Numerical Groundwater Model for the Kaweah Delta Water Conservation District

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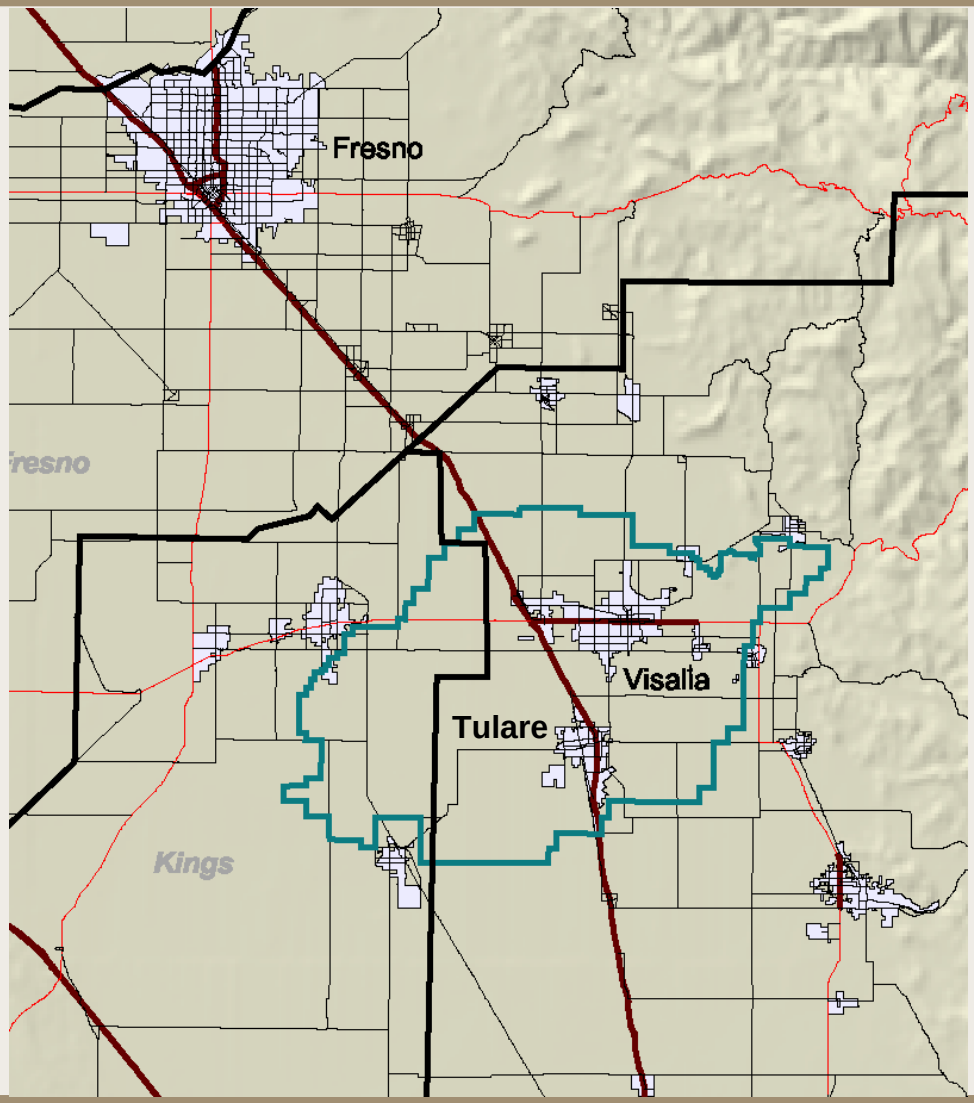
Presentation Outline

- Background and Setting of Study Area
- Groundwater Model Development
- Model Application: Five Future Scenarios
- Groundwater Model for the City of Visalia

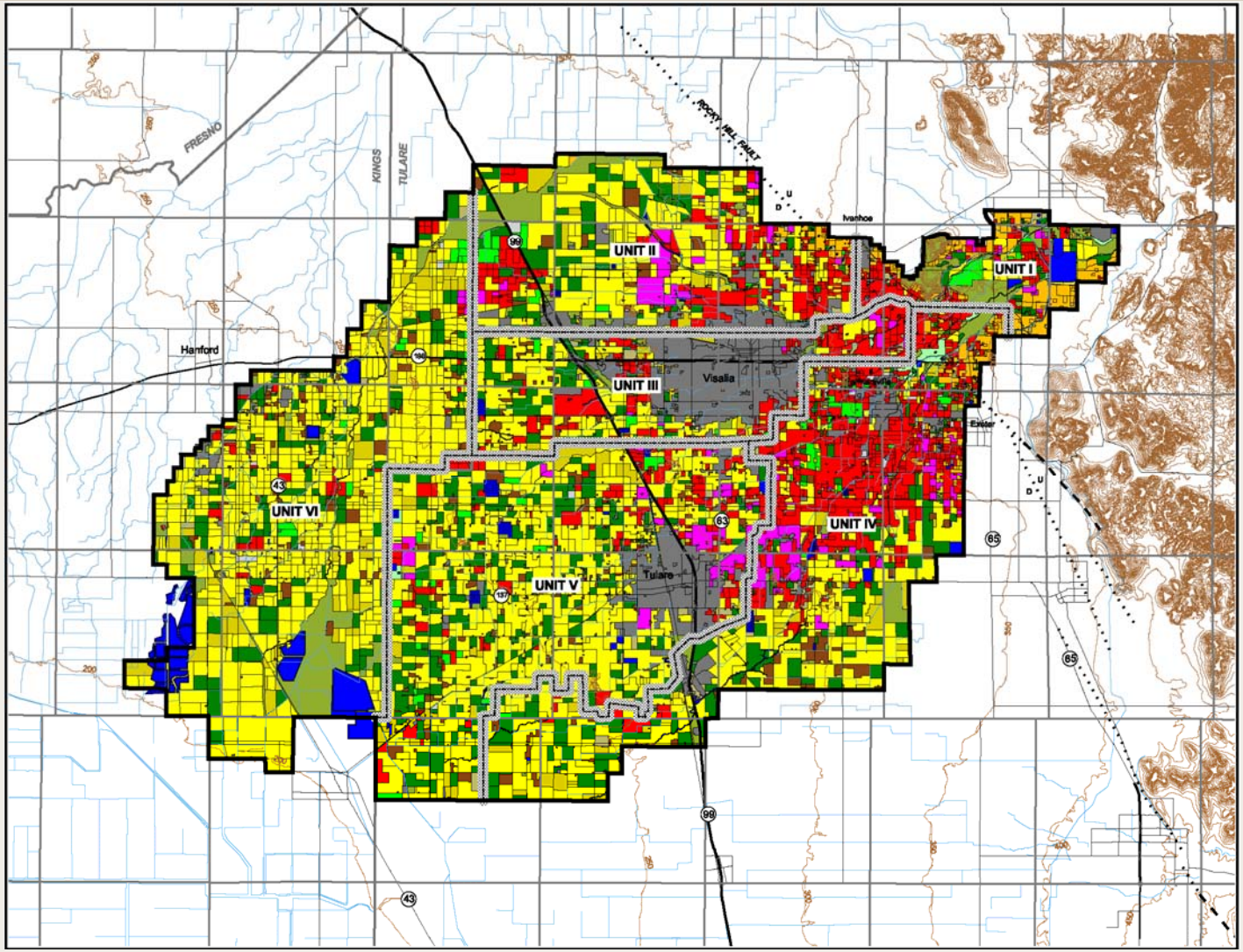
Study Area Location



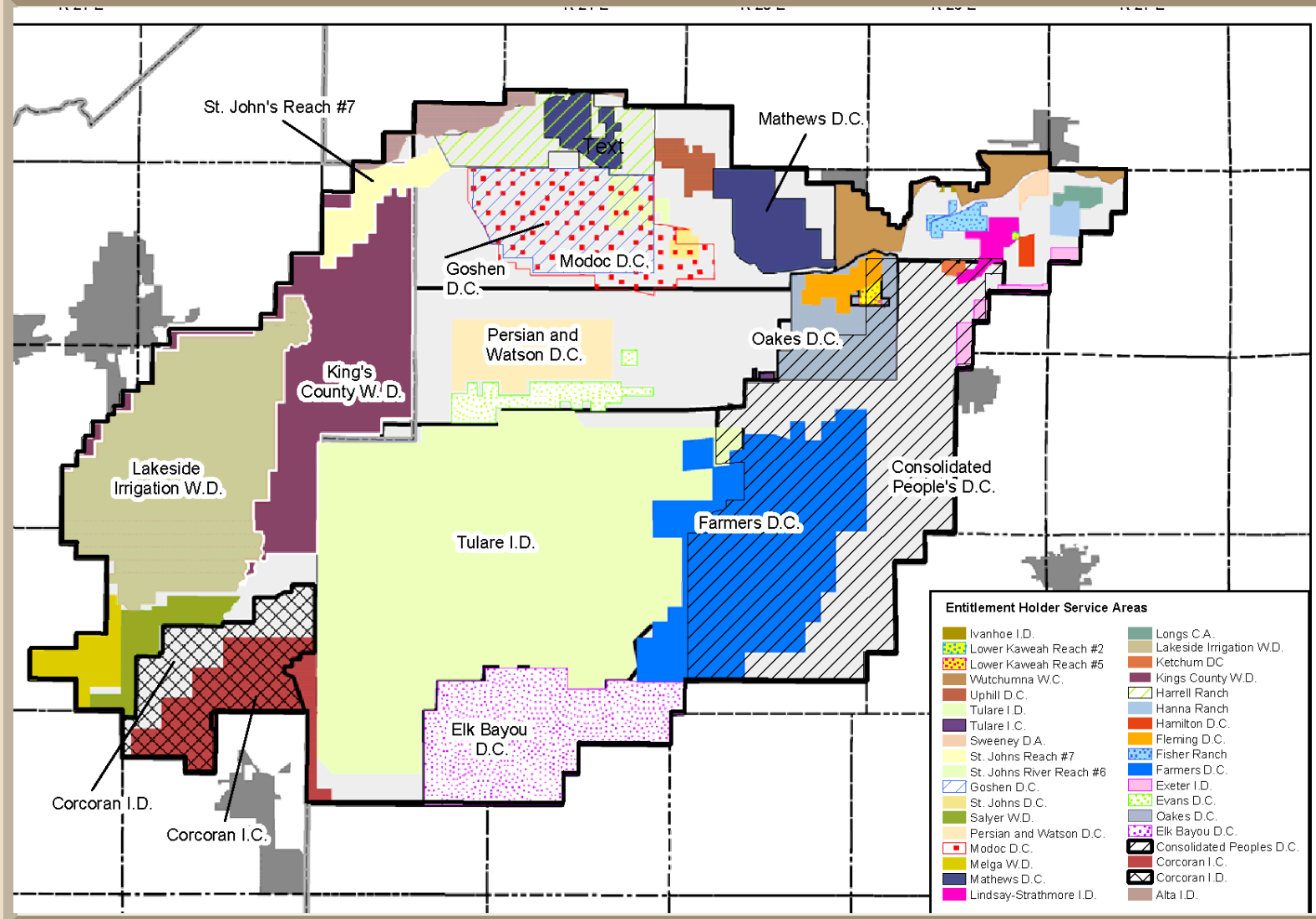
Background and Setting

- Kaweah Delta Water Conservation District (District) is approx. 340,000 acres in size
- Agricultural comprises 285,000 acres; urban areas are 40,000 acres; undeveloped lands are 15,000 acres
- District uses approx. 880,000 acre-feet of surface water and groundwater per year
- Irrigated agriculture consumes more than 95% of the surface water and groundwater
- District has more than 35 entitlement holders

Major Land Uses



Entitlement Holder Services Areas



Basic Elements of the Groundwater Model

- Base period: water years from 1981 to 1999
- Conceptual model of aquifer system hydrogeology
- Hydrologic balance: major groundwater recharge and discharge components
- MODFLOW software using Argus ONE GUI
- Calibrated the model using PEST software

Aquifer System Recharge

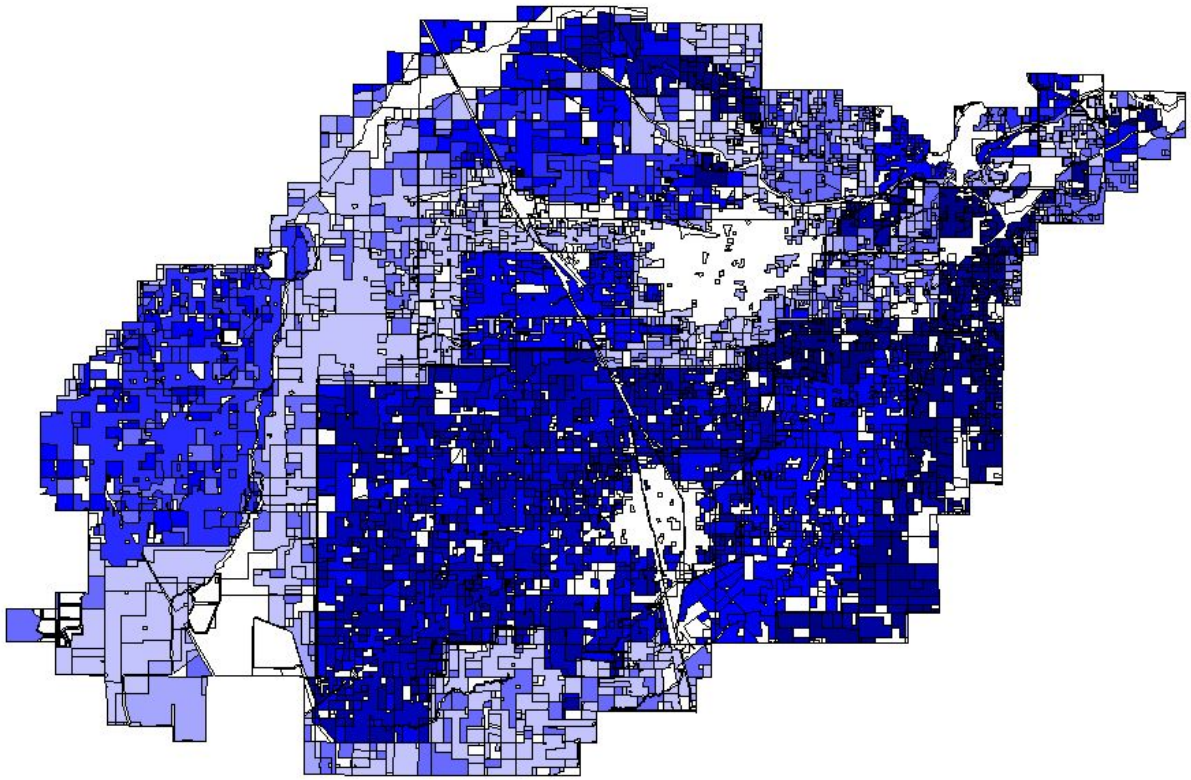
- Subsurface groundwater inflows from surrounding areas
- Seepage from surface water channels (rivers, ditches, canals)
- Deep percolation of excess irrigation
- Deep percolation of precipitation
- Artificial recharge in percolation basins
- Discharge from urban wastewater treatment plants

Aquifer System Discharge

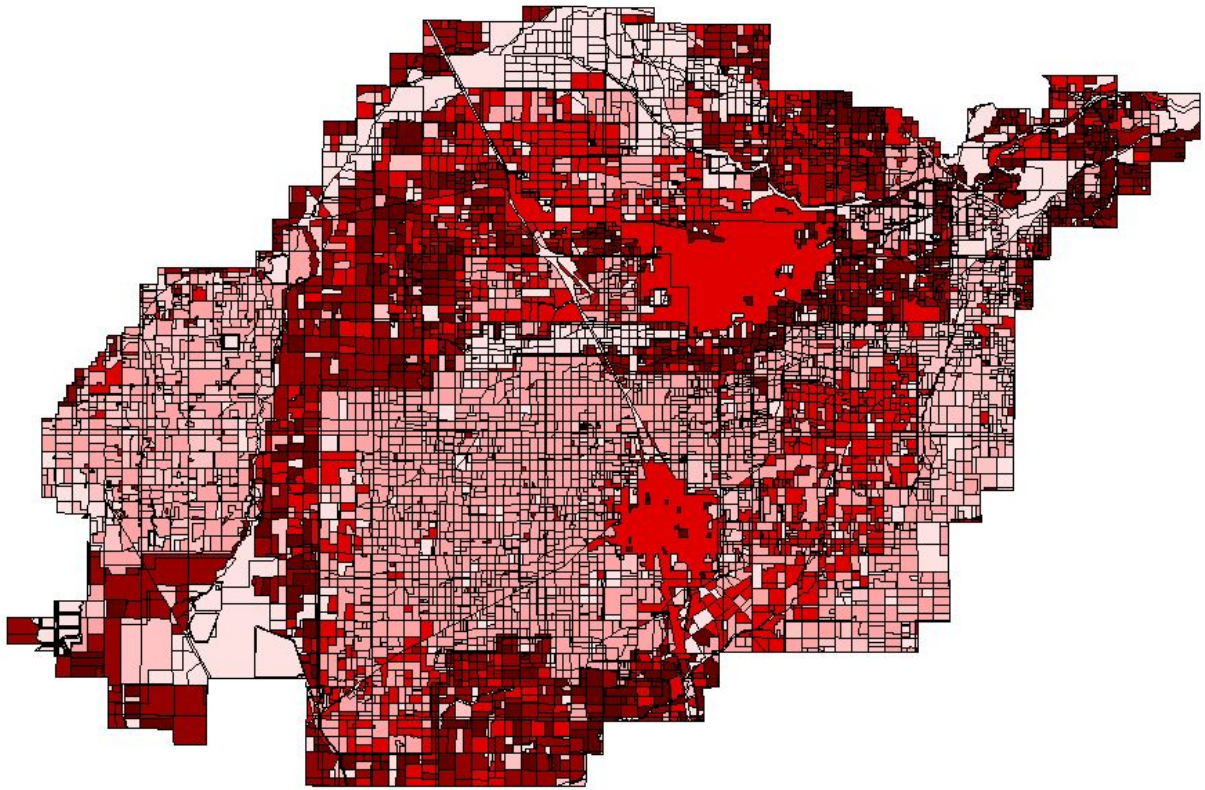
- Subsurface groundwater outflows into surrounding areas

- Agricultural, semi-agricultural, & urban pumping

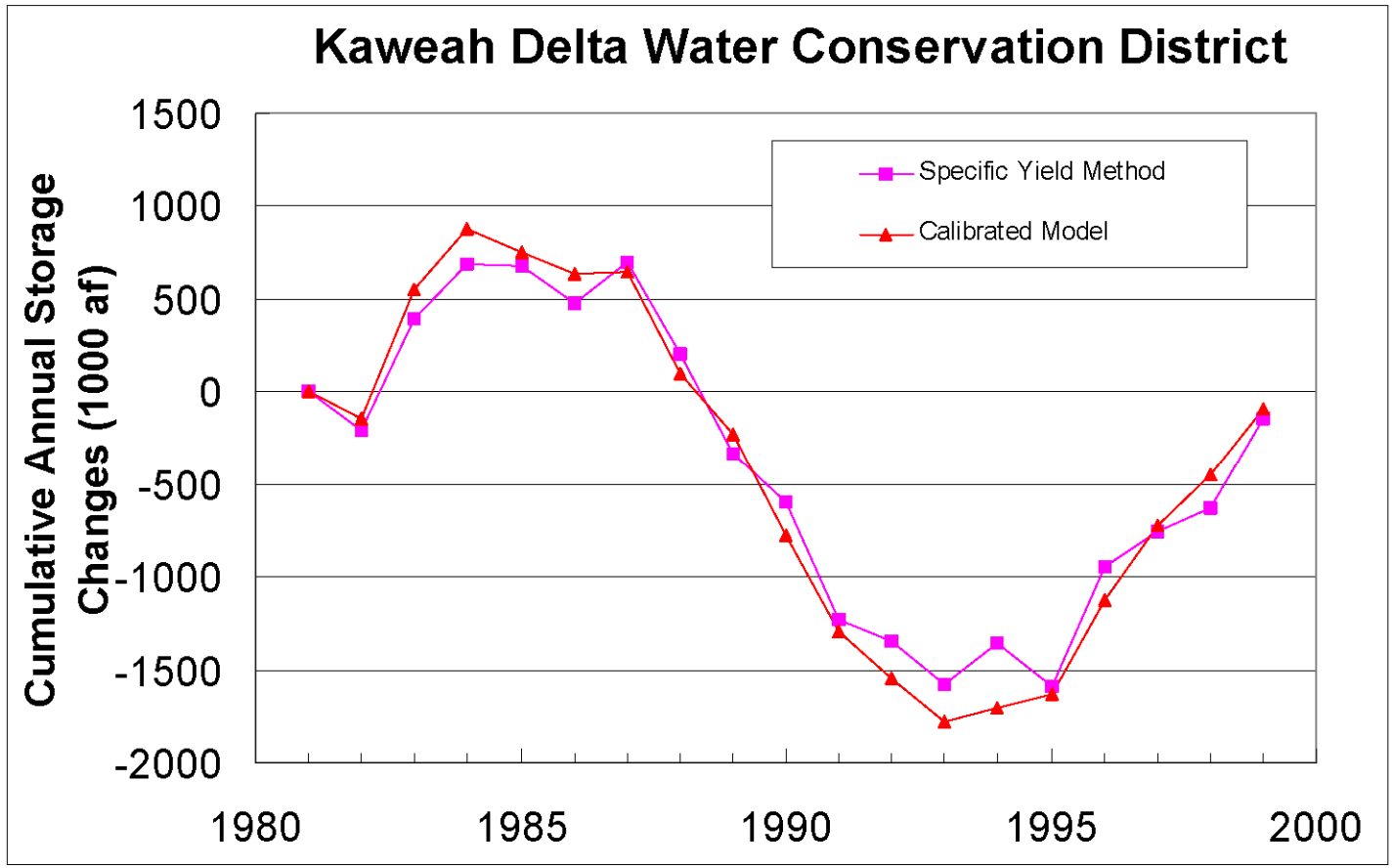
Groundwater Recharge
for Spring-Summer Stress Period of 1998



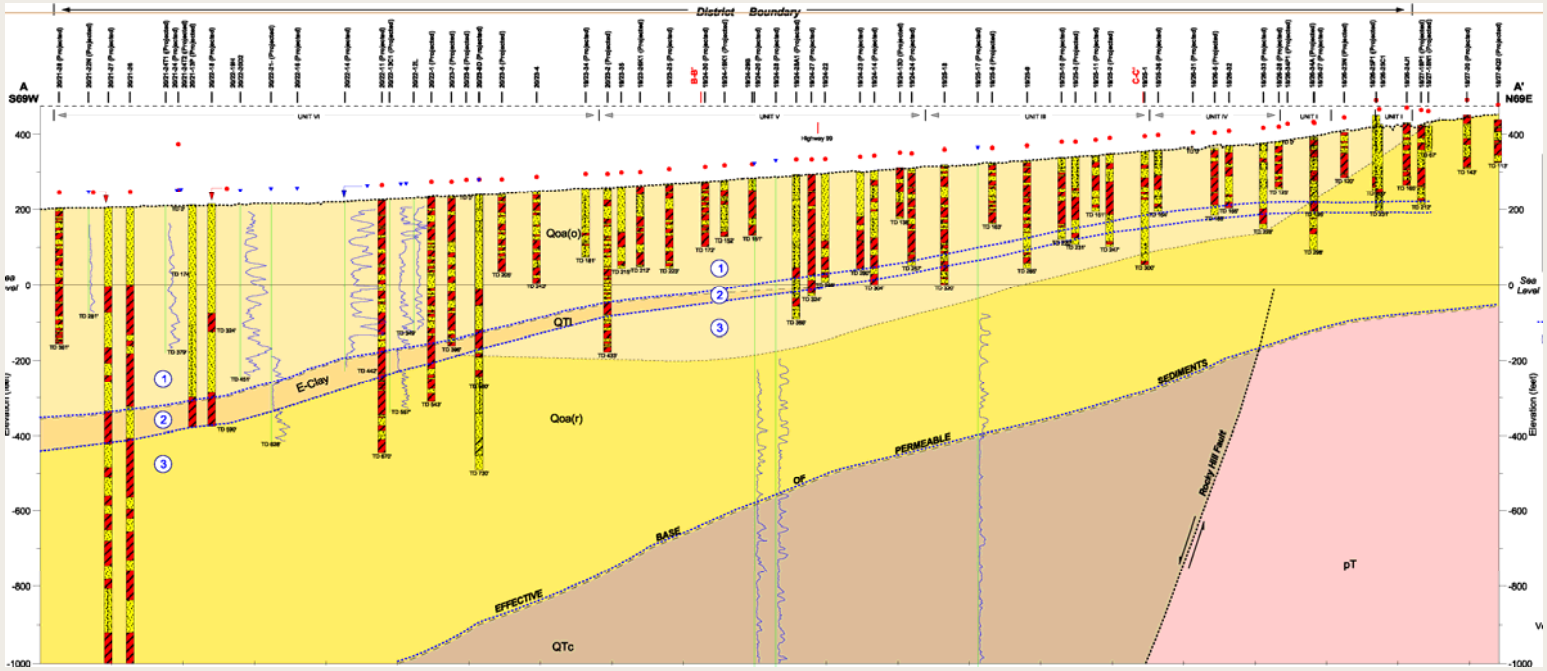
Groundwater Pumping
for Spring-Summer Stress Period of 1998



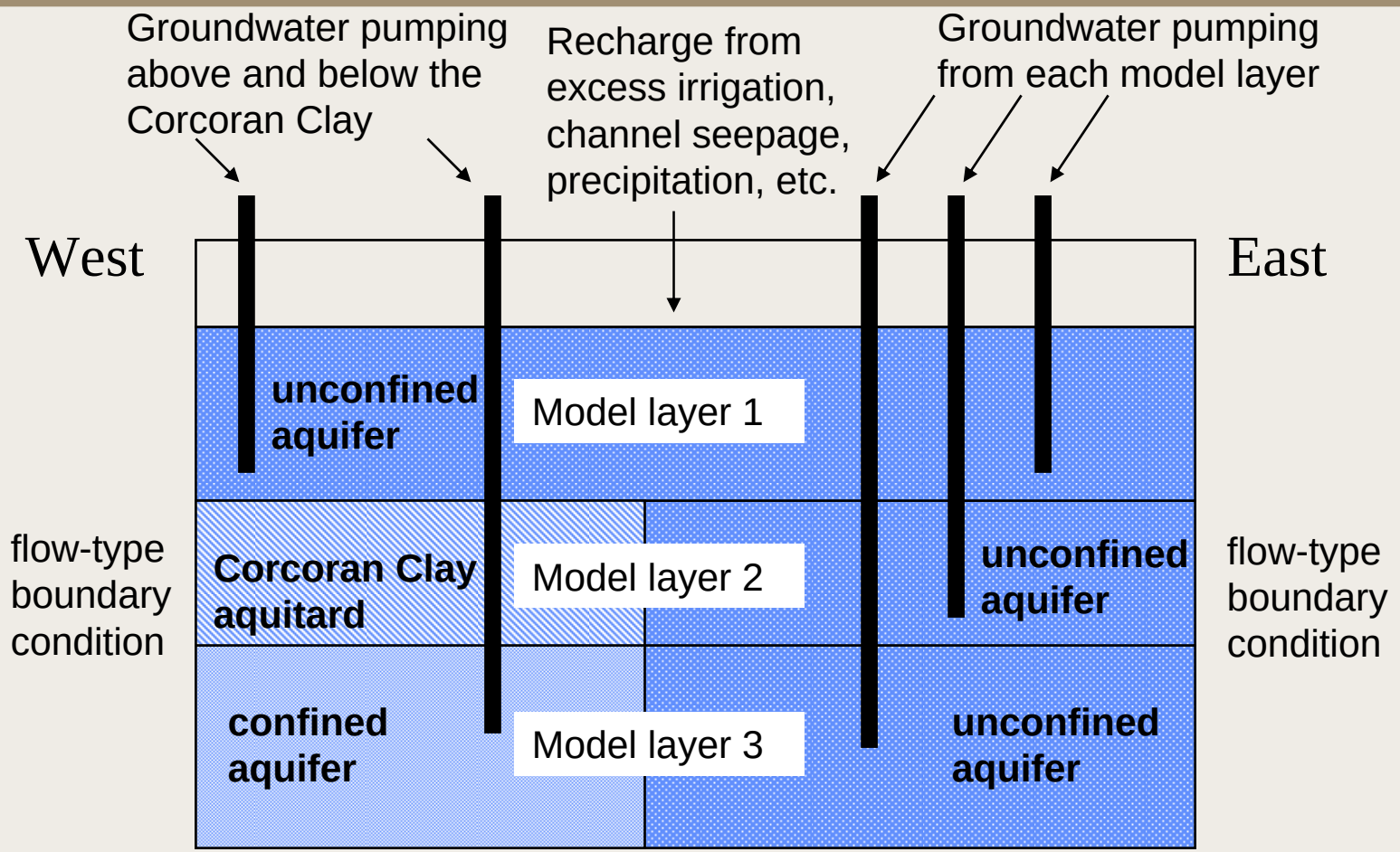
Hydrologic Water Balance: Storage Changes



Geologic Cross Sections



Conceptual Model of Hydrogeology



Future Scenarios of Water Supply and Demand

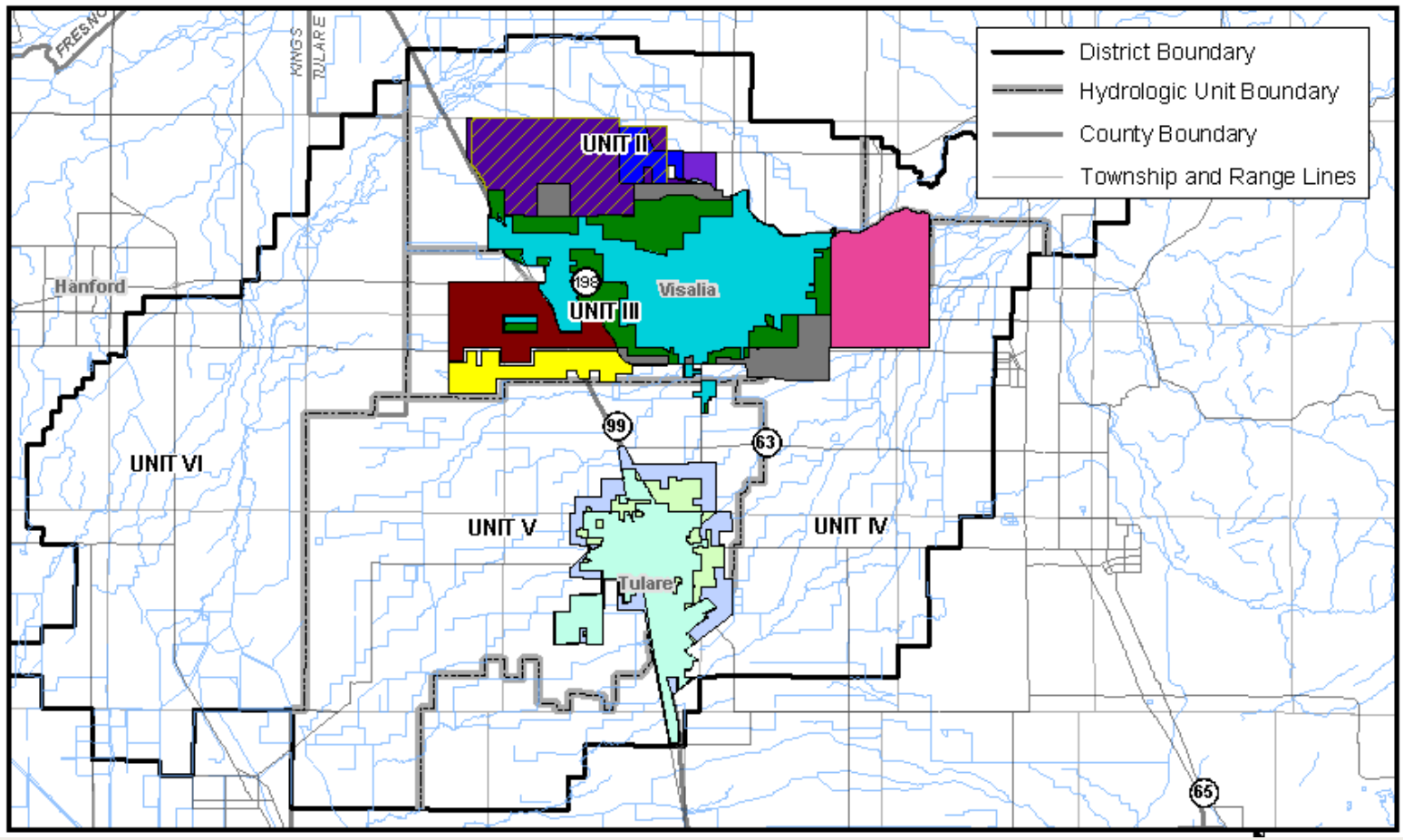
- Calibrated model used to evaluate 5 future scenarios of water supply and demand in the District

- Future simulation period: 2000 to 2018

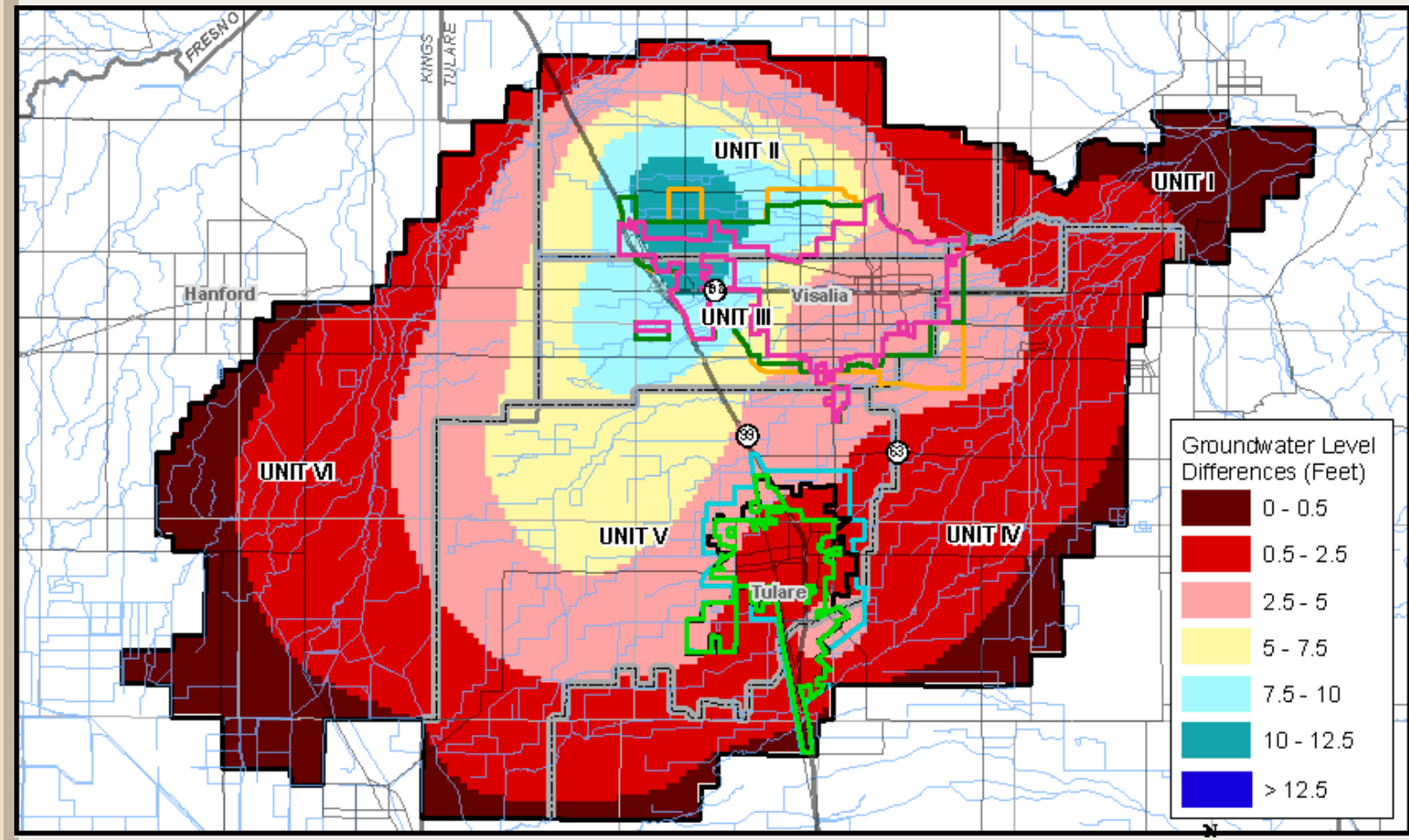
- Future scenarios assume same natural hydrology as 1981 to 1999 base period

- Future scenarios evaluated by comparison against a “no-change” scenario from 2000 to 2018

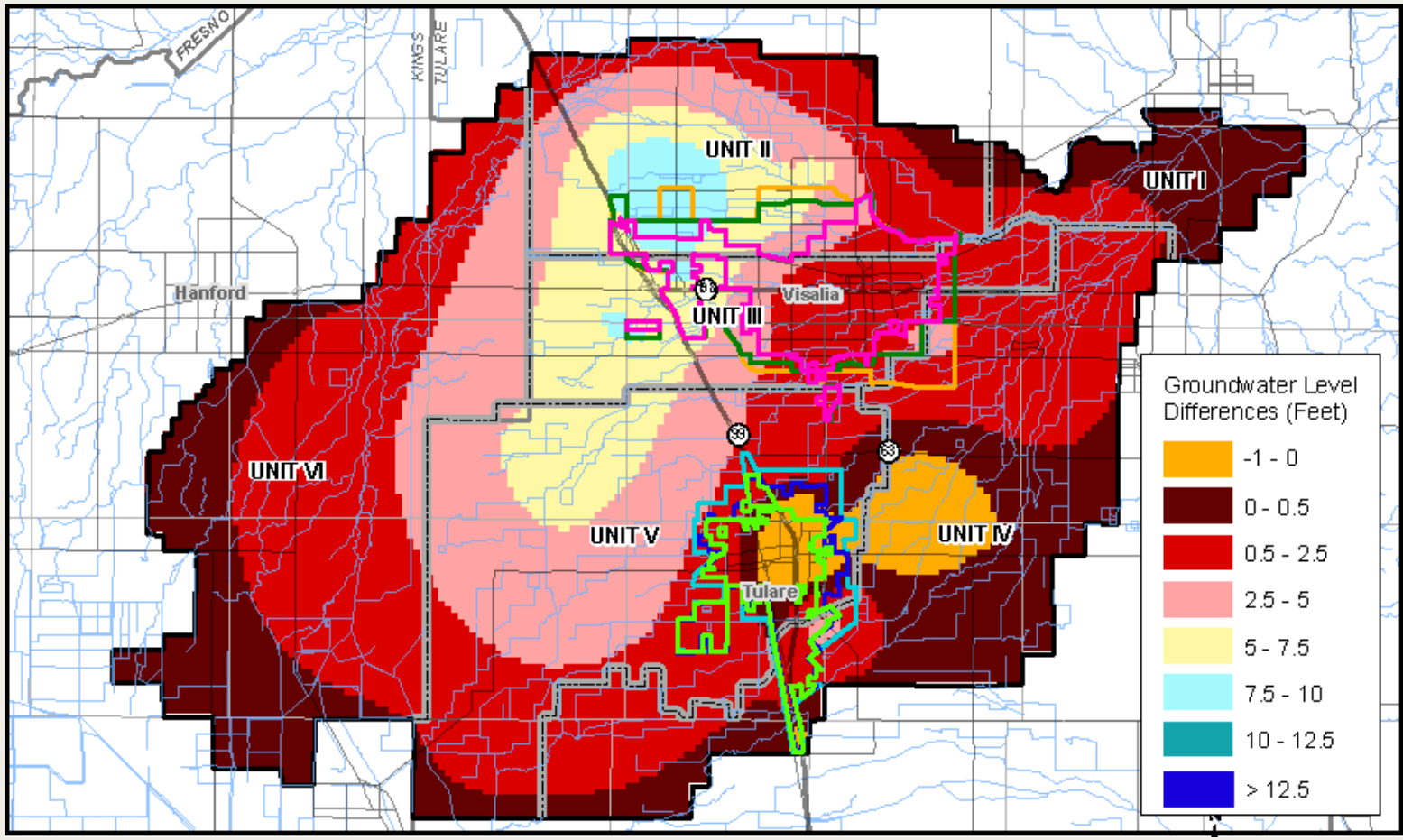
Scenarios 1 and 2: Urban Growth in the Cities of Visalia and Tulare



Scenario 1: 2% Annual Urban Growth Rate



Scenario 2: 3% Annual Urban Growth Rate



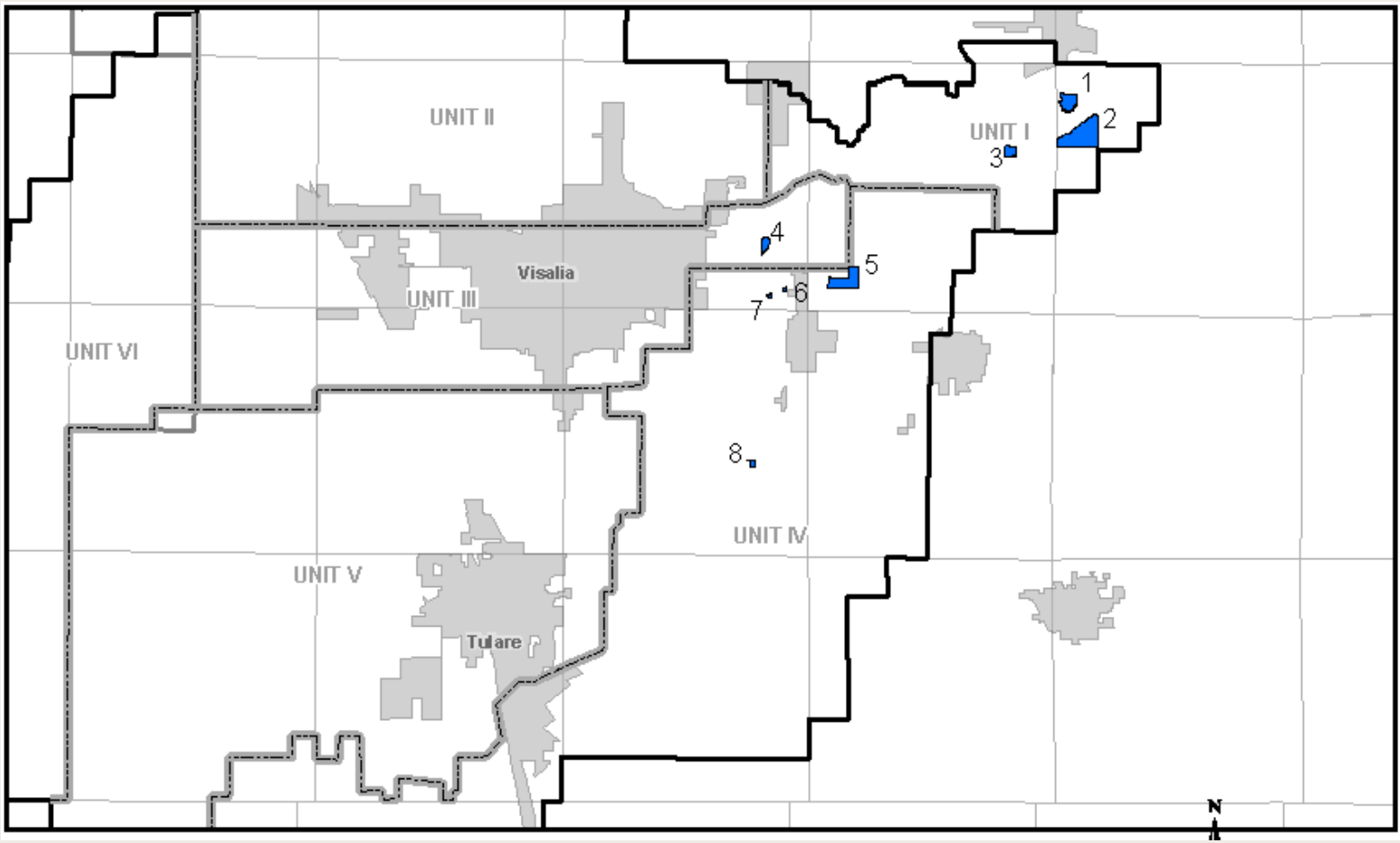
Scenario 3: District Water Management Basins

- Supplemental surface water used to recharge 8 District water management basins (682 acres)

- Supplemental water from captured spills and fixed annual CVP supply of 4,250 acre-feet obtained through a local agreement

- Total recharge over 19-year future period was 408,571 acre-feet

Scenario 3: District Water Management Basins



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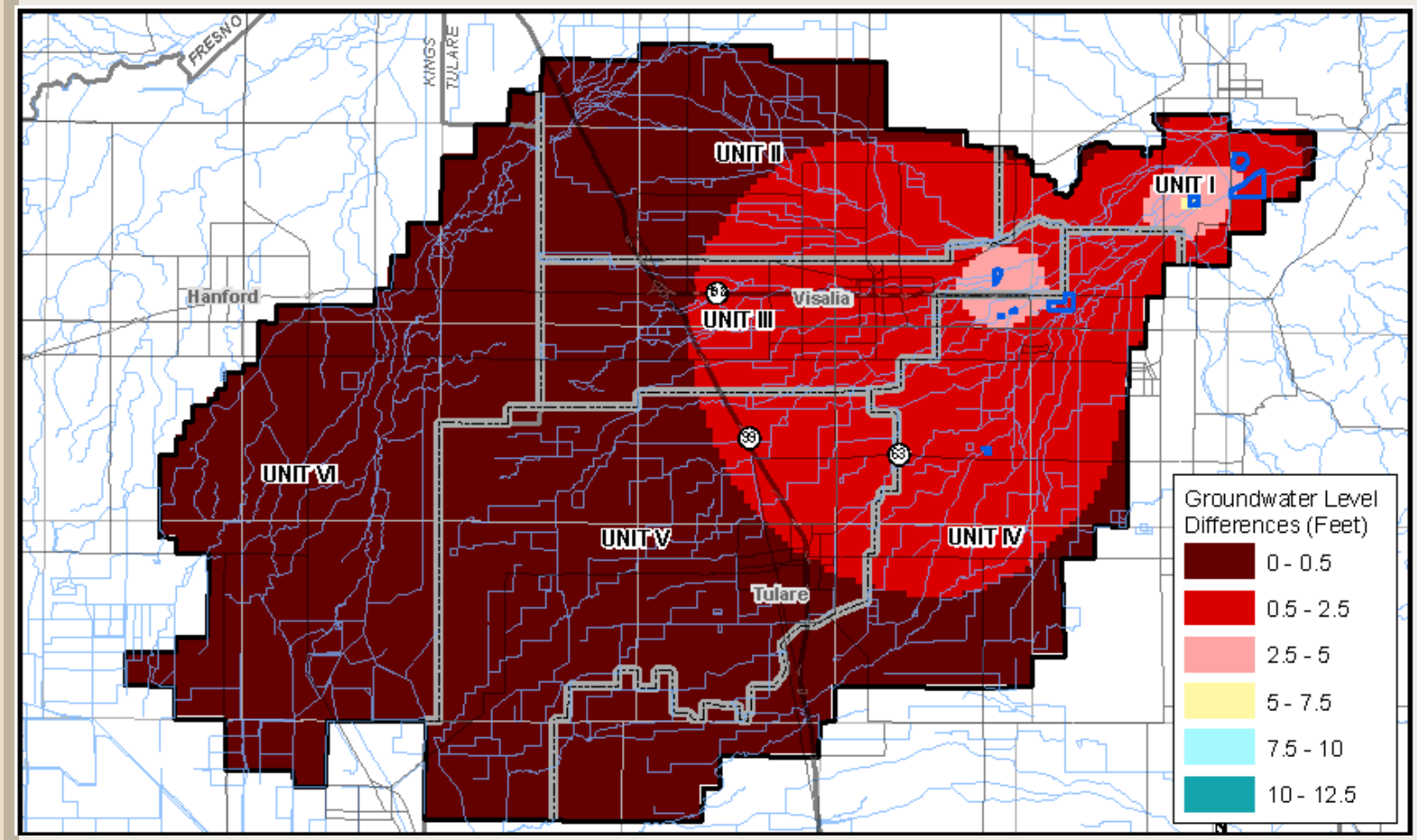


Scenario 4: Conceptualized Delta View Improvement District

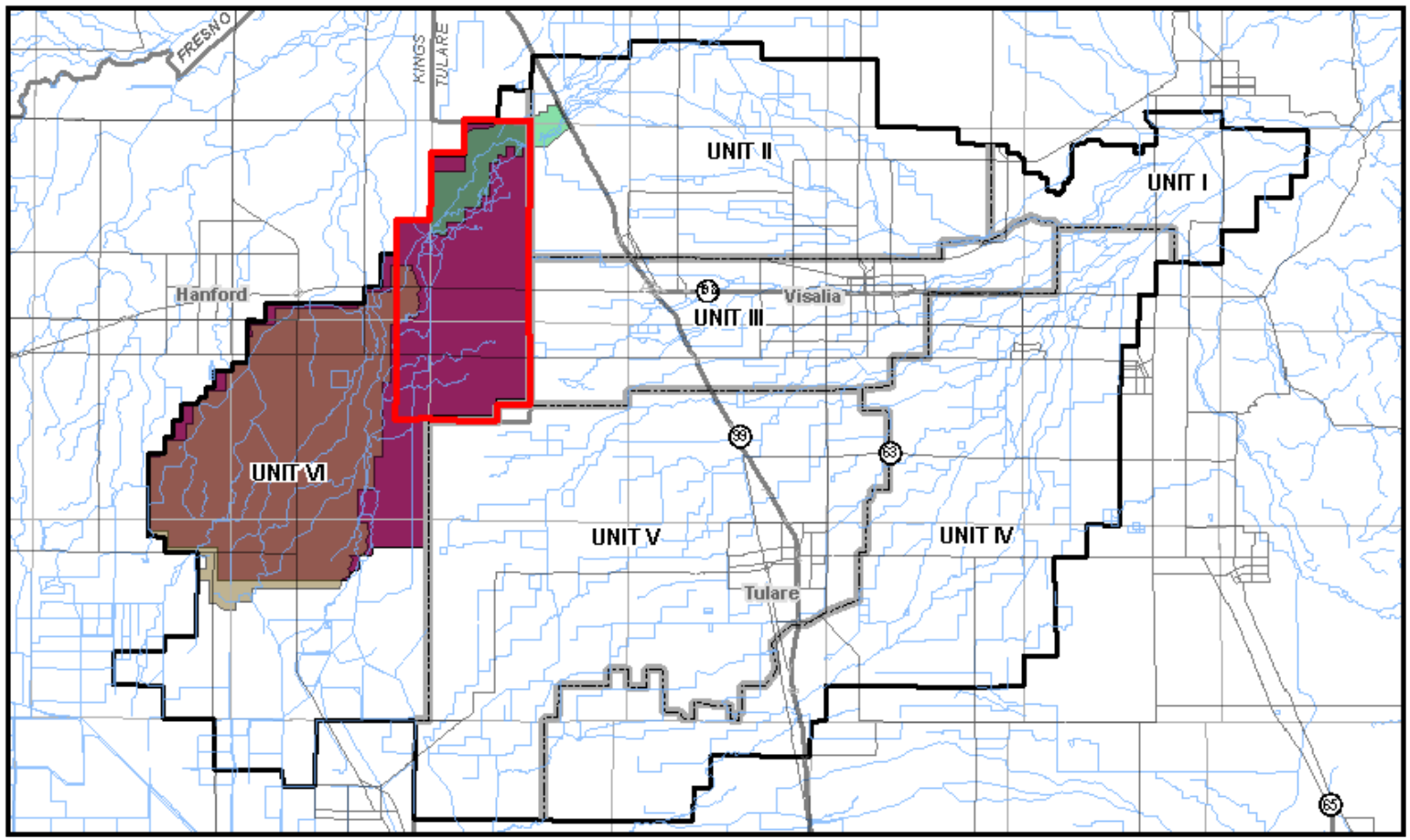
- Supplemental CVP surface water diverted to conceptualized Delta View Improvement District

- 20,000 acre-feet annually diverted 11 of 19 future water years

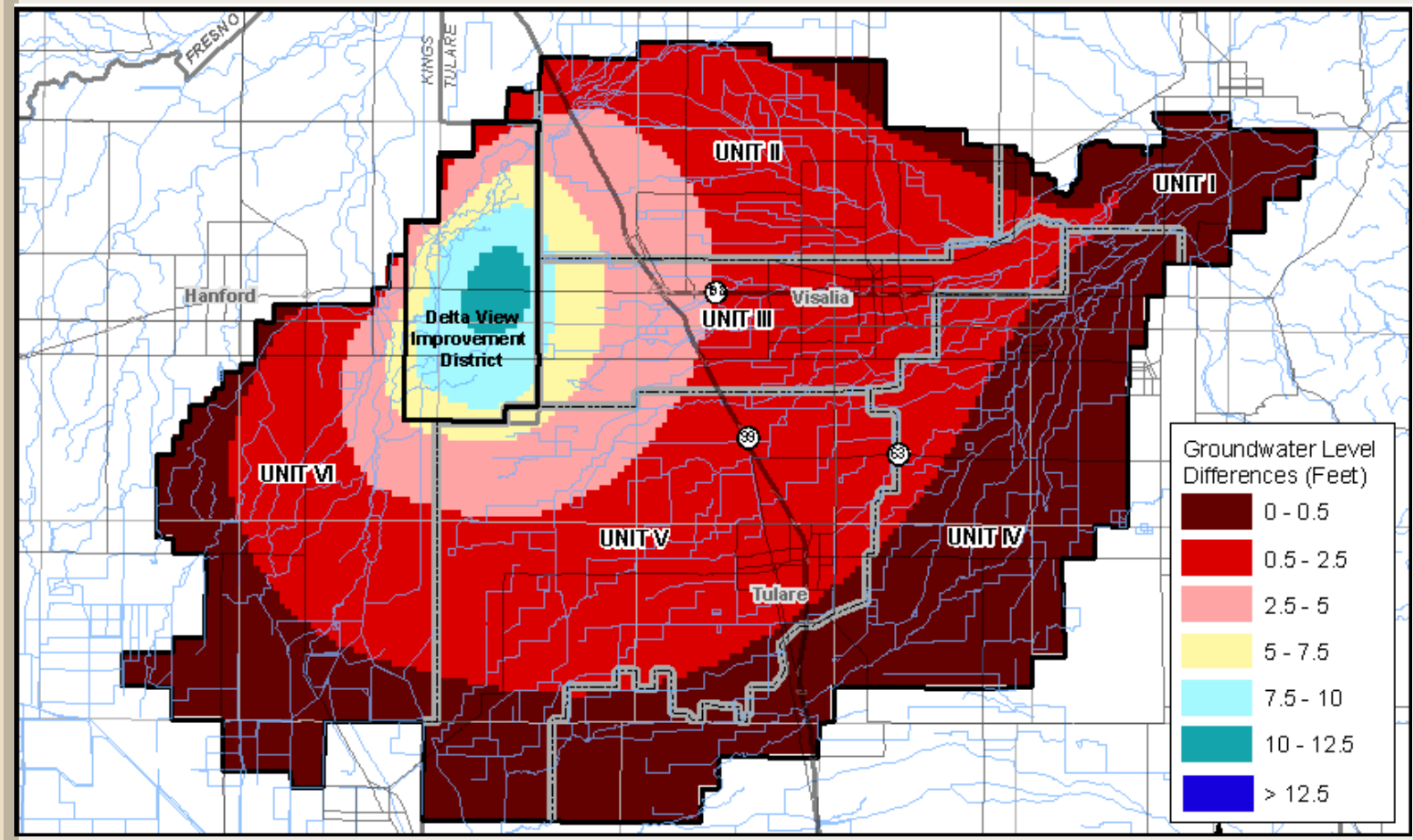
- 12,000 acre-feet annually applied in each of the 11 years after accounting for conveyance losses

- Supplemental supplies diverted over typical irrigation schedule

Scenario 4: Delta View Improvement District



Scenario 4: Delta View Improvement District



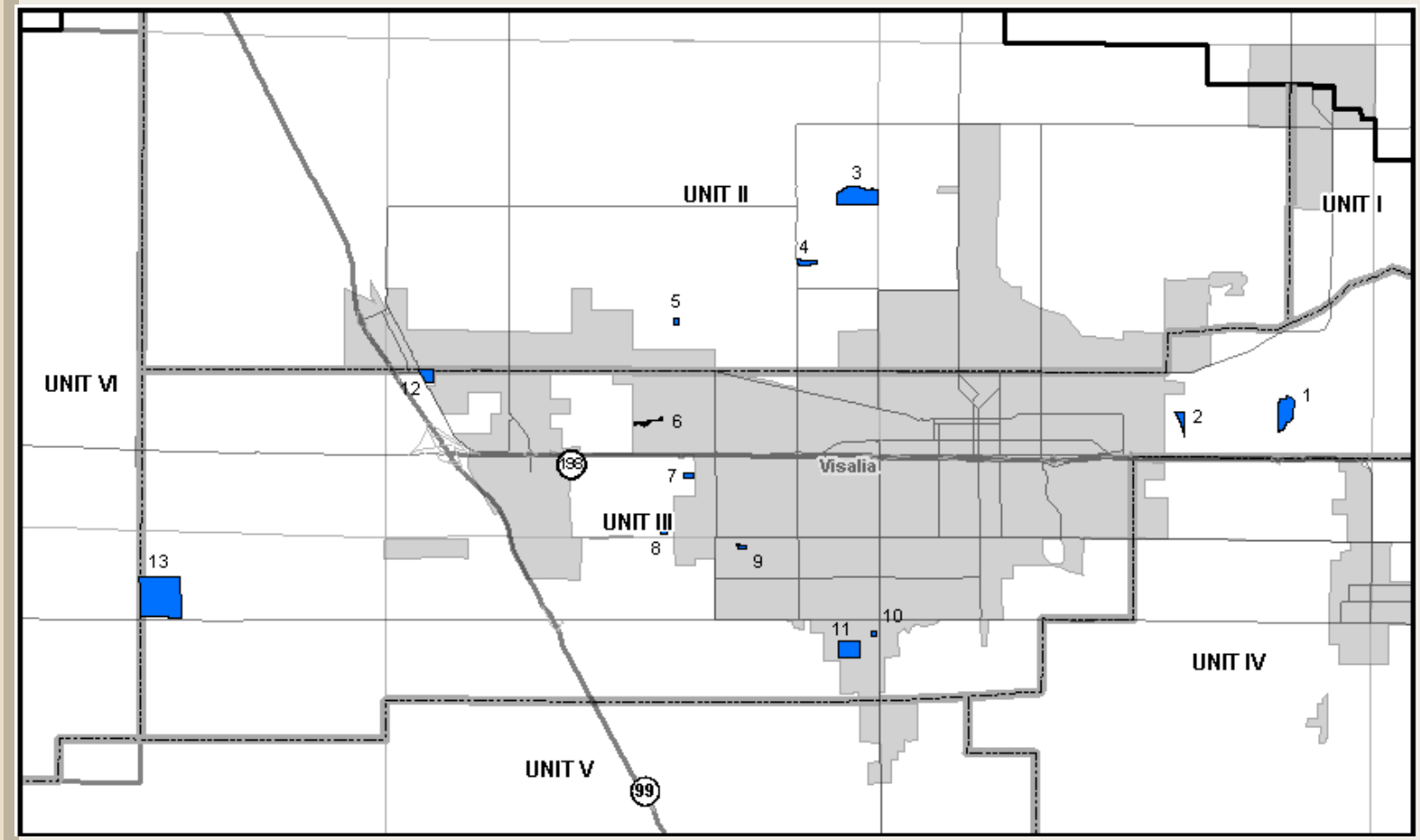
Scenario 5: City of Visalia Stormwater/Recharge Basins

- Supplemental surface water used to recharge 13 stormwater/recharge basins in and around Visalia (344 acres)

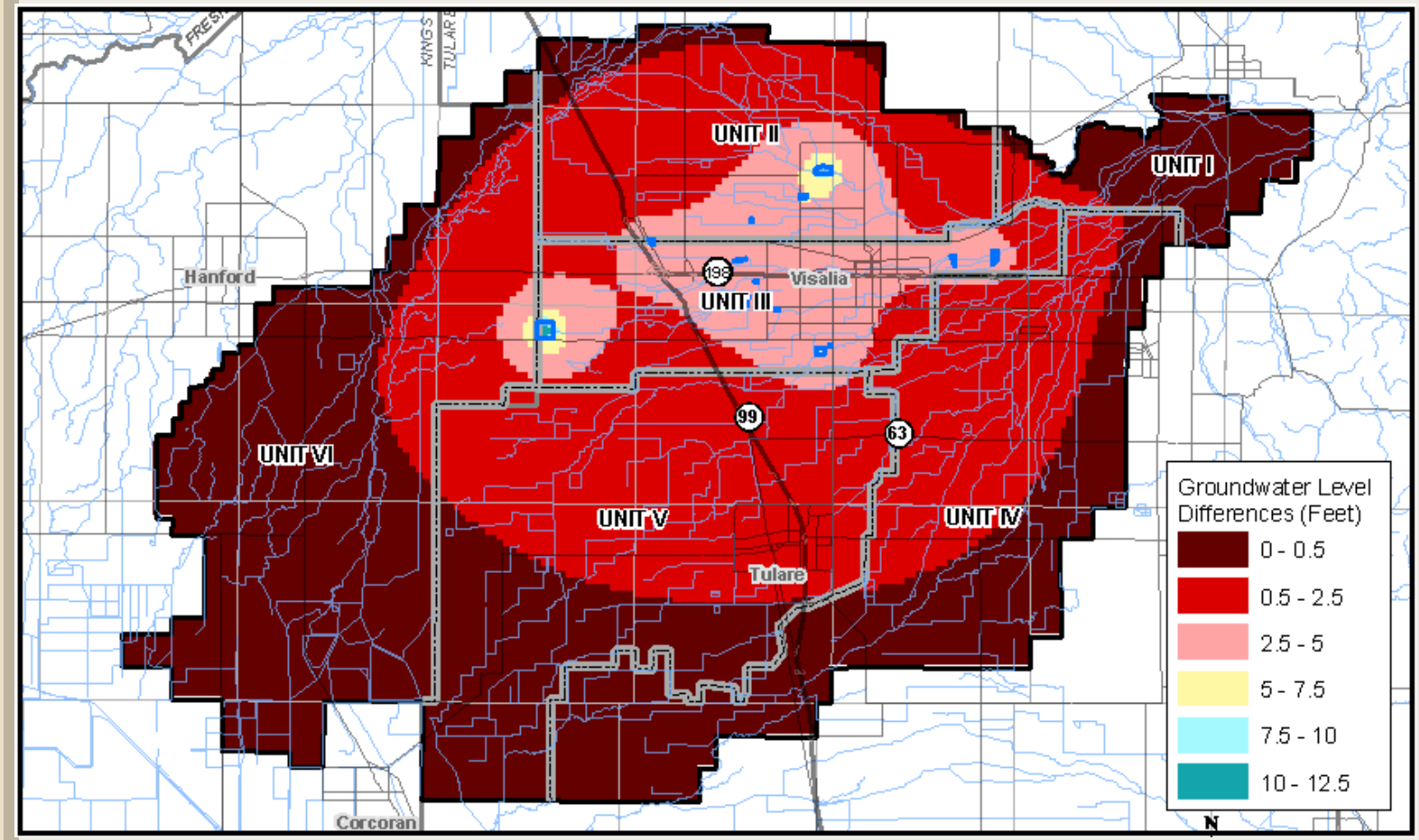
- 8,000 acre-feet annually diverted 11 of 19 future water years

- 4,000 acre-feet diverted in May and 4,000 acre-feet diverted in June

Scenario 5: City of Visalia Stormwater/Recharge Basins



Scenario 5: City of Visalia Stormwater/Recharge Basins



General Conclusions of Modeling Study

- Model reliable for simulating future scenarios of a geographic scope and magnitude as those in this study and demonstrating measurable benefits
- Due to grid cell size (1000 x 1000 feet), not suitable for scenarios at smaller scales (e.g., residential developments, individual basins)
- District model useful for developing smaller scale models of local processes
- Application of the model revealed numerous areas of improvement in terms of data collection and model conceptualization

Groundwater Model for the City of Visalia