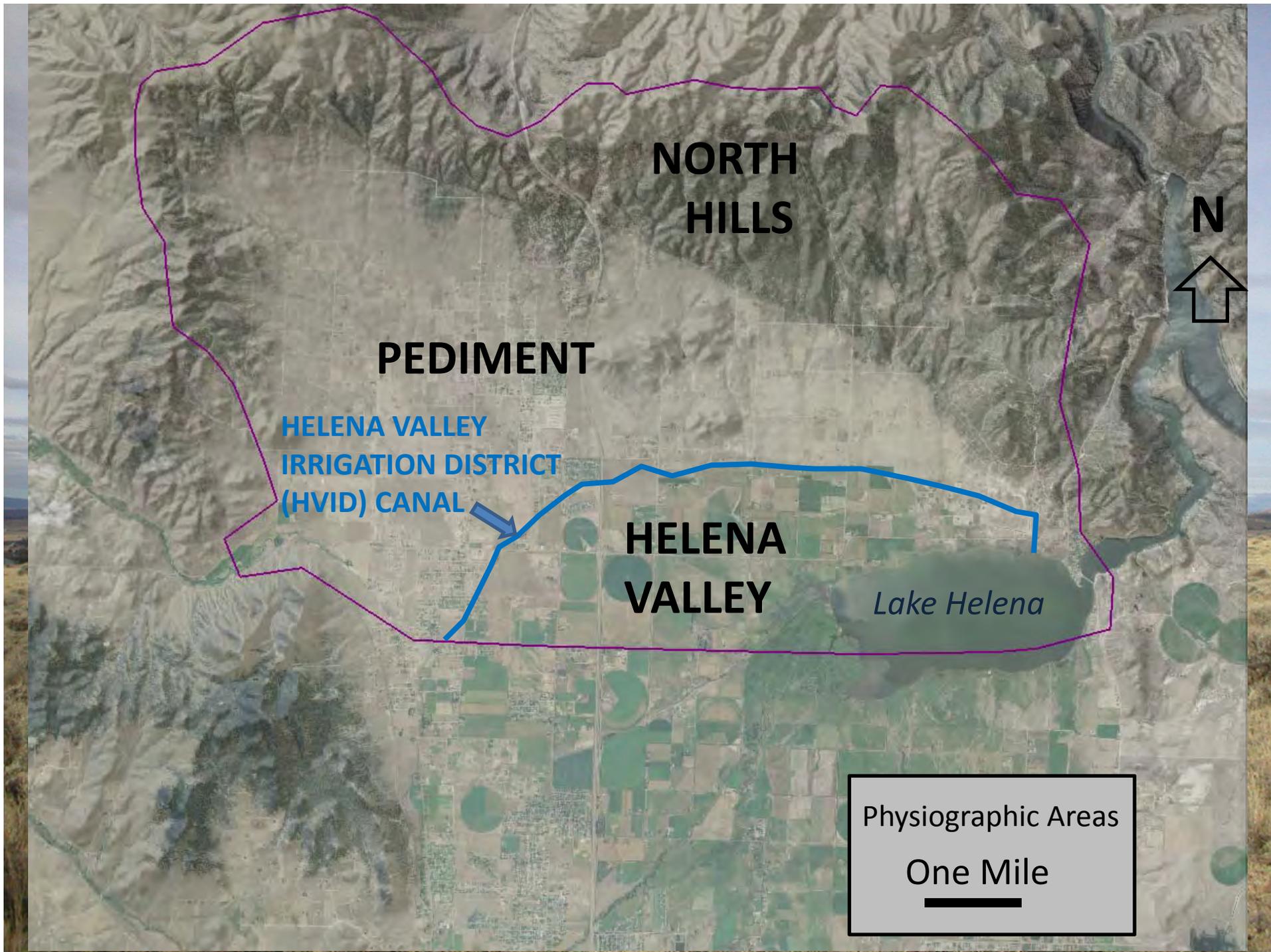




# North Hills Groundwater Models

Kirk Waren, Andy Bobst, Julie Ahern, Jane  
Madison, James Swierc

in cooperation with the Lewis and Clark County  
Local Water Quality Protection District



**NORTH  
HILLS**

**PEDIMENT**

**HELENA VALLEY  
IRRIGATION DISTRICT  
(HVID) CANAL**

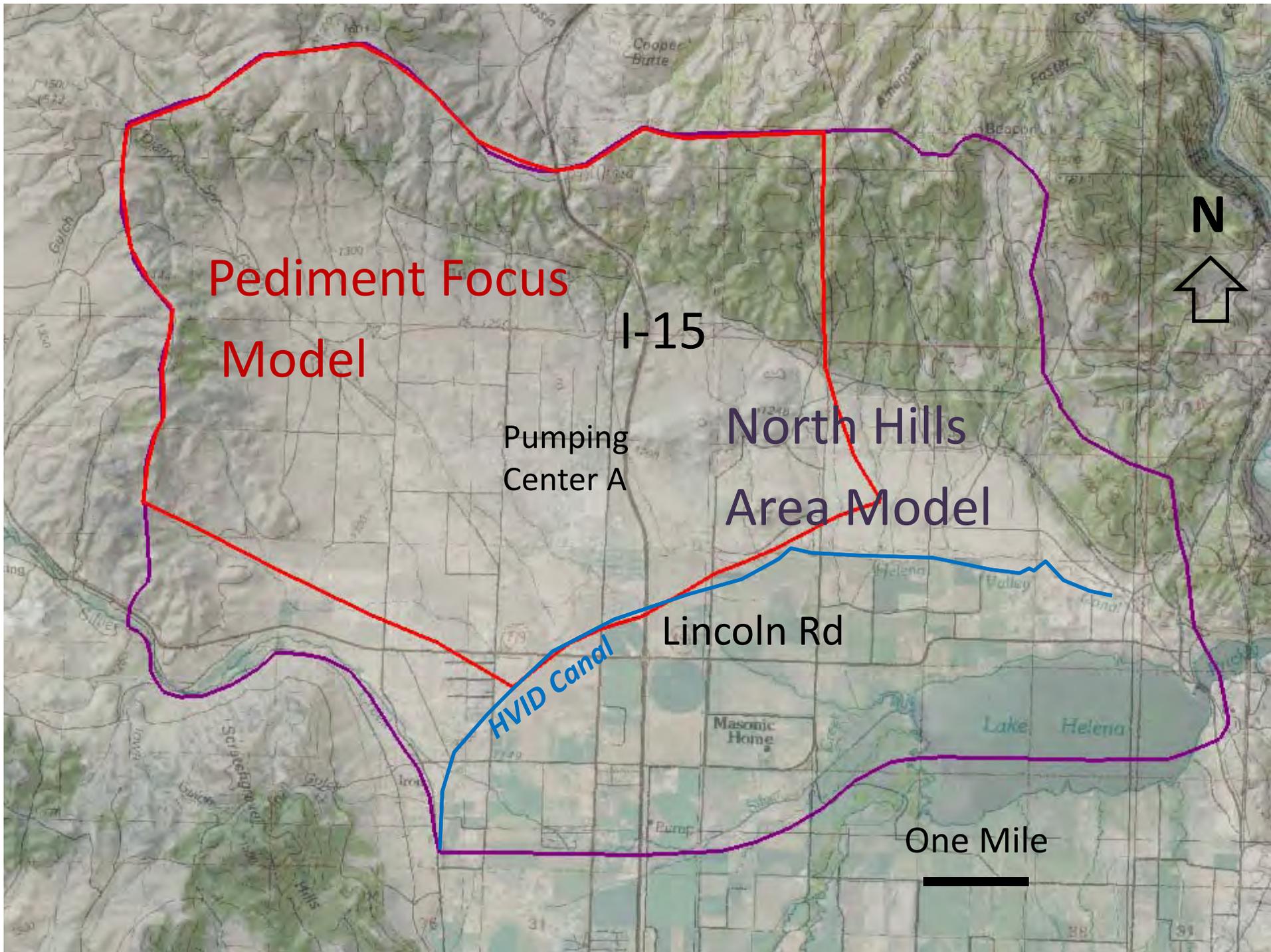
**HELENA  
VALLEY**

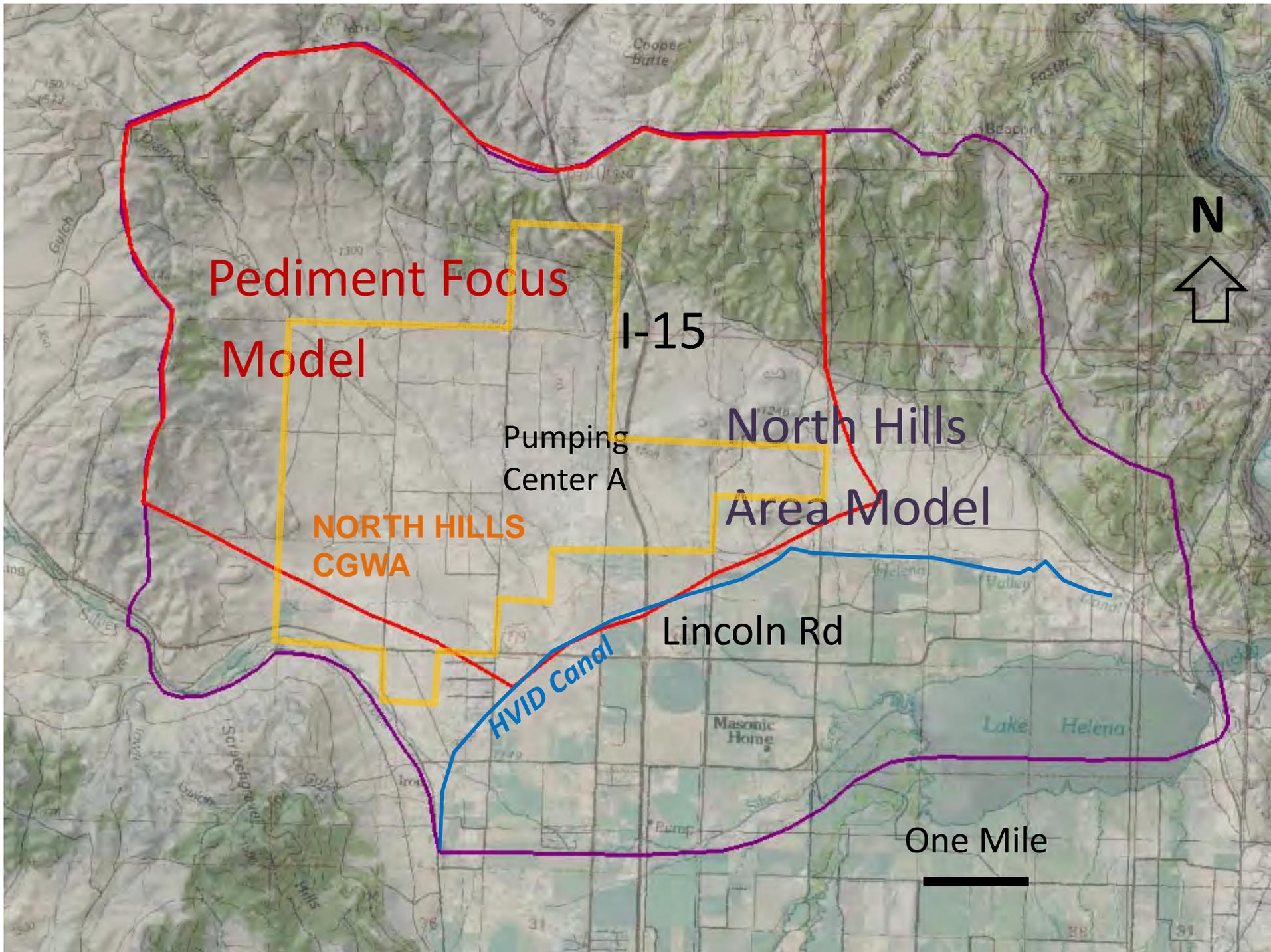
*Lake Helena*

**N**

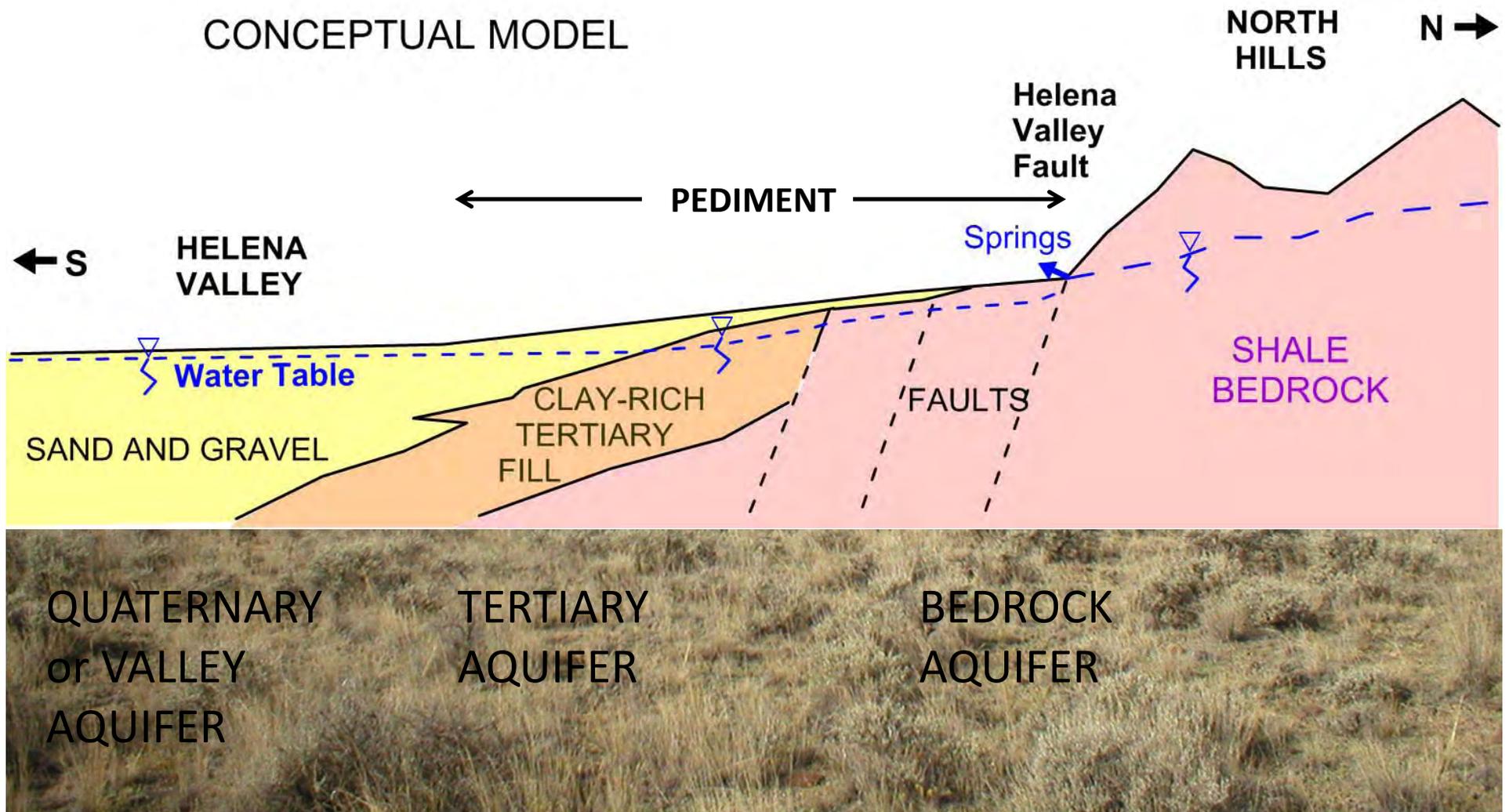
Physiographic Areas

One Mile

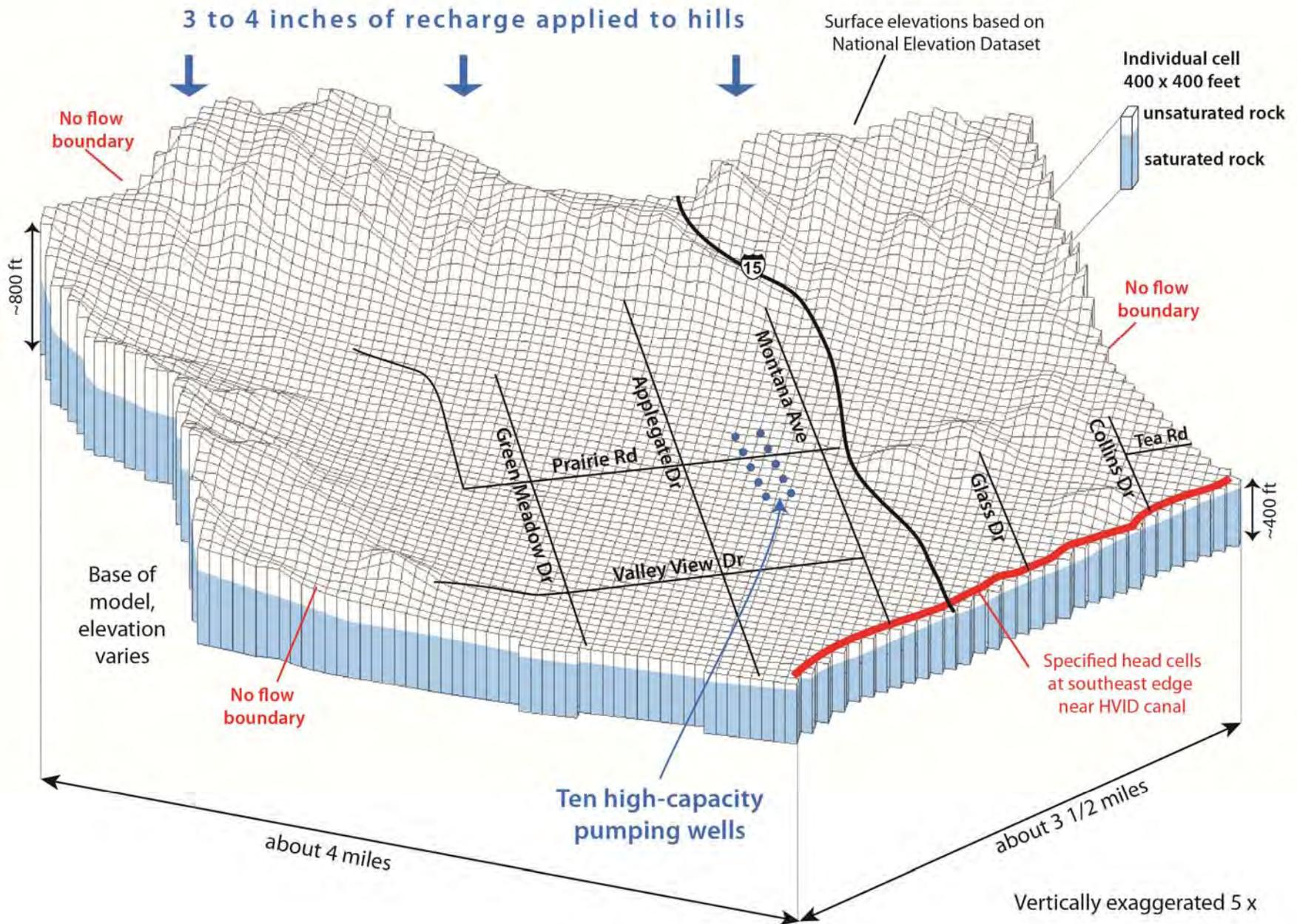




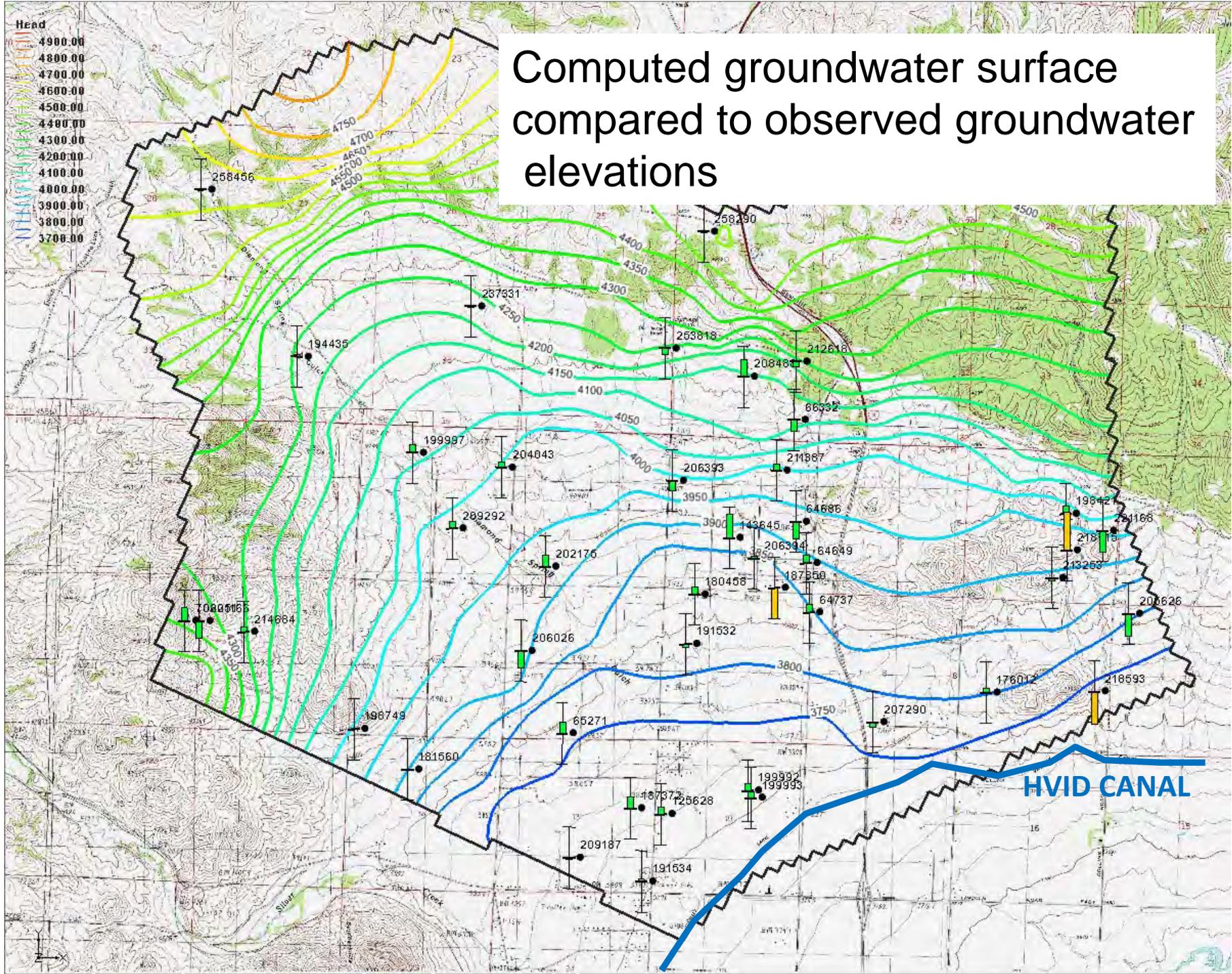
# Geologic setting



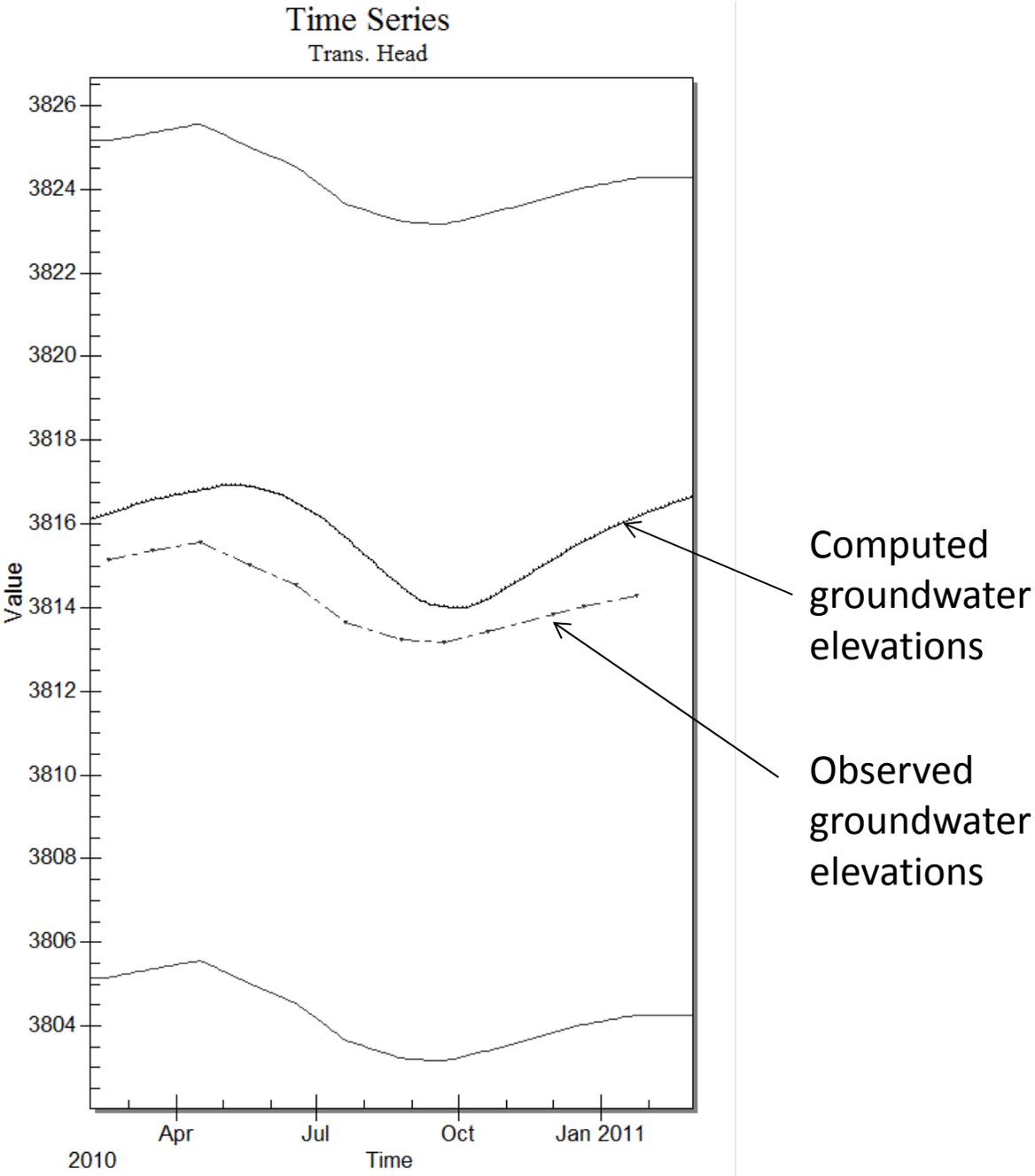
# North Hills Pediment Focus Model Schematic View



Computed groundwater surface compared to observed groundwater elevations

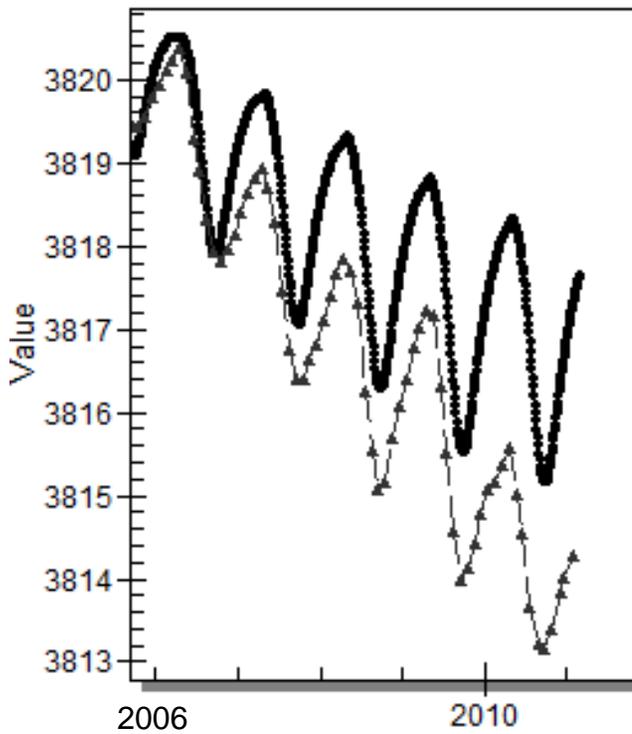


Well 64737  
State Lands East

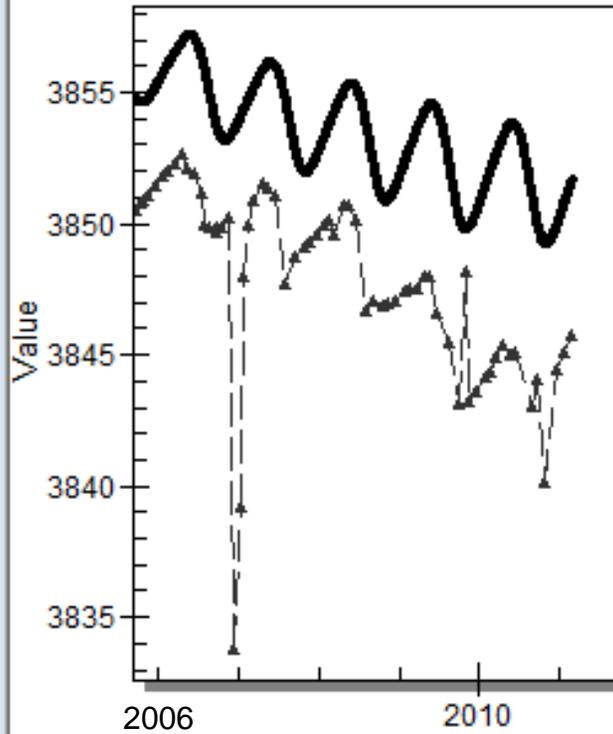


# Computed vs. observed groundwater levels

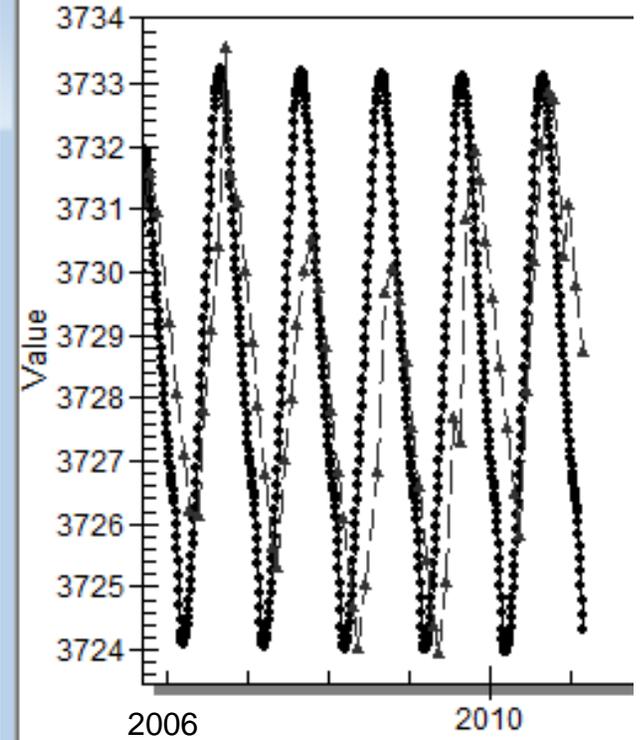
Well 191532 North Hills

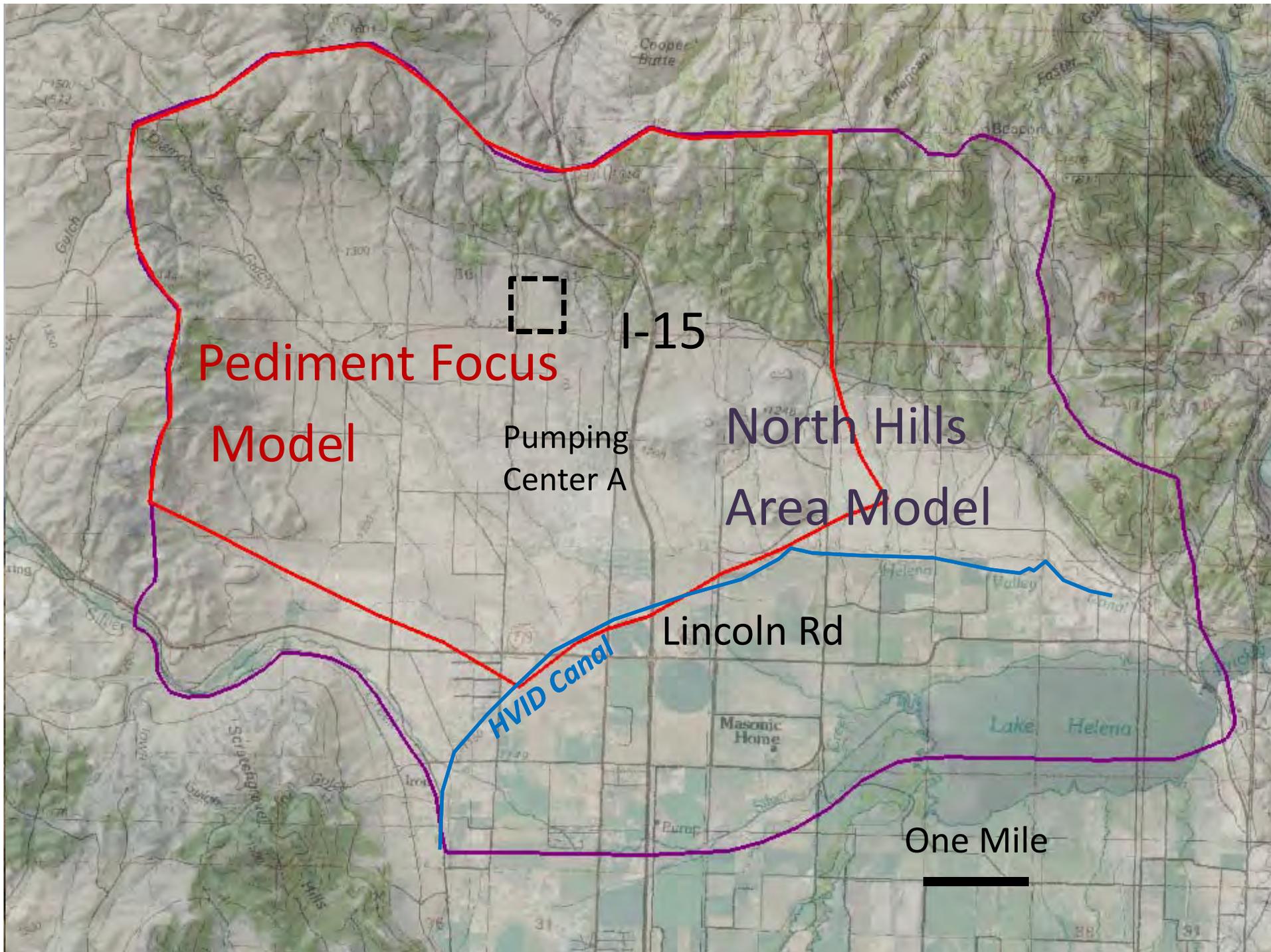


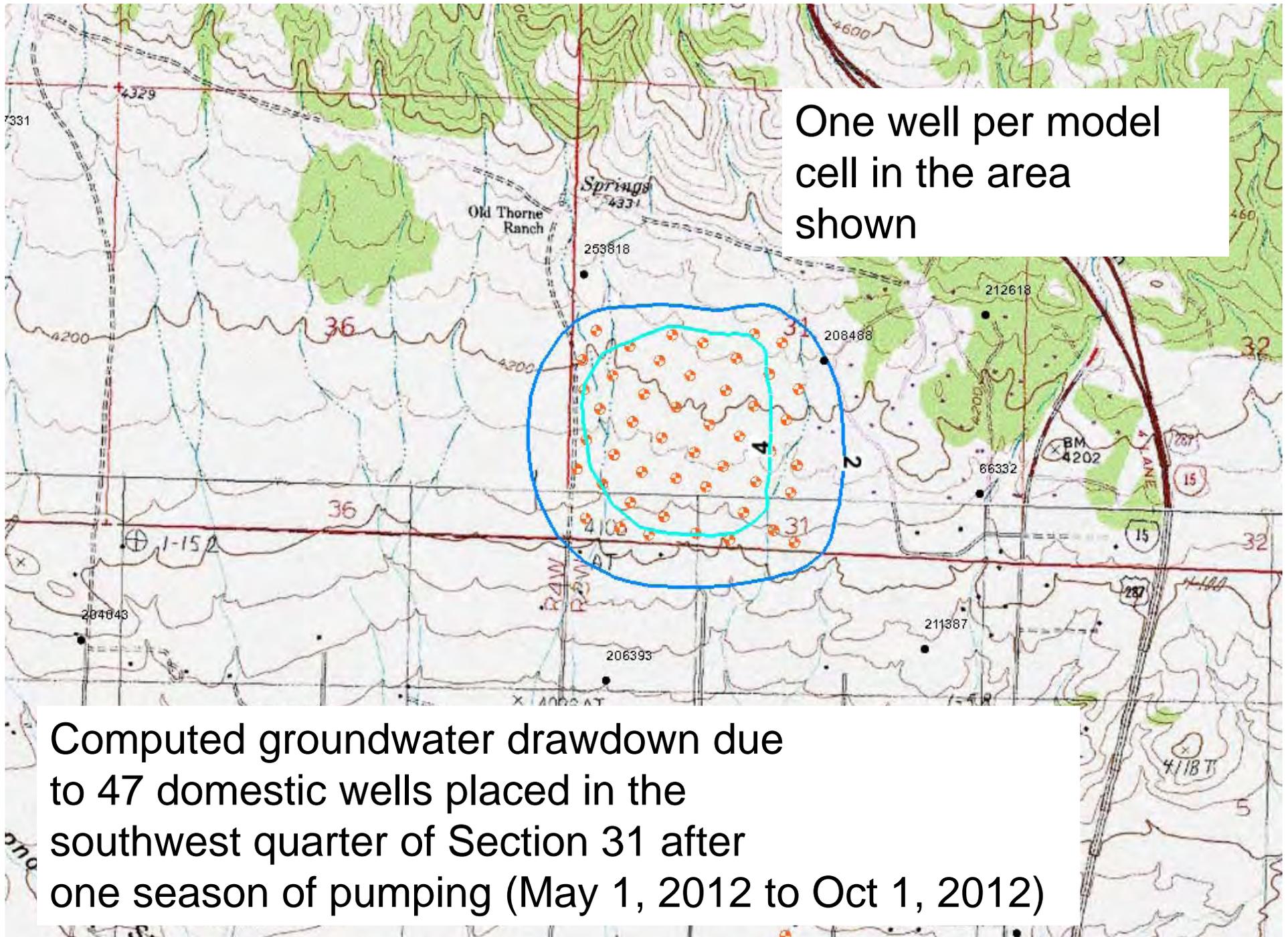
Well 64737 State Lands East



Well 19993 Tangen

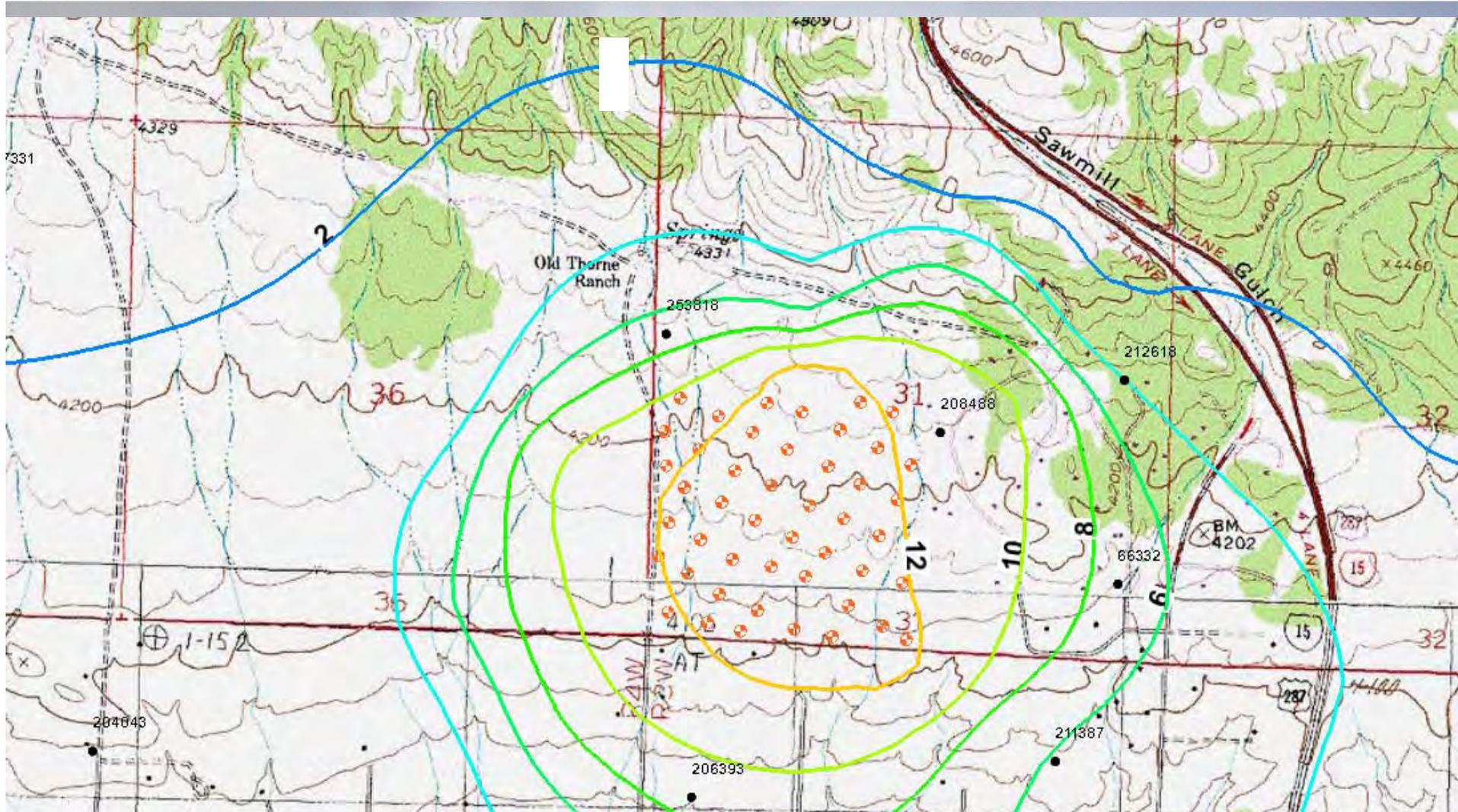






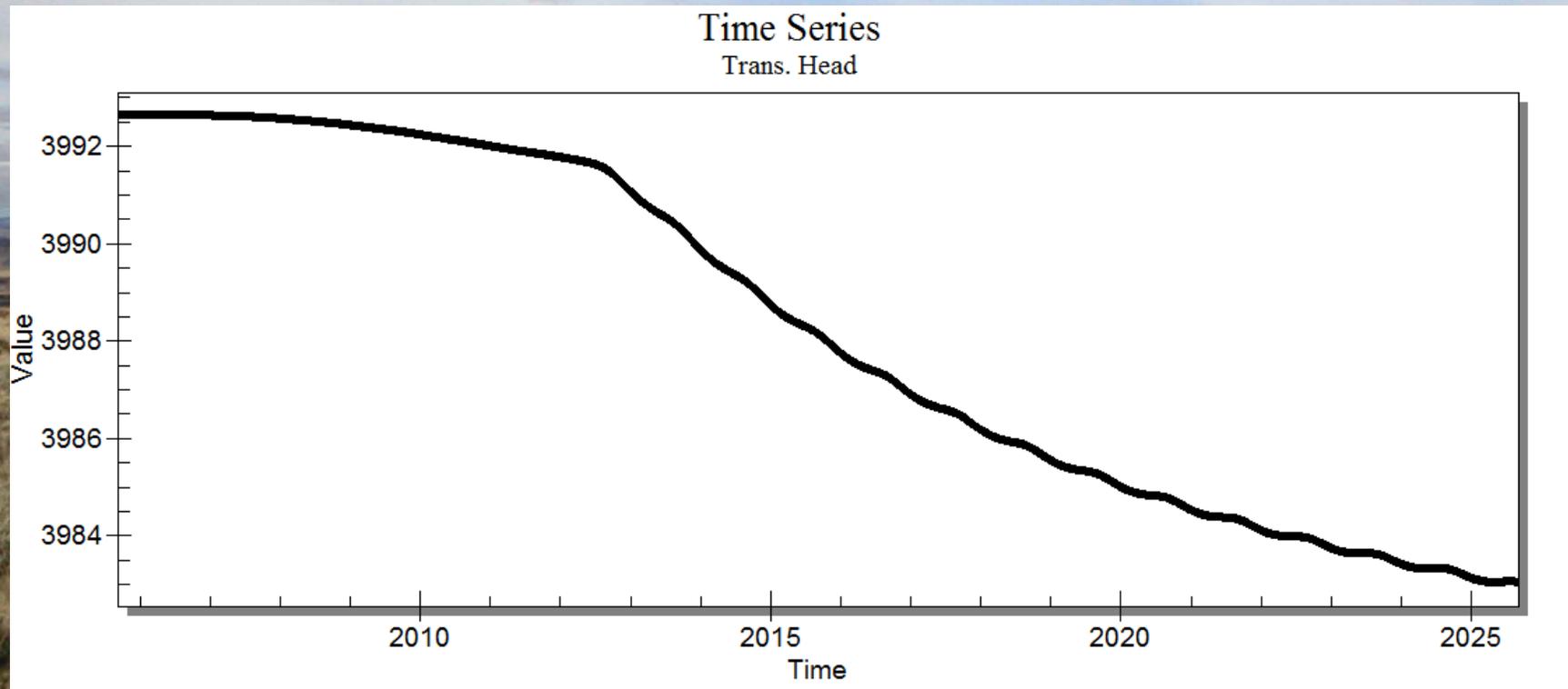
One well per model cell in the area shown

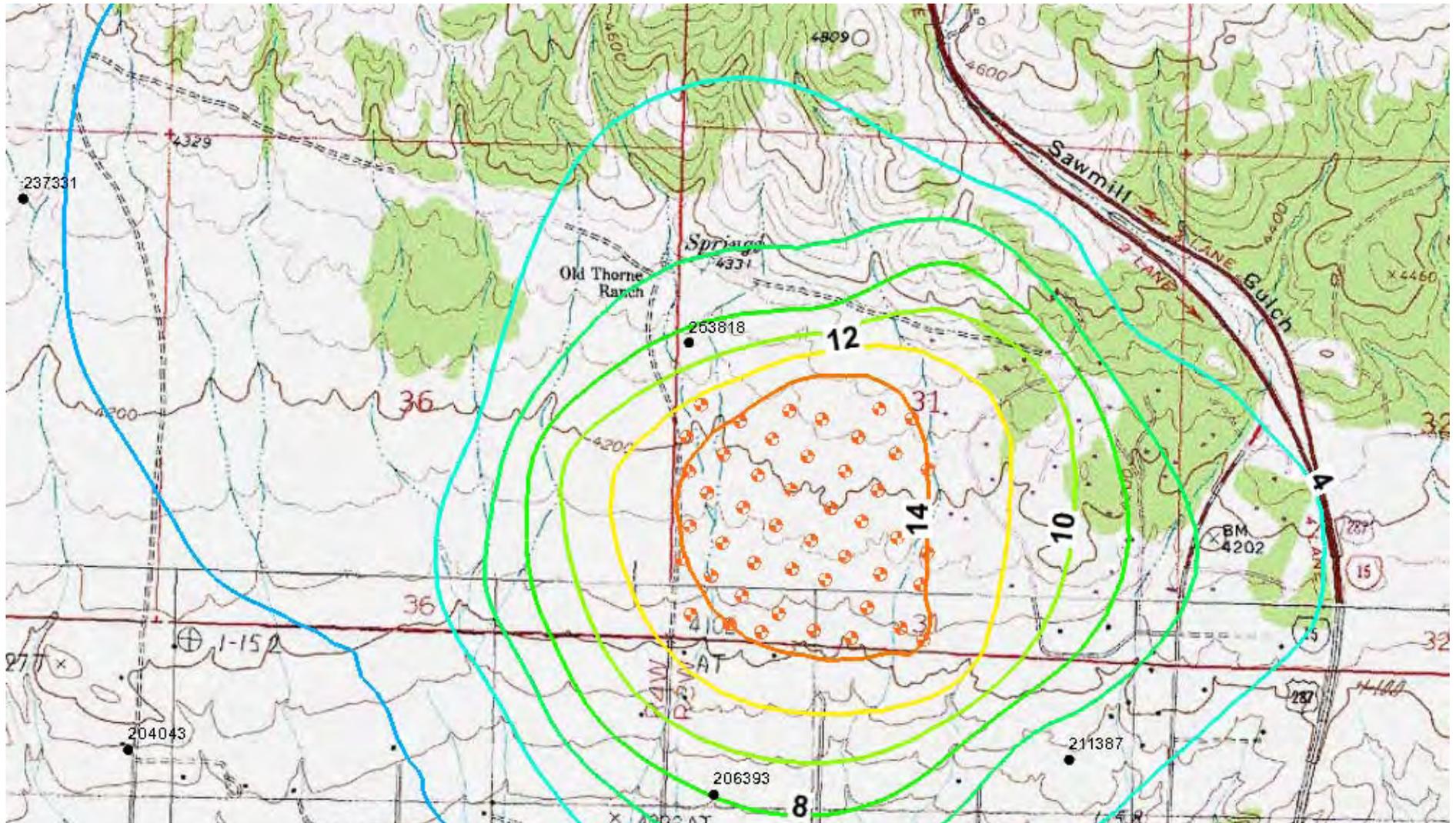
Computed groundwater drawdown due to 47 domestic wells placed in the southwest quarter of Section 31 after one season of pumping (May 1, 2012 to Oct 1, 2012)



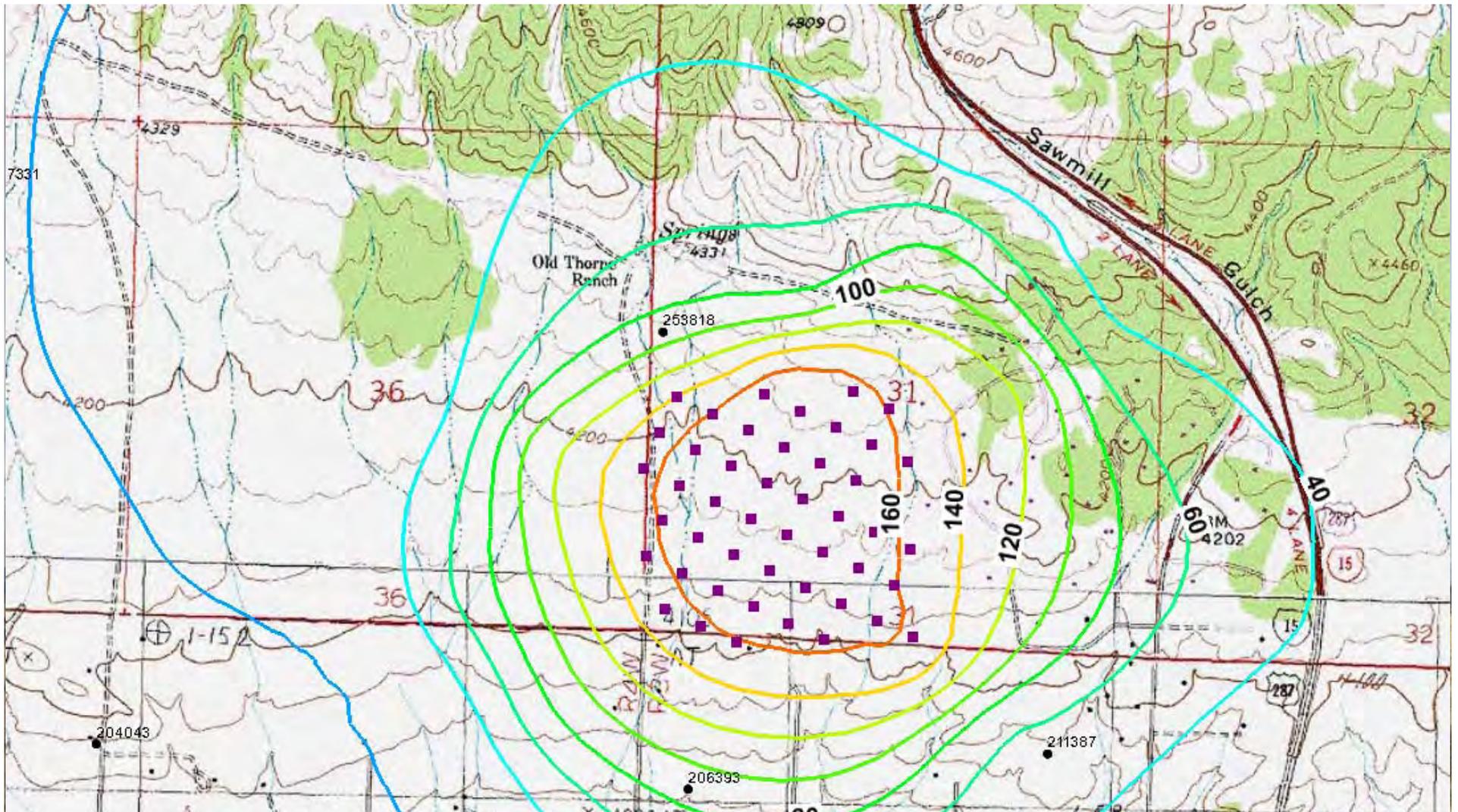
Computed groundwater drawdown due to 47 domestic wells placed in the southwest quarter of Section 31 after fourteen seasons of pumping (May 1, 2012 to Oct 1, 2025)

# Drawdown impacts over time at well 206393 located about ¼ mile downgradient of the development

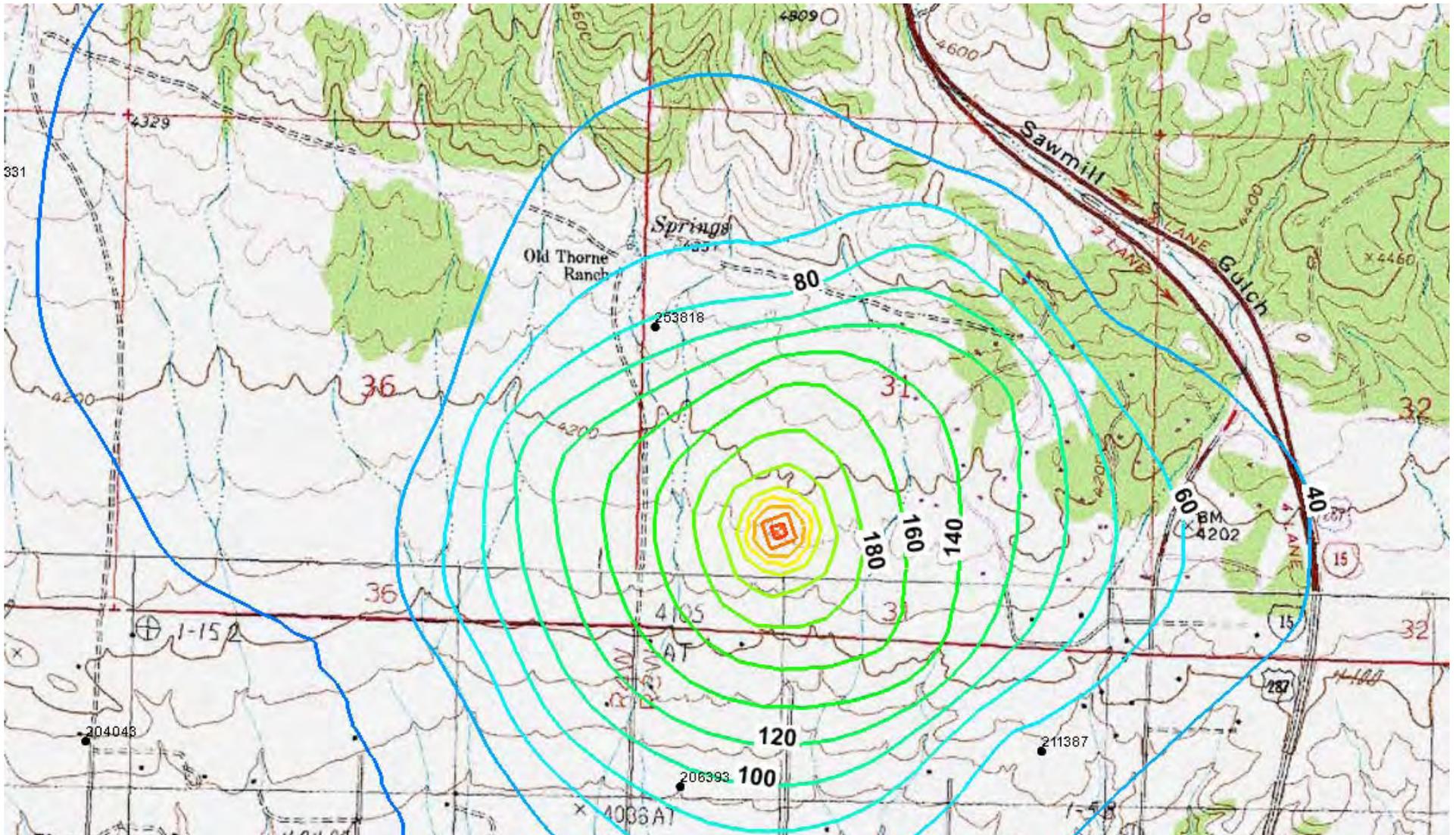




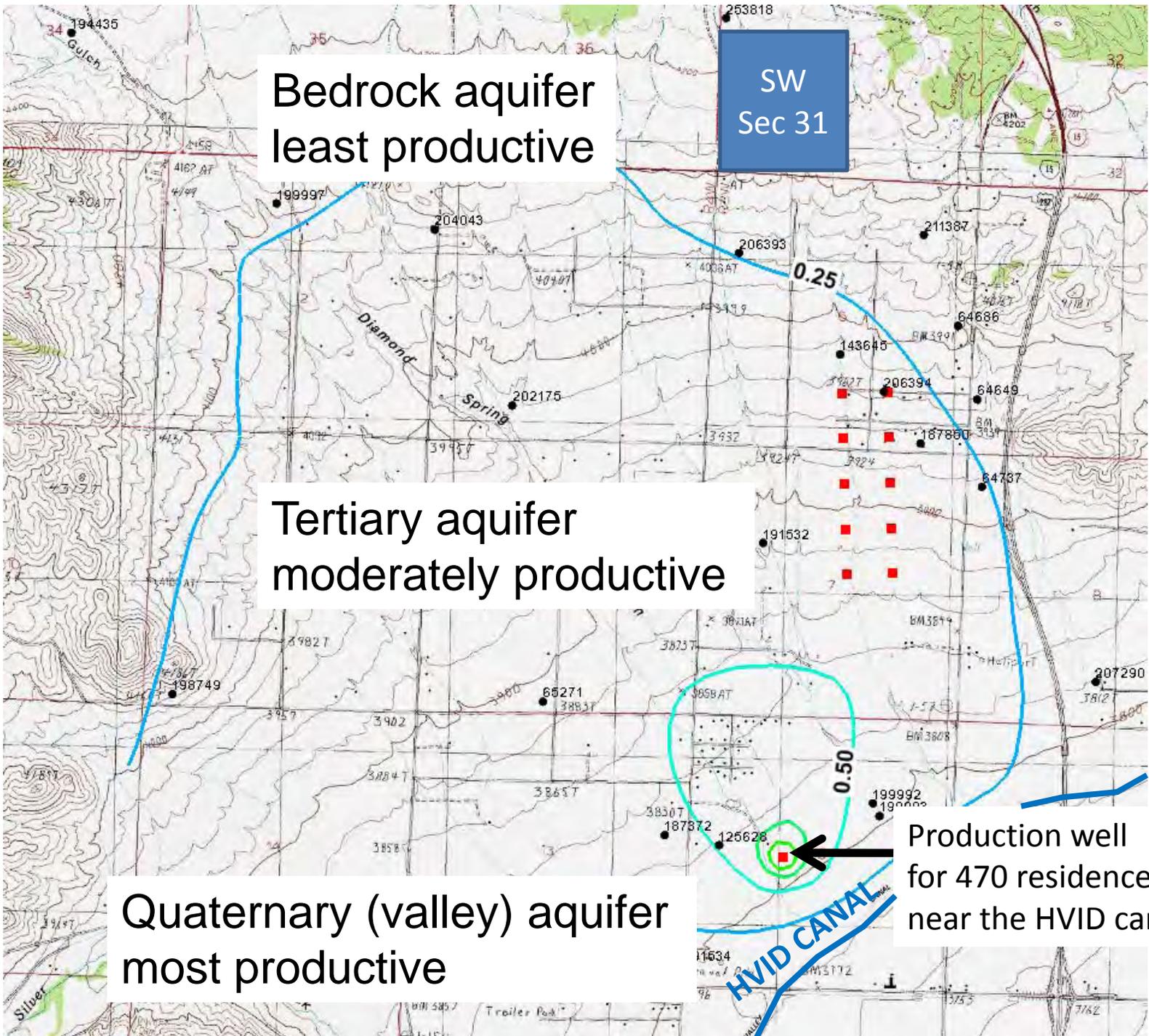
Computed groundwater drawdown due  
to 47 domestic wells placed in the  
southwest quarter of Section 31  
Steady-state solution



Computed groundwater drawdown due to 470 residences drawing water from 47 wells placed in the southwest quarter of Section 31  
Steady-state solution



Computed groundwater drawdown due to 470 domestic residences placed in the southwest quarter of Section 31 – with one public water supply well  
Steady-state solution



Bedrock aquifer  
least productive

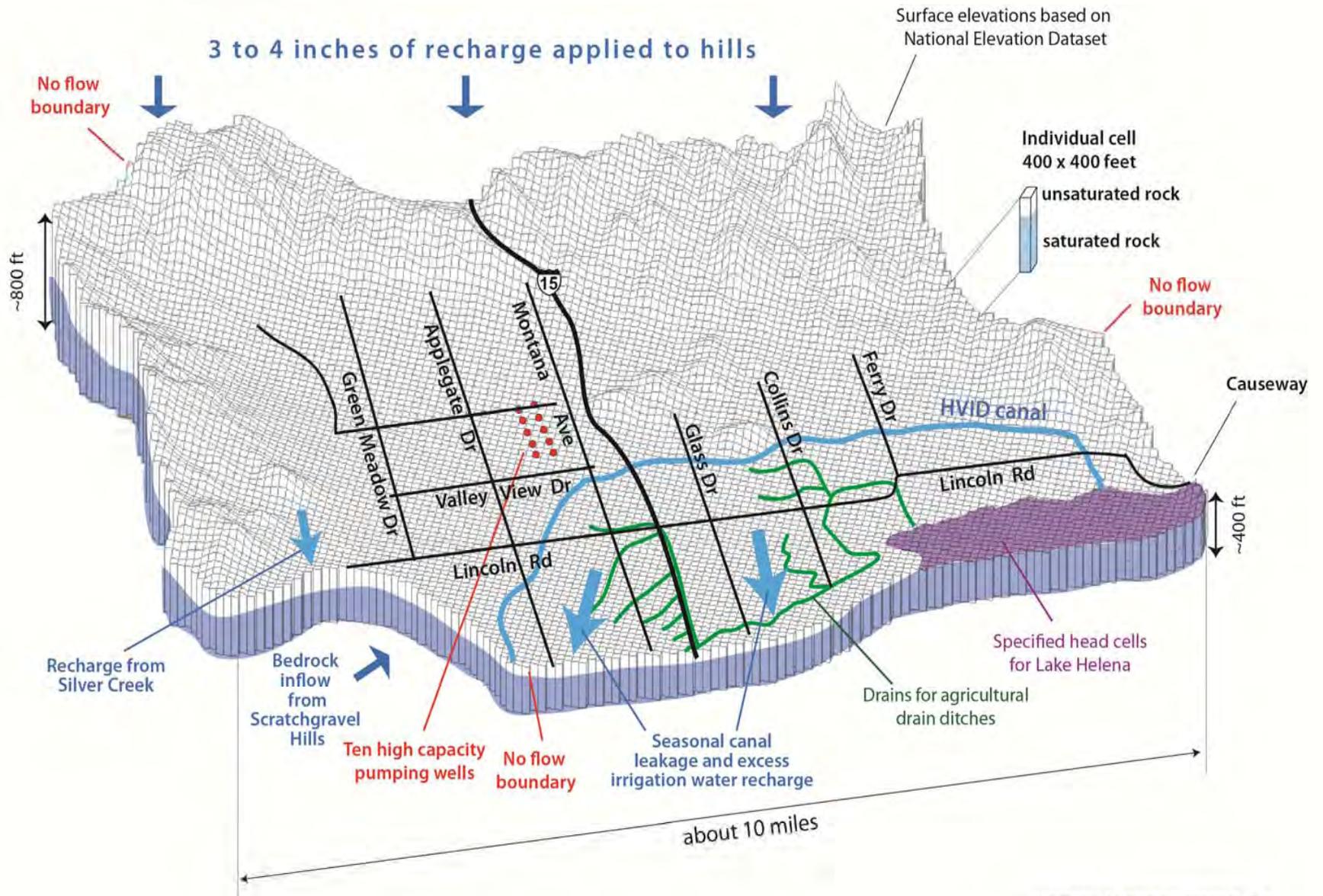
SW  
Sec 31

Tertiary aquifer  
moderately productive

Quaternary (valley) aquifer  
most productive

Production well  
for 470 residences  
near the HVID canal

# North Hills Area Model Schematic View

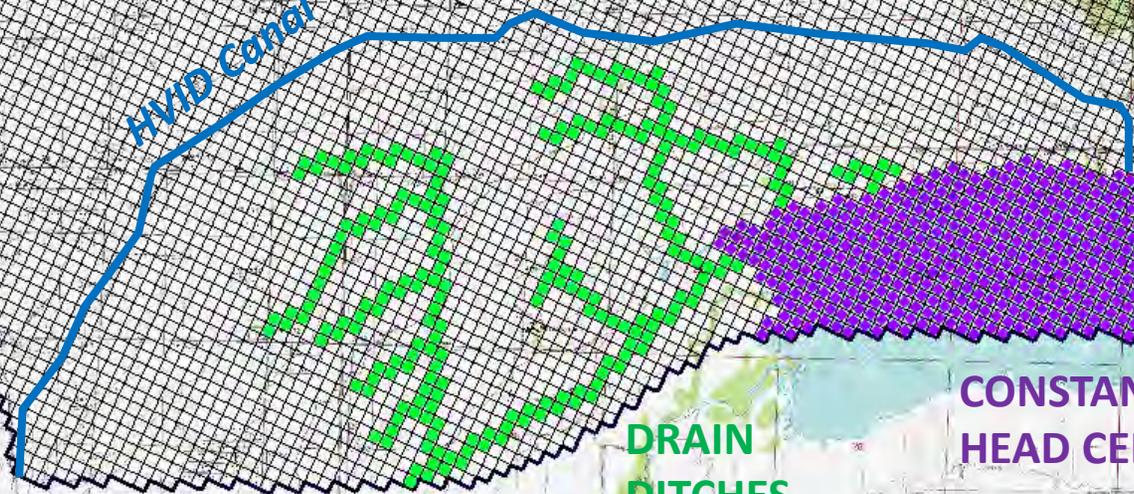


# North Hills Area Model

**Modeled  
Pumping  
Wells**

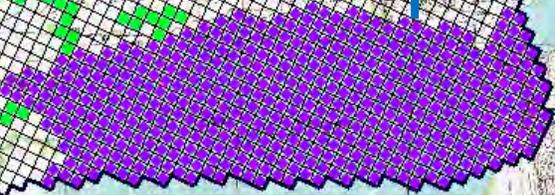


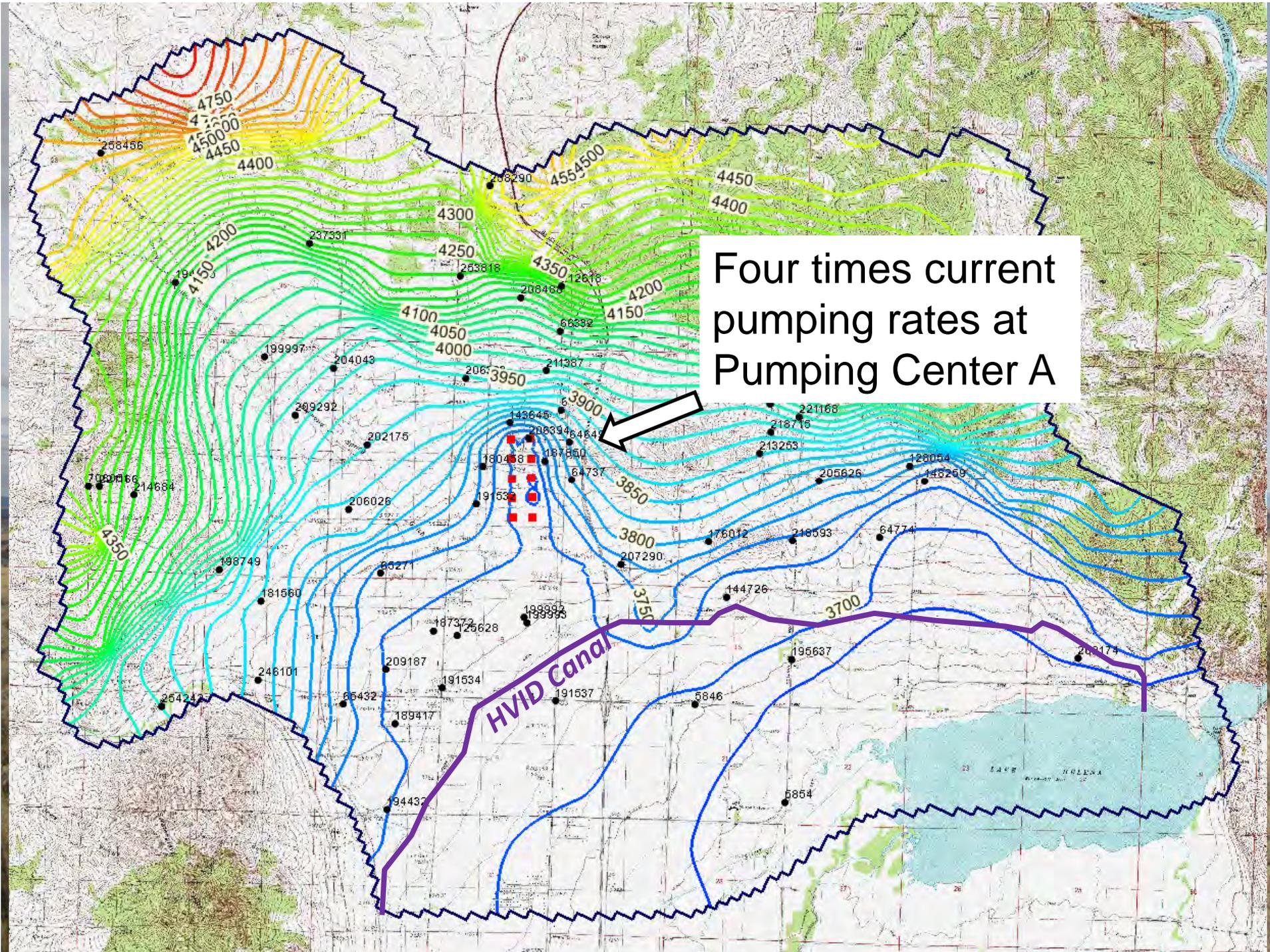
**HVID Canal**



**DRAIN  
DITCHES**

**CONSTANT  
HEAD CELLS**





Four times current  
pumping rates at  
Pumping Center A



HVID Canal

LAKE HOLENA

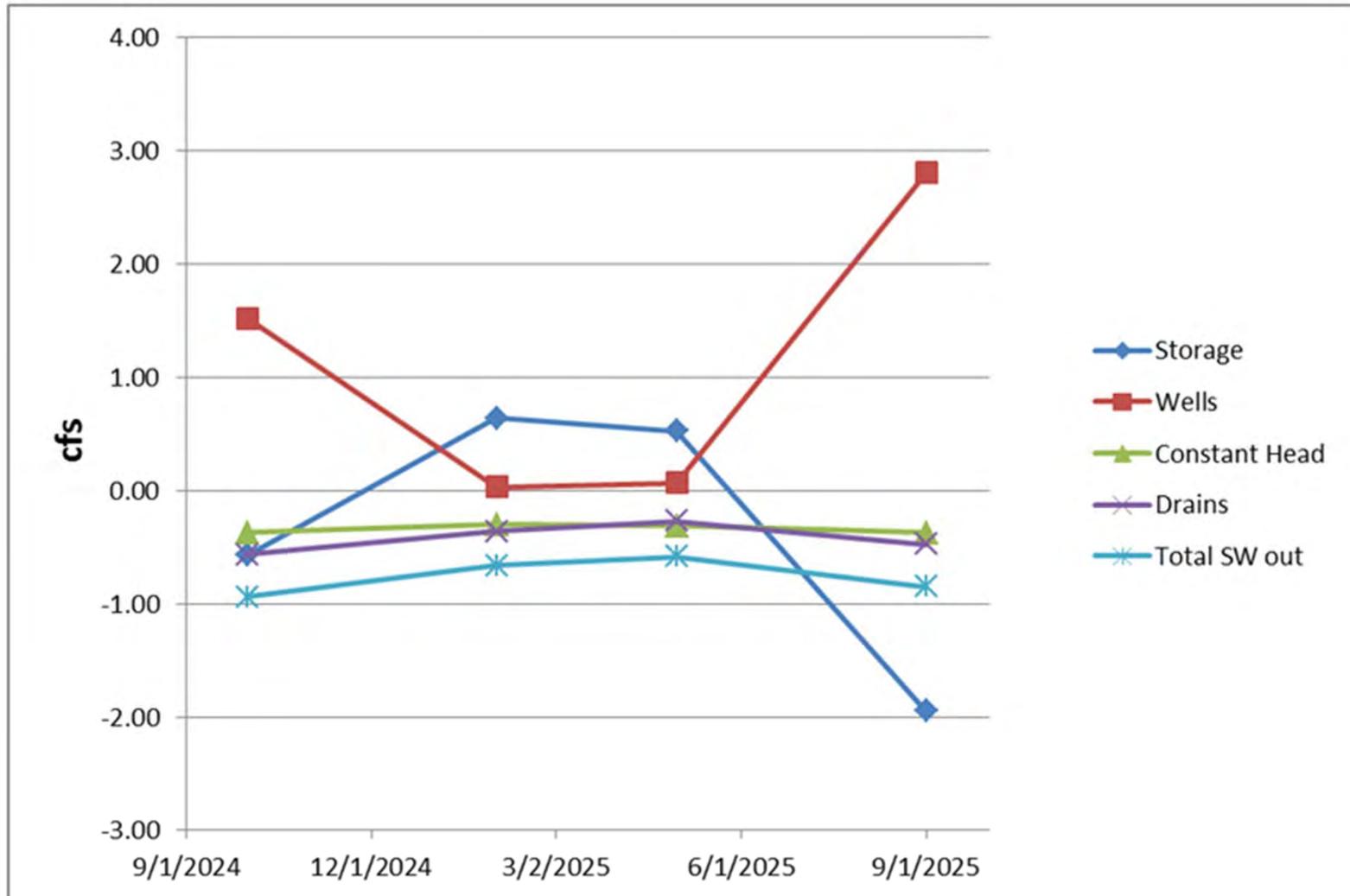
- Video Clip



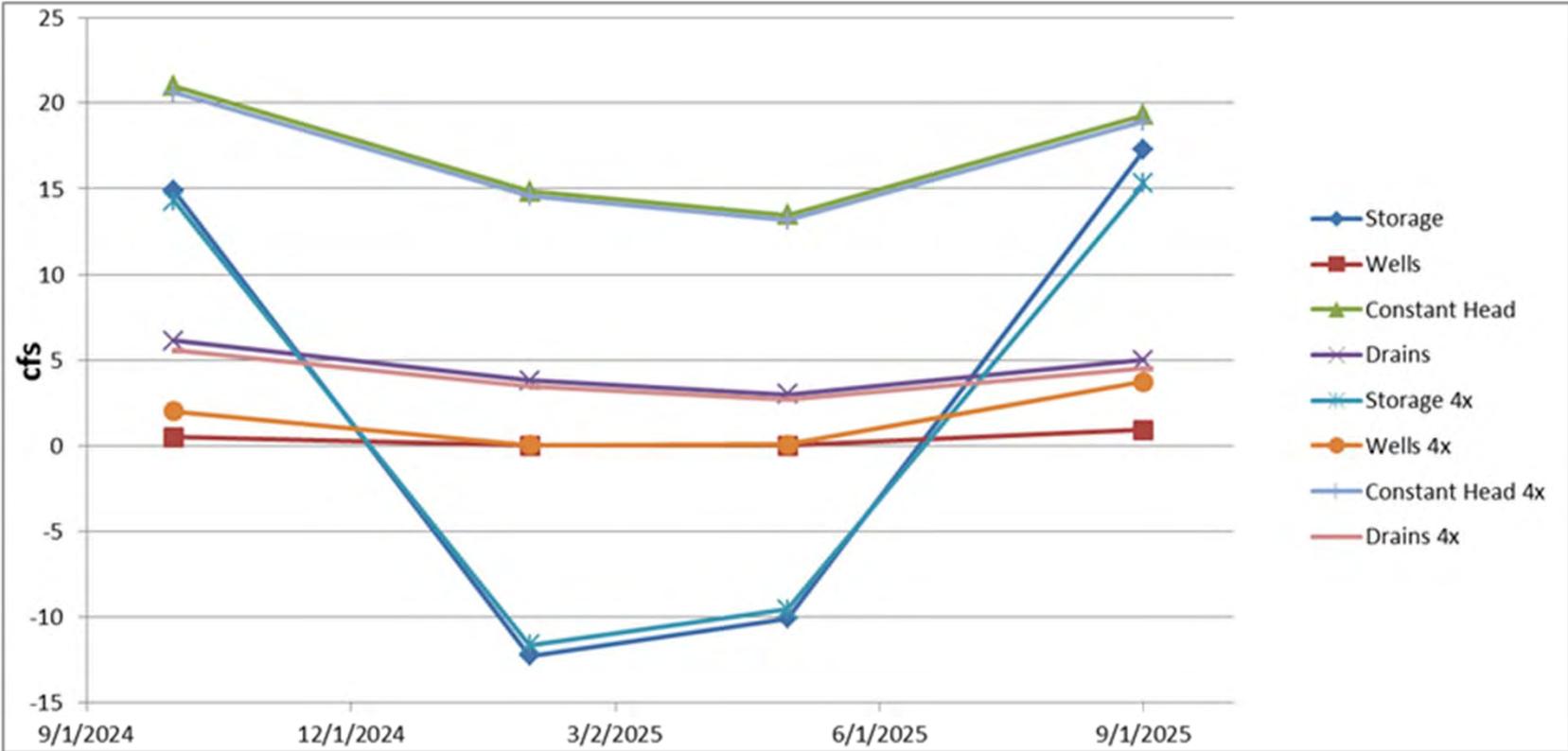
# North Hills Groundwater Models capabilities:

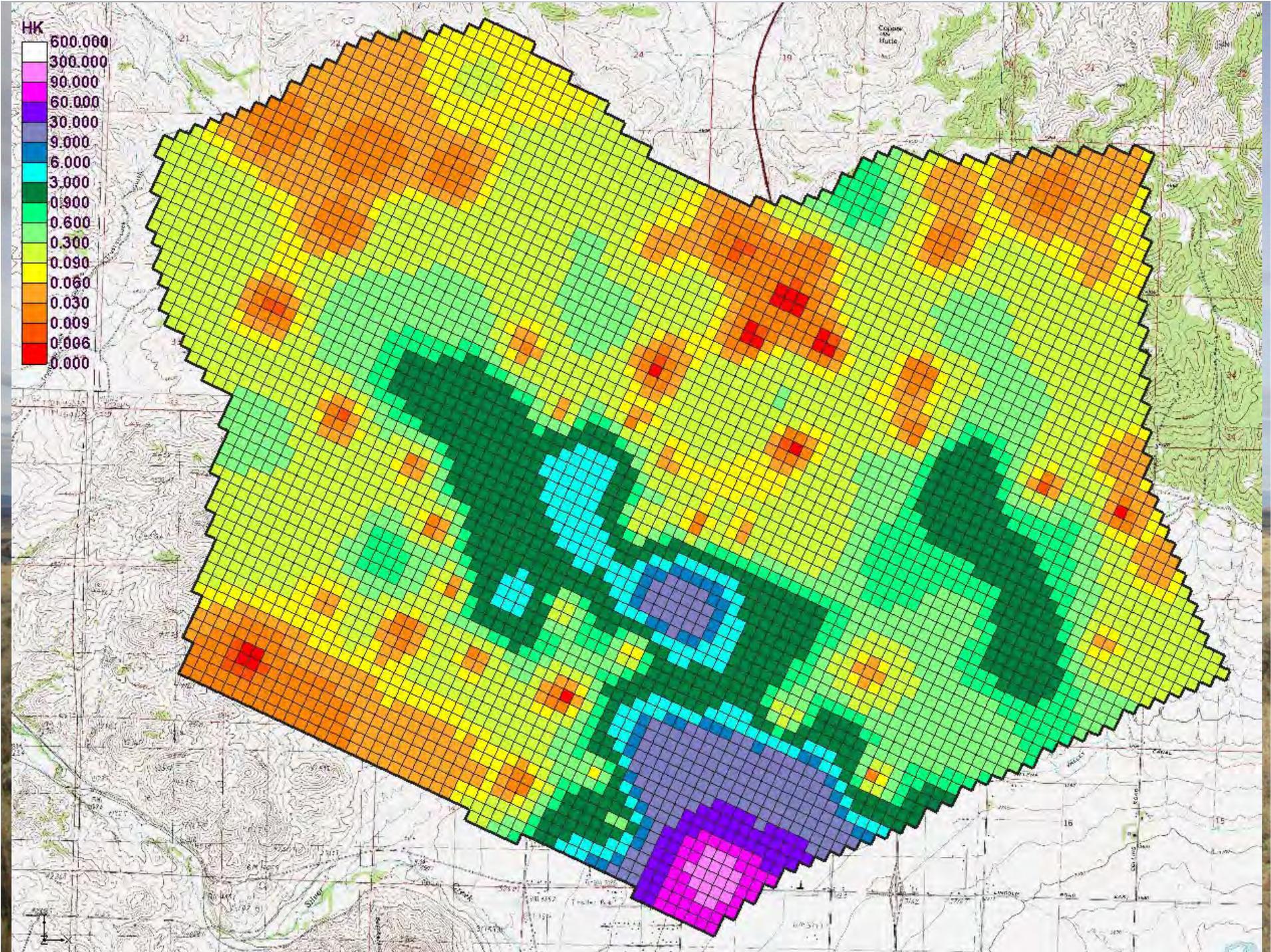
- Estimate drawdown from additional groundwater withdrawals
- Estimate drawdown or recovery from increases or decreases in pumping in current developments
- Estimate timing and magnitude of impacts of groundwater pumping to Lake Helena (Missouri River)
- Analyze the effects of other hydrologic changes such as draughts, changes in irrigation practices, etc.

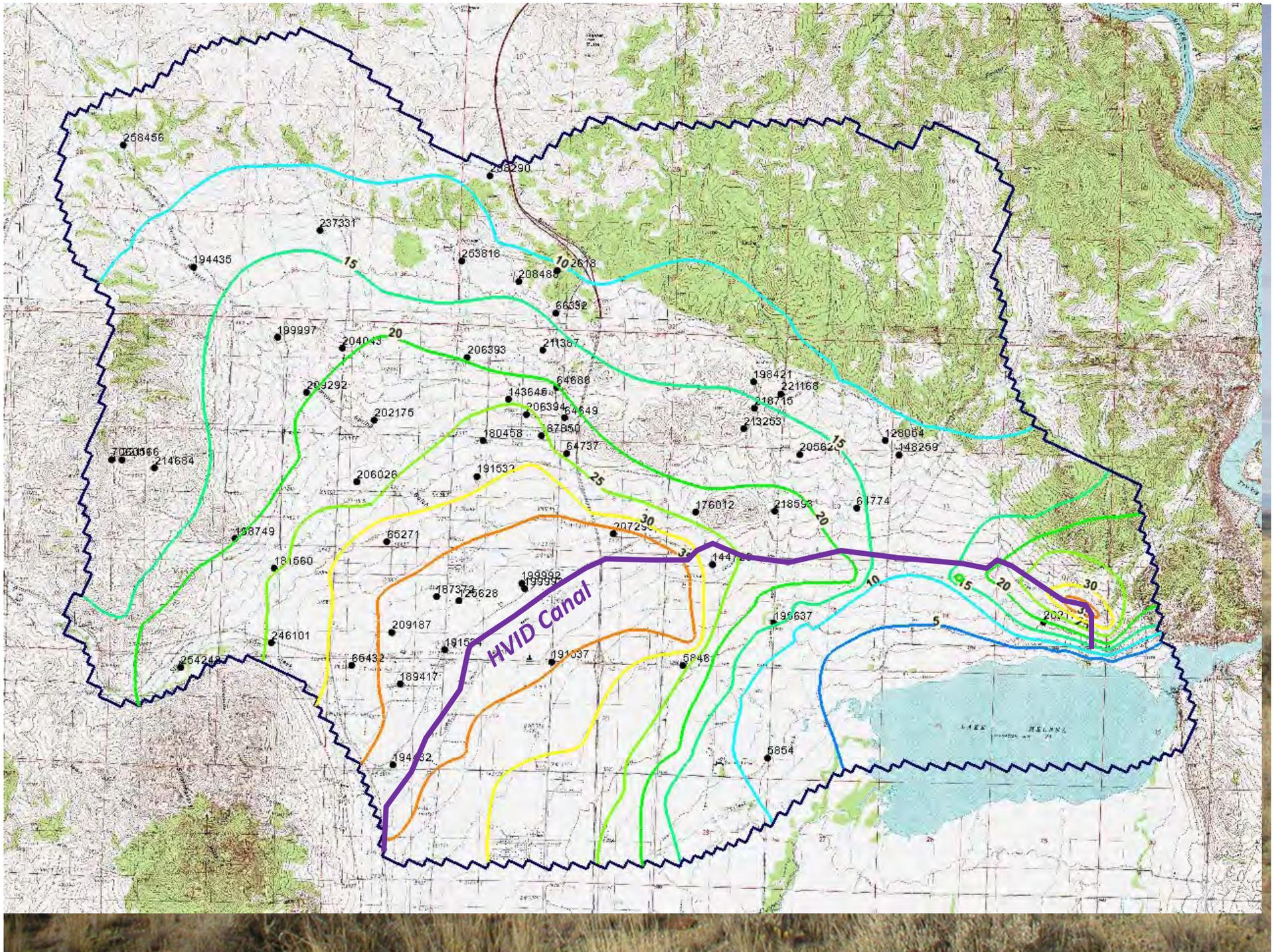
# Water Budget Impacts of Pumping



# Water budget







DD if HVID\_gone

- 35.00
- 30.00
- 25.00
- 20.00
- 15.00
- 10.00
- 5.00

