# Updated Groundwater Flow Model Results

January 16, 2019

**Prepared for:**
**Tule Subbasin MOU Group**

Thomas Harder & Co.
Groundwater Consulting

# Presentation Overview

- Summary of Model Updates
- Model Calibration
- Model Results
  - Projections of Groundwater Levels by GSA
  - Projections of Land Subsidence
  - Subsidence Sensitivity by GSA
- Next Steps

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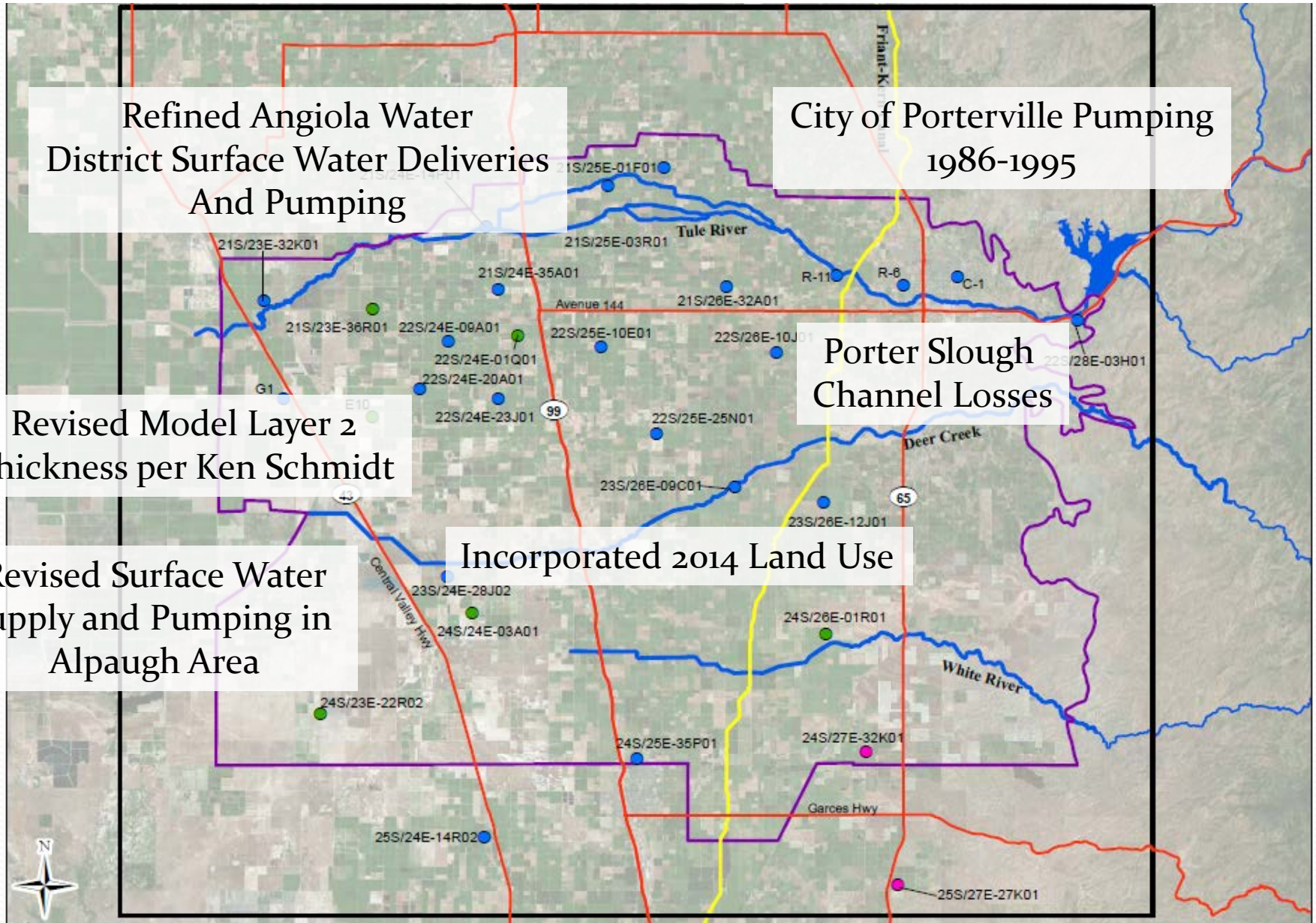
# Model Updates



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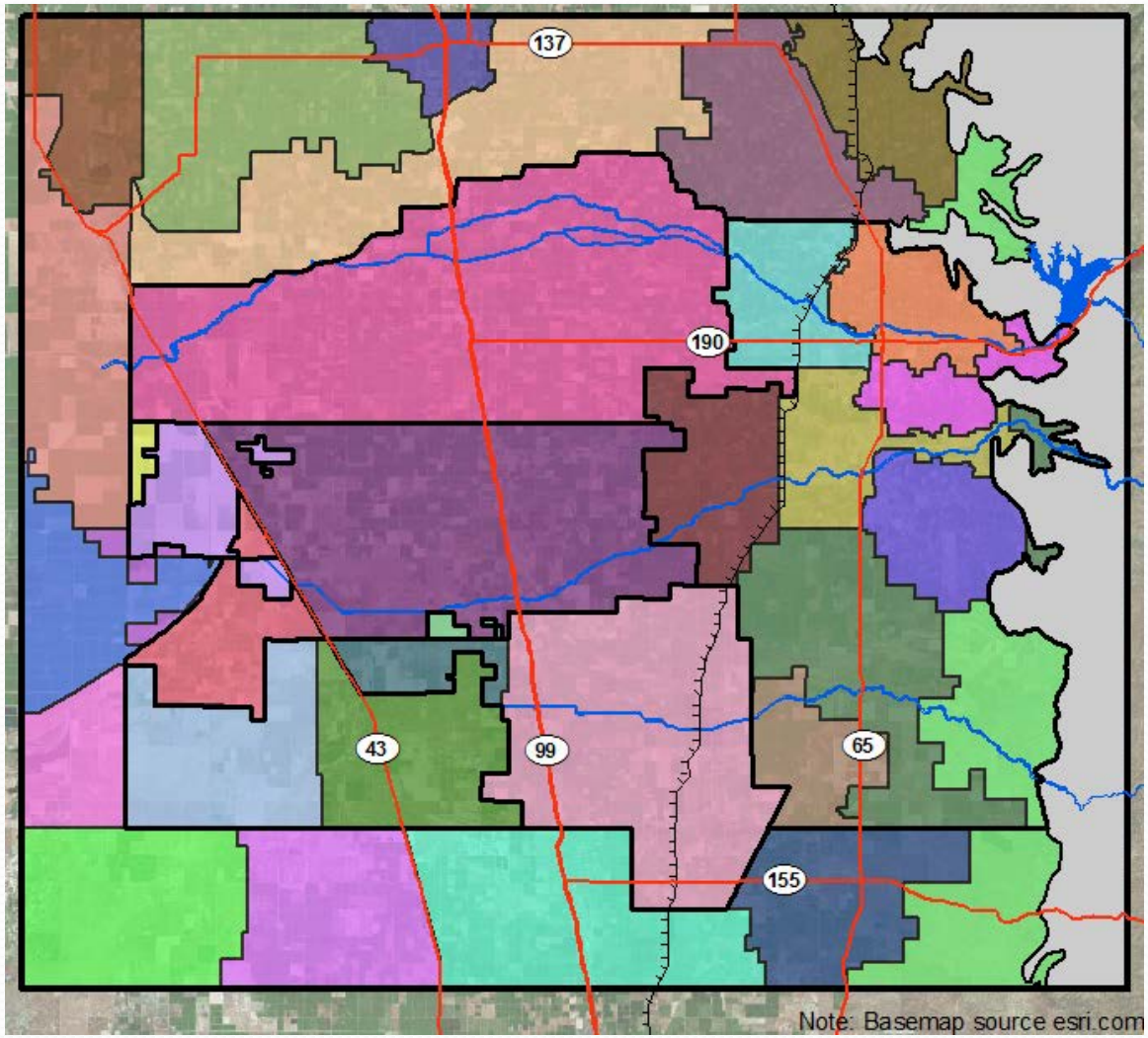
# Water Budget Areas

Areas of similar land use and water source



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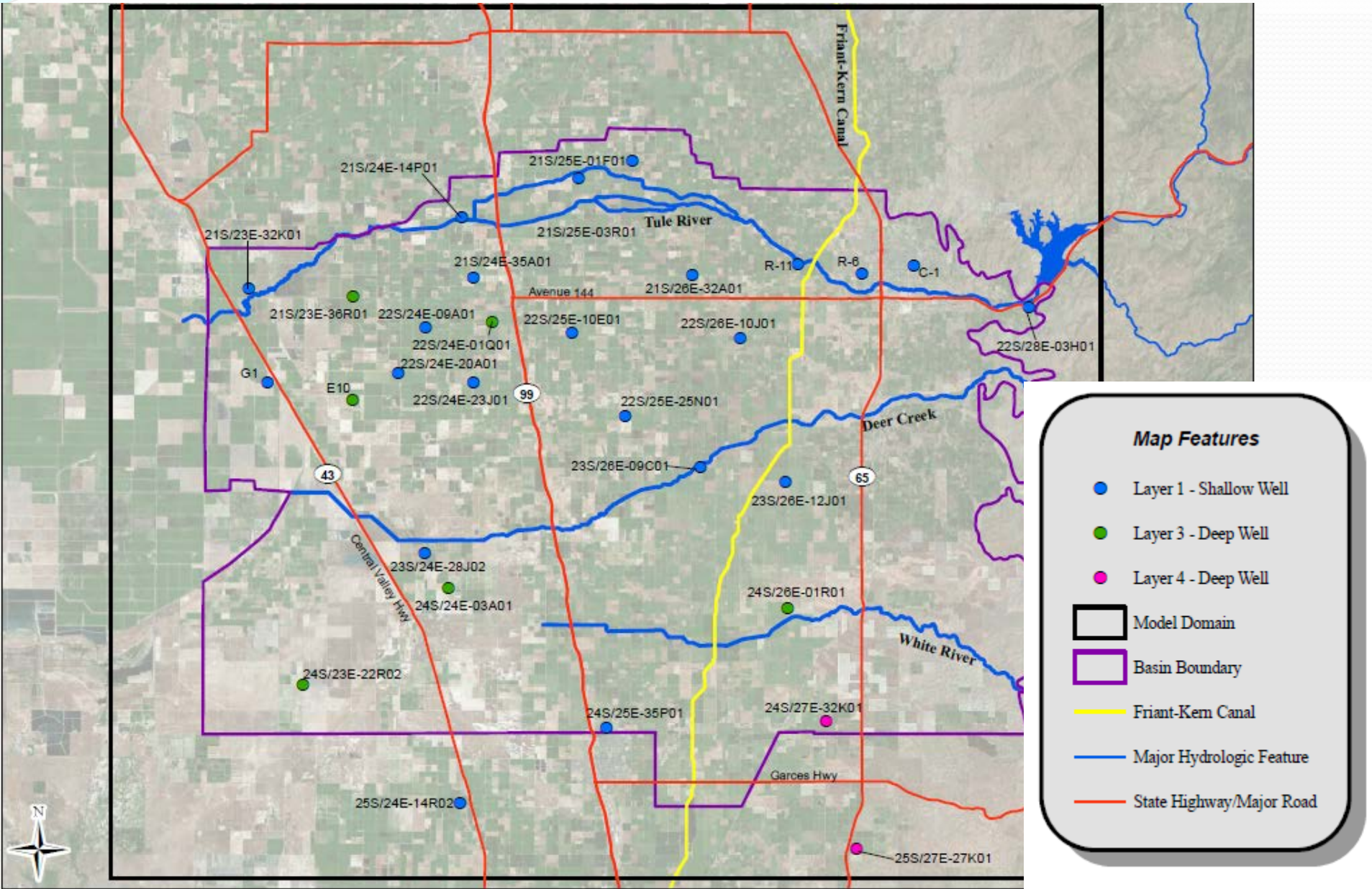
# Model Calibration – Groundwater Levels



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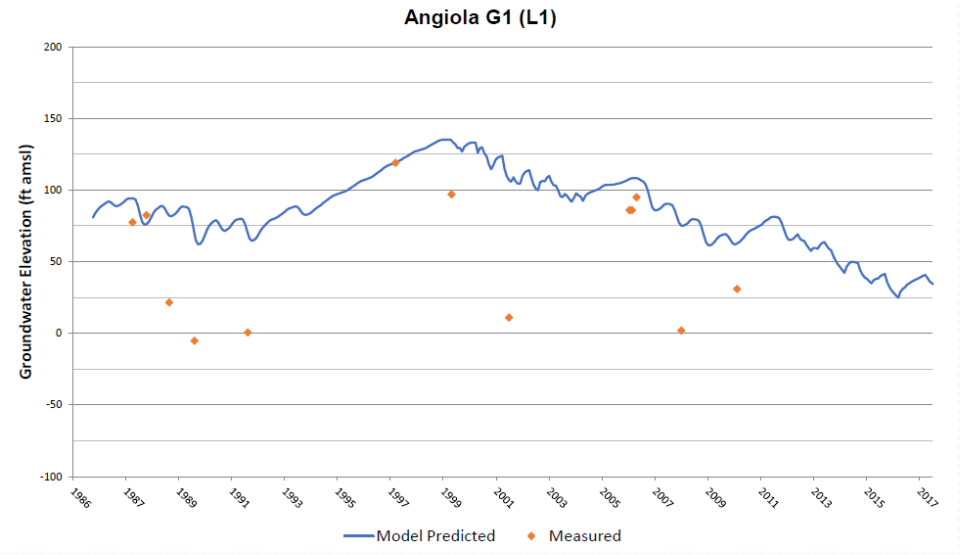


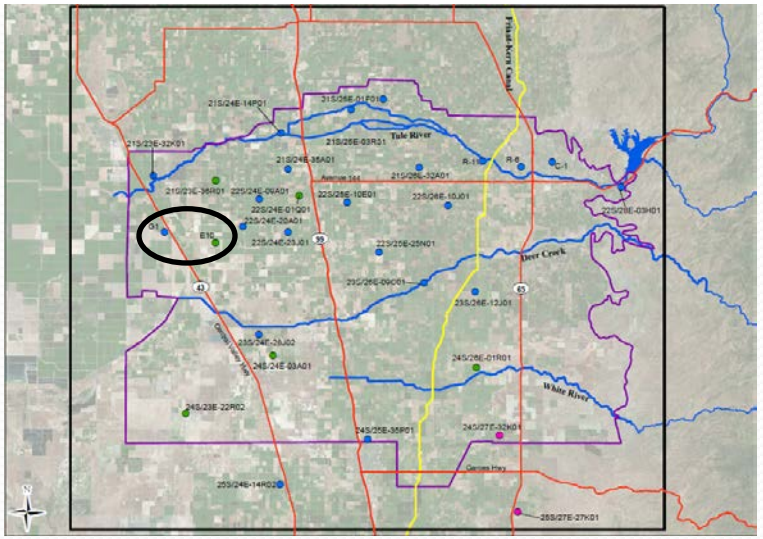


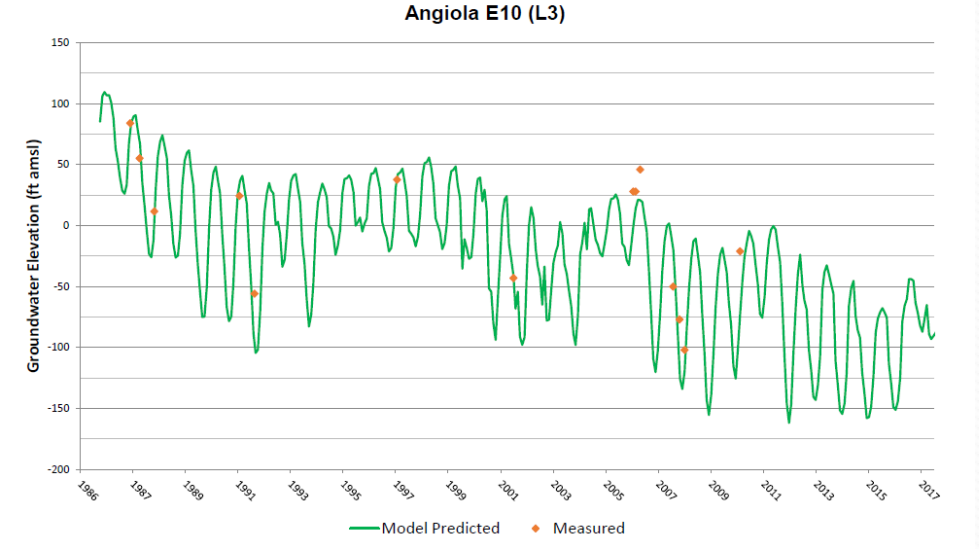


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# Model Calibration – Groundwater Levels

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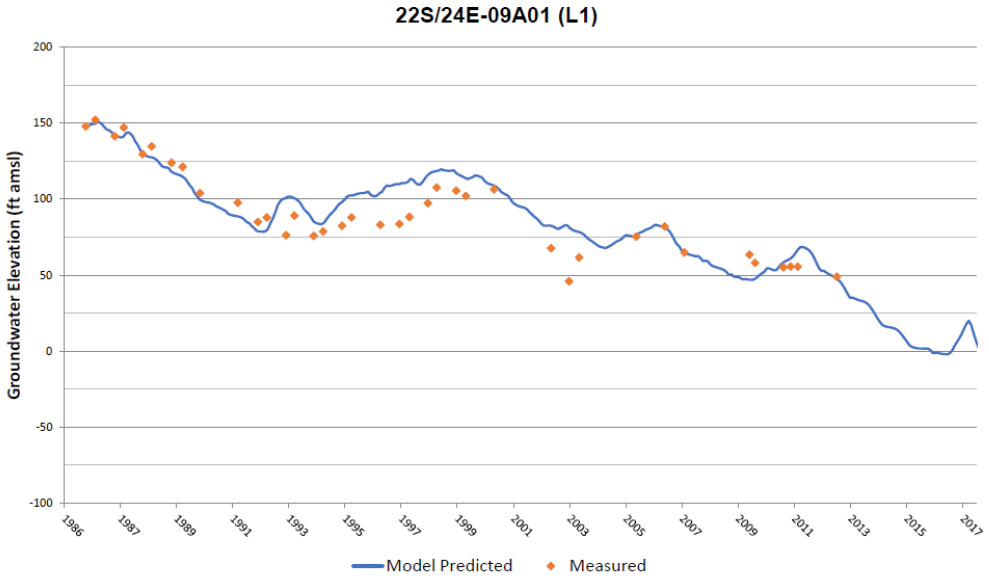


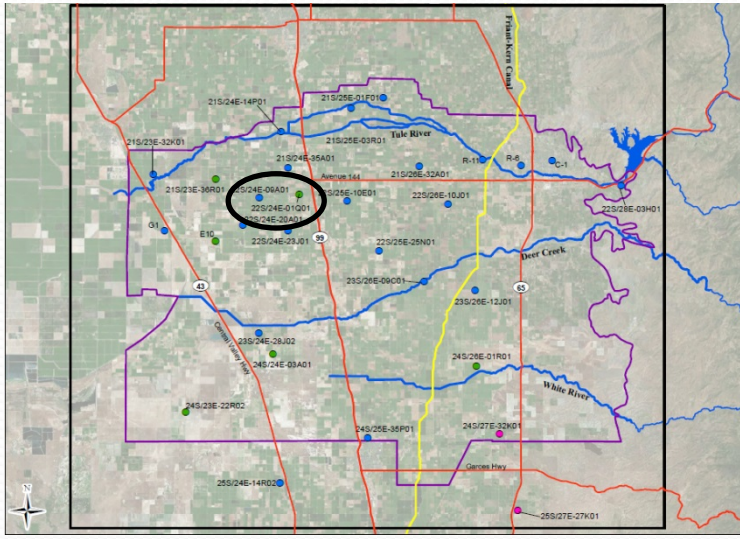


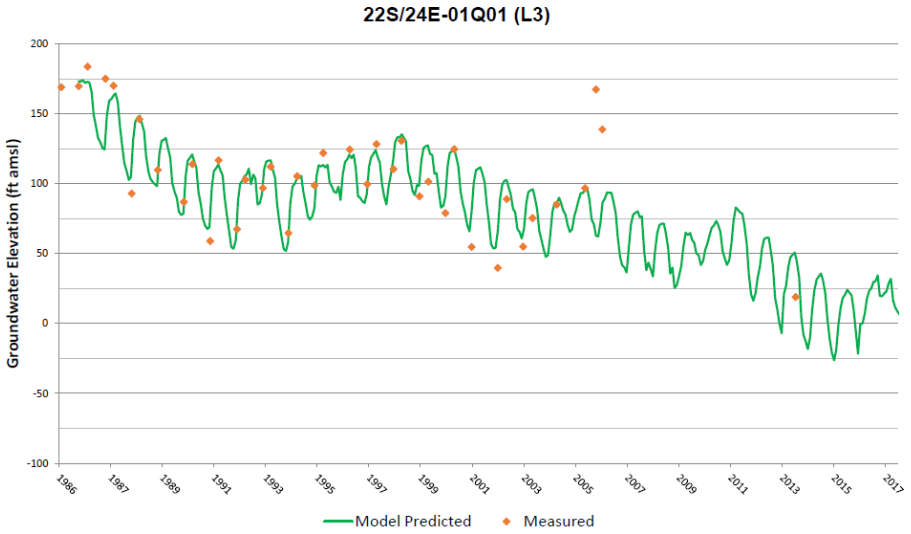


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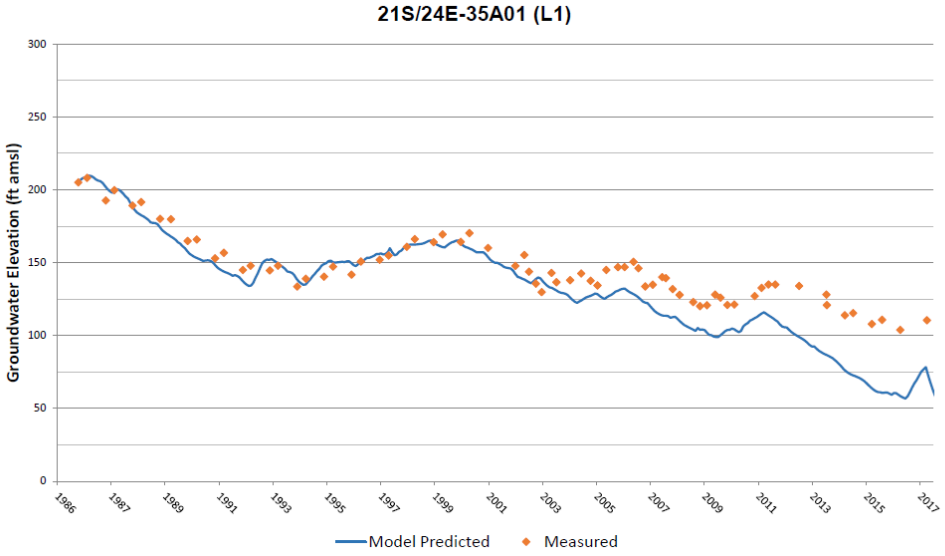


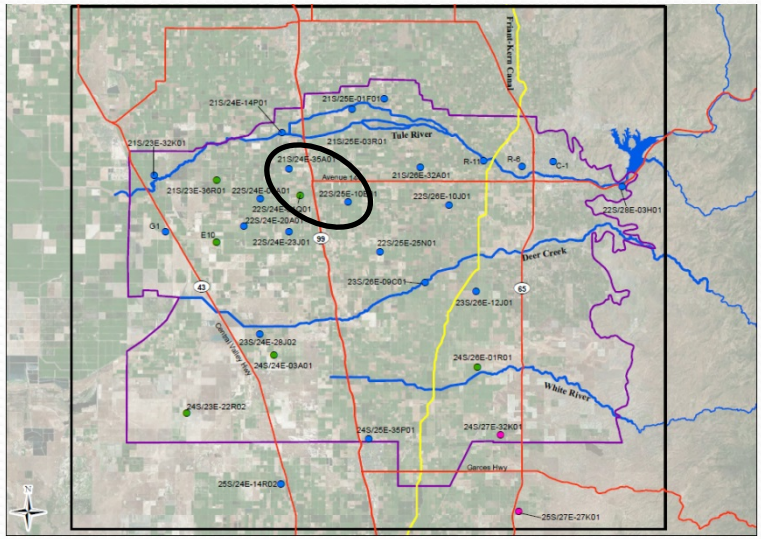


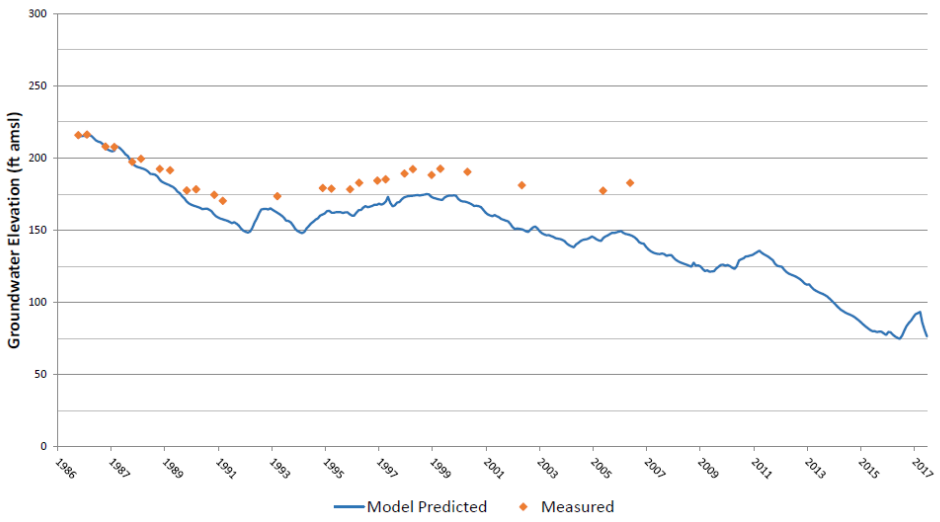


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# Model Calibration – Groundwater Levels

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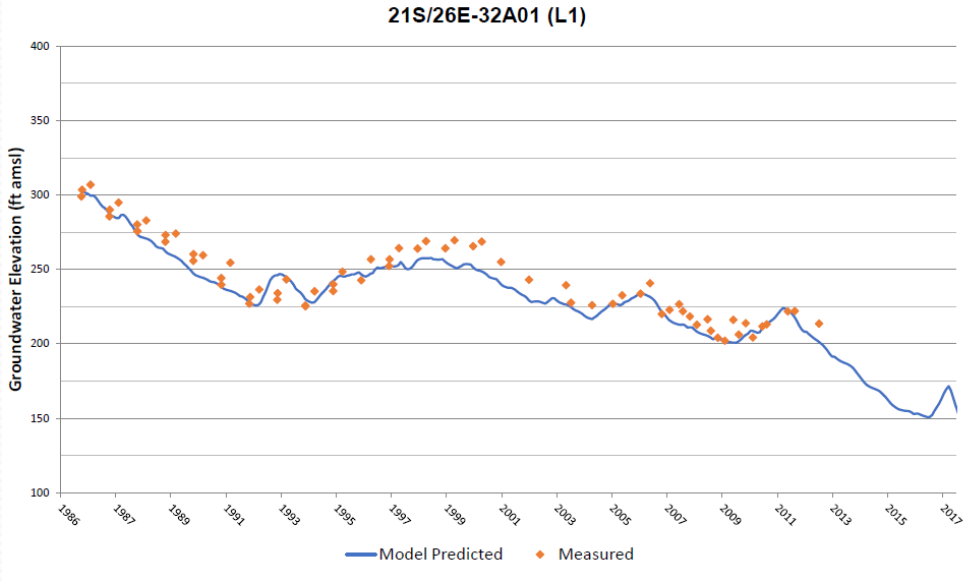


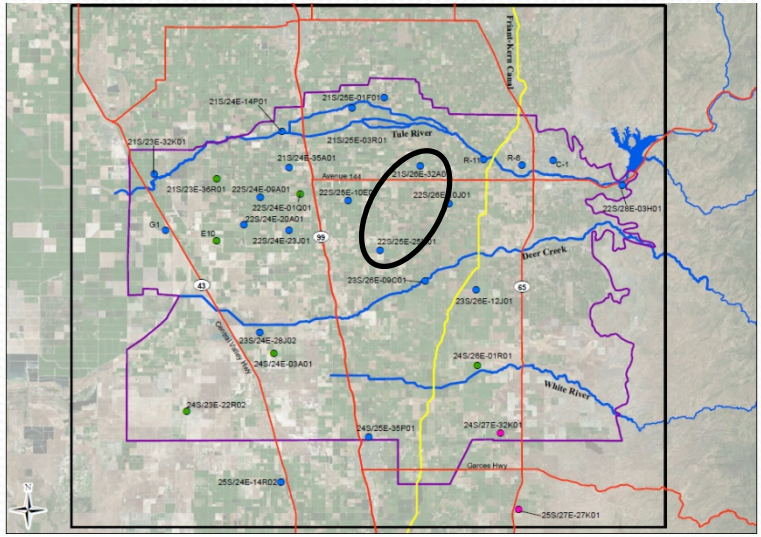


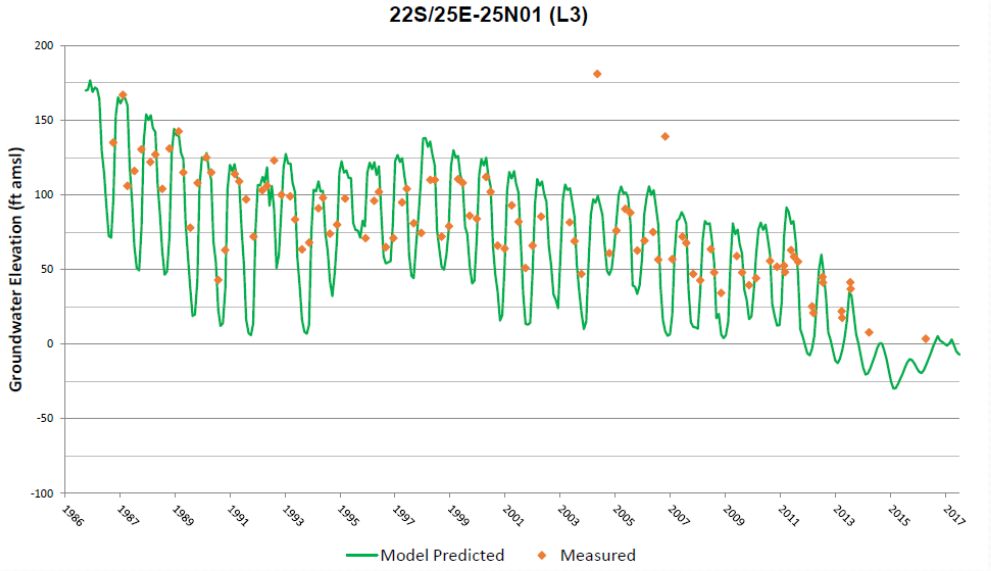


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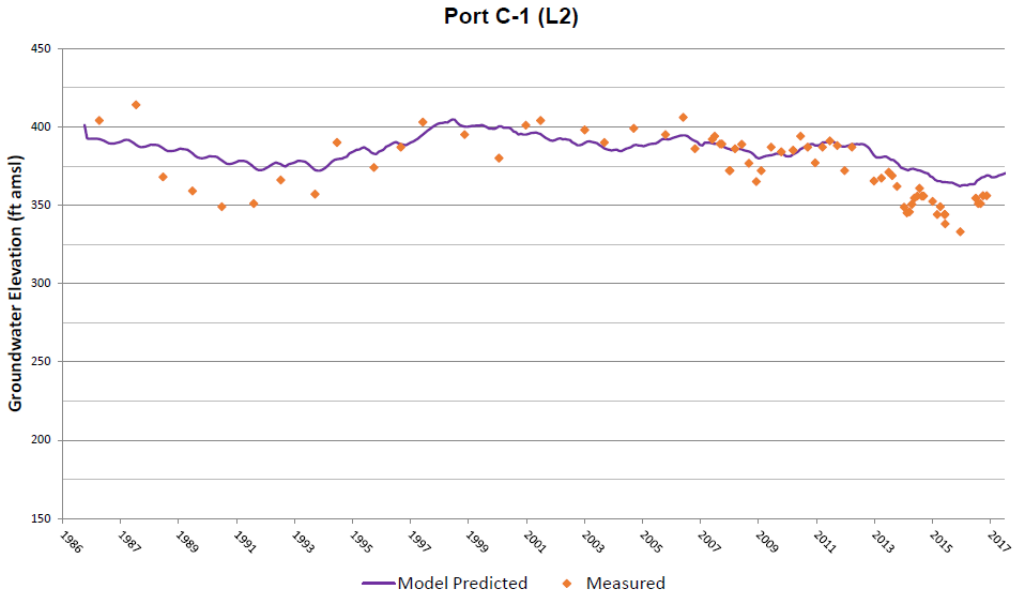


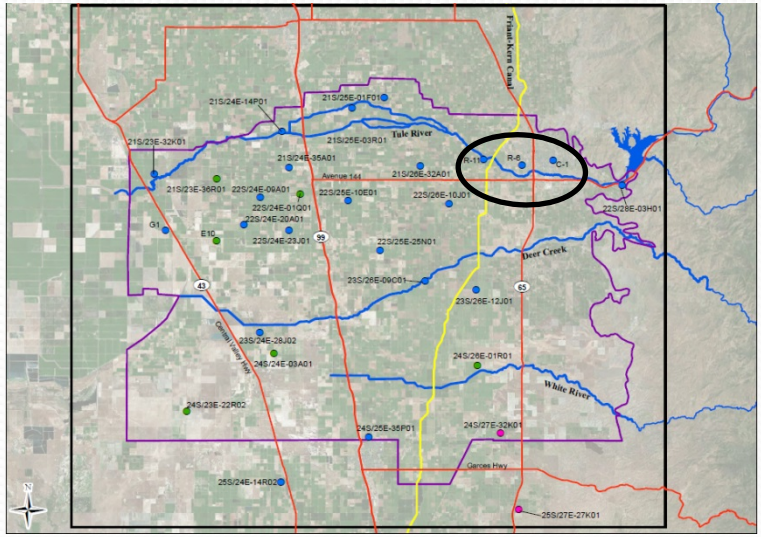


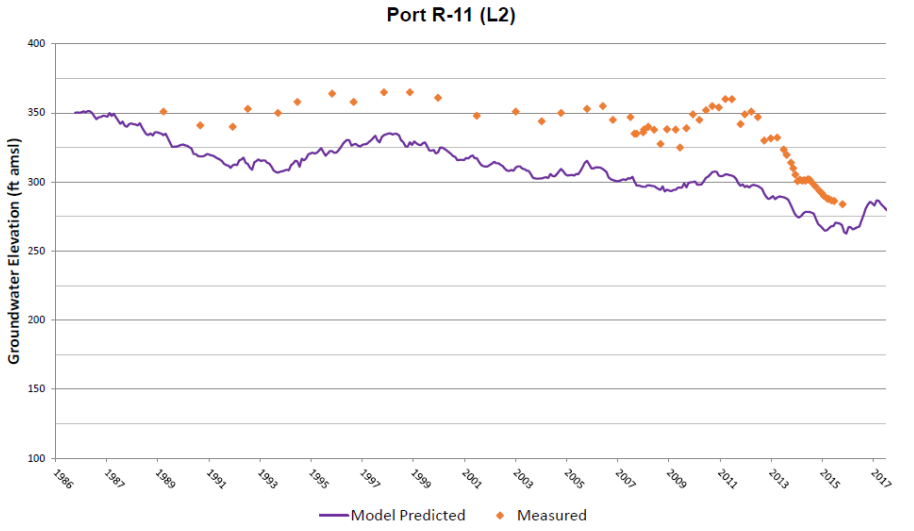


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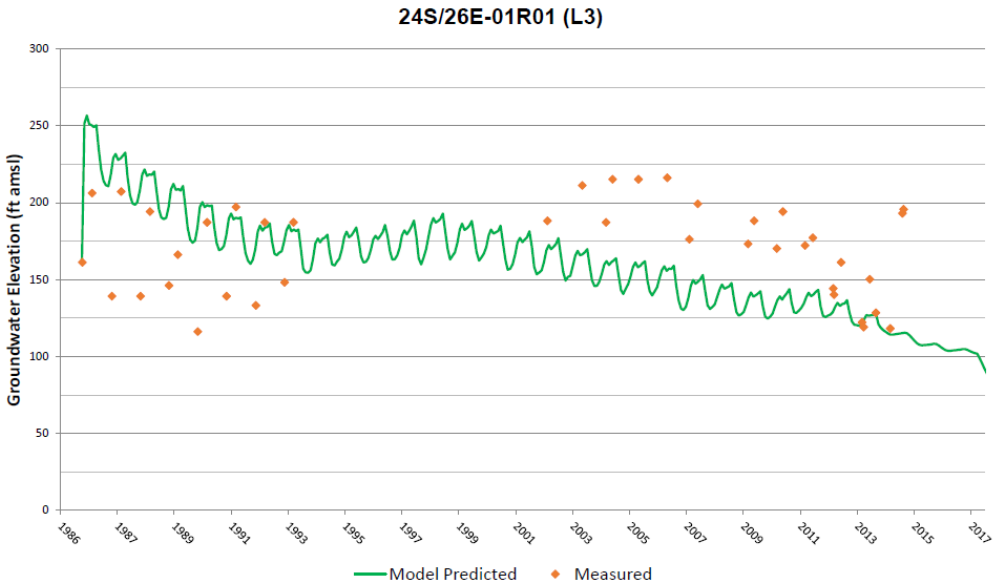


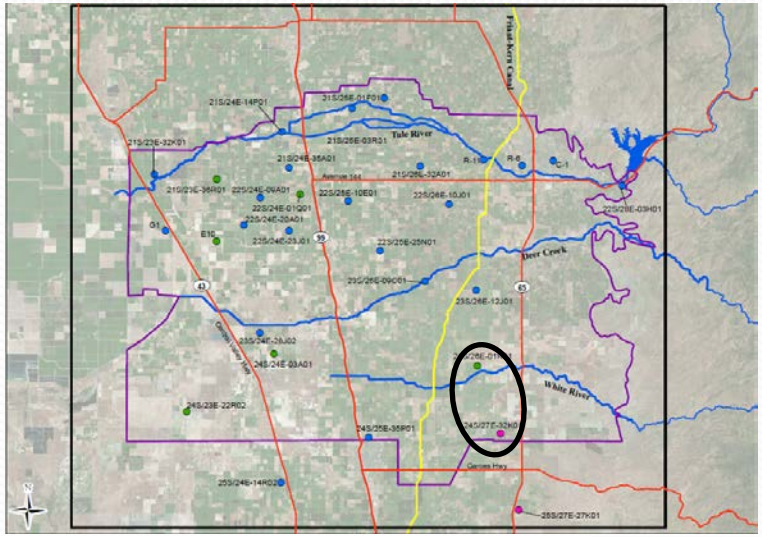


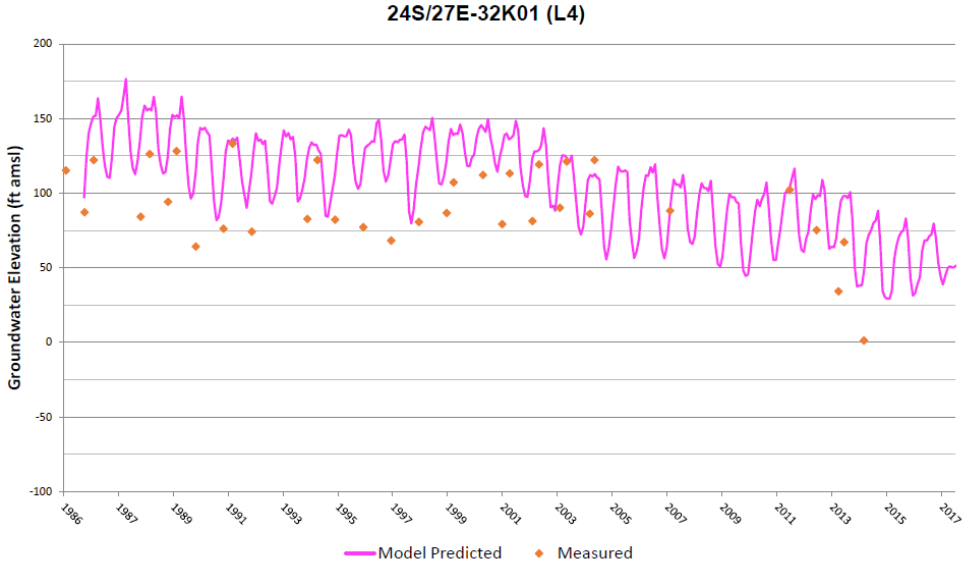


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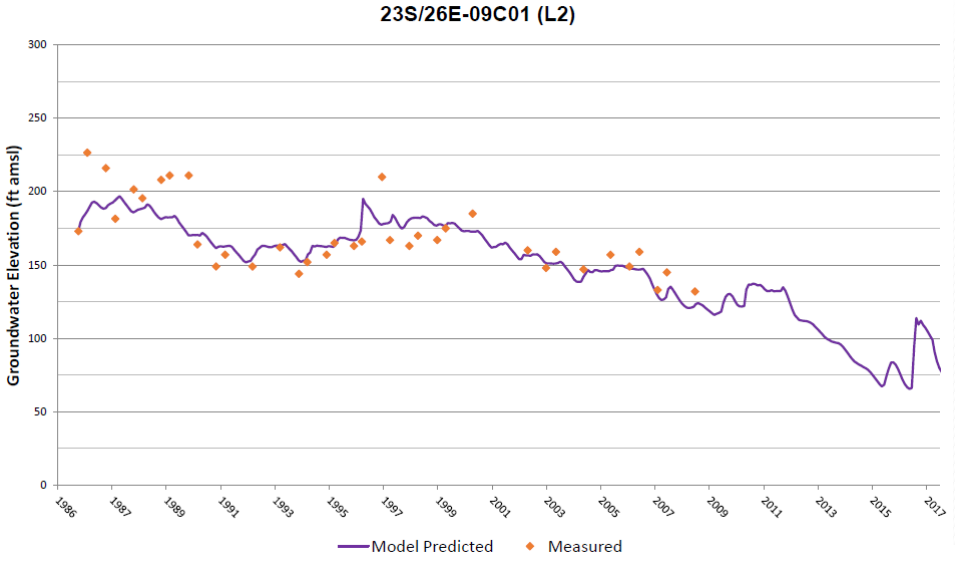


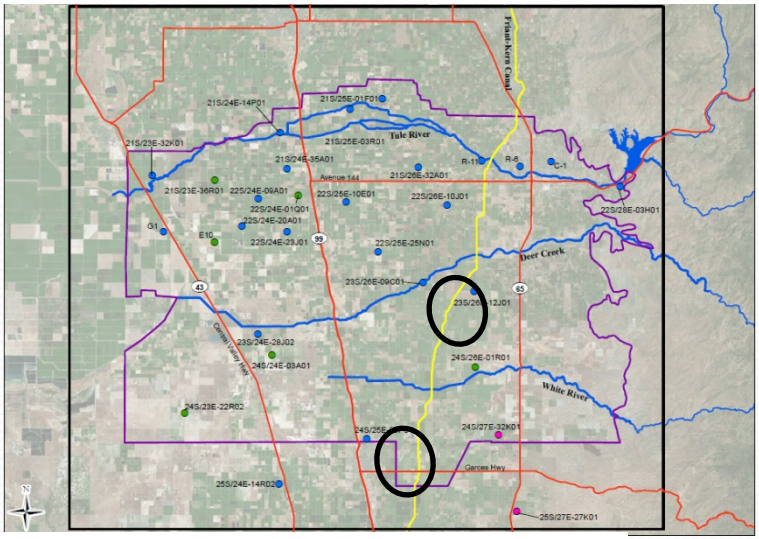


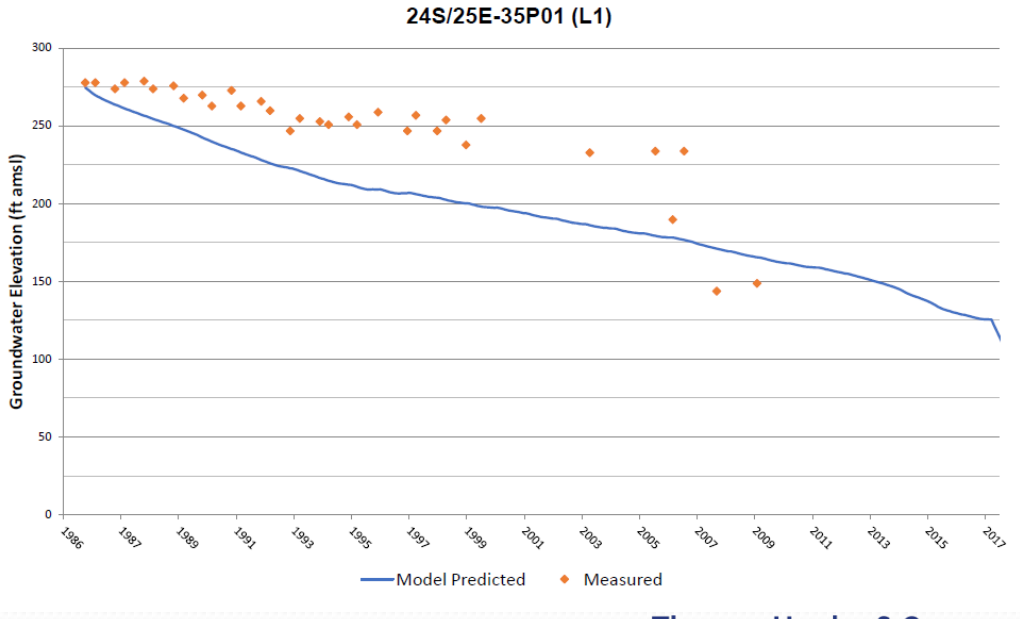


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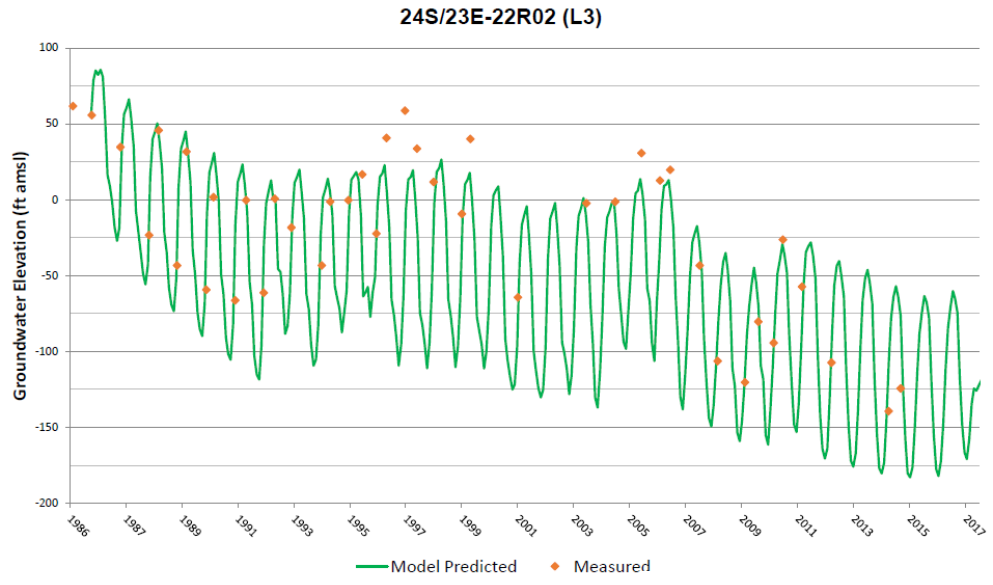


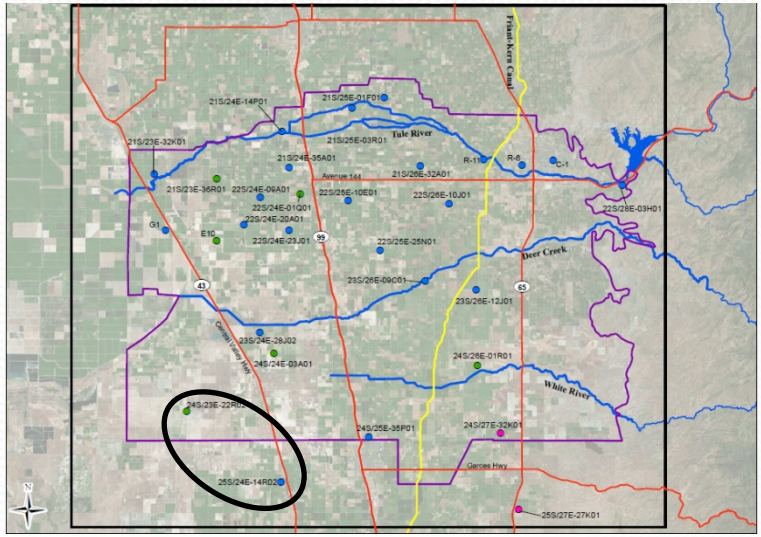


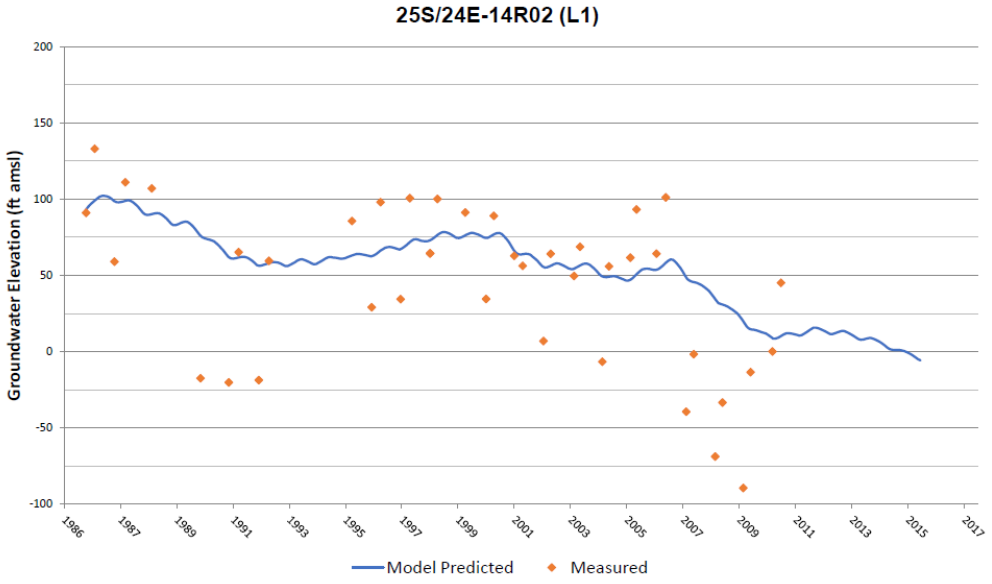


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# Model Calibration – Land Subsidence

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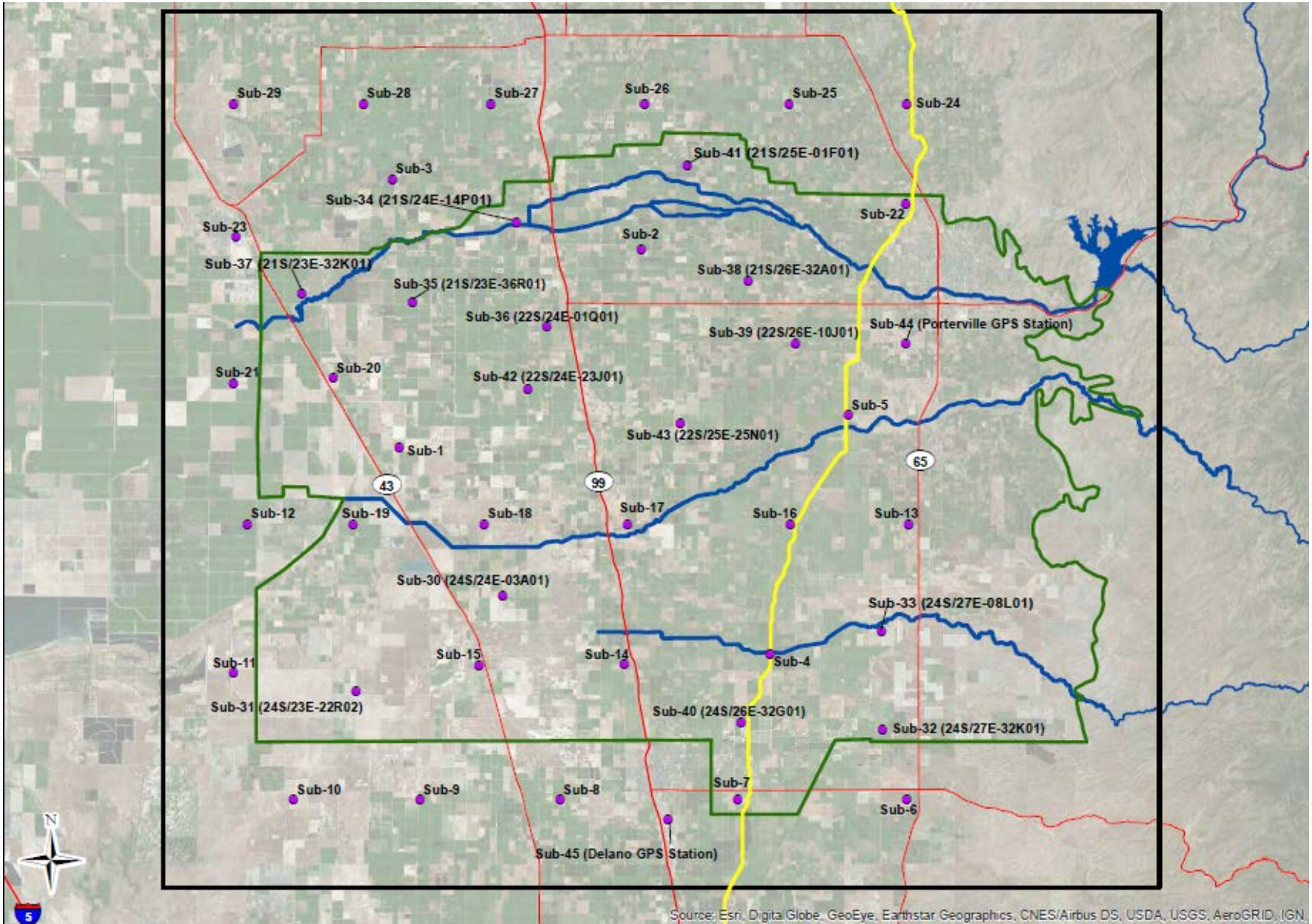

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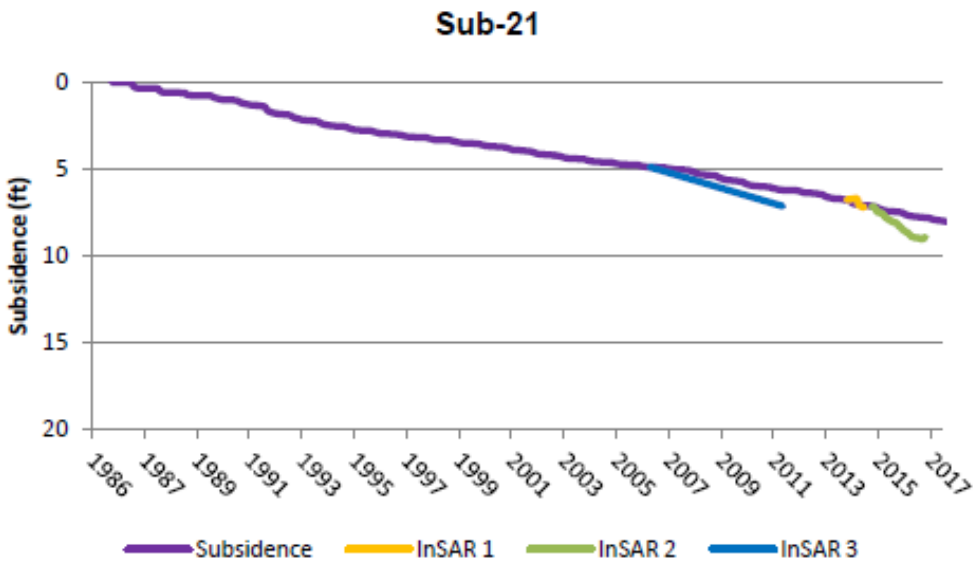


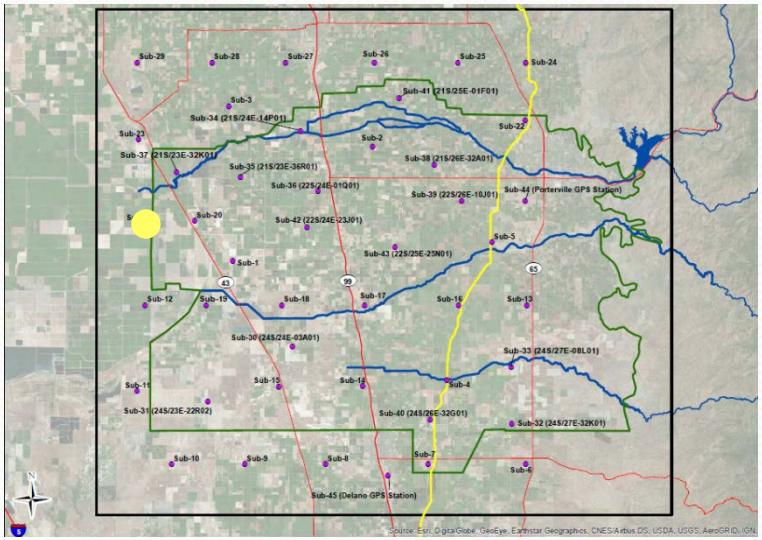


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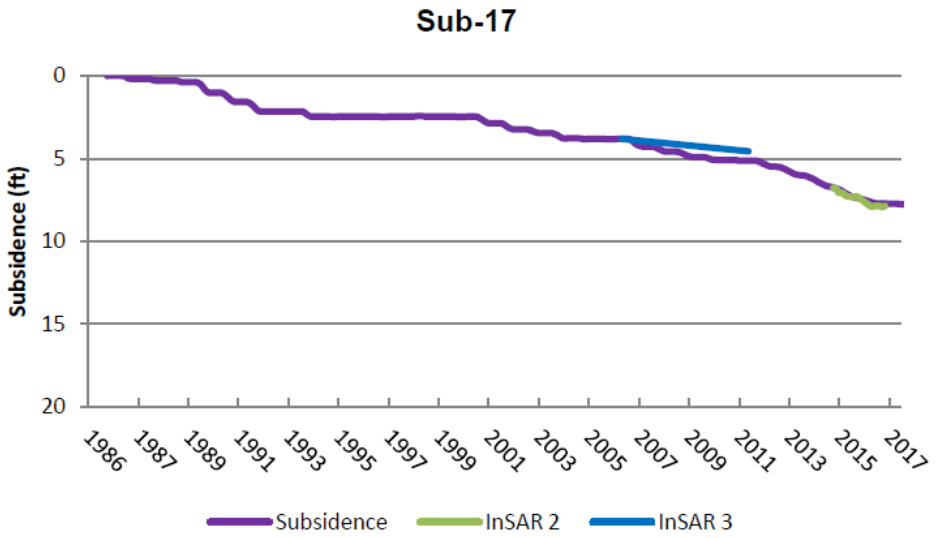


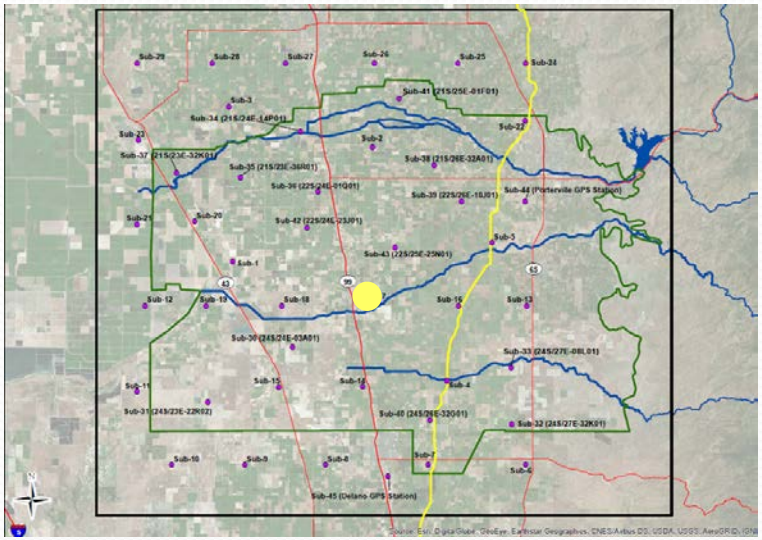

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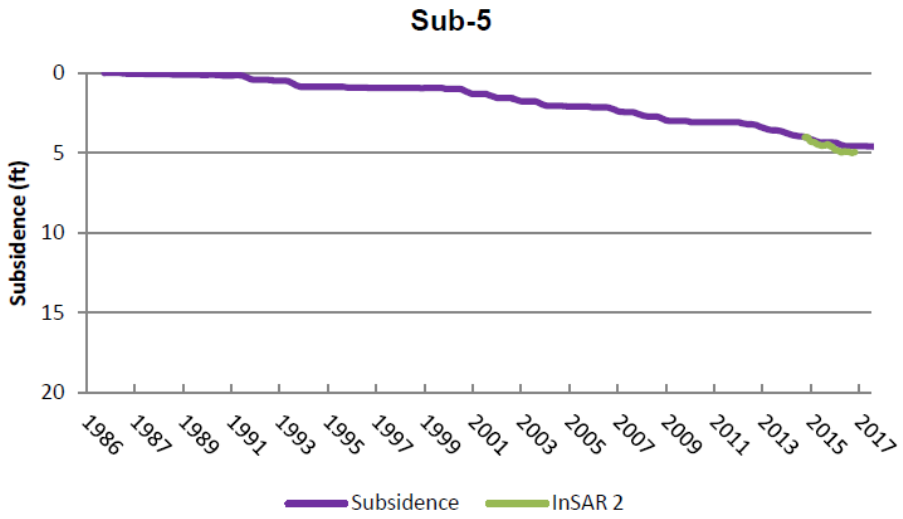


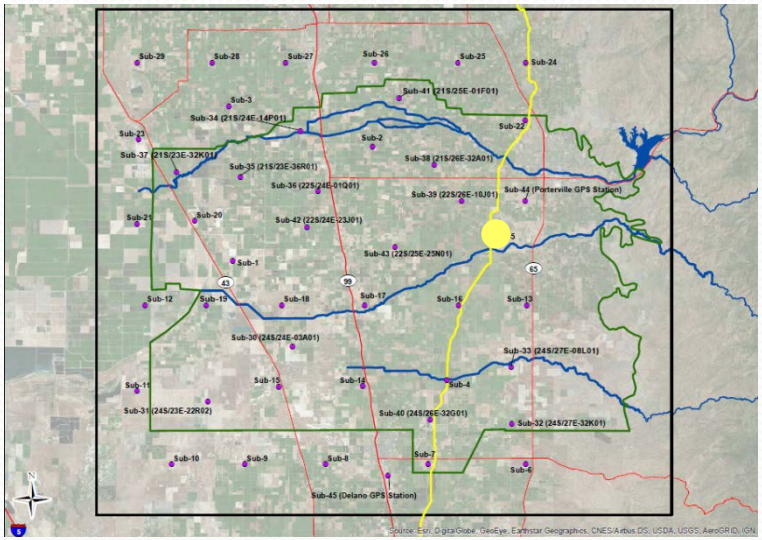


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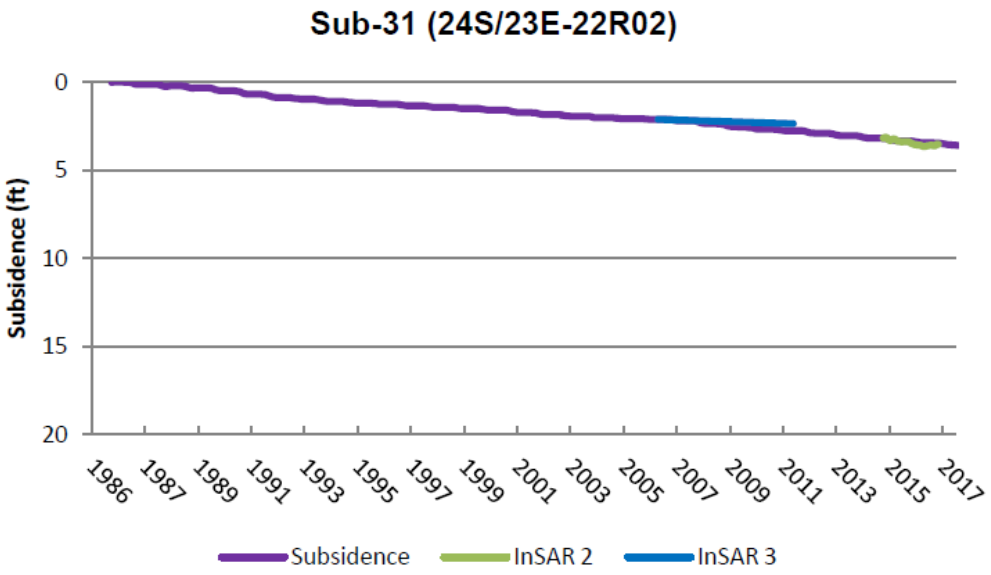


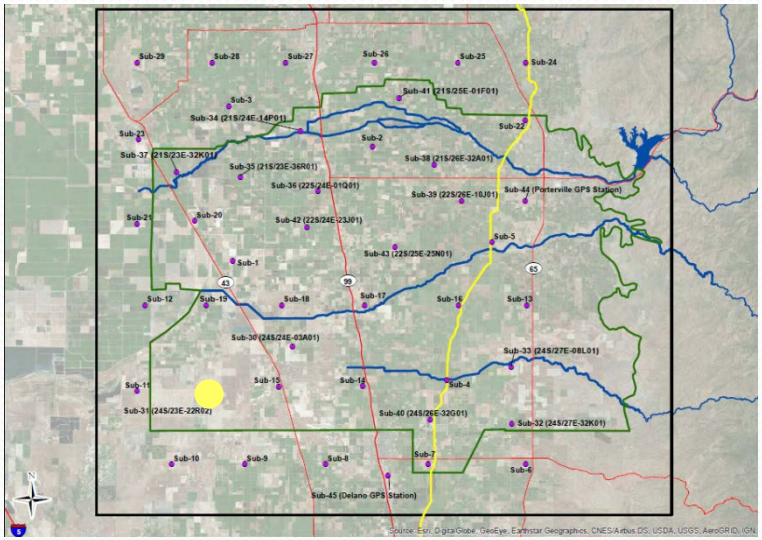


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# Model Projections of Future Pumping and Recharge Were Used to Evaluate the Sustainable Yield

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- Assume Subbasin-Wide Sustainable Yield of 257,725 acre-ft/year
- Assume Average Hydrological Conditions for Water Deliveries (Average of 1986 – 2017)
- Assume Municipal Groundwater Production (Including Porterville) Remains Constant at 2017 Rates
- Assume Average Hydrological Conditions for Recharge (Mountain Block Recharge, Stream Bed Infiltration)
- Maintained Constant Groundwater Elevation at the Boundaries

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# Future Scenarios Analyzed with the Model

- Scenario 1
  - 5-Yr Ramp Down (2020 – 2025) in Agricultural Groundwater Production From Current Levels to Levels Consistent with the Sustainable Yield
  - Average Hydrological Conditions (1986 – 2017)
    - Canal Deliveries
    - River Diversions
    - Mountain Block and Precipitation Recharge
    - Managed Recharge

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# Future Scenarios Analyzed with the Model

- Scenario 2
  - 20-Yr Ramp Down (2020 – 2040) in Agricultural Groundwater Production From Current Levels to Levels Consistent with the Sustainable Yield
  - Average Hydrological Conditions (1986 – 2017)
    - Canal Deliveries
    - River Diversions
    - Mountain Block and Precipitation Recharge
    - Managed Recharge

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# Future Scenarios Analyzed with the Model

- Scenario 3
  - Continue Current Levels of Agricultural Groundwater Production for 10 Yrs (2020 – 2030)
  - 10-Yr Ramp Down (2030 – 2040) in Agricultural Groundwater Production From Current Levels Consistent with the Sustainable Yield
  - Average Hydrological Conditions
    - Canal Deliveries
    - River Diversions
    - Mountain Block and Precipitation Recharge
    - Managed Recharge

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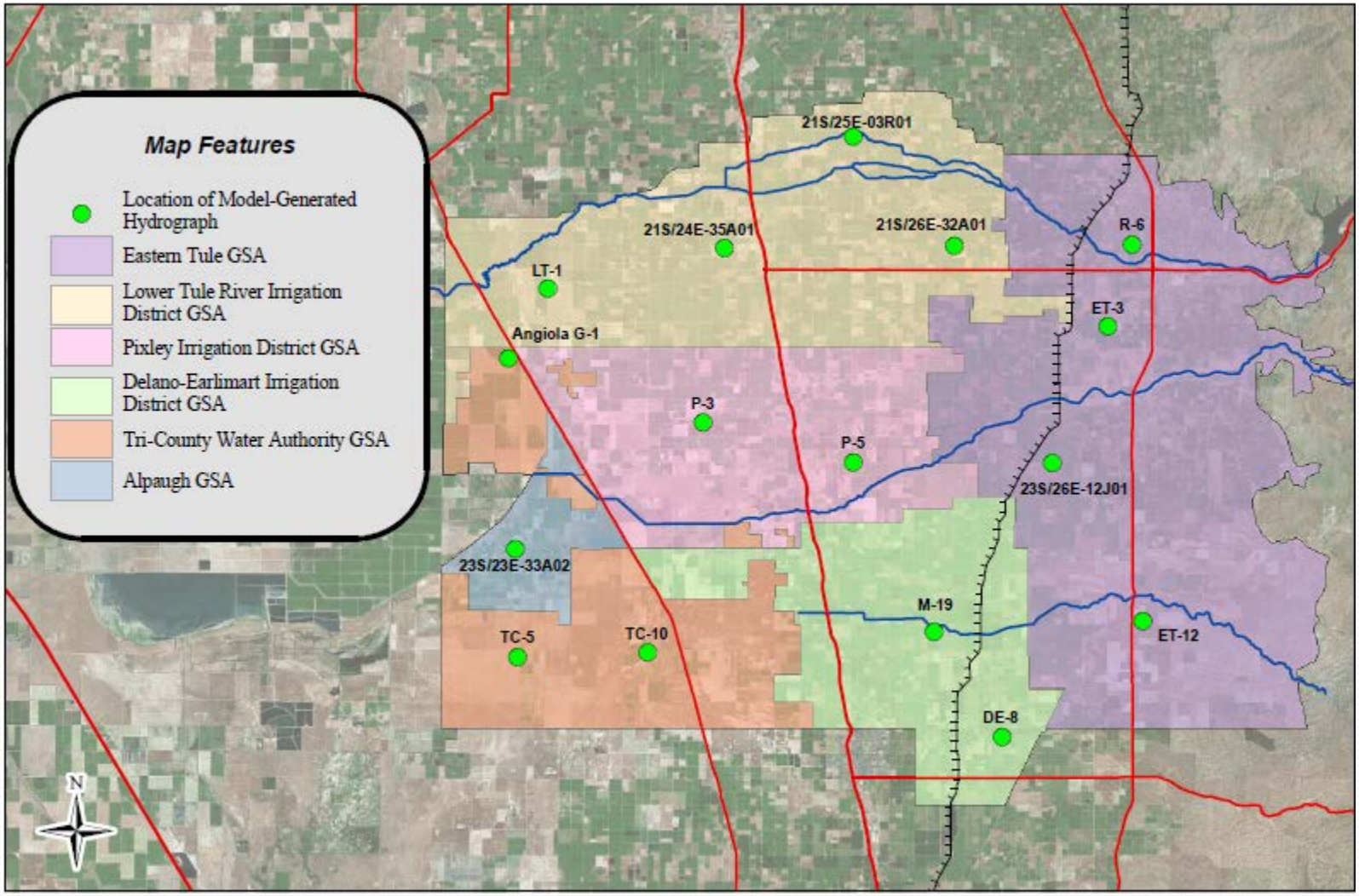
# Future Scenarios Analyzed with the Model

- Scenario 4
  - 10-Yr Ramp Down (2020 – 2040) in Agricultural Groundwater Production From Current Levels to Levels Consistent with the Sustainable Yield
  - Average Hydrological Conditions
- Scenario 5
  - No Ramp Down – Begin Sustainable Groundwater Production Starting in 2020
  - Average Hydrological Conditions

# Model-Projected Groundwater Elevations

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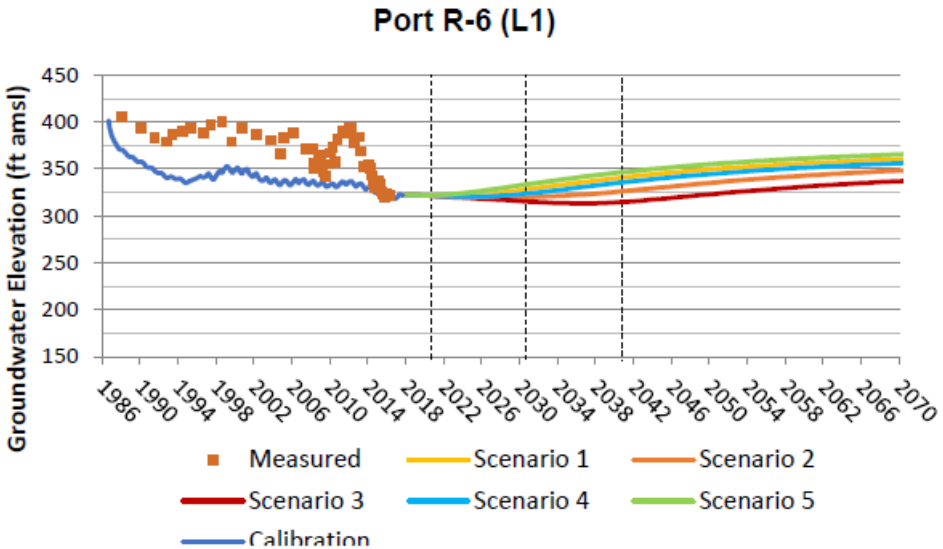


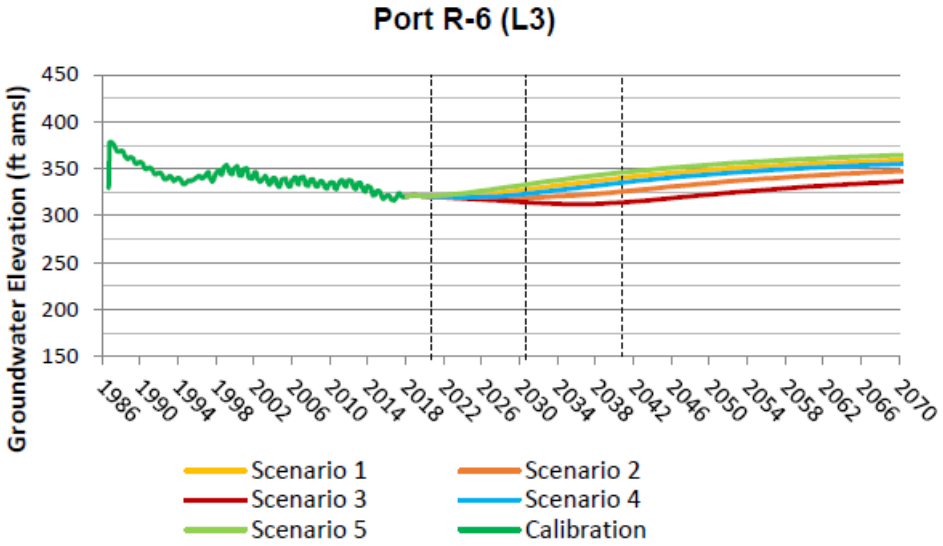


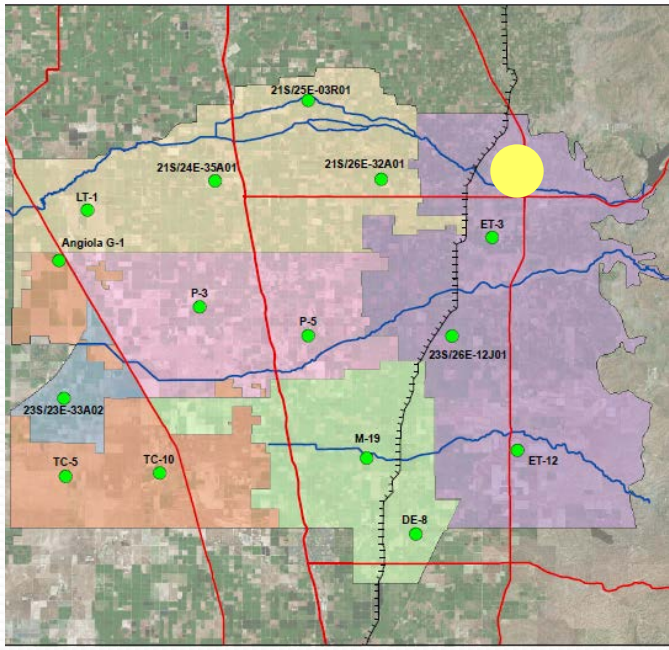


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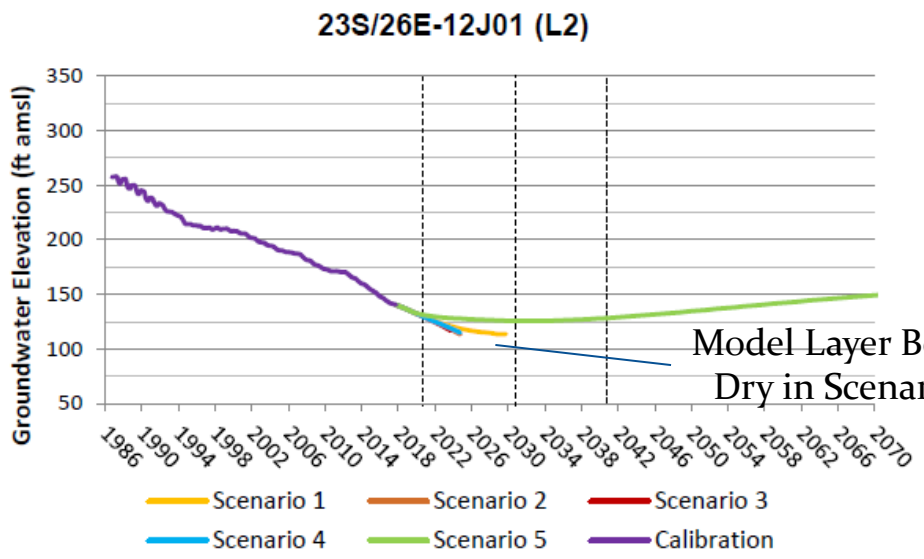
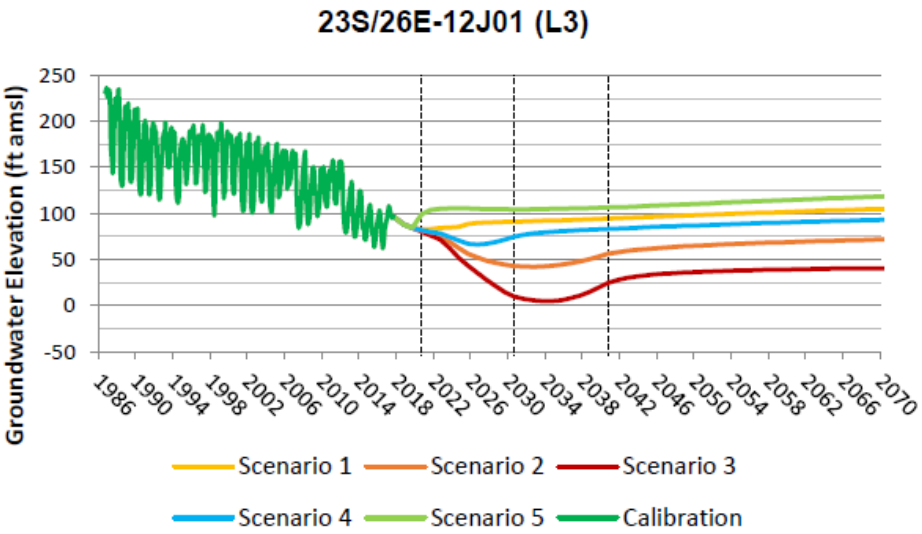
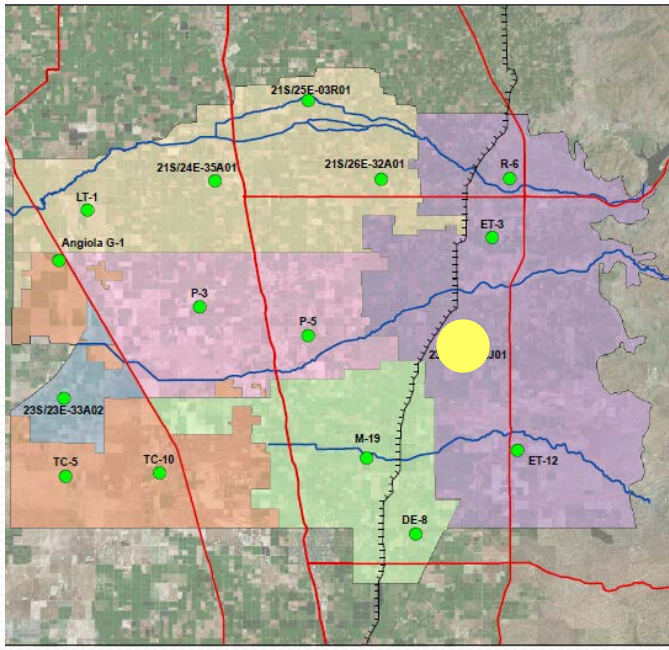



Model Layer Becomes Dry in Scenarios 1-4

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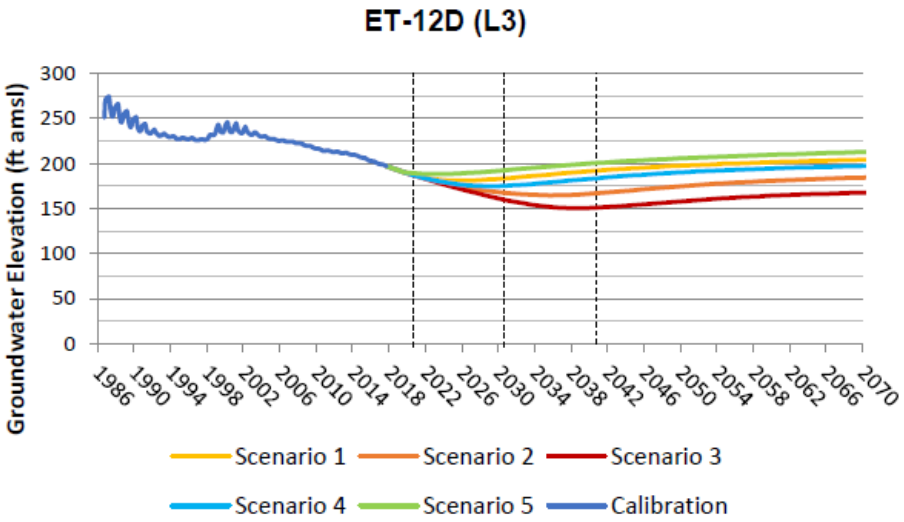


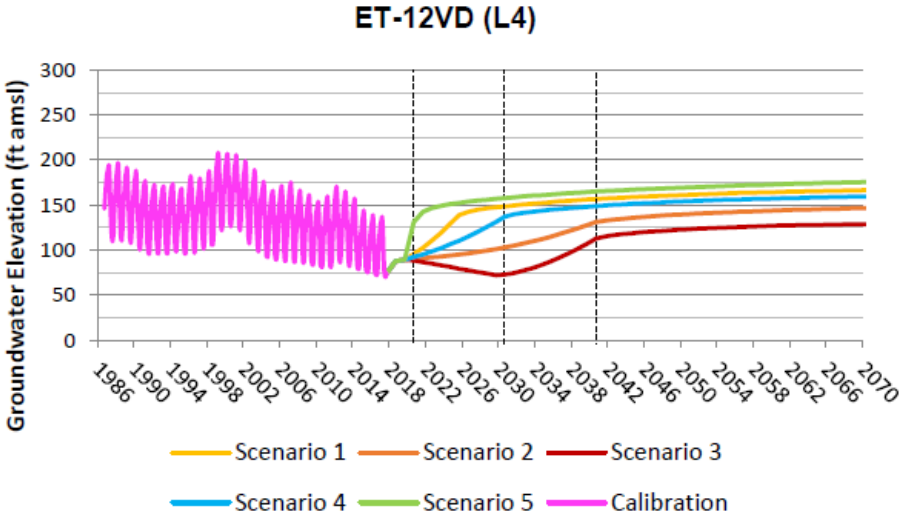


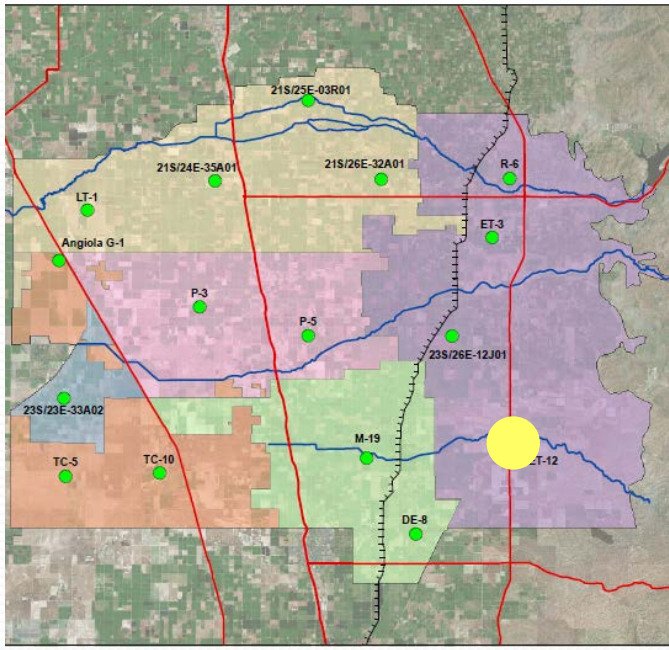


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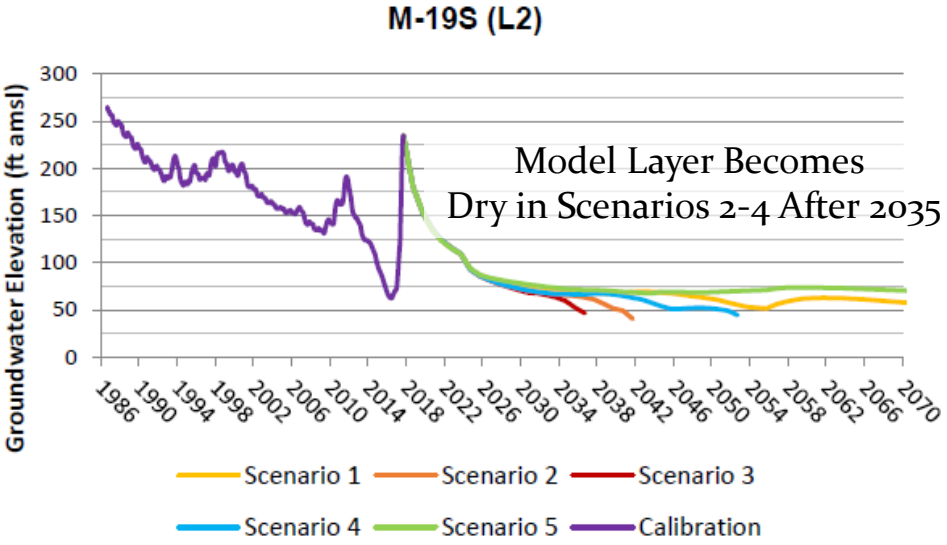


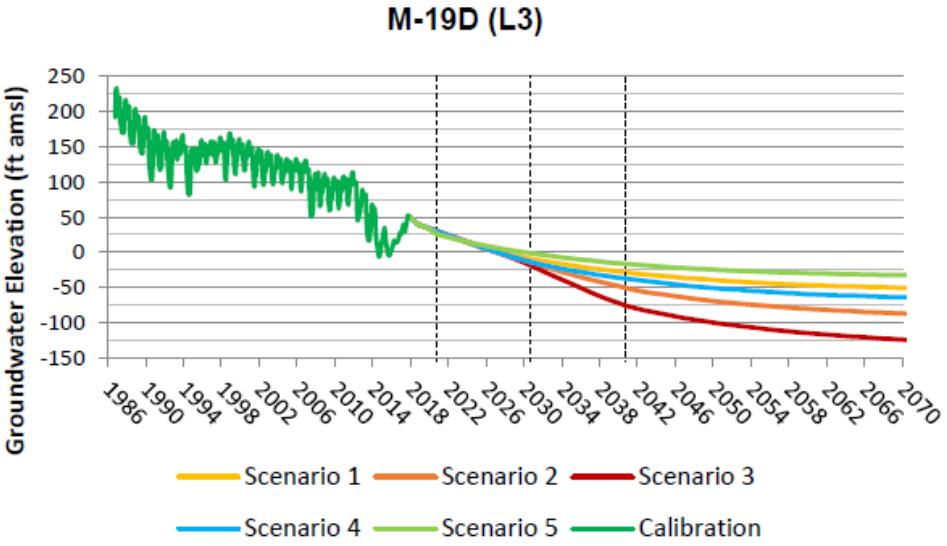


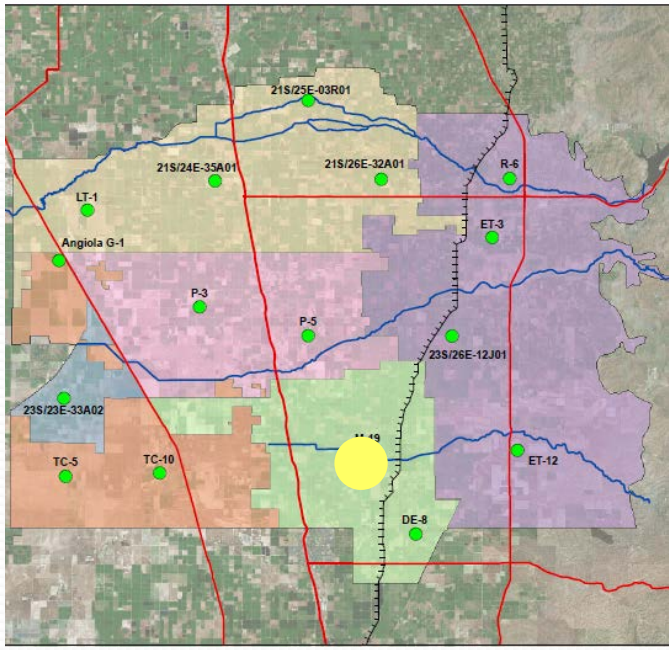


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# Model-Projected Groundwater Elevations

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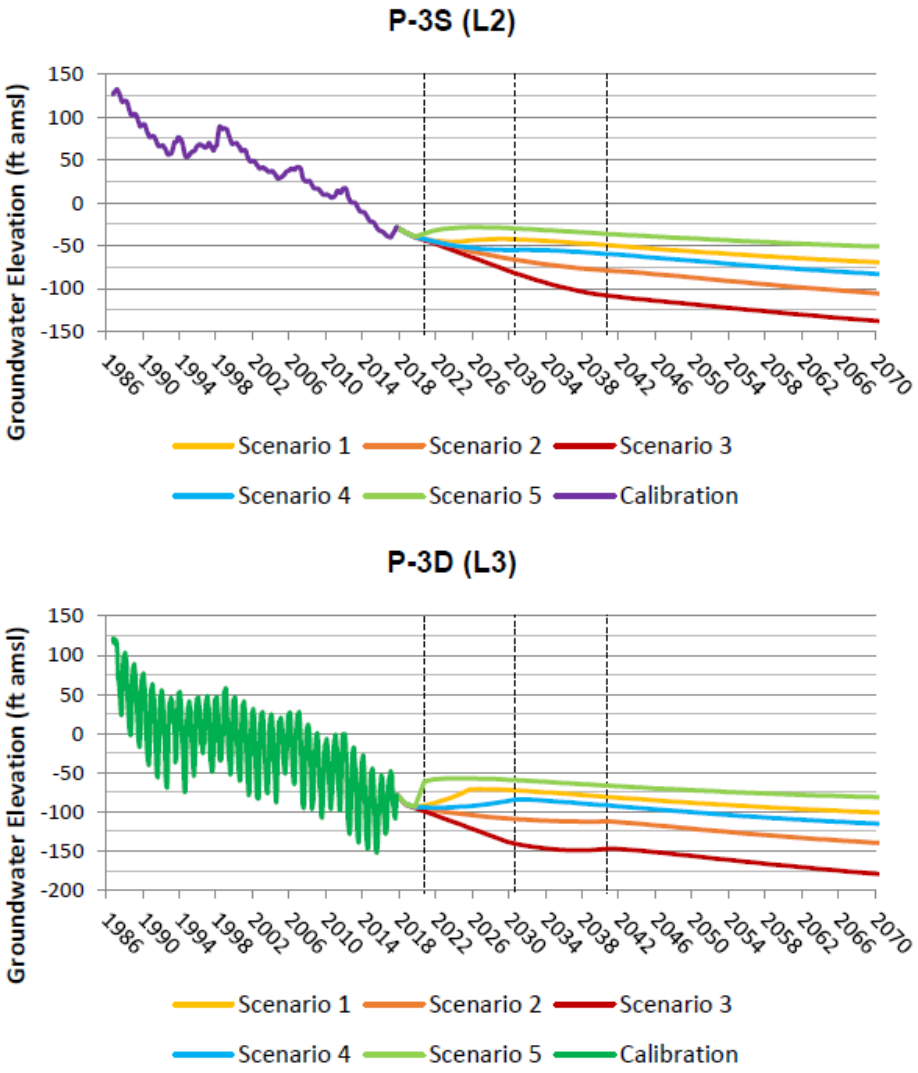


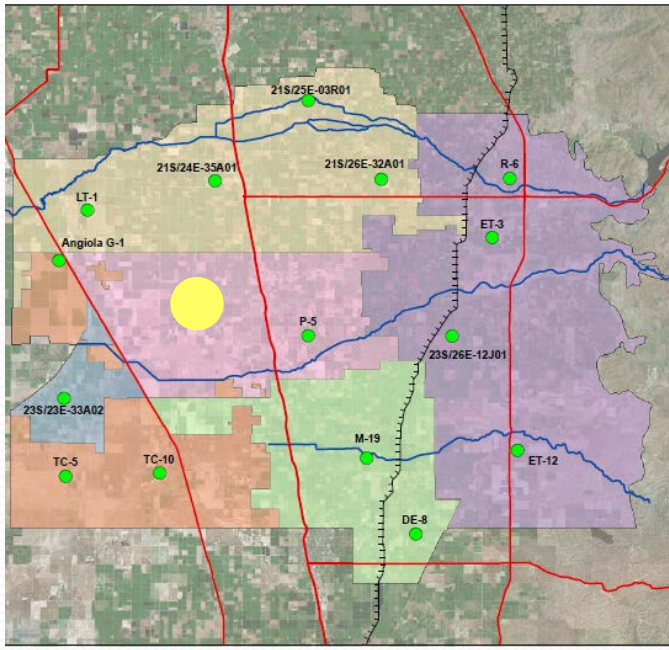


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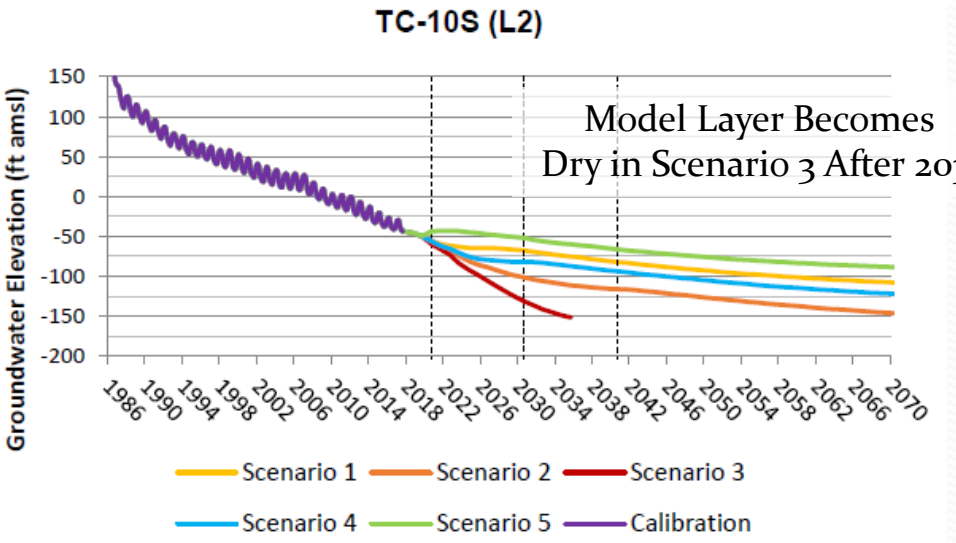
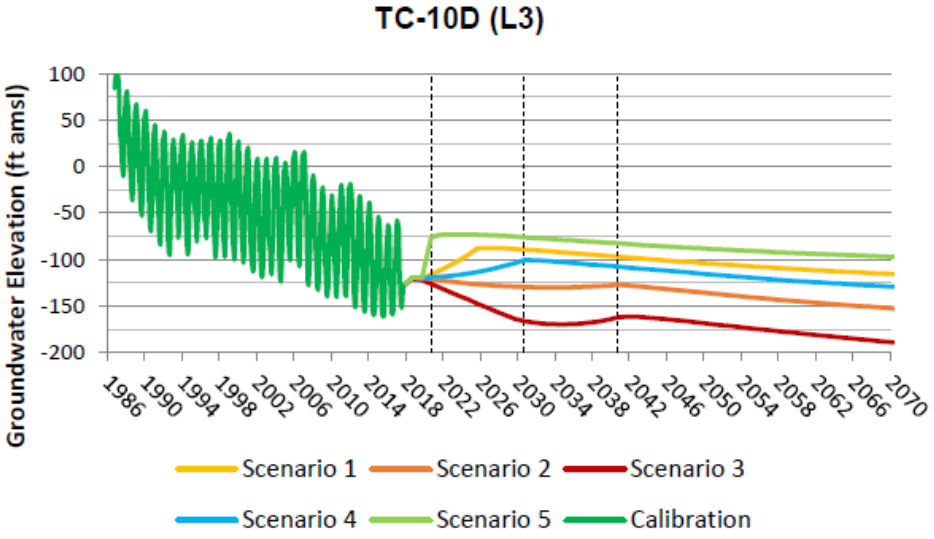
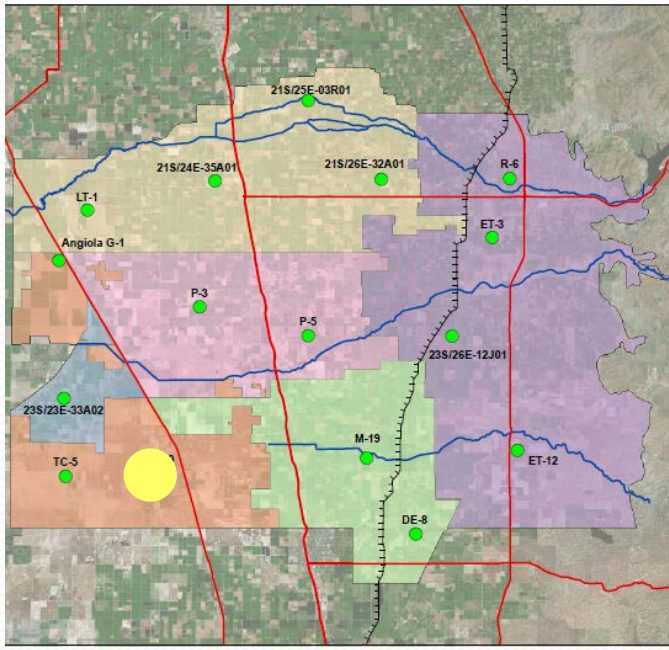
# Model-Projected Groundwater Elevations




Model Layer Becomes Dry in Scenario 3 After 2035

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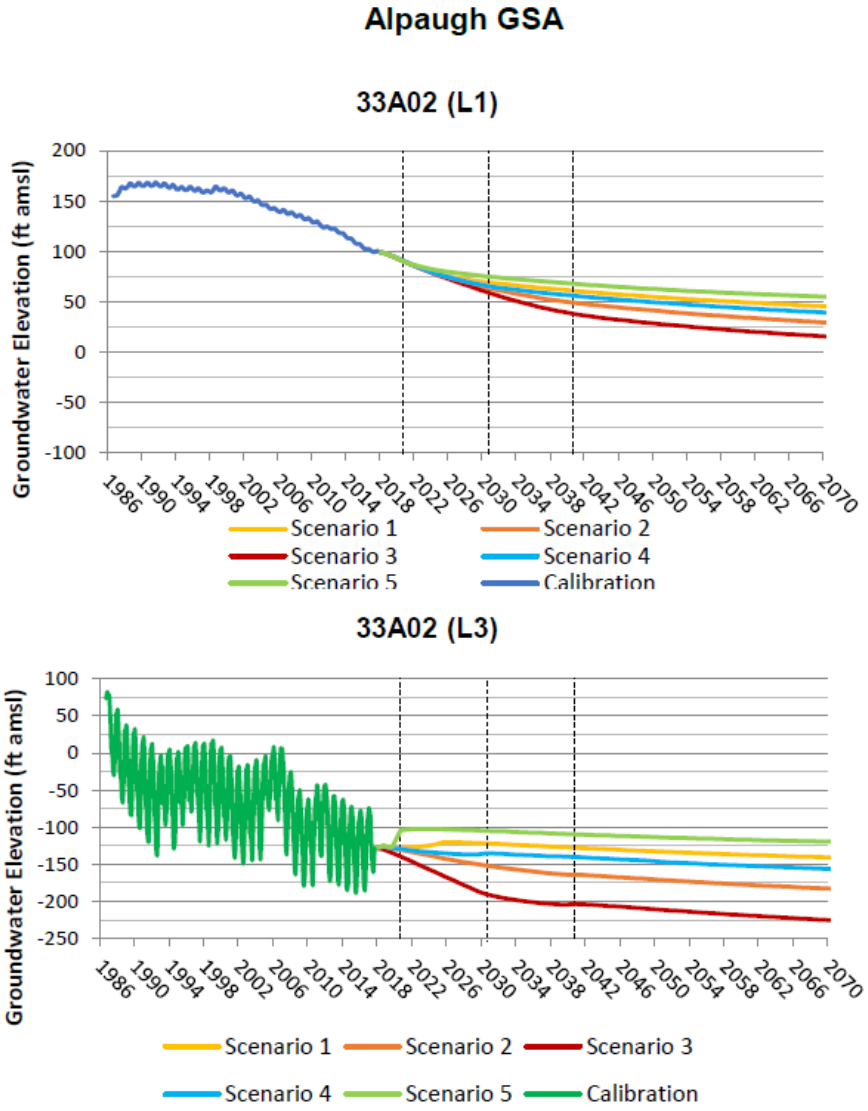


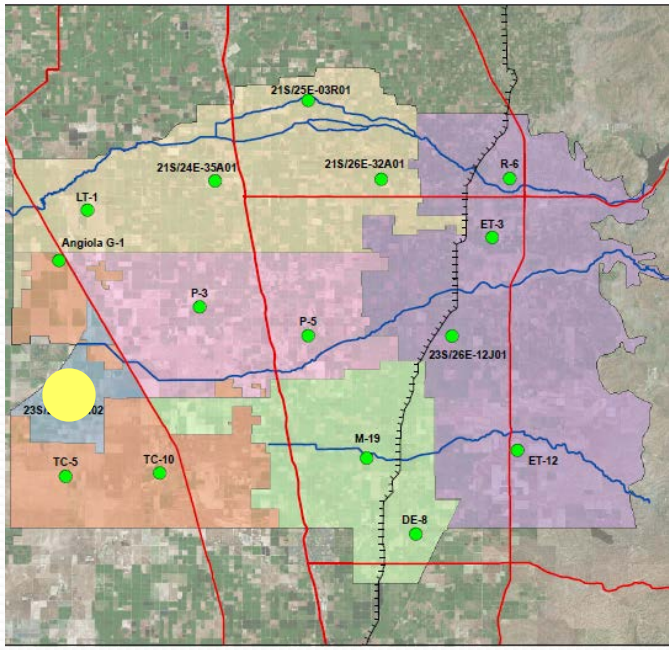


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# Model-Projected Groundwater Elevations

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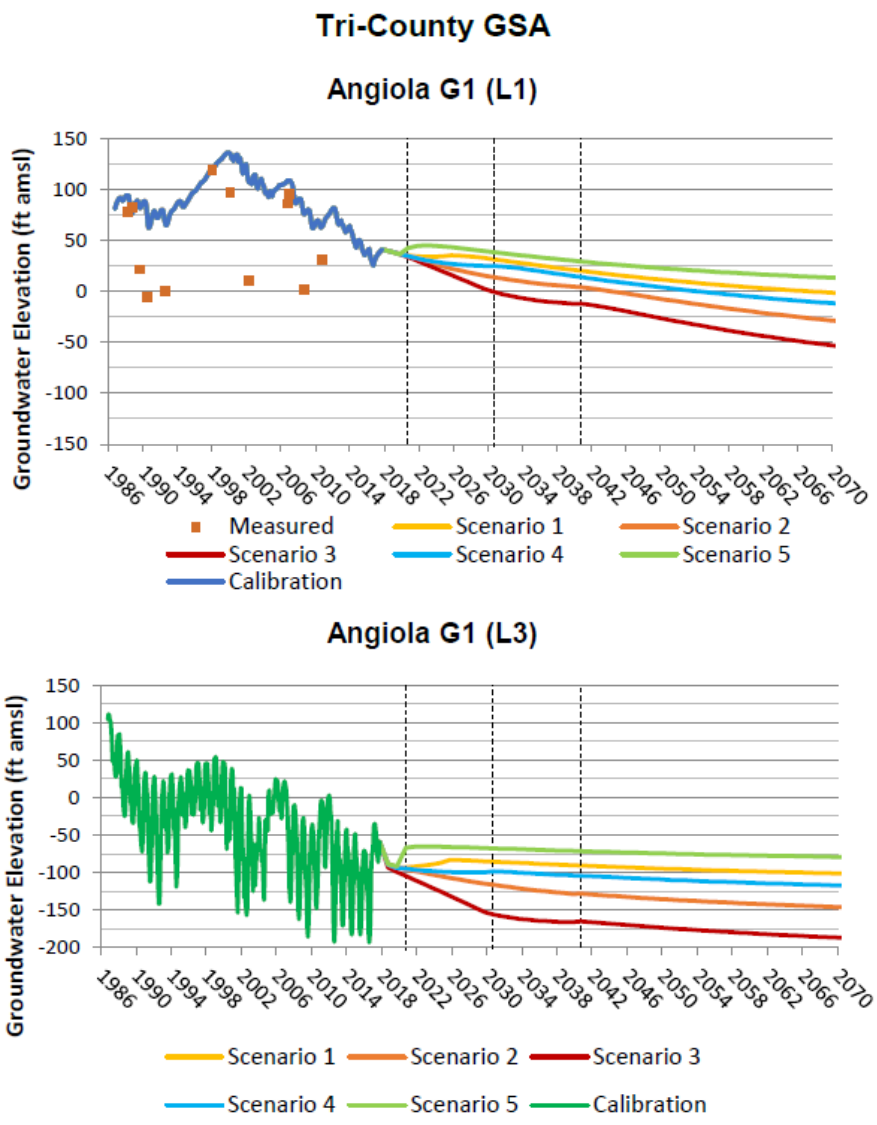


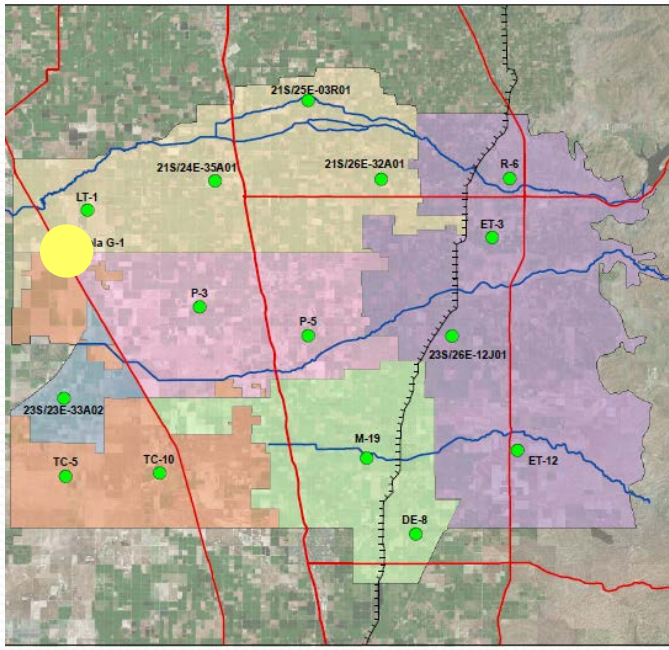


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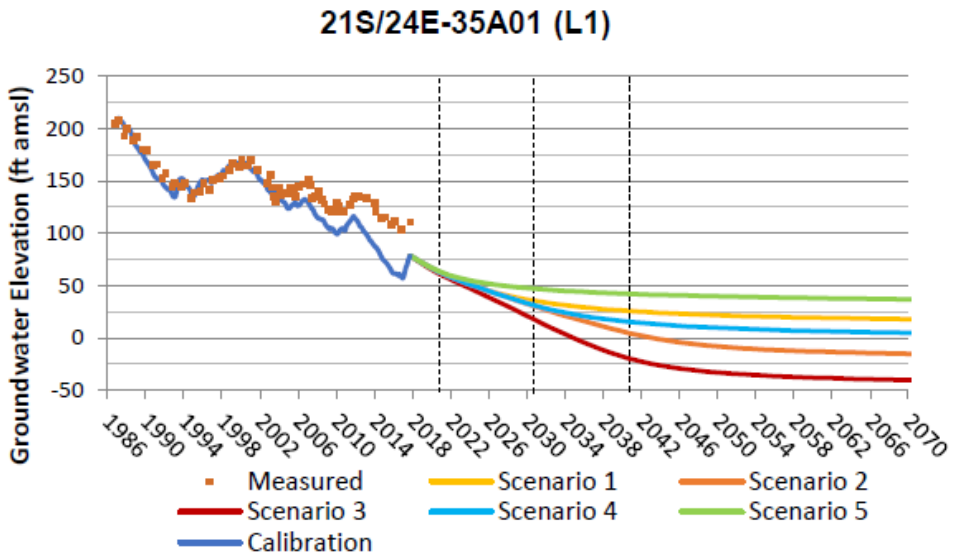
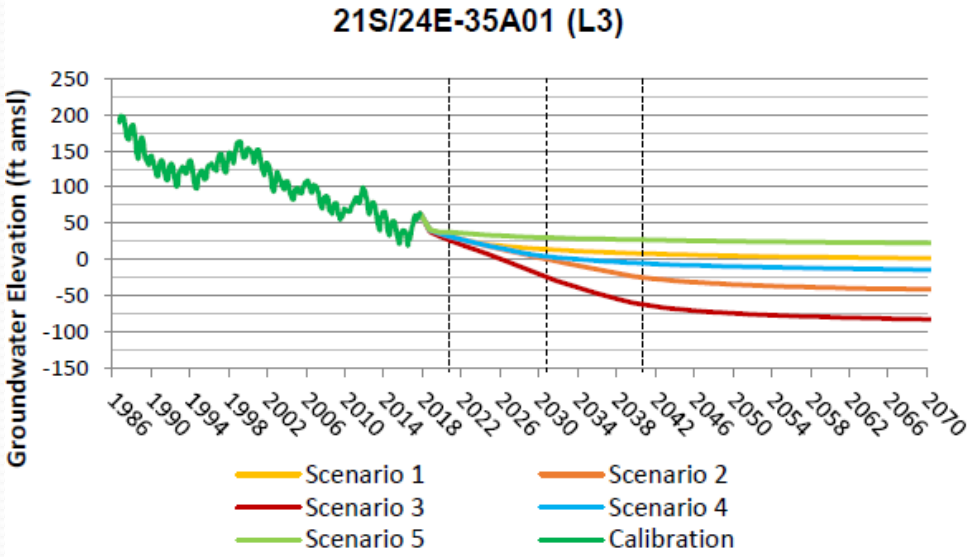
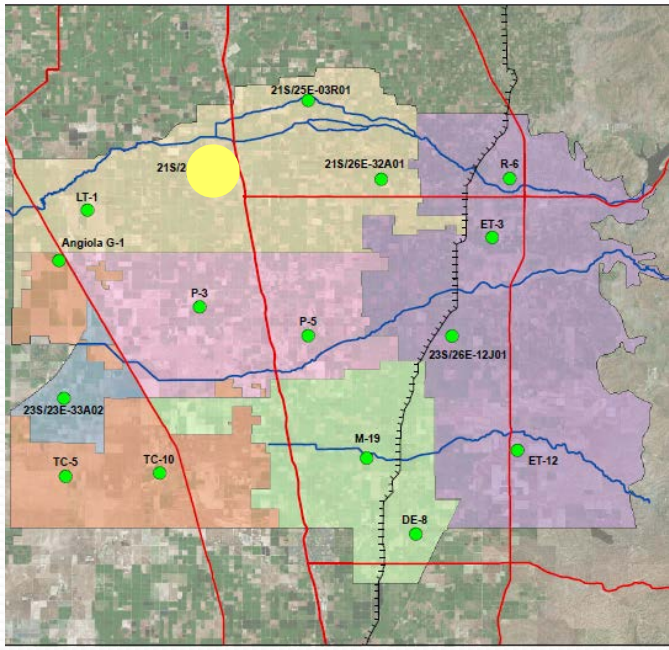
# Model-Projected Groundwater Elevations

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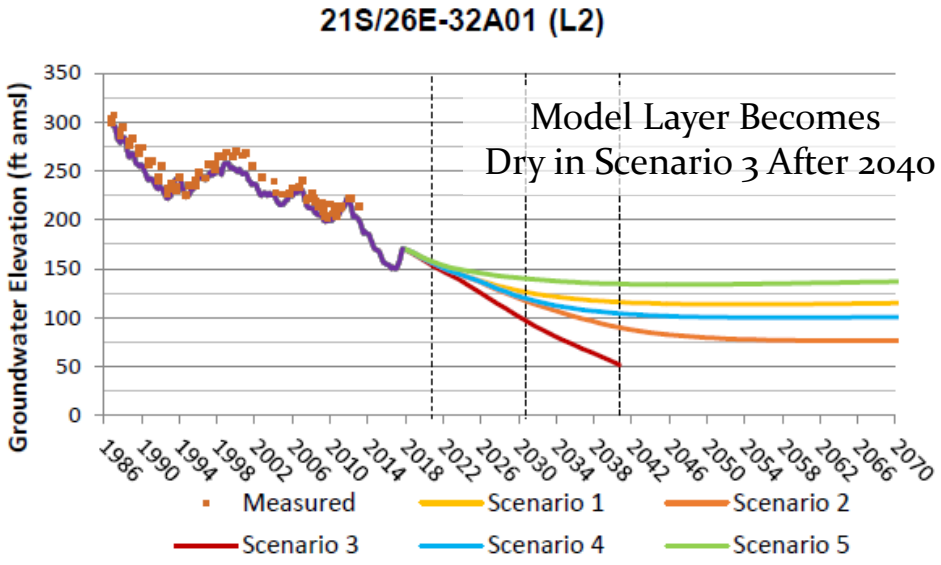
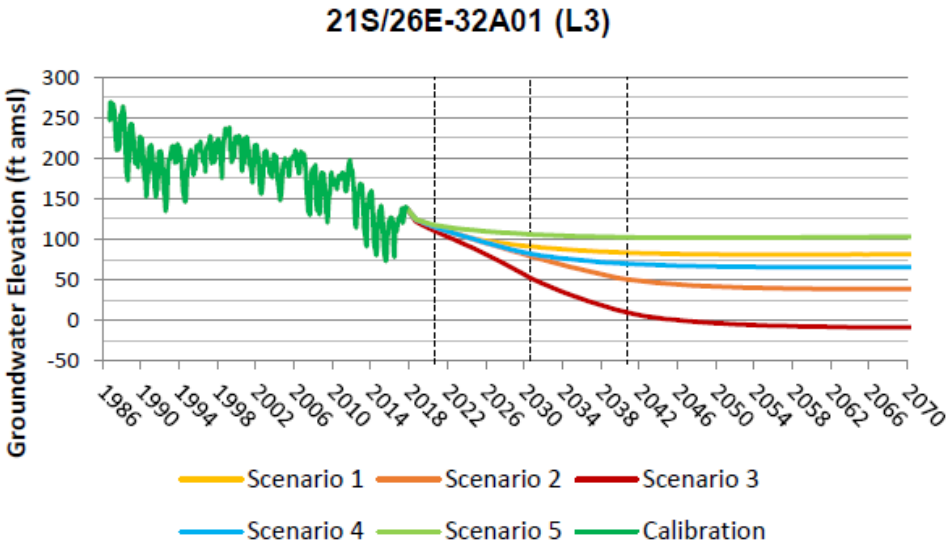
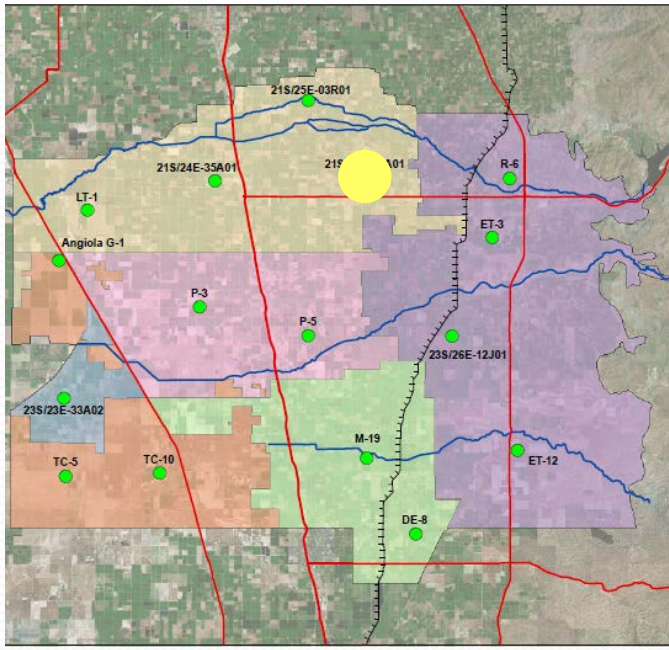
# Model-Projected Groundwater Elevations

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# Model-Projected Land Subsidence Scenario 5 – No Ramp Down

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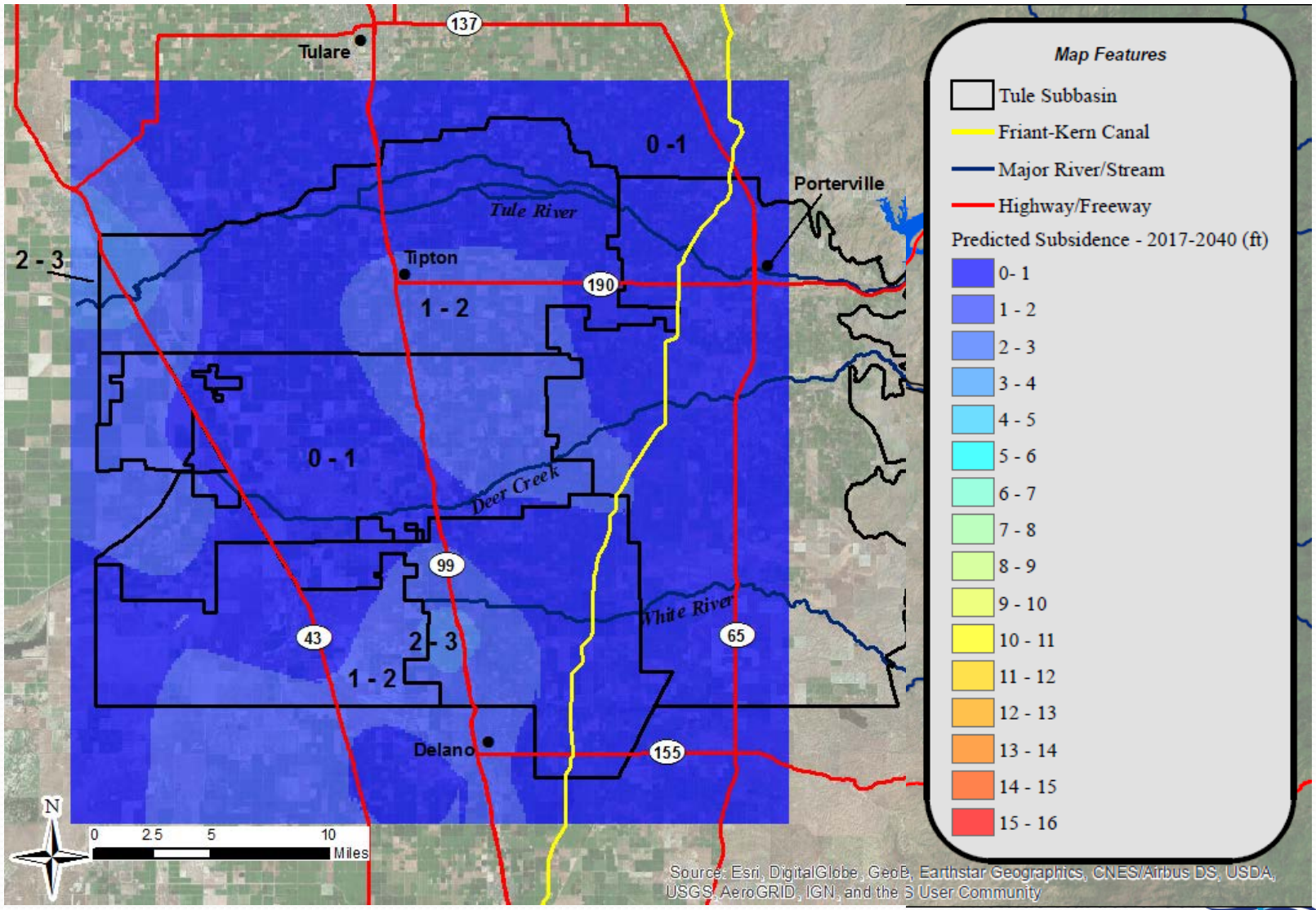

# Model-Projected Land Subsidence Scenario 1

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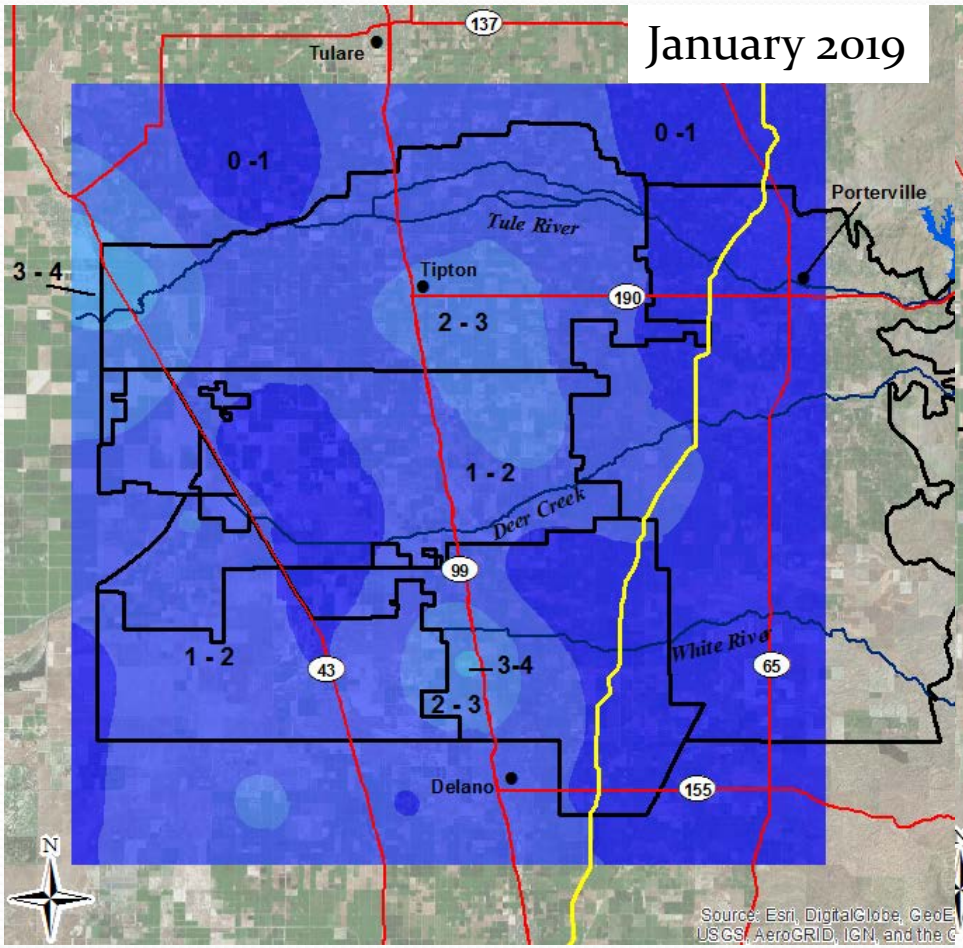
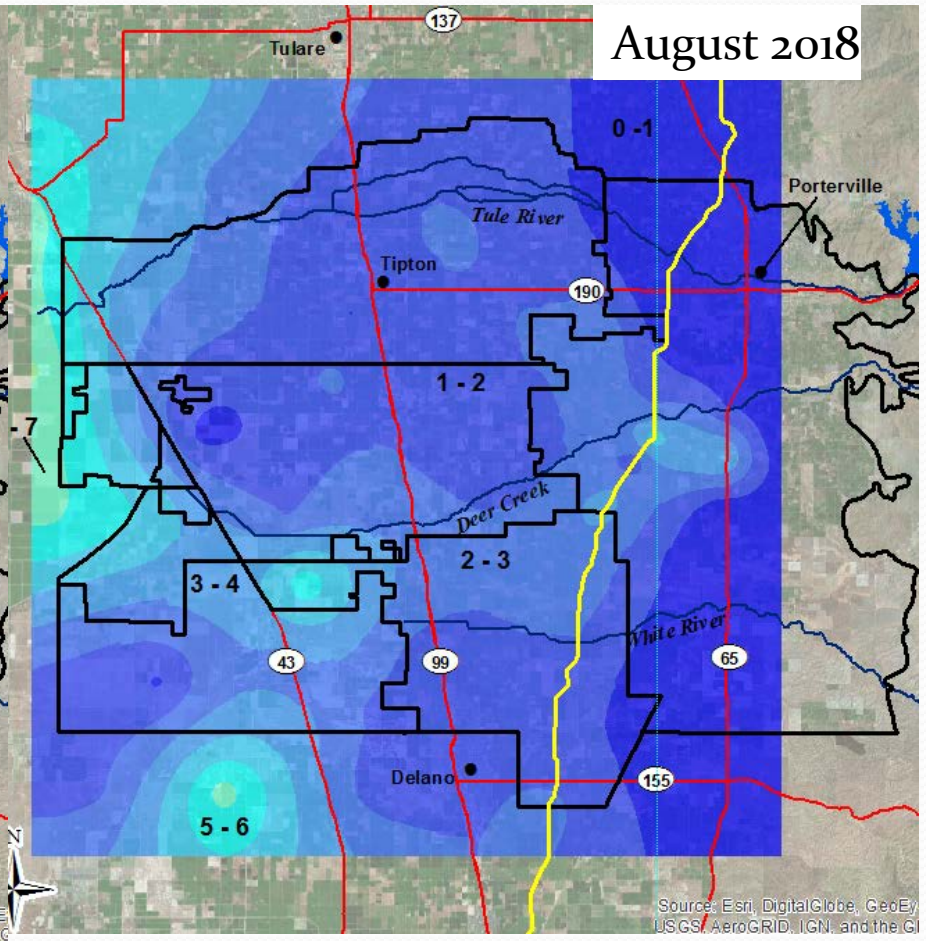
5-Yr Ramp Down

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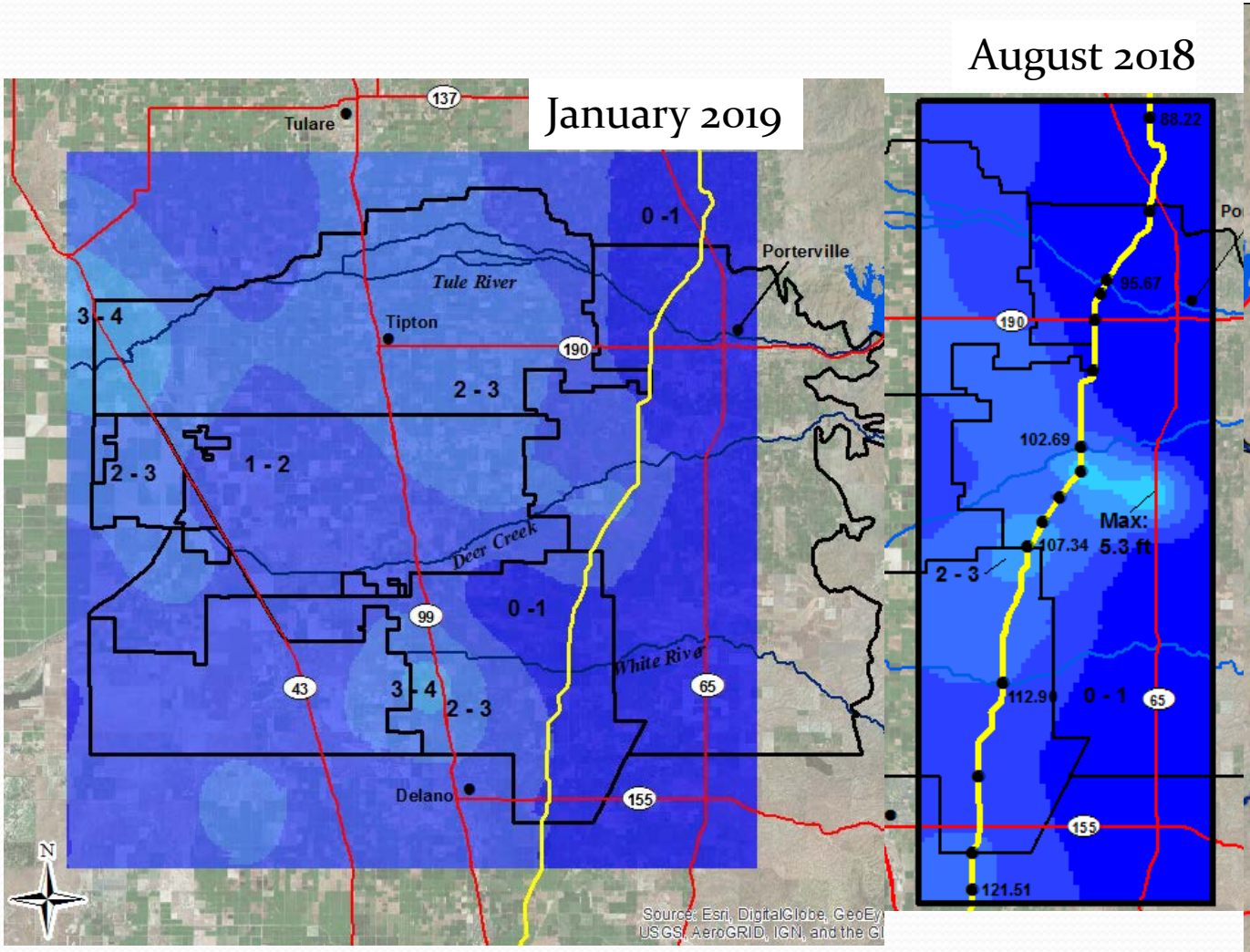
# Model-Projected Land Subsidence

## Scenario 4

10 -Yr Ramp Down



# Model-Projected Land Subsidence Scenario 2

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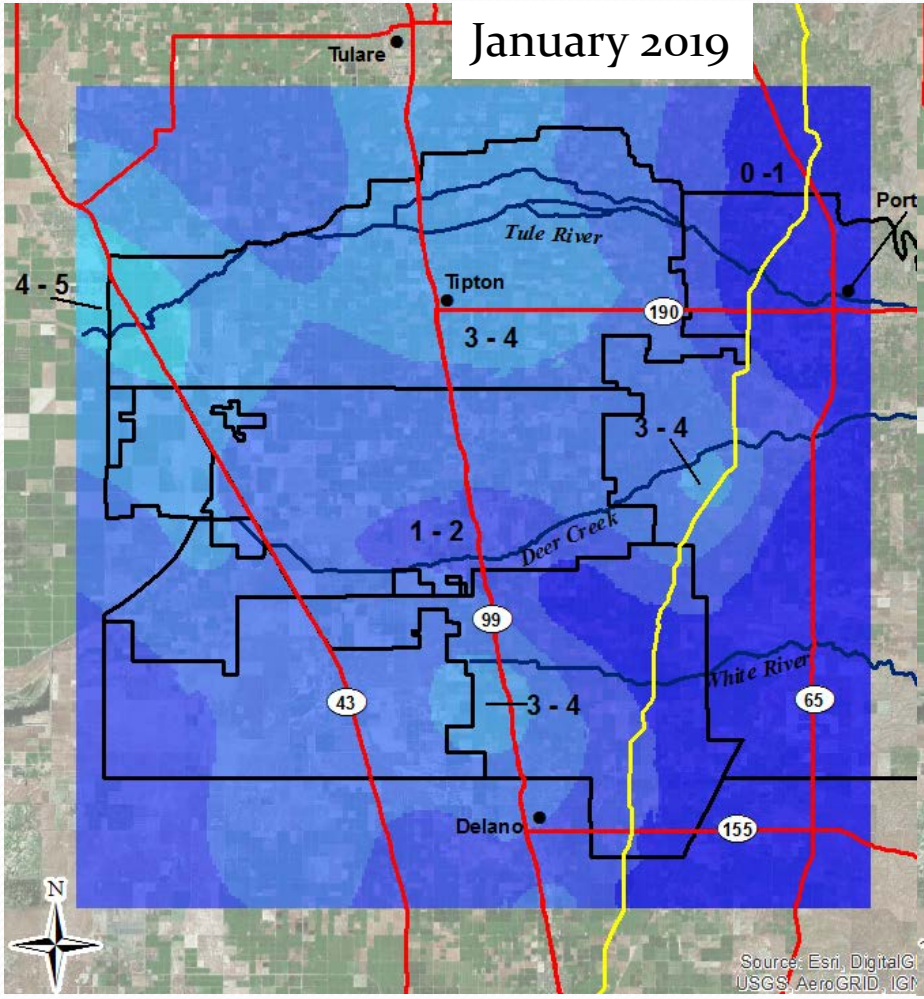
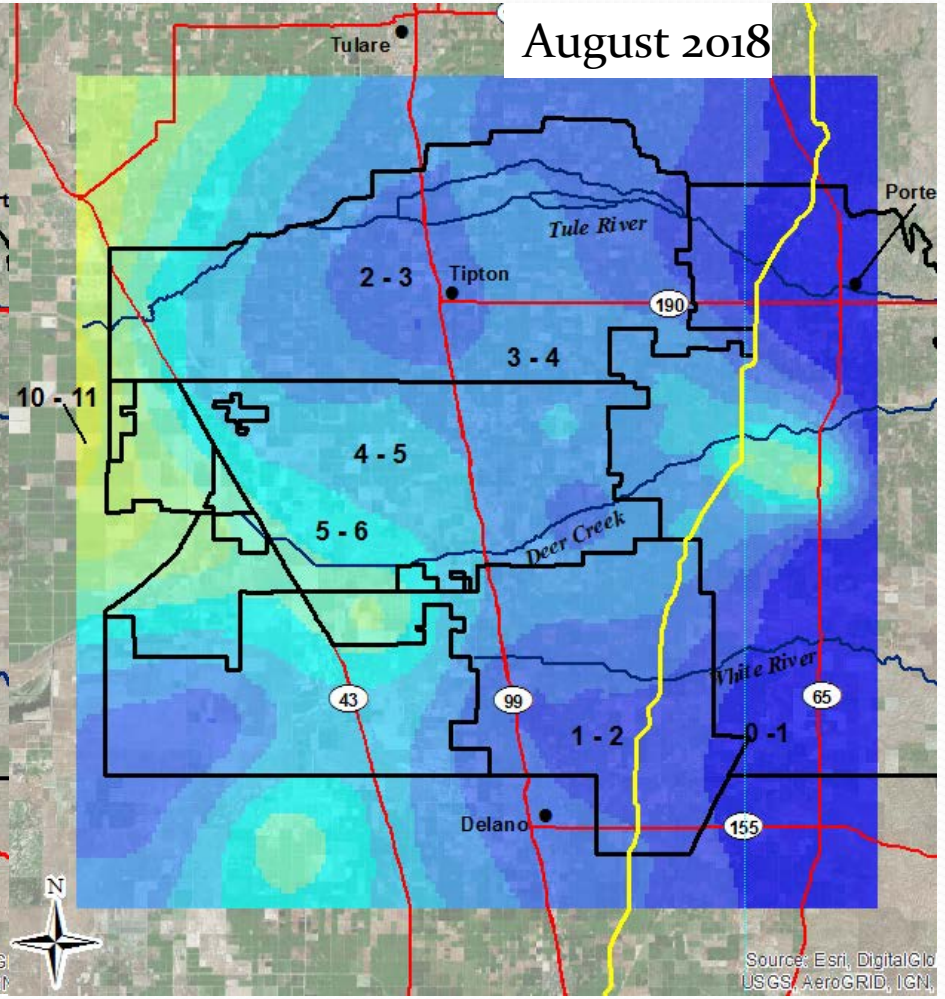
20-Yr Ramp Down



# Model-Projected Land Subsidence

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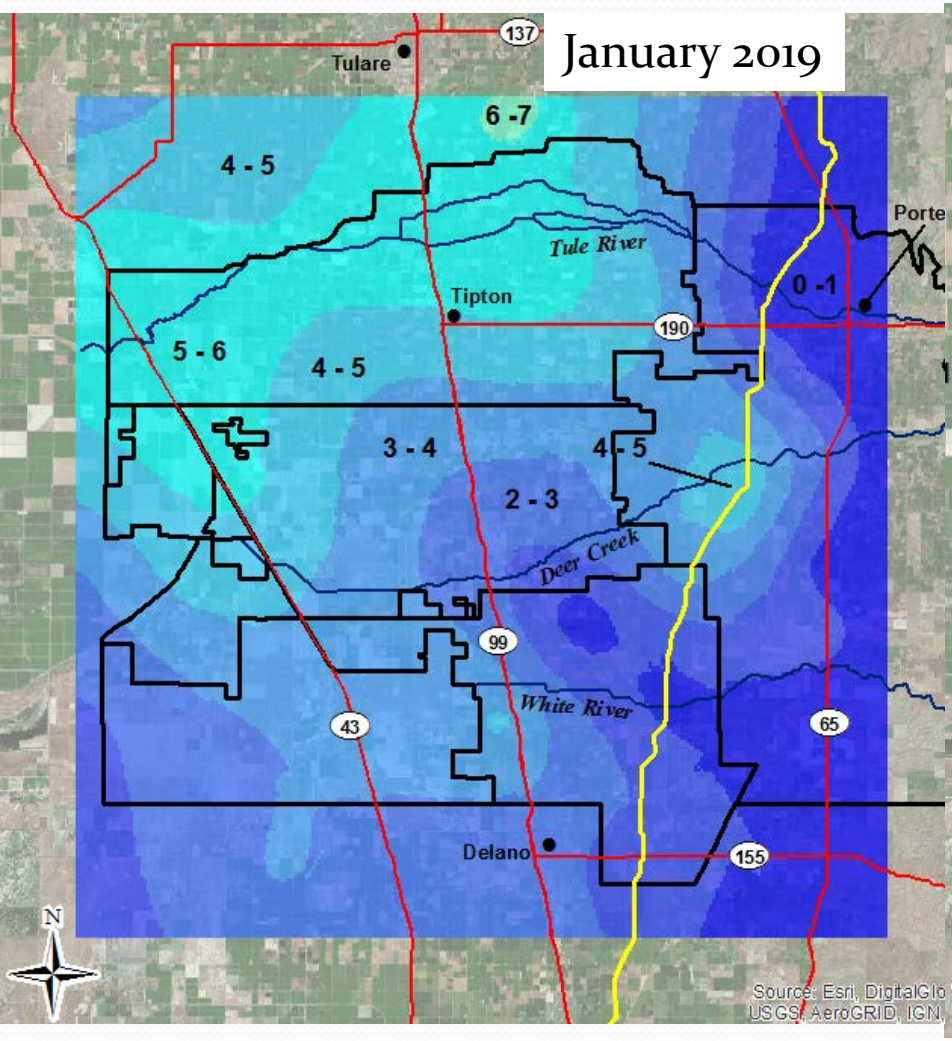
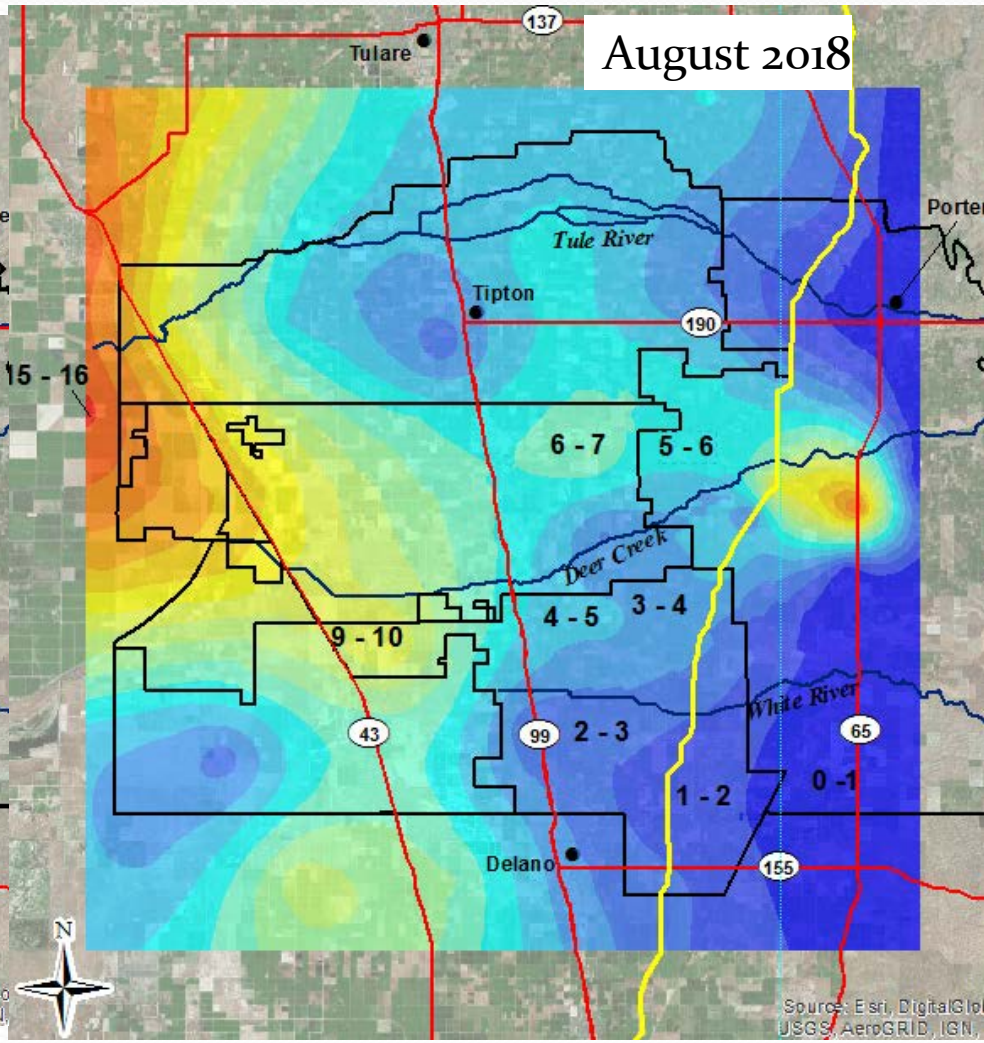
## Scenario 3

2020 – 2030 No Change
2030 – 2040 Yr Ramp Down



# Model-Projected Land Subsidence Beneath Friant-Kern Canal 2017 - 2030

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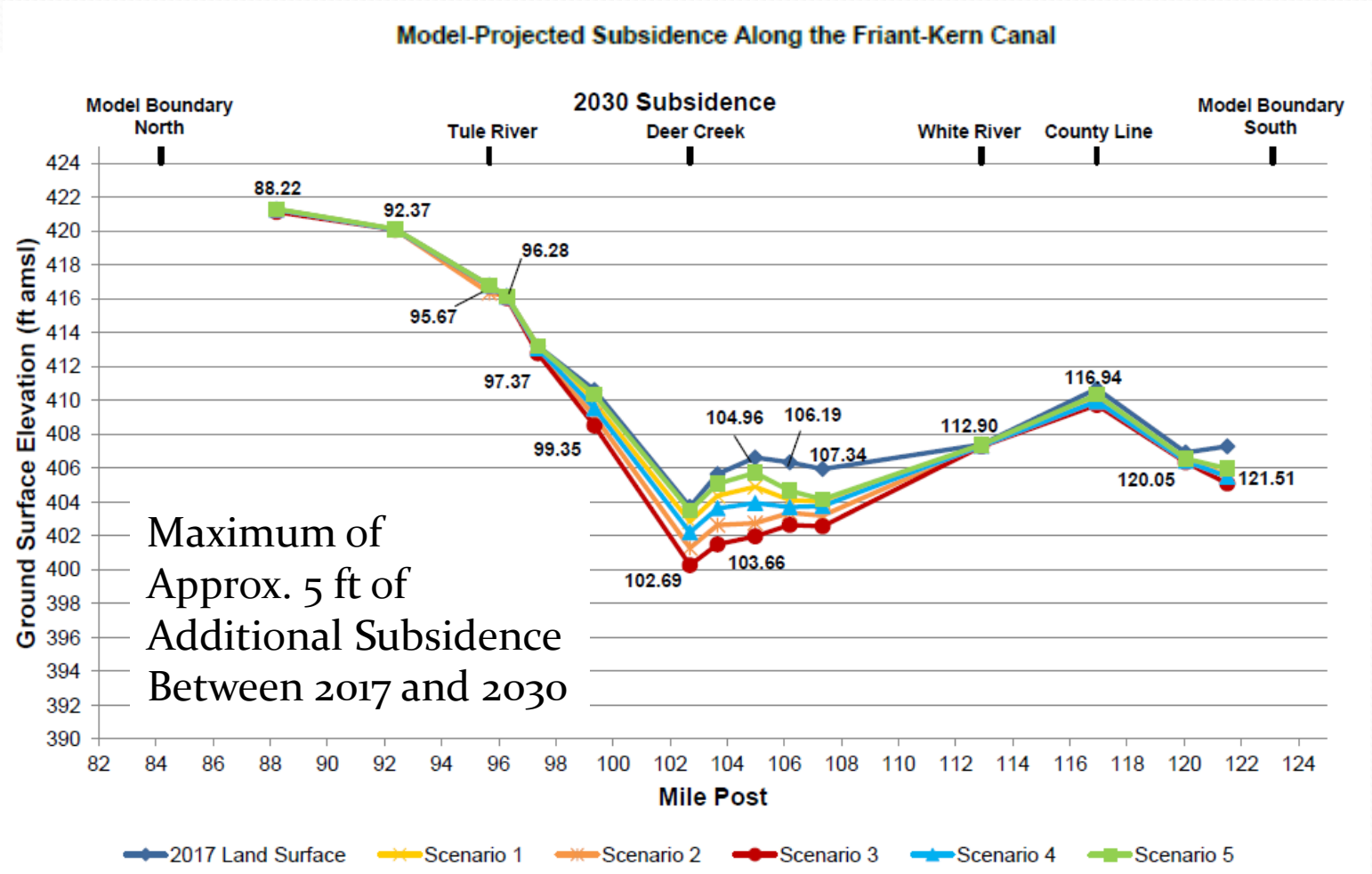


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# Model-Projected Land Subsidence Beneath Friant-Kern Canal 2017 - 2040

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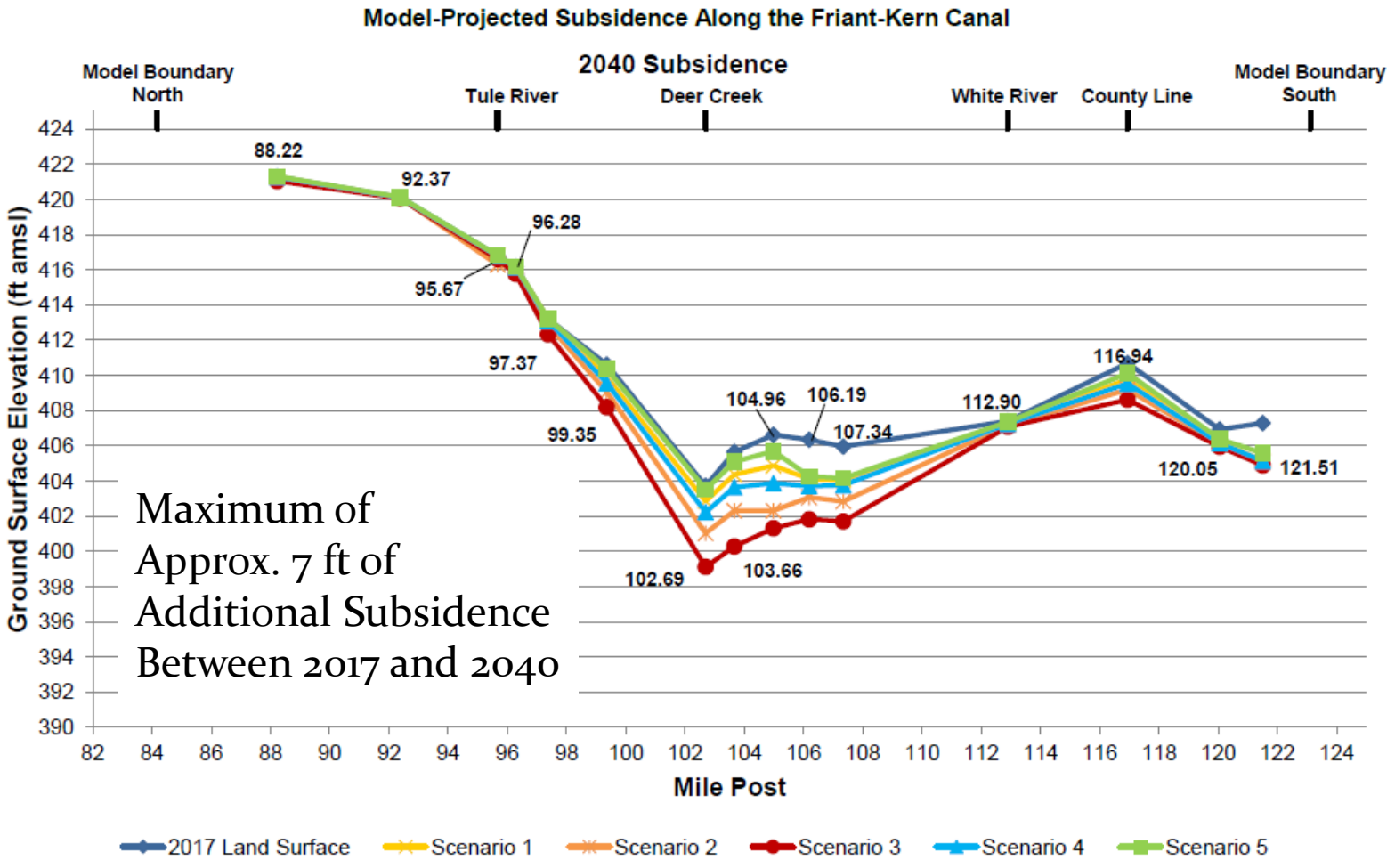


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# Model-Projected Land Subsidence Beneath Friant-Kern Canal 2017 - 2050

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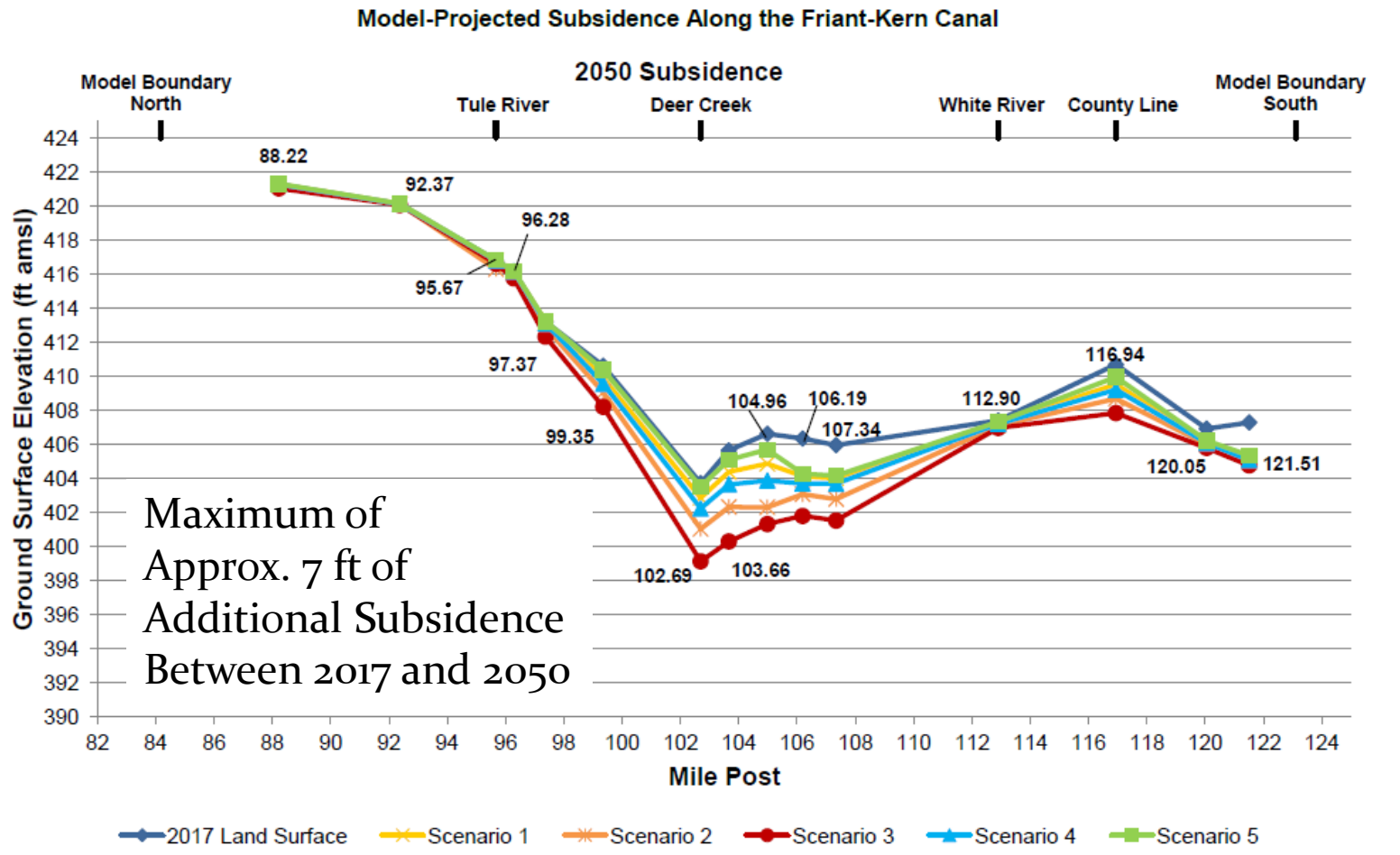


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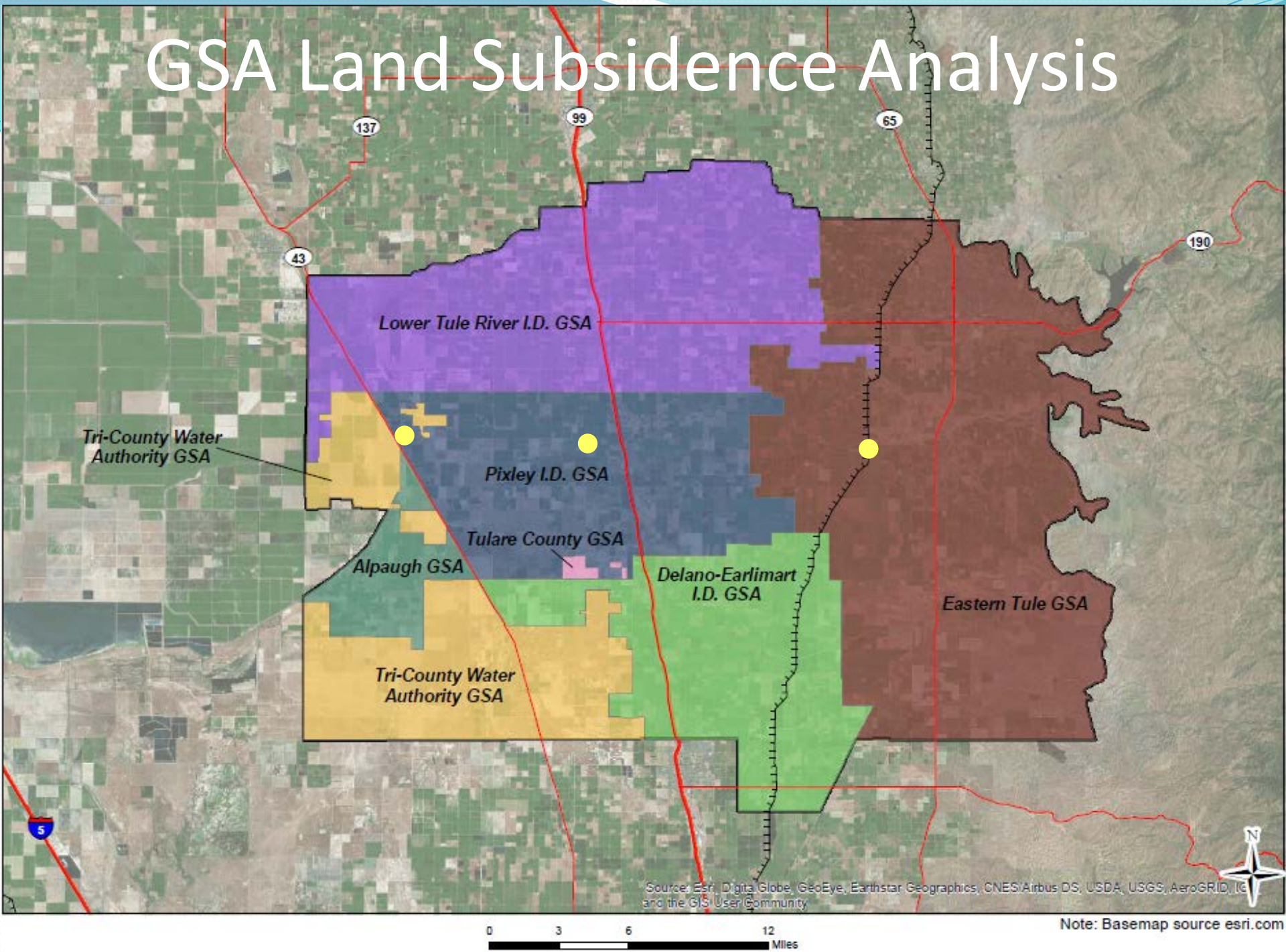
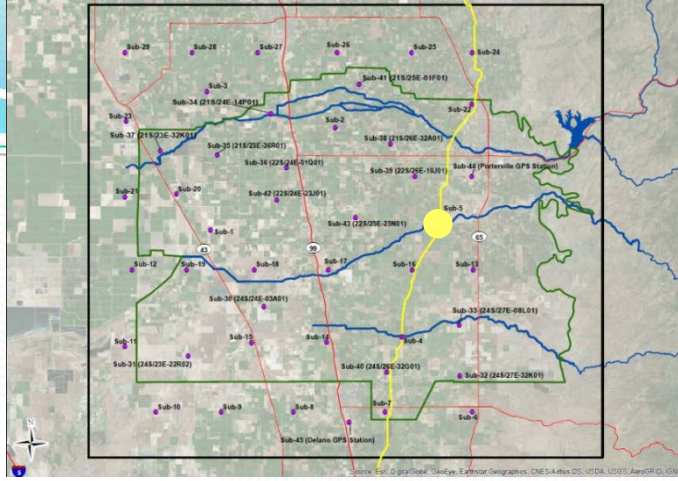
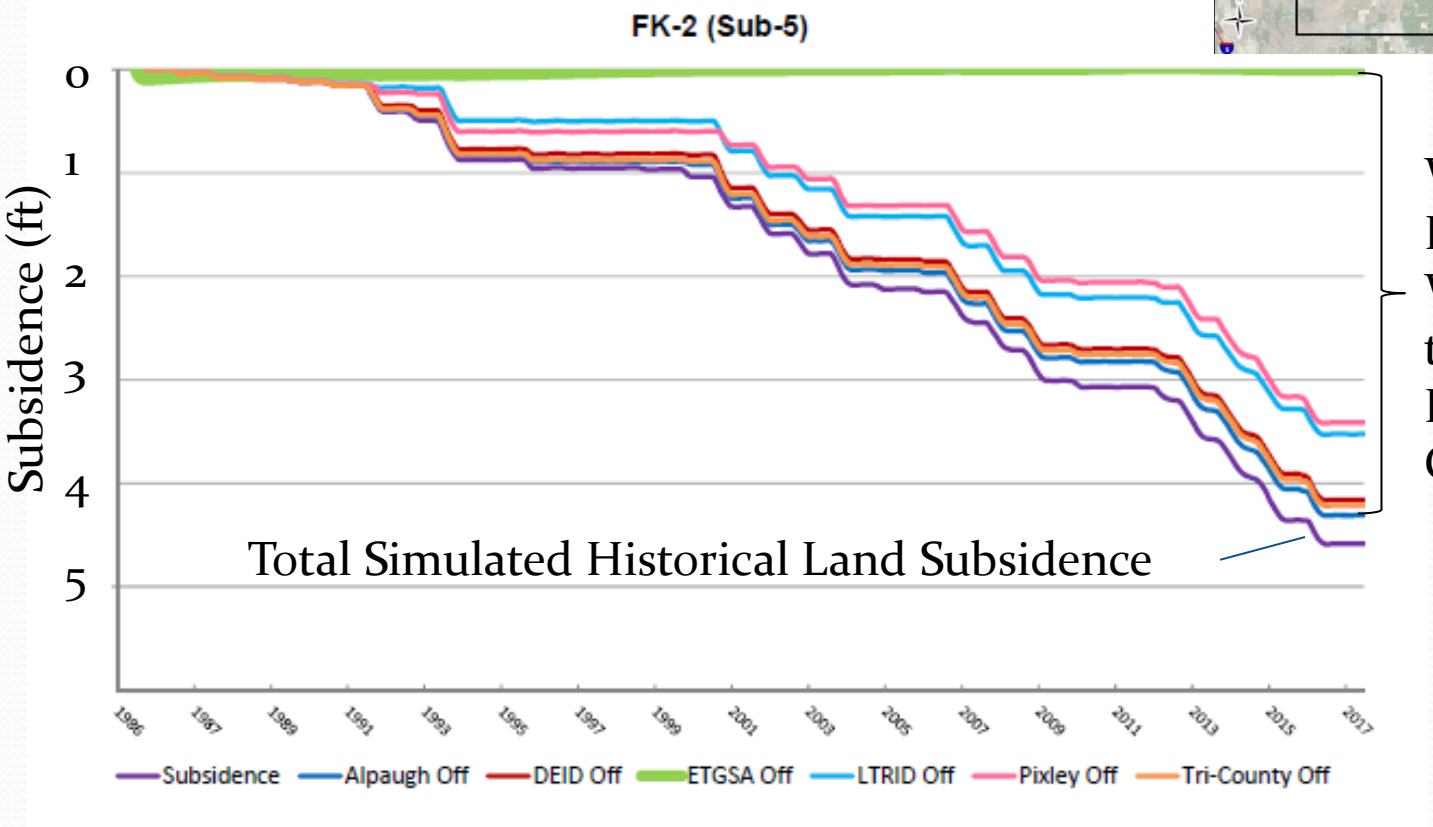
# GSA Land Subsidence Analysis




Note: Basemap source esri.com

# Relative Contribution to Subsidence Beneath the Friant-Kern Canal






What Historical Land Subsidence Would Have Been If the Individual GSAs Had Not Pumped Groundwater

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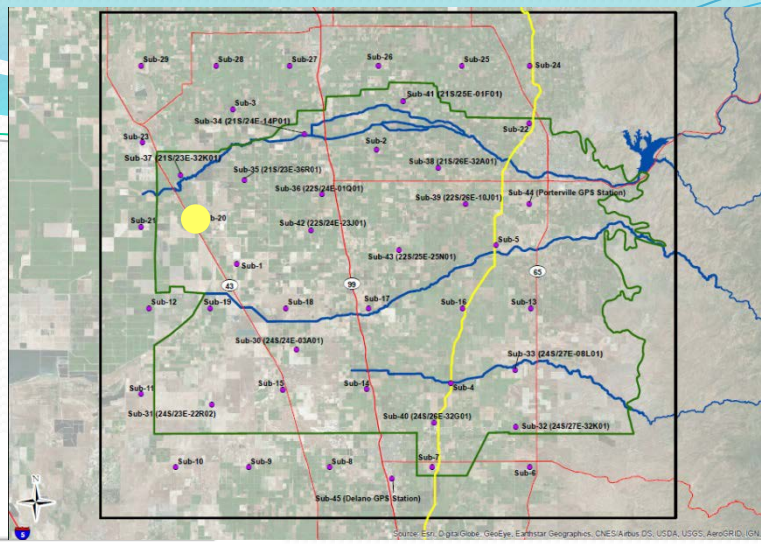
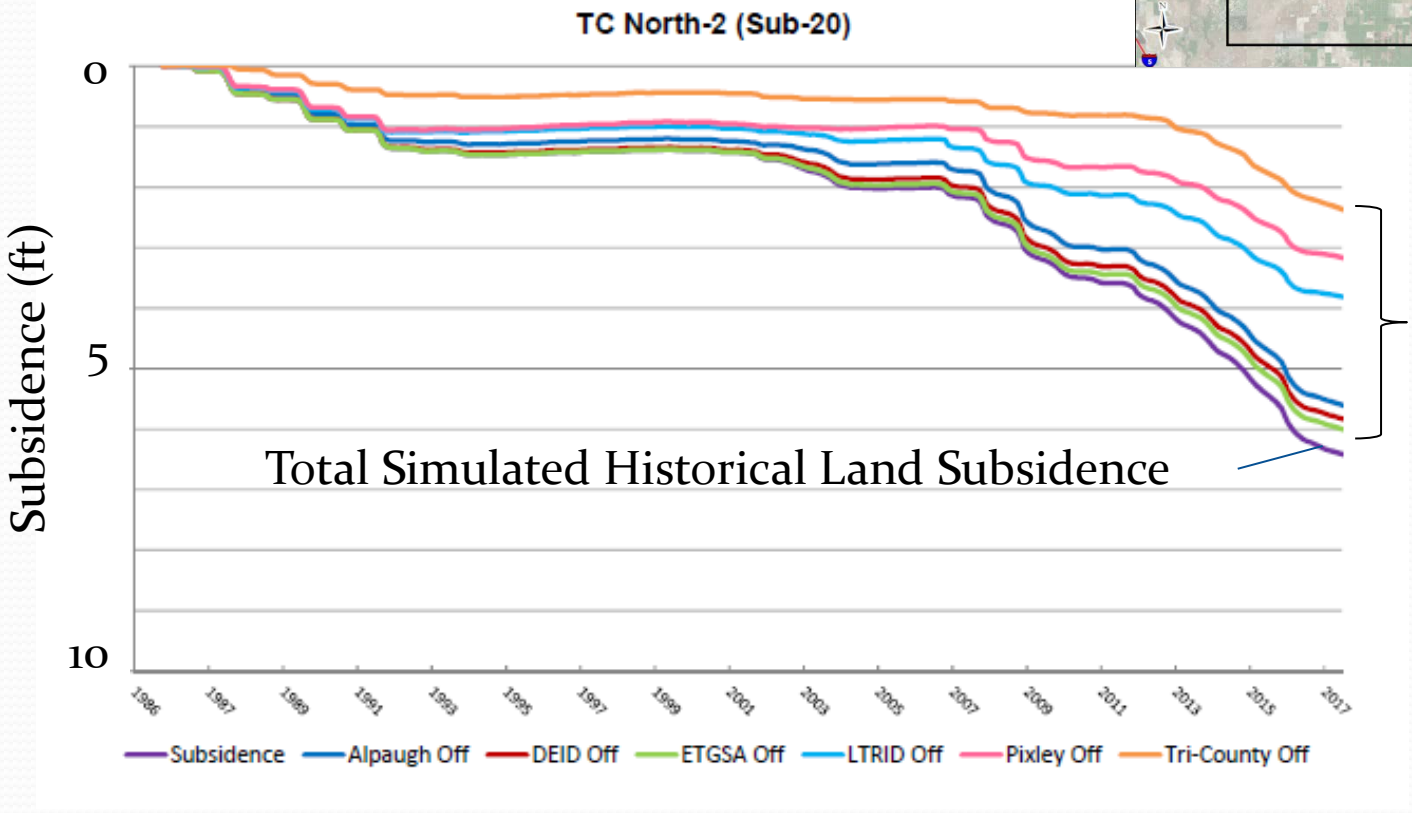
# Relative Contribution to Subsidence Tri-County North Area




What Historical Land Subsidence Would Have Been If the Individual GSAs Had Not Pumped Groundwater

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# GSP Next Steps

- Estimate GSA Specific Water Budgets
  - Historical – 1986 – 2017
  - Current
  - Future
- Future Water Budget will Incorporate:
  - Estimated Future Deliveries on the Friant-Kern Canal
  - Projected Urban Water Demand
  - Hydrology that Incorporates DWR Estimates for Climate Change
  - Timing for Reductions in Crop Consumptive Use (i.e Ramp Down)

# GSP Next Steps

- What We Need from the GSAs:
  - The Timing for Reductions in Crop Consumptive Use
  - Minimum Thresholds for Land Subsidence
  - Projects?
- Schedule?

# Questions