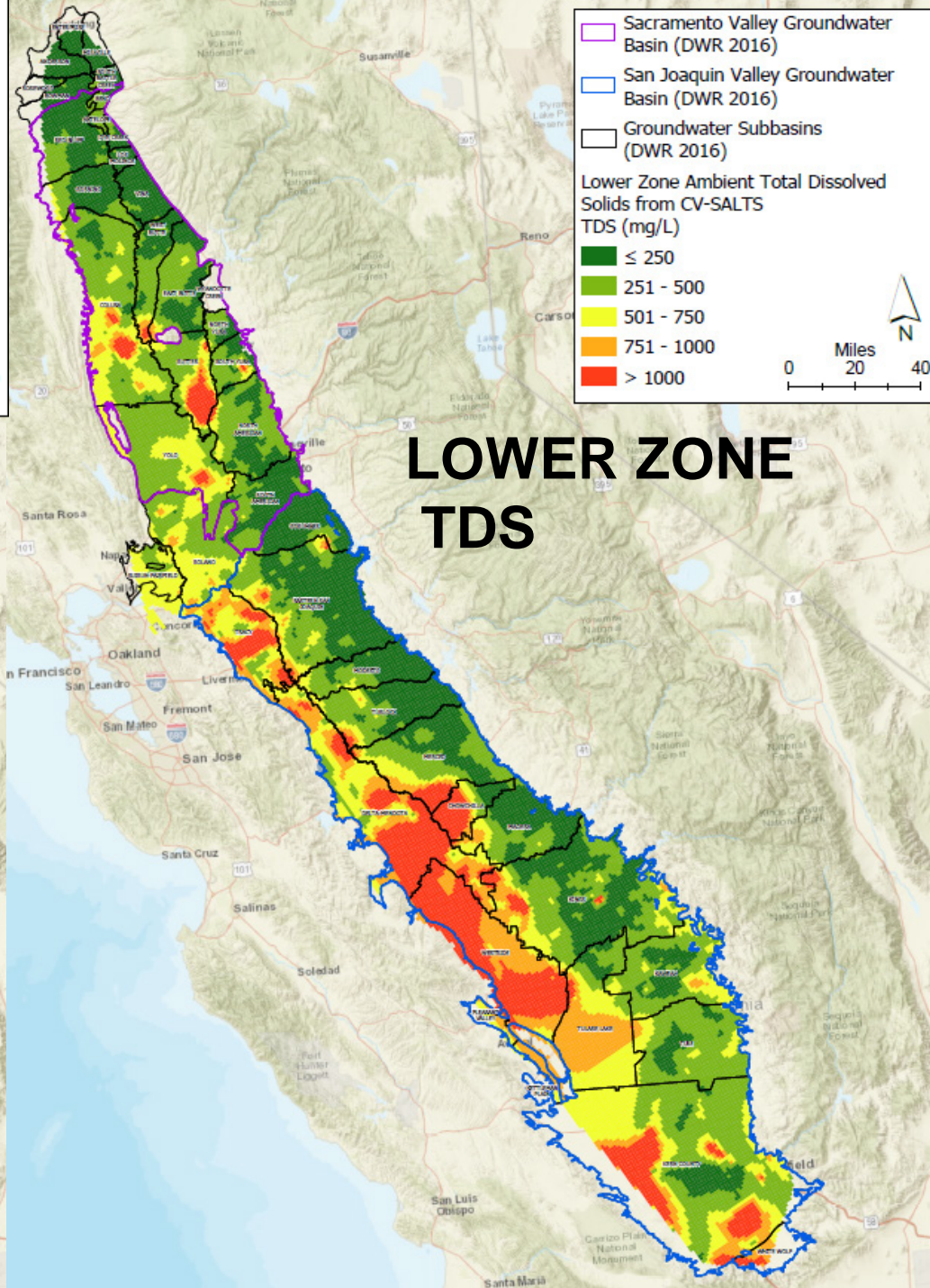
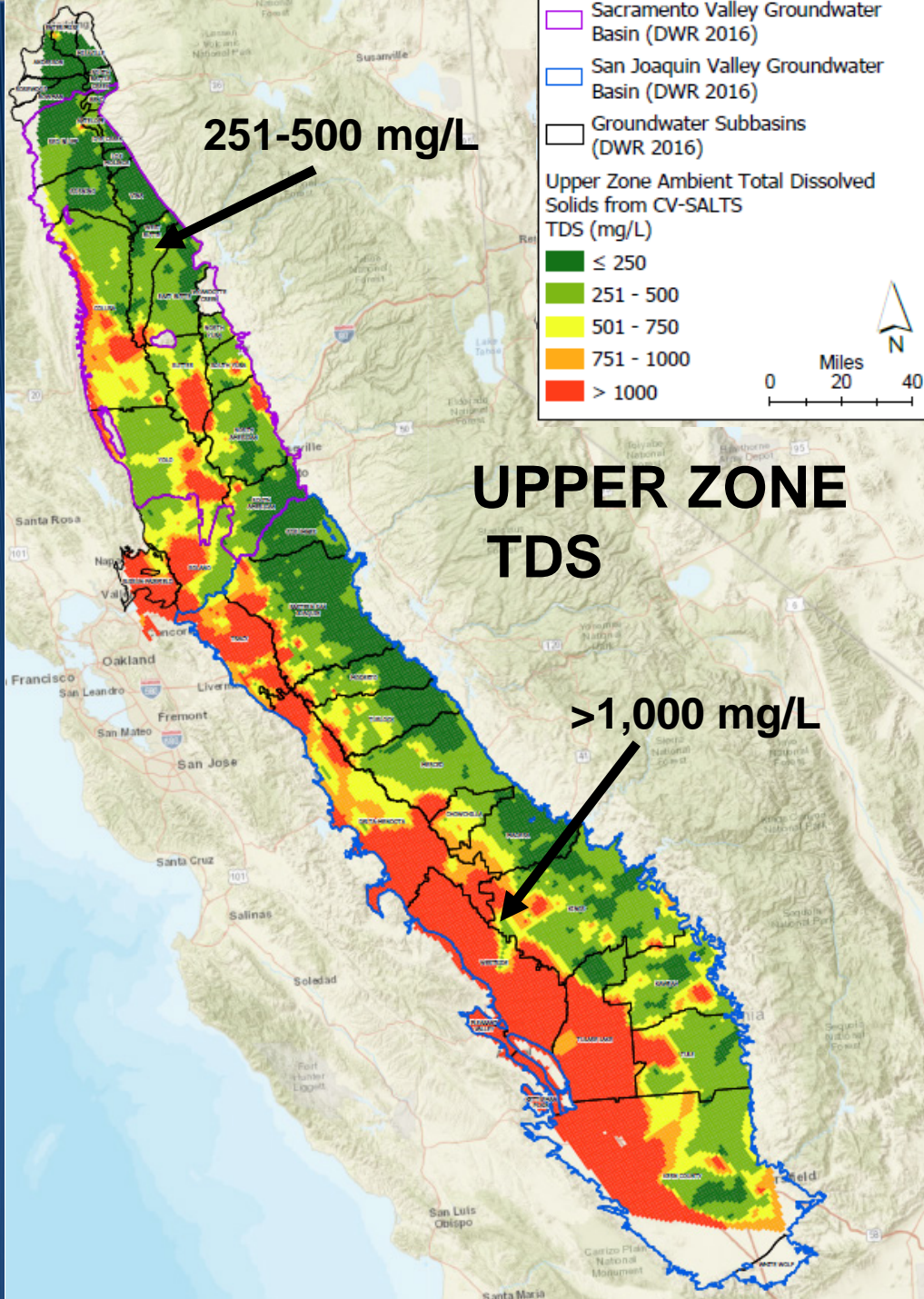
Average Well Concentration (Data: 2000-2016)

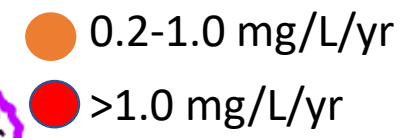
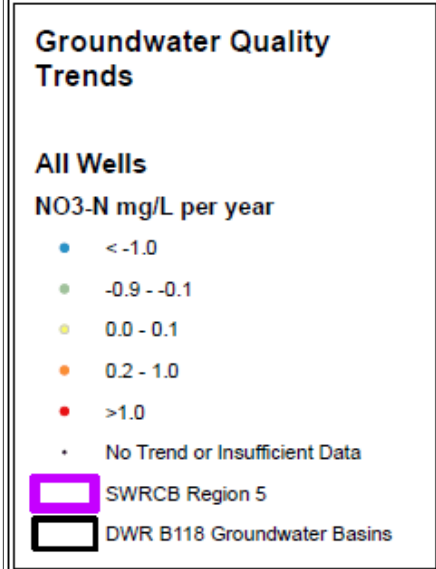
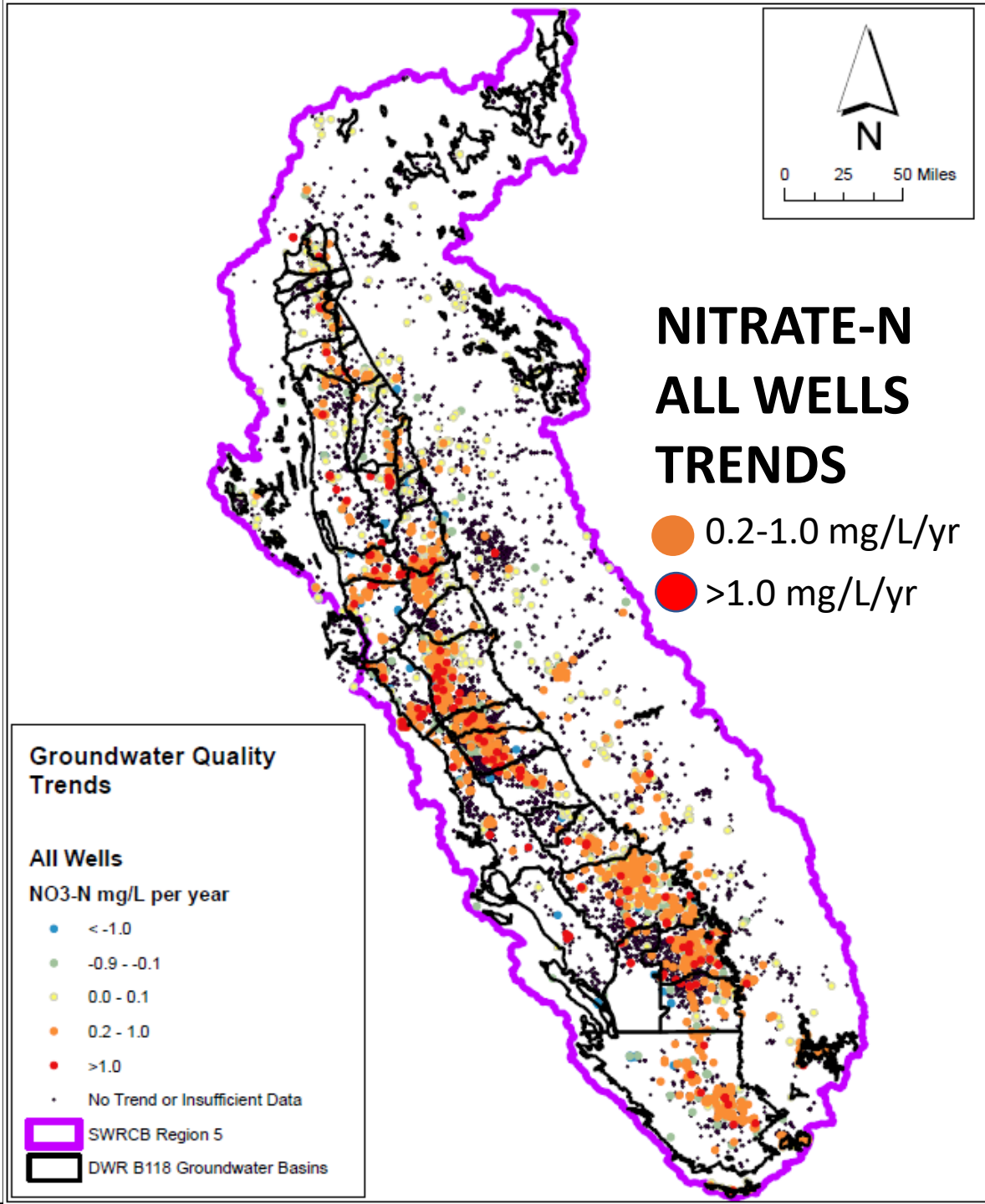
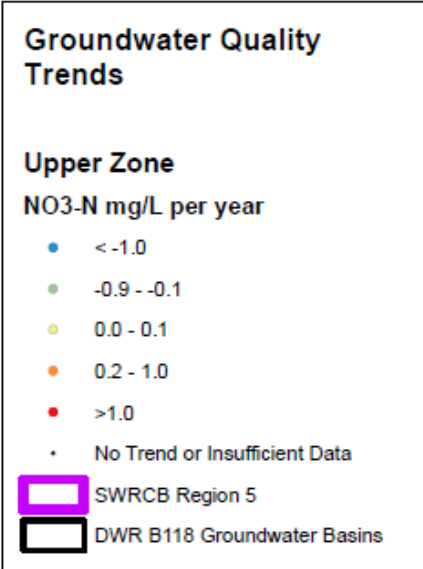
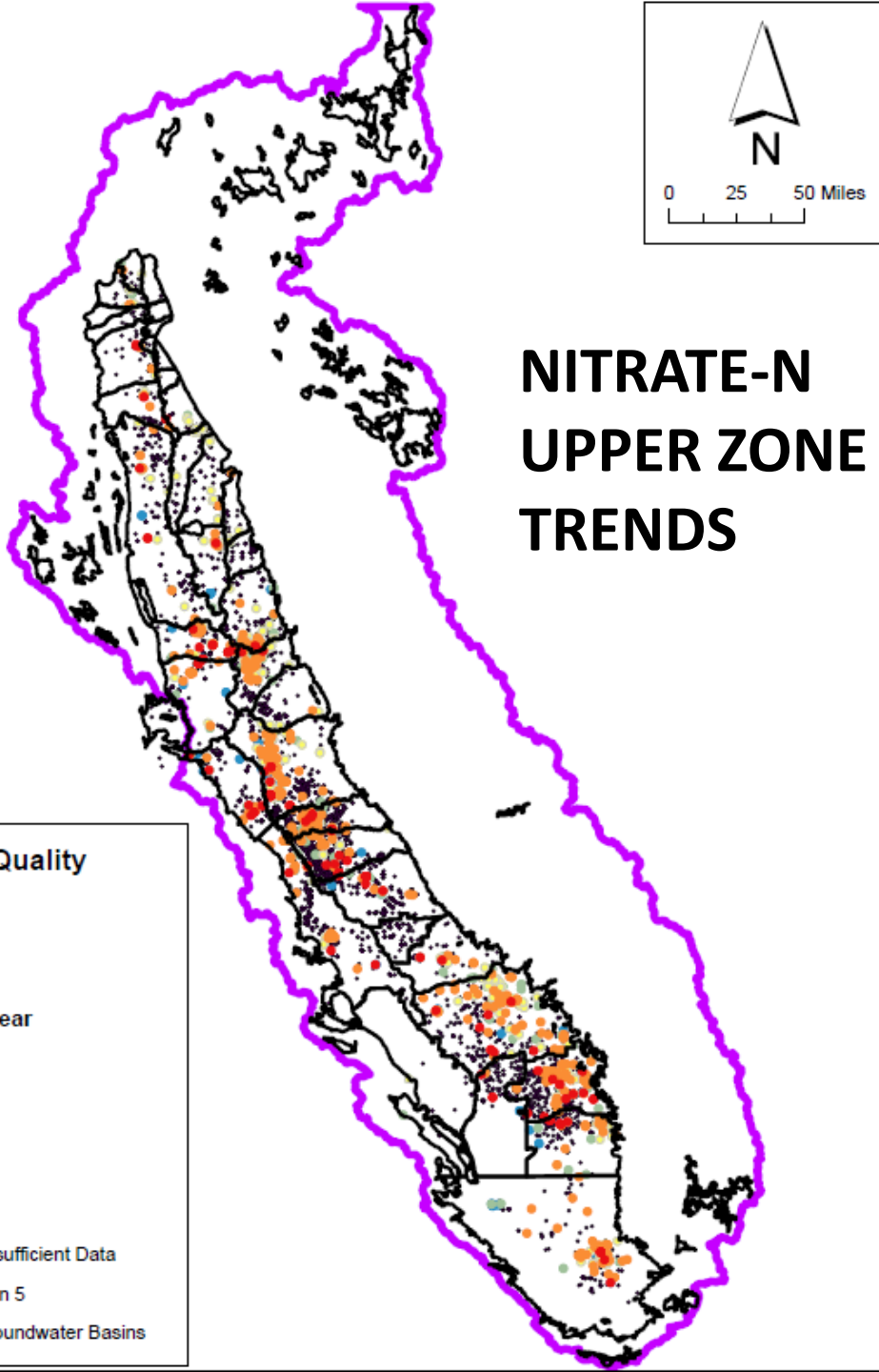
Upper Zone NO₃-N (mg/L)

- 0.1 - 2.5
- 2.6 - 5.0
- 5.1 - 7.5
- 7.6 - 10.0
- >10

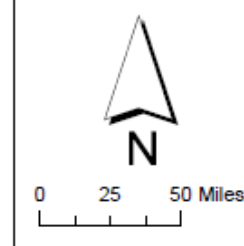
- DWR B118 Groundwater Basins
- SWRCB Region 5





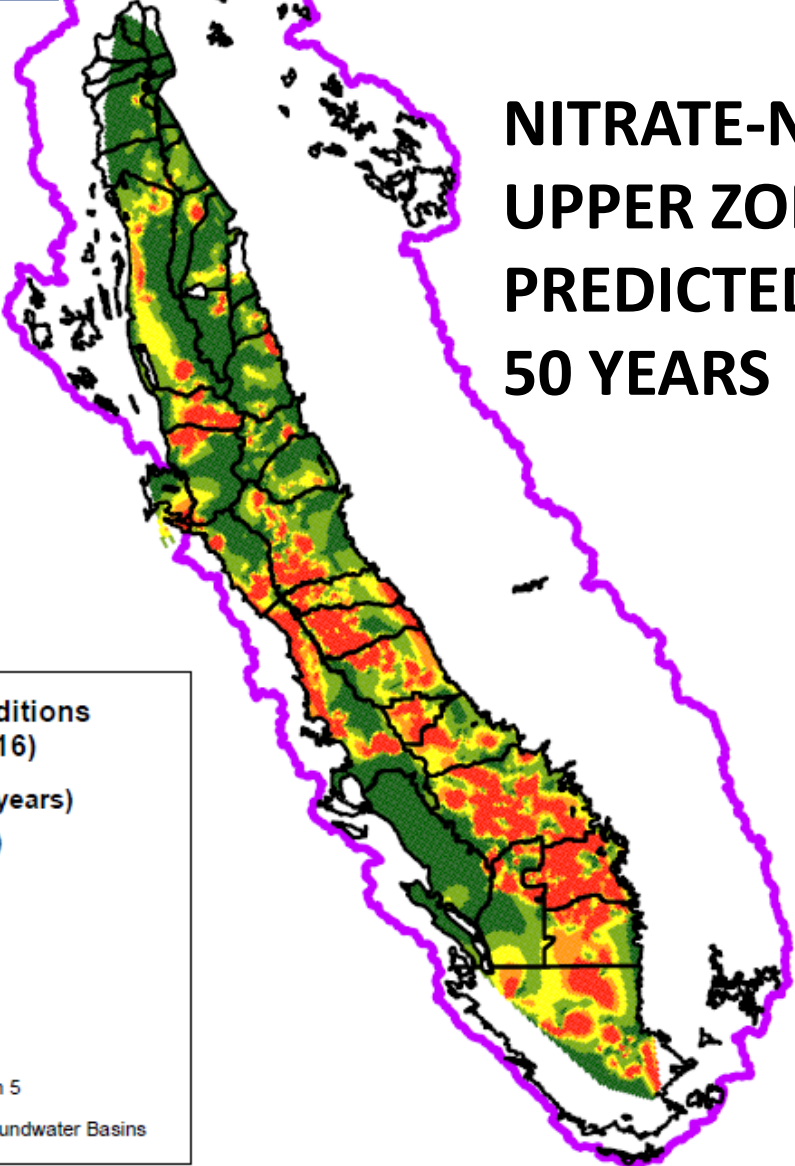
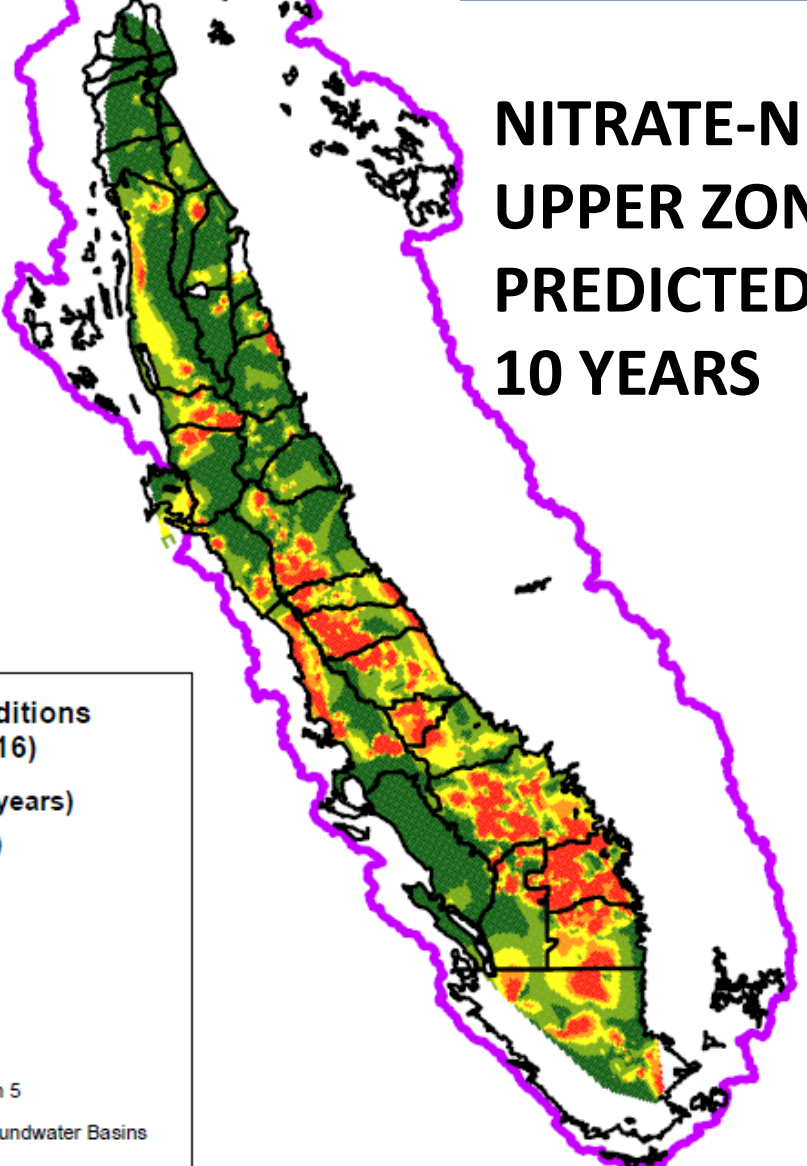


Predictions Based on Historical Observations



**NITRATE-N
UPPER ZONE
PREDICTED:
10 YEARS**

**NITRATE-N
UPPER ZONE
PREDICTED:
50 YEARS**



**Predicted Conditions
(Data: 2000-2016)**

Upper Zone (10 years)

Nitrate (mg/L as N)

- 0.1 - 2.5
- 2.6 - 5.0
- 5.1 - 7.5
- 7.6 - 10.0
- >10

- SWRCB Region 5
- DWR B118 Groundwater Basins

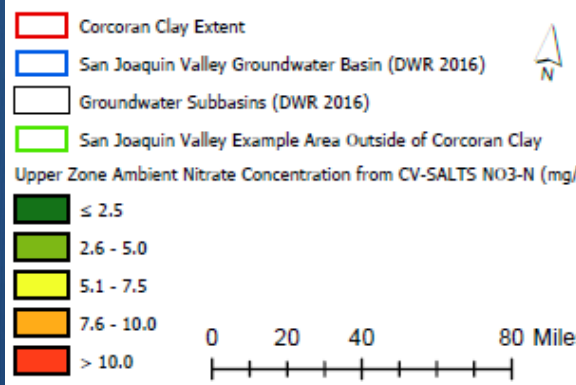
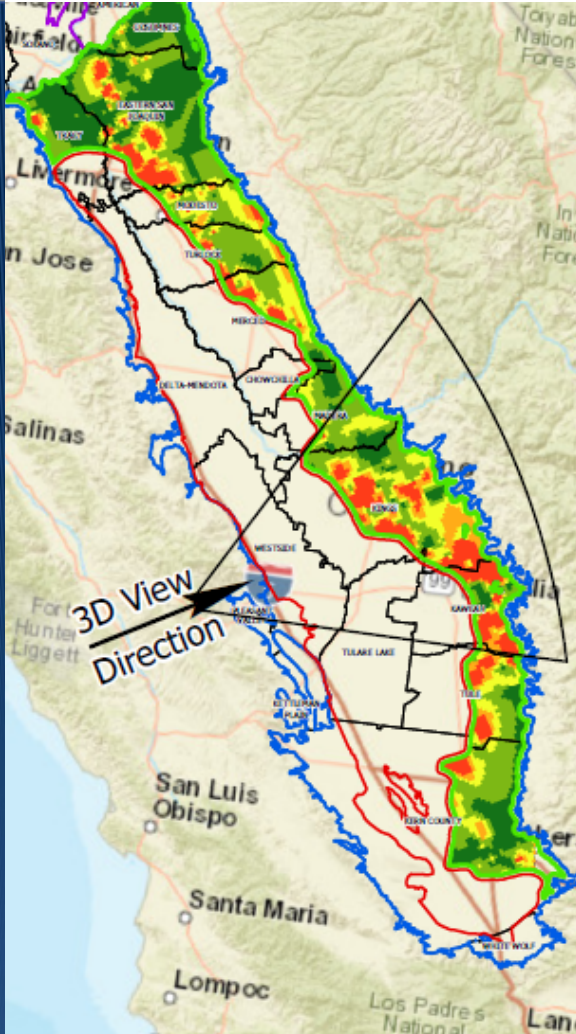
**Predicted Conditions
(Data: 2000-2016)**

Upper Zone (50 years)

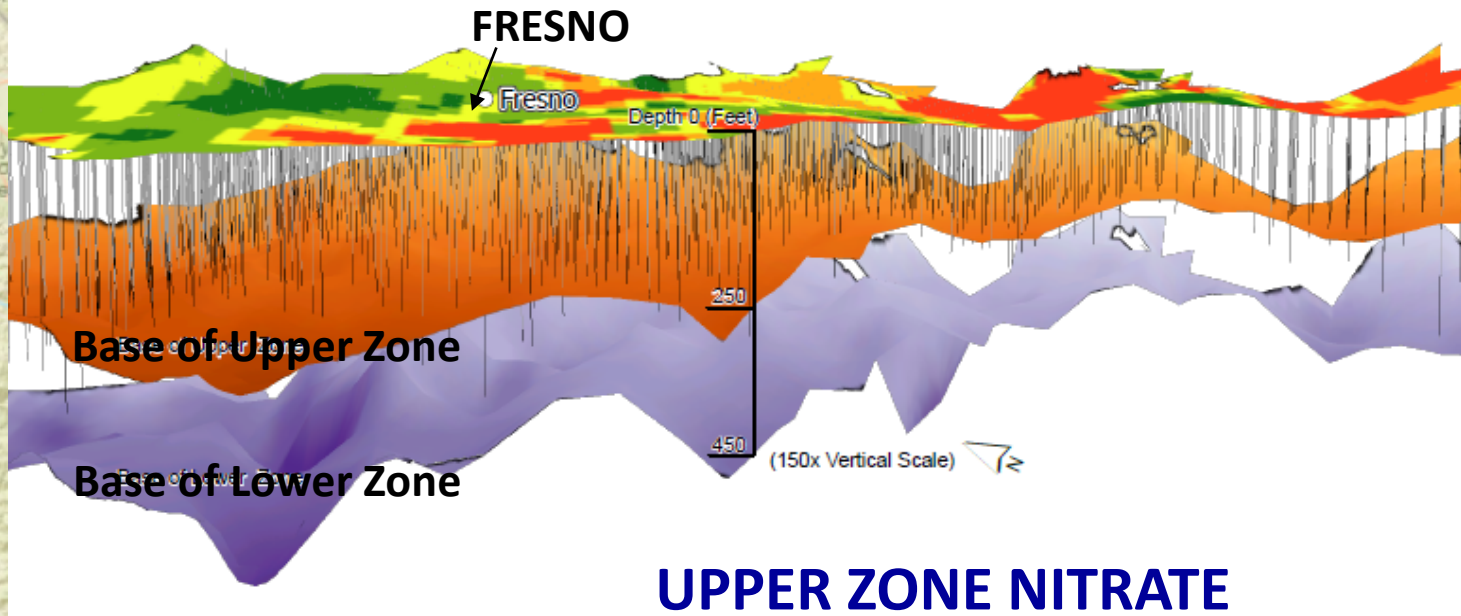
Nitrate (mg/L as N)

- 0.1 - 2.5
- 2.6 - 5.0
- 5.1 - 7.5
- 7.6 - 10.0
- >10

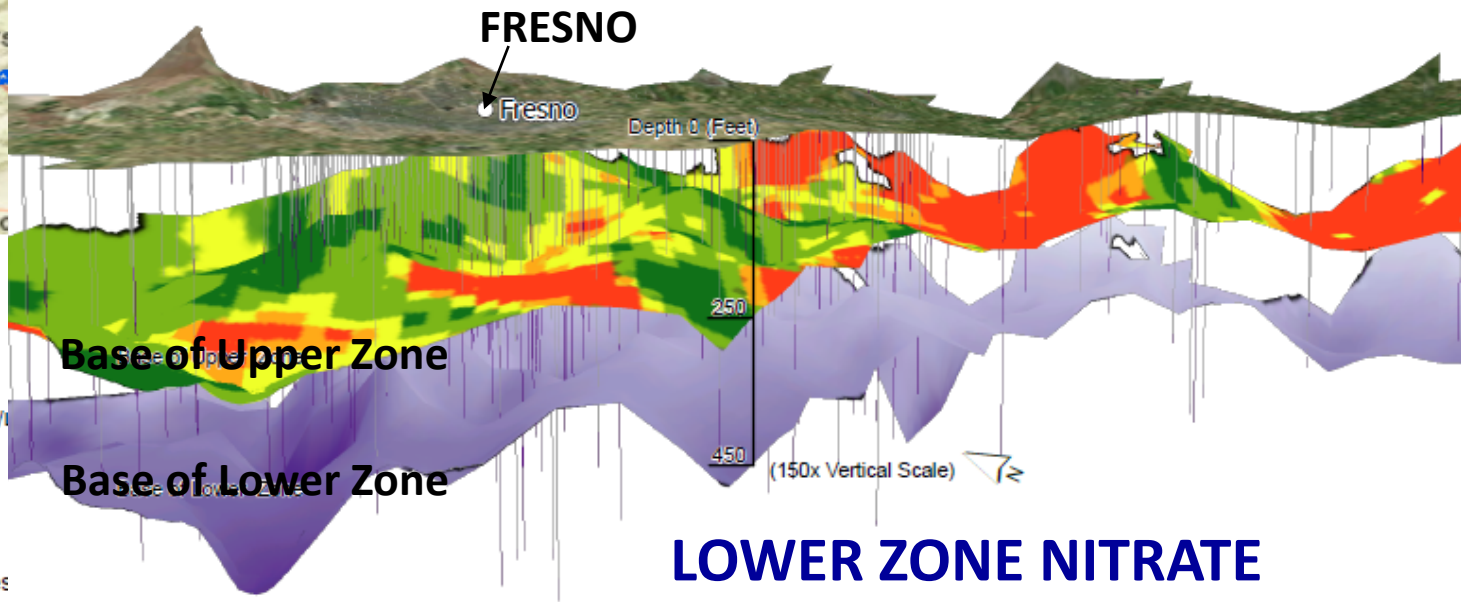
- SWRCB Region 5
- DWR B118 Groundwater Basins




Upper Zone Ambient Nitrate Concentration with Average Domestic Well Depths and Perforations by Section in Fresno Vicinity

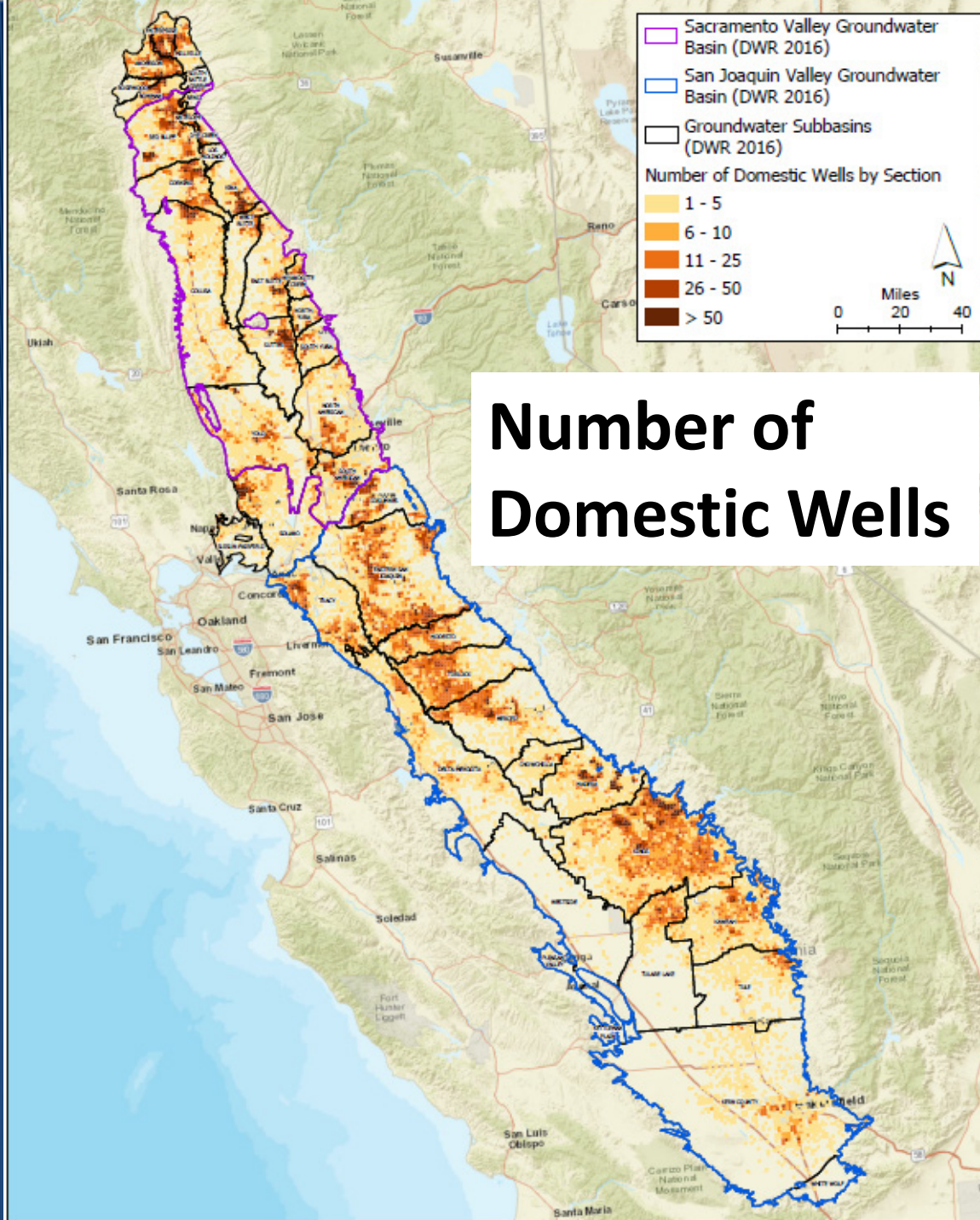


Lower Zone Ambient Nitrate Concentration with Average Municipal Well Depths and Perforations by Section in Fresno Vicinity

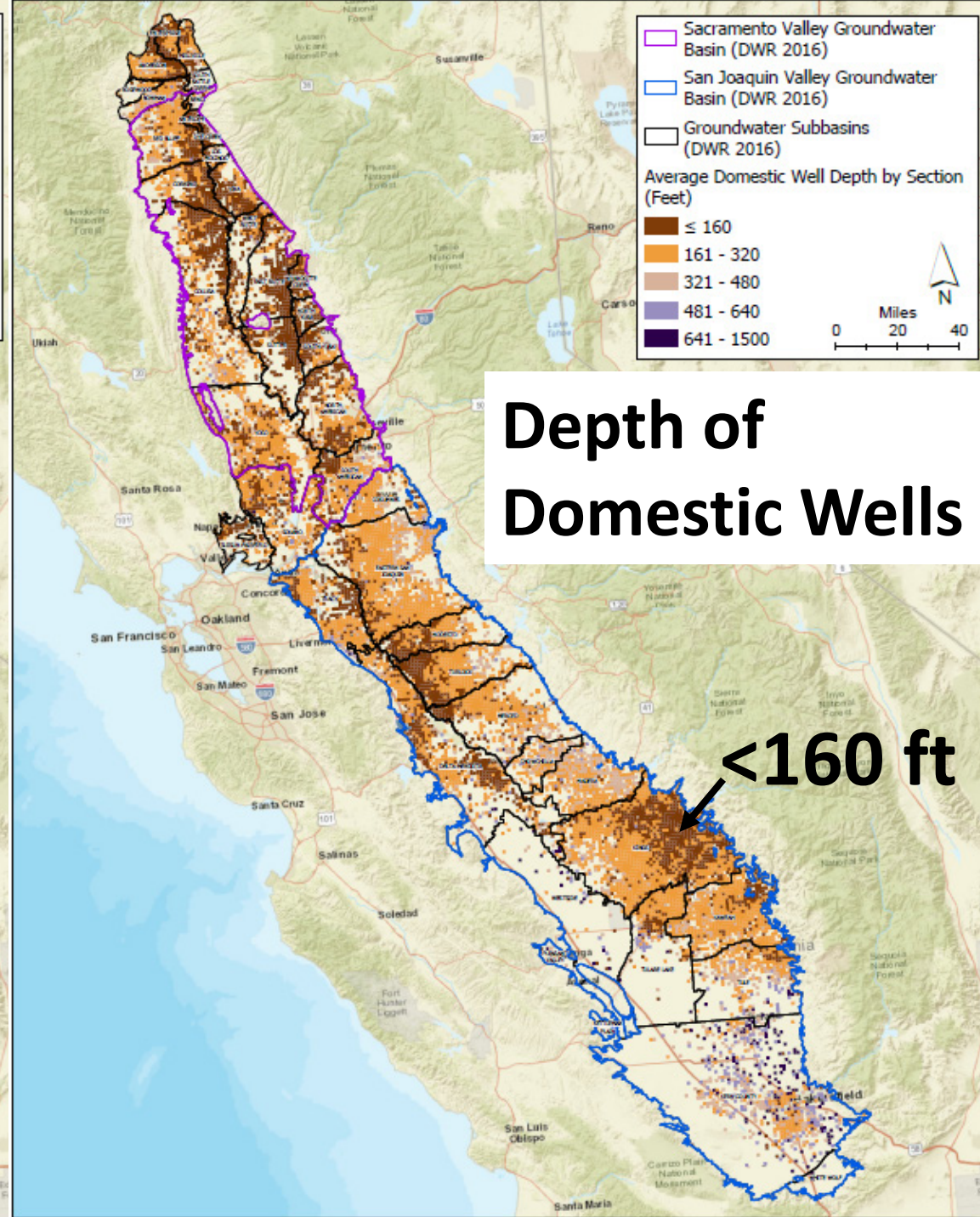




**Domestic Wells Characterization
(Number and Depth)
with Nitrate Conditions:
Central Valley and Local Example**



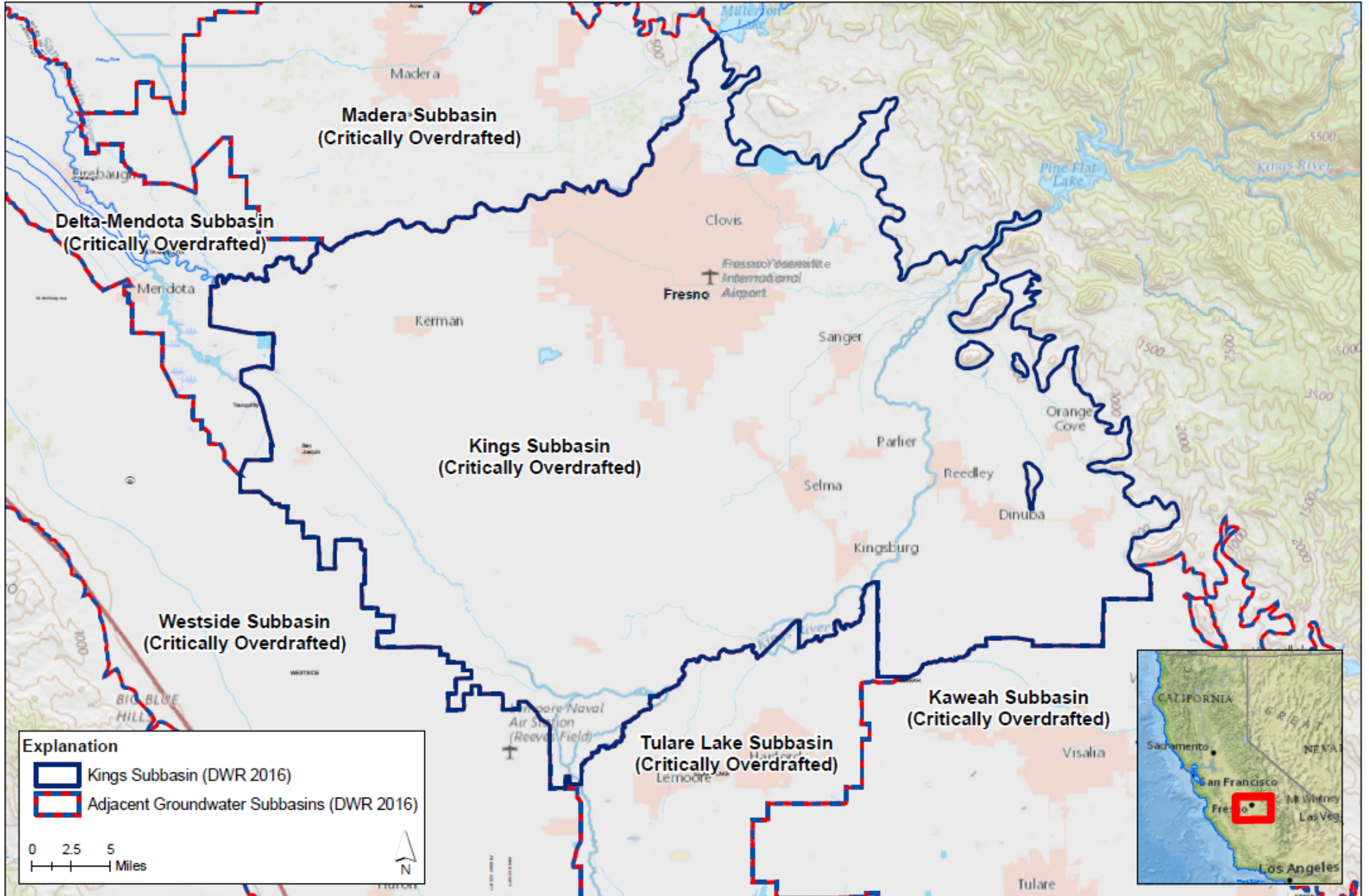
Number of Domestic Wells



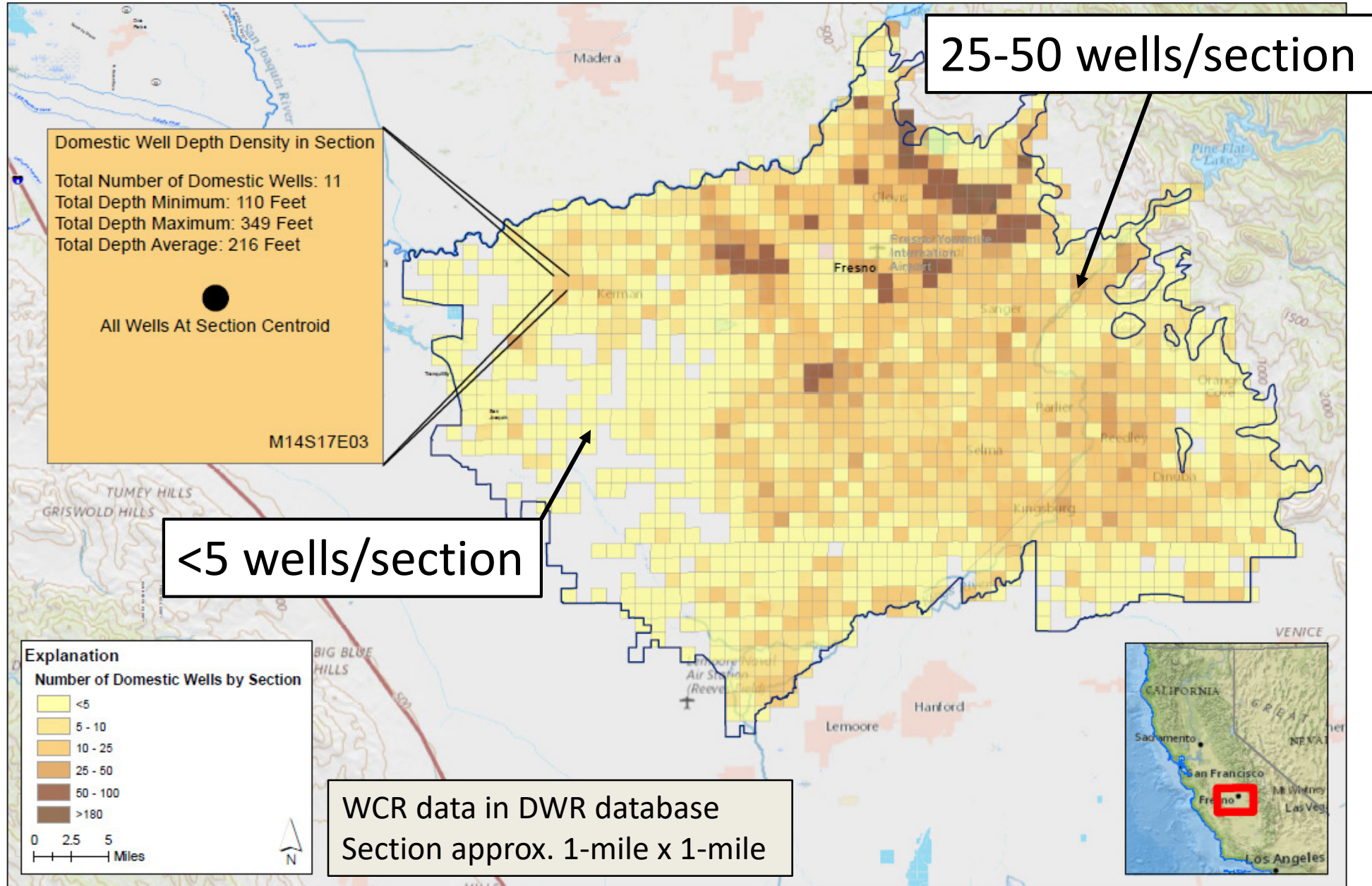
Depth of Domestic Wells

<160 ft

Kings Subbasin and Adjacent Basins

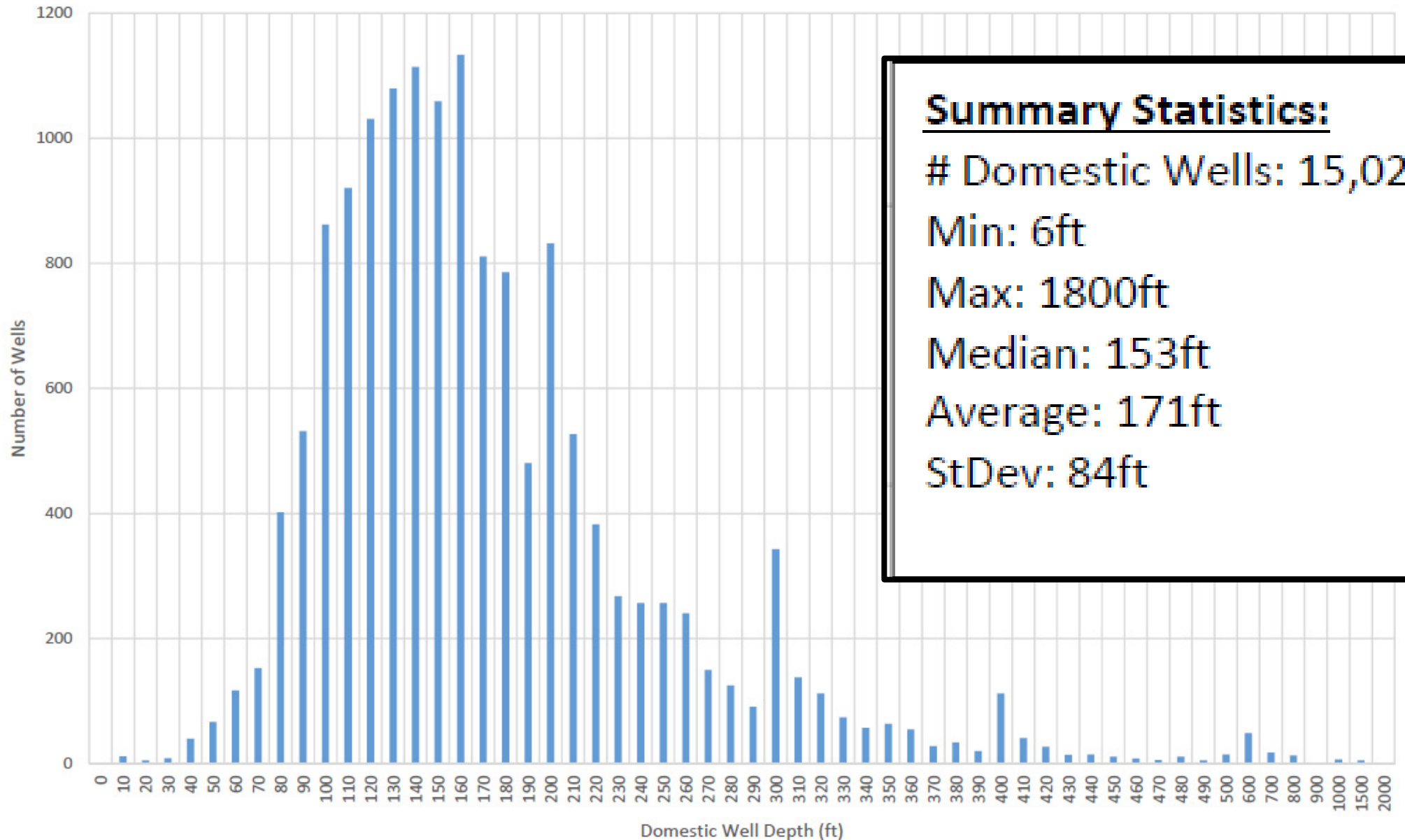


Domestic Well Density by Section

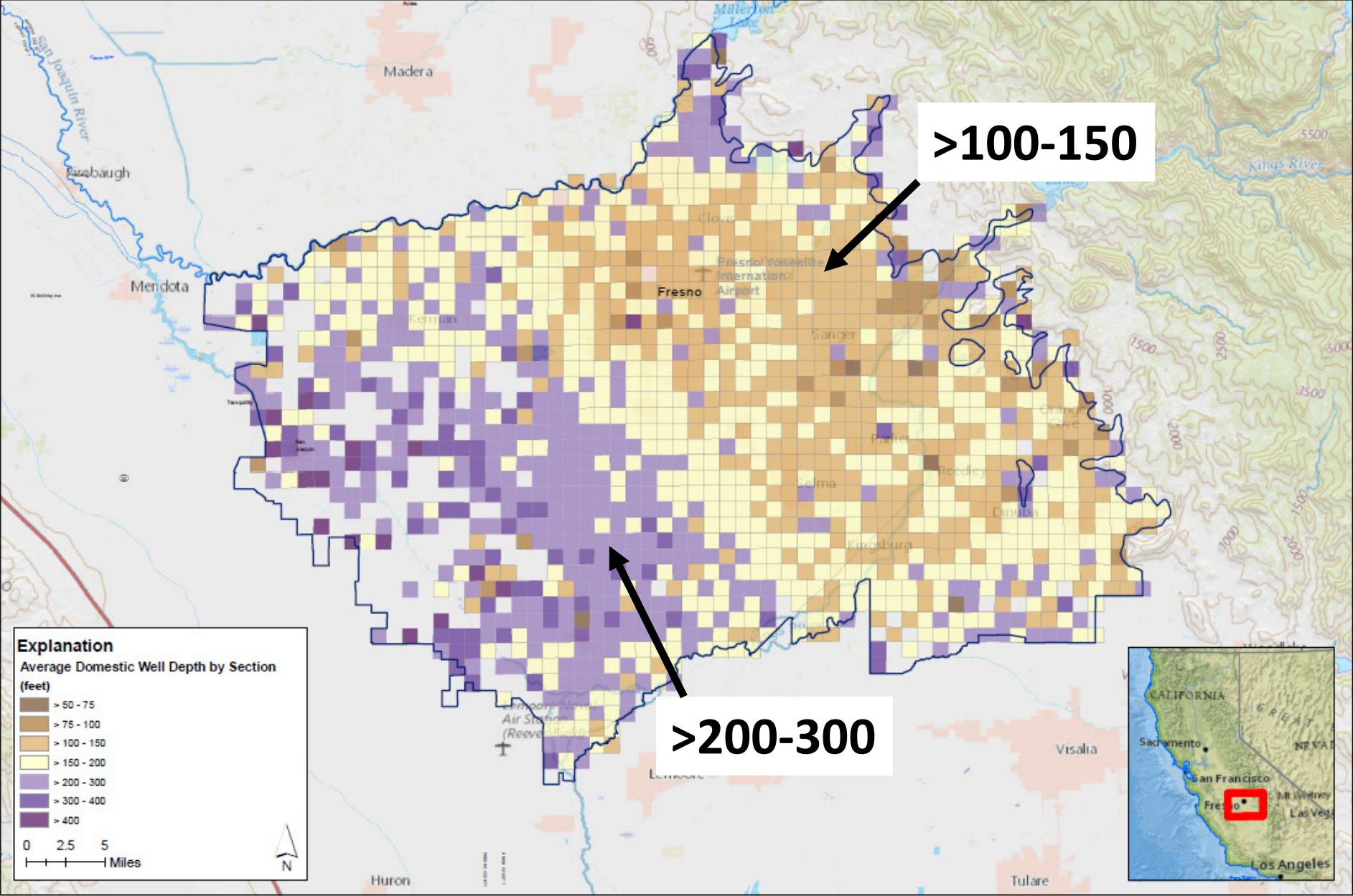


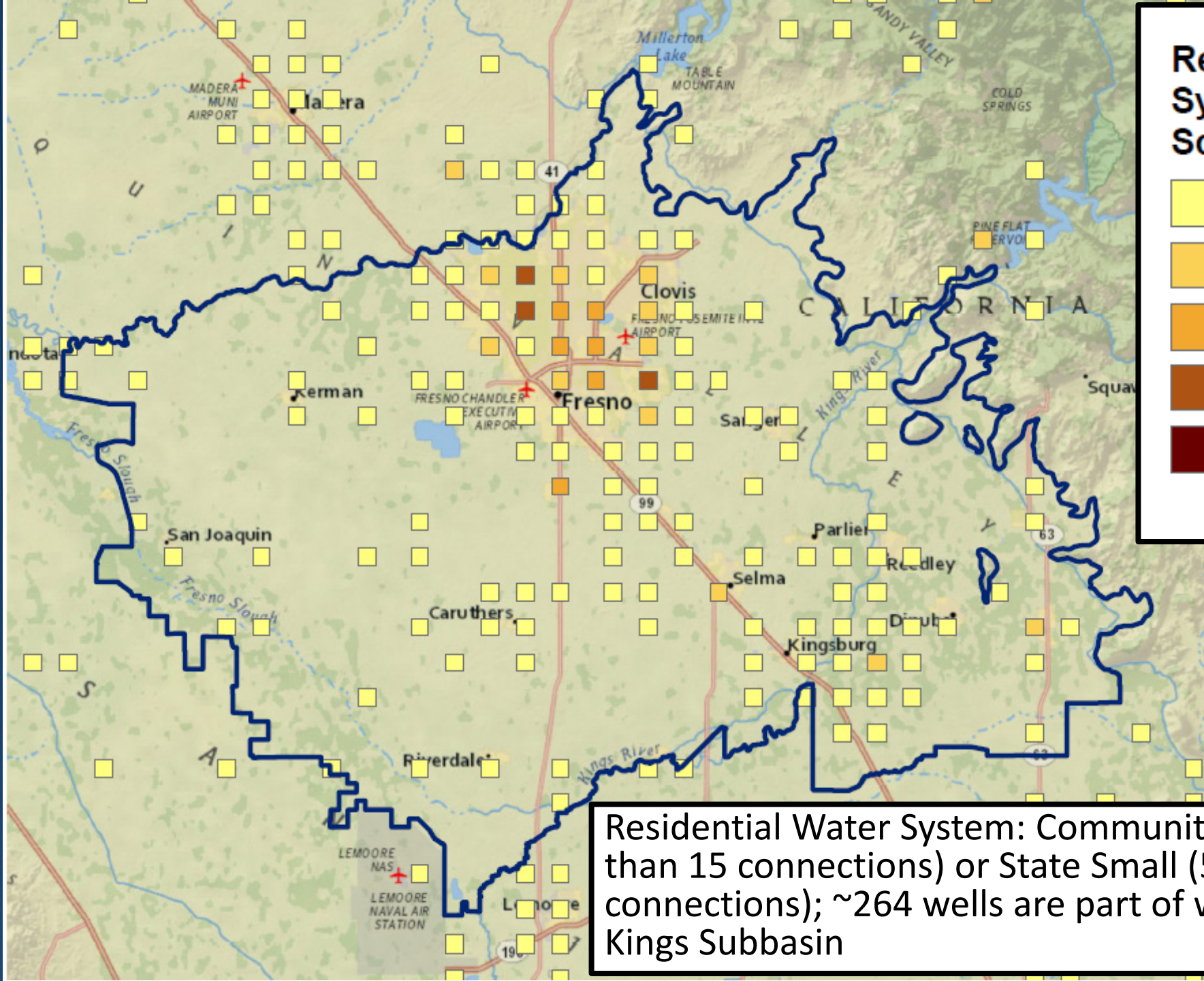
Domestic Well Depths: Kings Subbasin

Domestic Well Depths in T/R-S's in Kings Subbasin

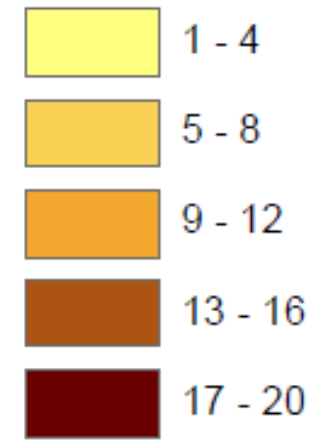


Avg. Domestic Well Depth by Section

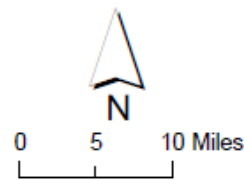
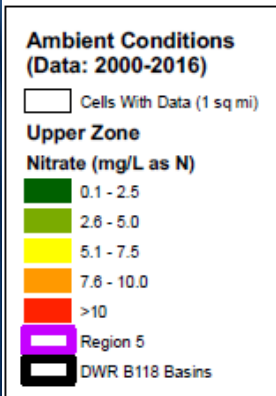
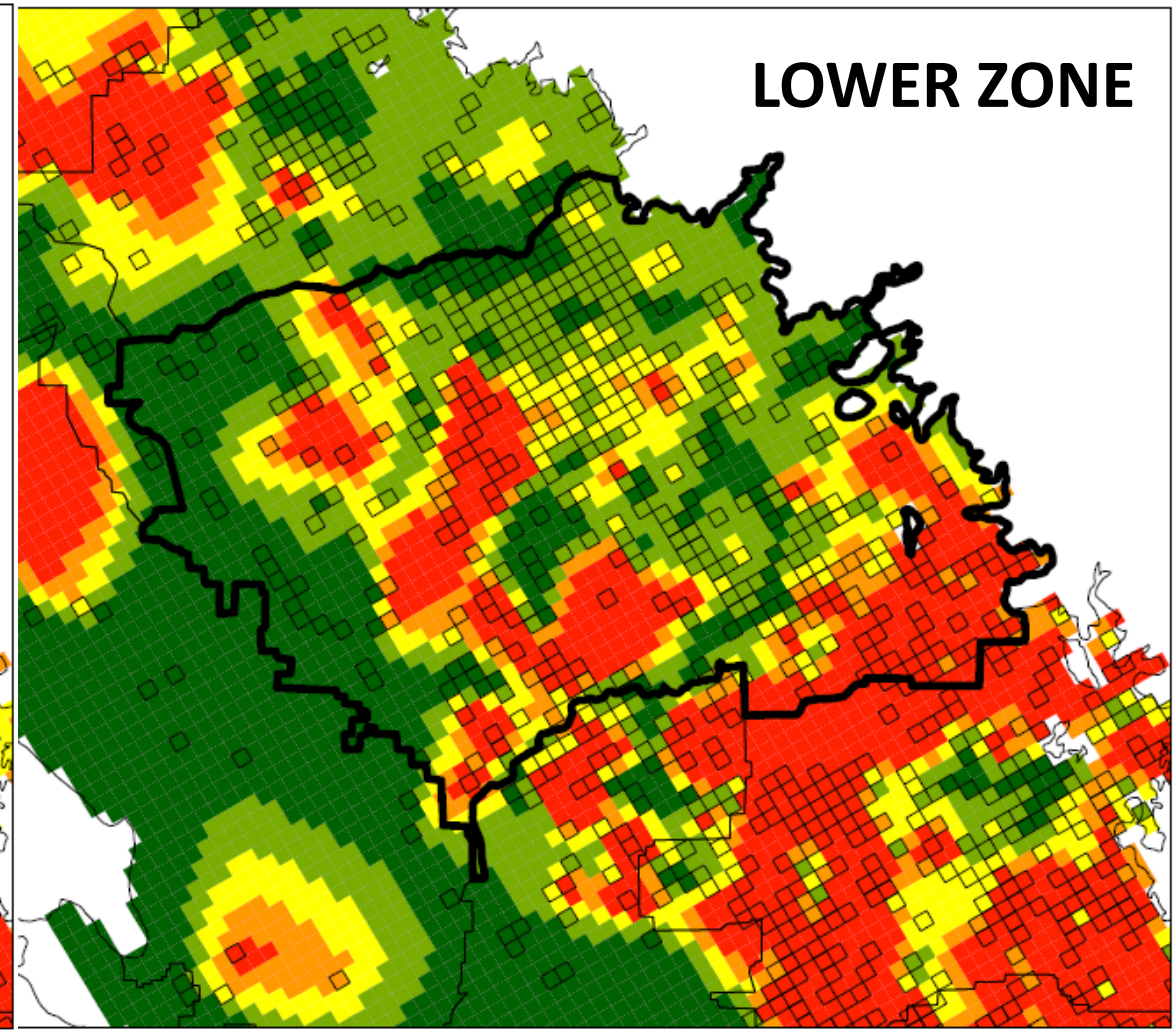
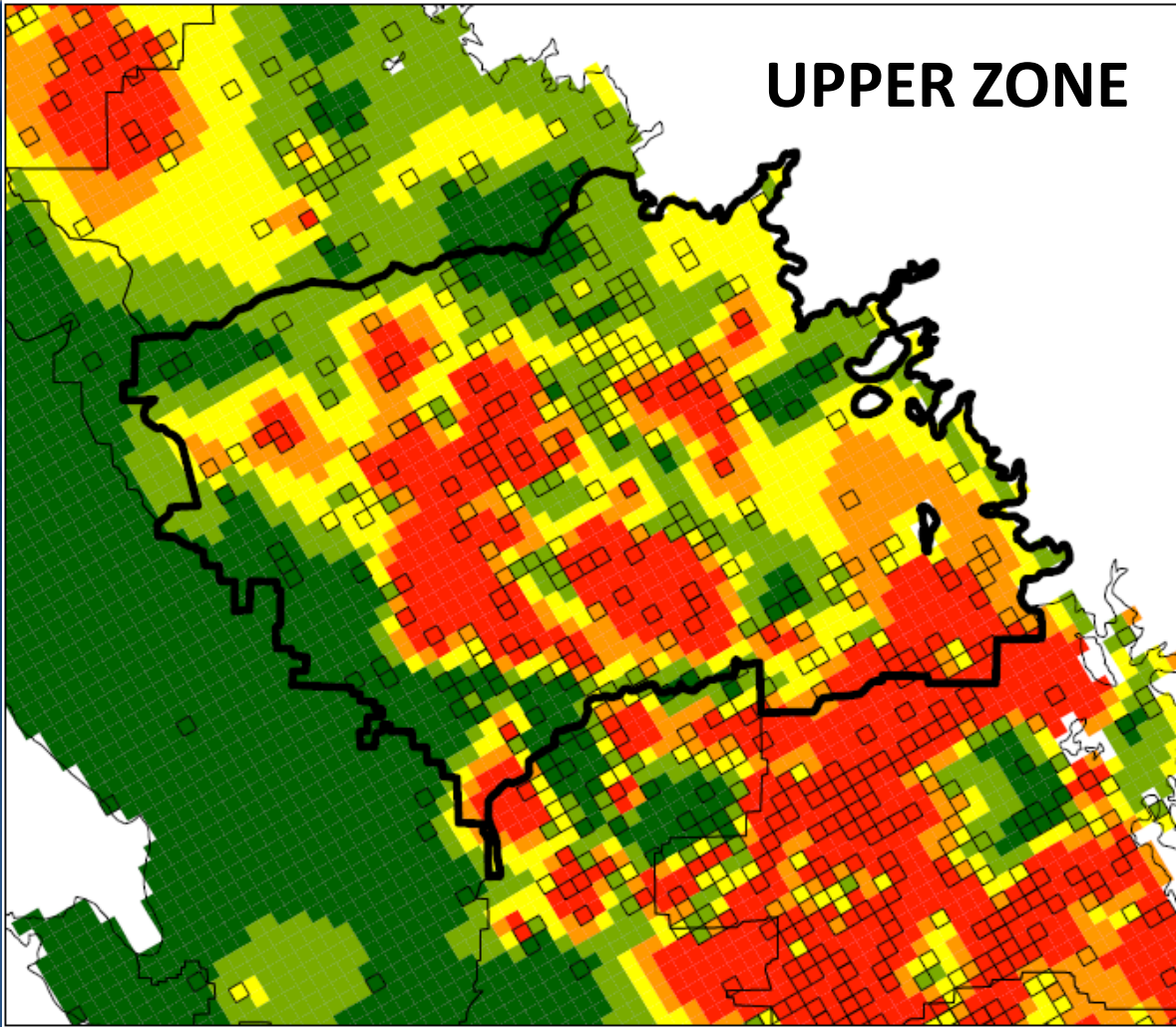




Residential Water System Wells per Square Mile



Residential Water System: Community system (more than 15 connections) or State Small (5-14 connections); ~264 wells are part of water systems in Kings Subbasin



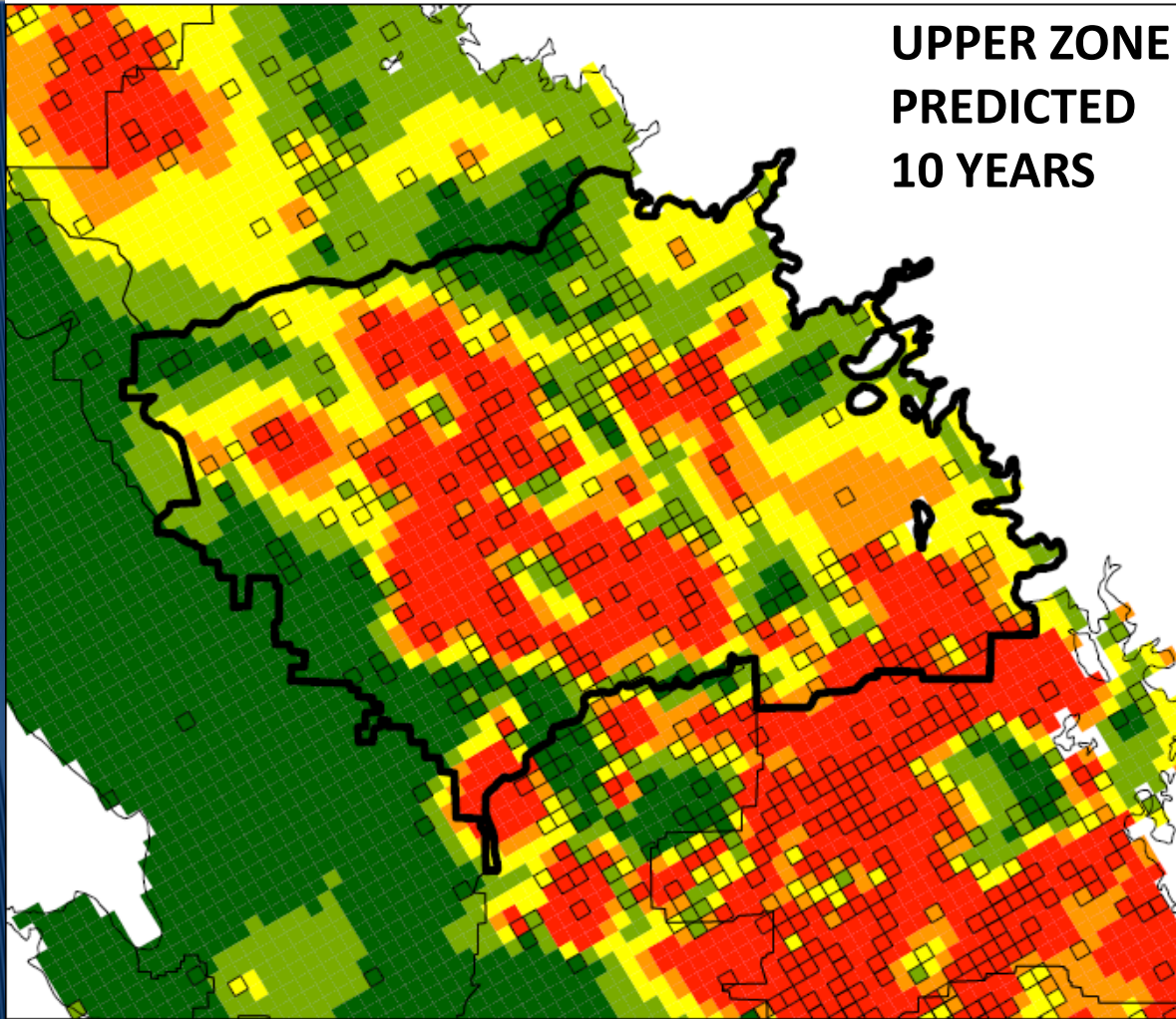
DWR B118 Code:5-22.08

**Groundwater Basin:
SAN JOAQUIN VALLEY
Groundwater Subbasin:
KINGS**

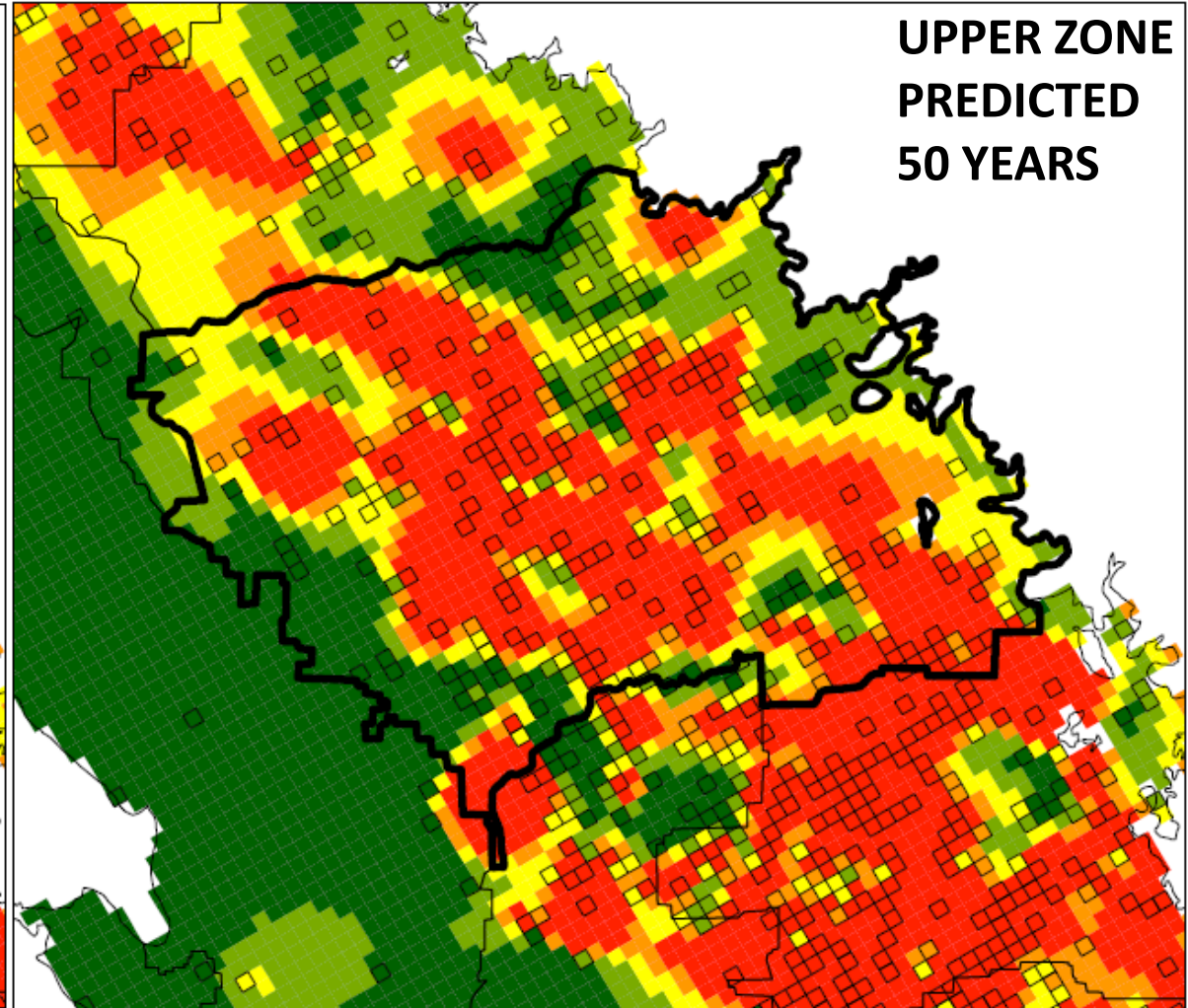


Ambient Nitrate-N Conditions; Data 2000-2016

□ Cells with Data (1 sq. mile)



**UPPER ZONE
PREDICTED
10 YEARS**



**UPPER ZONE
PREDICTED
50 YEARS**

**Predicted Conditions
(Data: 2000-2016)**

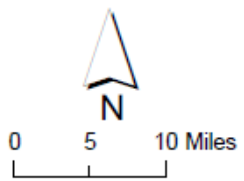
□ Cells With Data (1 sq mi)

**Upper Zone (10 years)
Nitrate (mg/L as N)**

- 0.1 - 2.5
- 2.6 - 5.0
- 5.1 - 7.5
- 7.6 - 10.0
- >10

Region 5

DWR B118 Basins



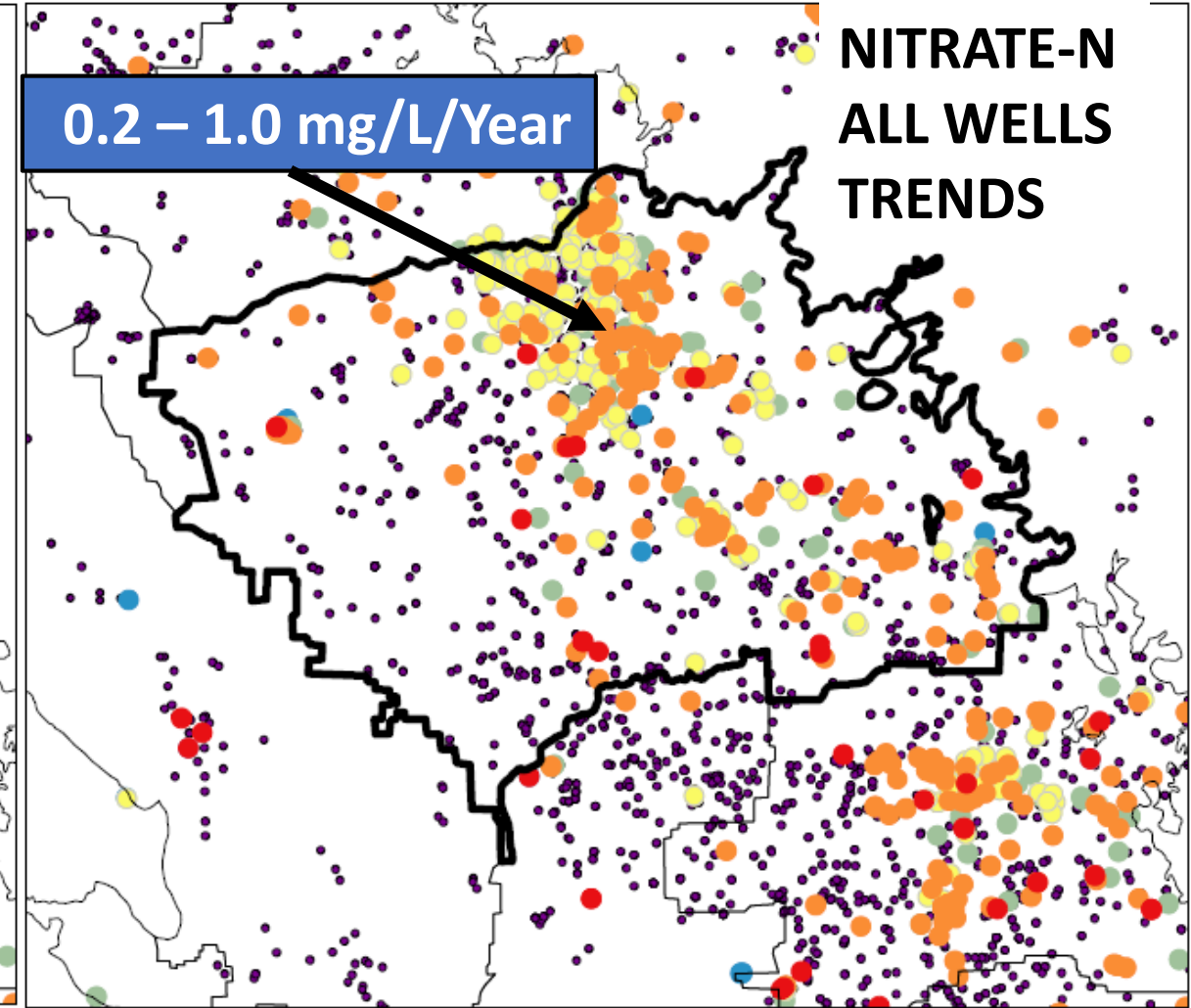
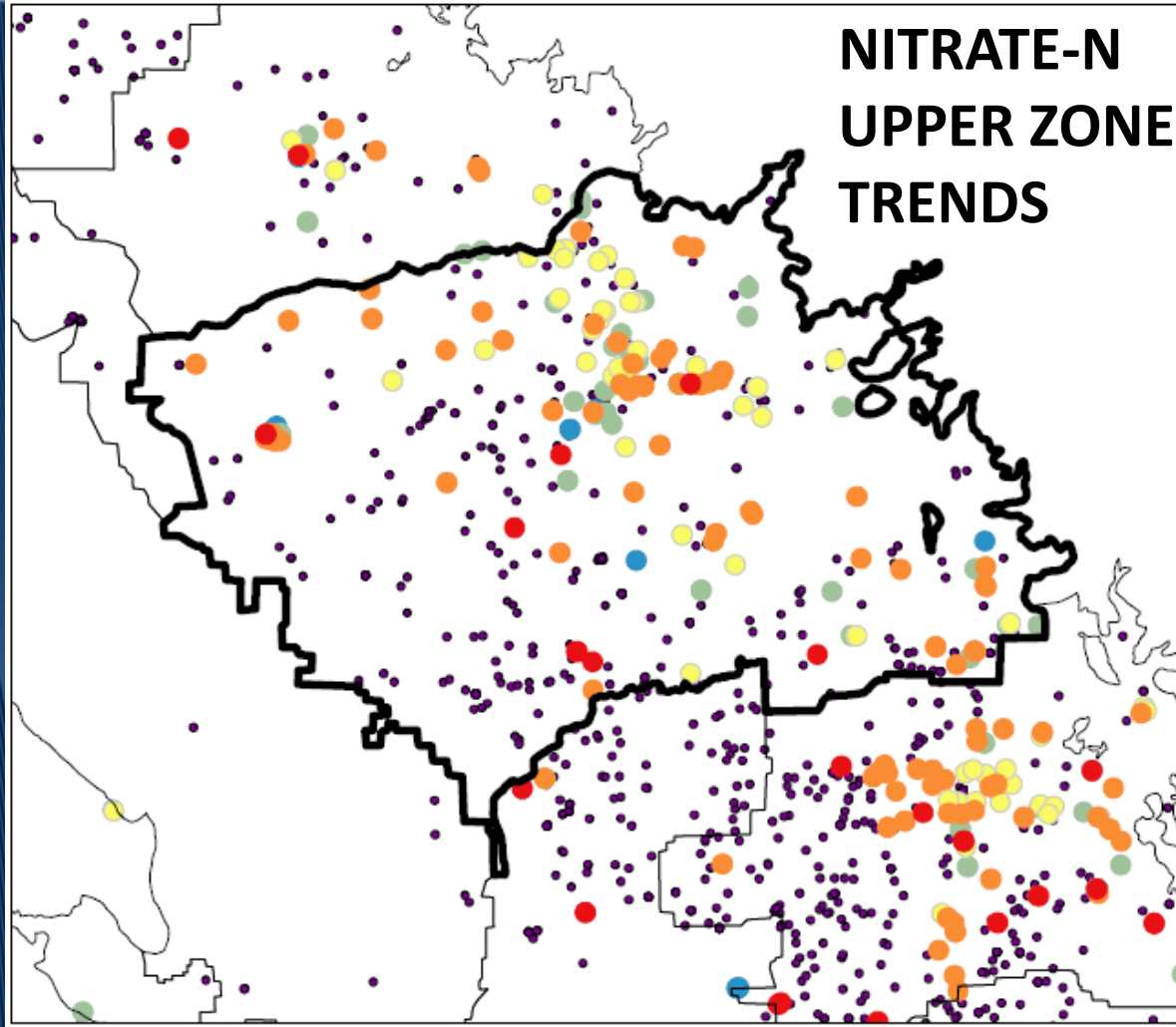
DWR B118 Code:5-22.08

**Groundwater Basin:
SAN JOAQUIN VALLEY
Groundwater Subbasin:
KINGS**



**Predicted Nitrate-N Conditions
(10 yrs & 50 yrs; Based on
Actual Historical Observations**

□ Cells with Data (1 sq. mile)

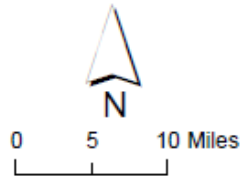


**Groundwater Quality Trends
(Data: 2000-2016)**

Upper Zone
NO₃-N mg/L per year

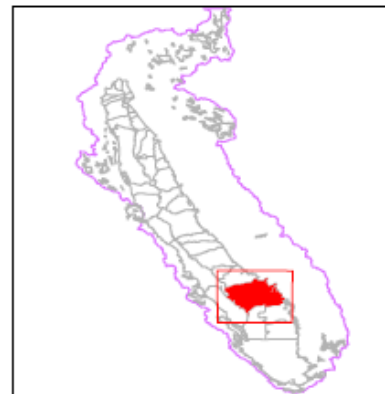
- < -1.0
- -0.9 - -0.1
- 0.0 - 0.1
- 0.2 - 1.0
- > 1.0
- No Trend or Insufficient Data

Region 5
 DWR B118 Basins



DWR B118 Code:5-22.08

**Groundwater Basin:
SAN JOAQUIN VALLEY
Groundwater Subbasin:
KINGS**

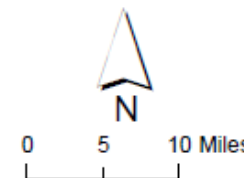


**Groundwater Quality Trends
(Data: 2000-2016)**

All Wells
NO₃-N mg/L per year

- < -1.0
- -0.9 - -0.1
- 0.0 - 0.1
- 0.2 - 1.0
- > 1.0
- No Trend or Insufficient Data

Region 5
 DWR B118 Basins

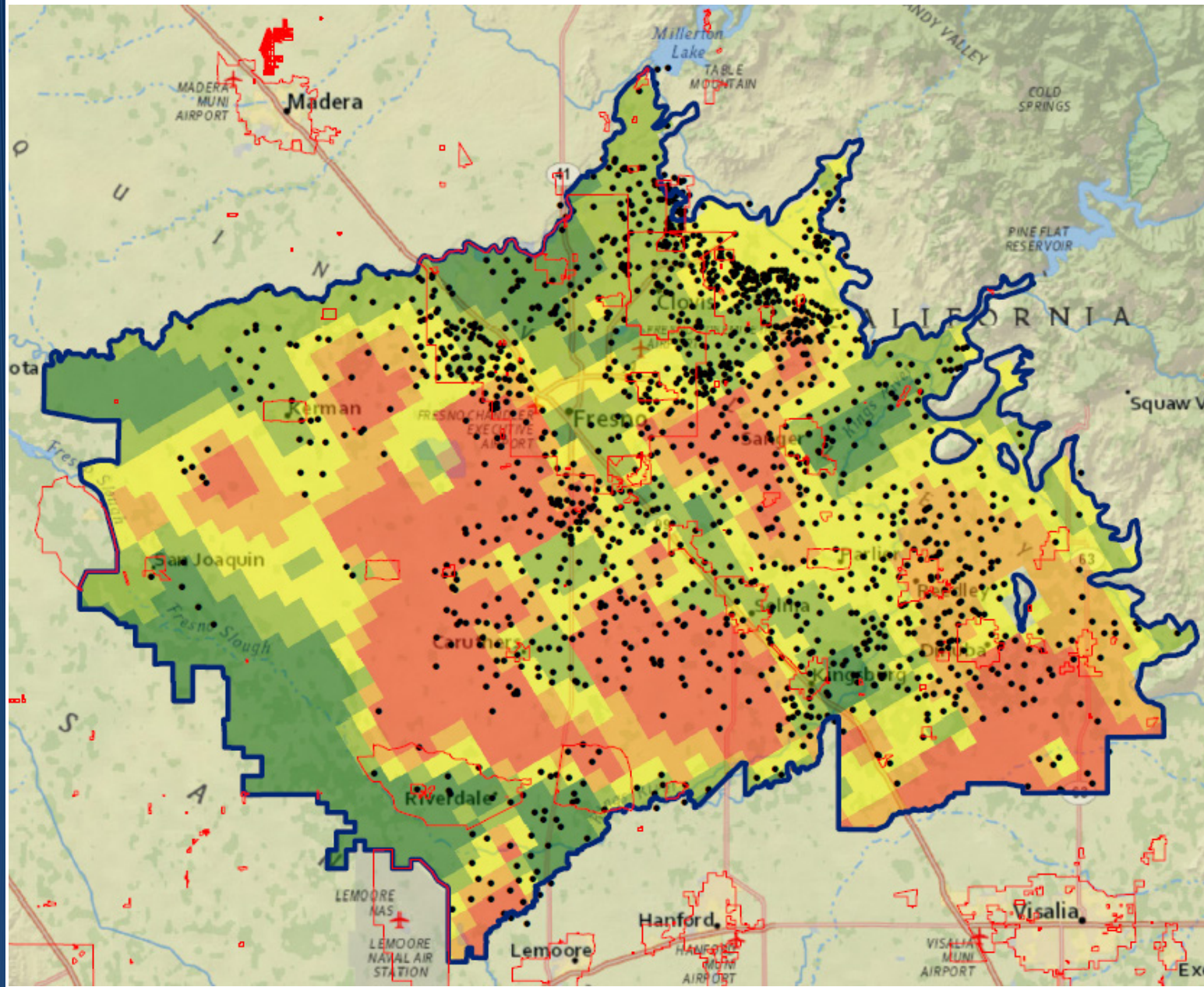


DWR B118 Code:5-22.08

**Groundwater Basin:
SAN JOAQUIN VALLEY
Groundwater Subbasin:
KINGS**



Upper Zone Ambient Nitrate-N and Domestic Well Density



Number of Domestic Wells by Section

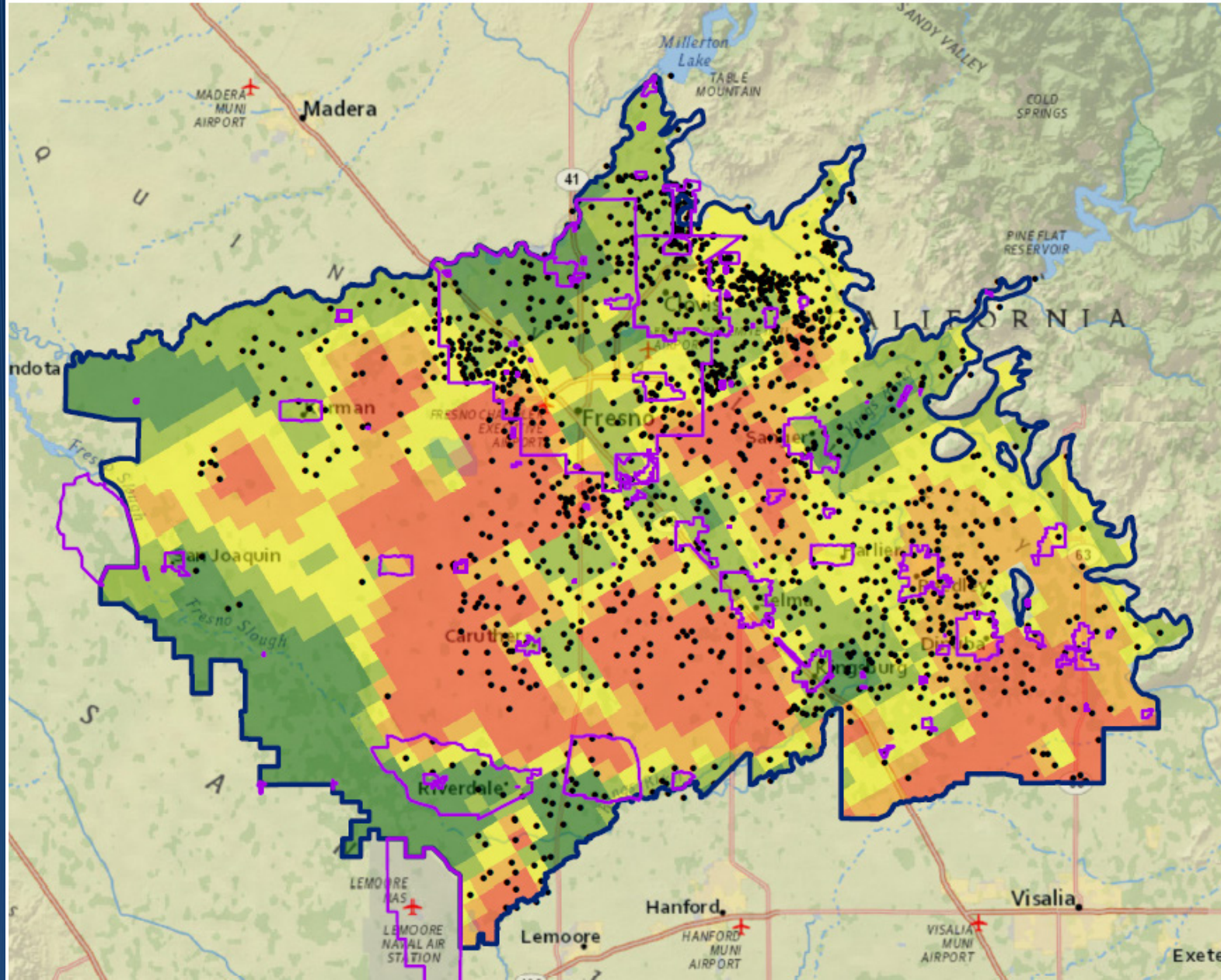
- 1 Dot = 10 wells
- Domestic well

Ambient Nitrate Concentrations*

- 0.1 - 2.5
- 2.6 - 5.0
- 5.1 - 7.5
- 7.6 - 10.0
- 10.1 - 152.1

*Upper Zone

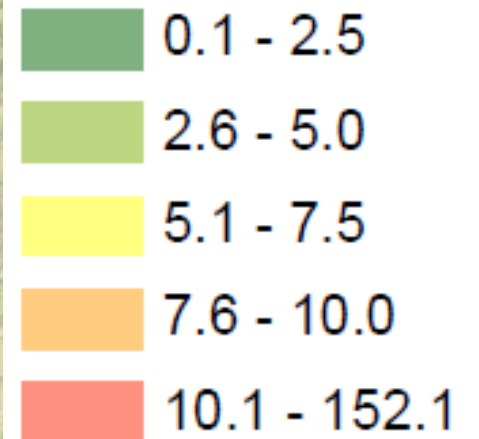
Upper Zone Ambient Nitrate-N with Residential Water System Boundaries and Domestic Wells



Number of Domestic Wells by Section

- 1 Dot = 10 wells
- Domestic well

Ambient Nitrate Concentrations*



Residential Water System Boundaries



*Upper Zone

Conclusions

- Mapping of existing groundwater quality conditions (nitrate and TDS) for Region 5 including Central Valley Floor
- Coordinate use of existing information with datasets previously developed by others (other talks today)
- Identify needs for more comprehensive statewide database of water systems
- Explore additional details at local level for needs assessment



THANK YOU