

Nye County Groundwater Evaluation Drilling Program

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Outline

- Groundwater Evaluation program
- Drilling program objectives
- Borehole locations
- Data collection
- Results by geographic location
- Future work

Groundwater Evaluation Program

- Funding provided by DOE for characterization of water resources in southern Nye County
 - Grant number DE-FG52-2006NA27205
 - Original award of \$2,477,000 in April 2006
 - Remaining \$1,511,000 transferred to NWRPO in April 2010
- Work accomplished under original grant:
 - Geophysical studies and determination of soil characteristics near Ash Meadows (BYU)
 - Established Nye County Water District
 - Construction of groundwater flow model for Pahrump Valley (DRI)
- Work elements developed for remaining funding:
 - Drilling Program (completed)
 - Evapotranspiration study (USGS)
 - Southern Amargosa eMbedded Model (USGS)
 - Outreach and resource management

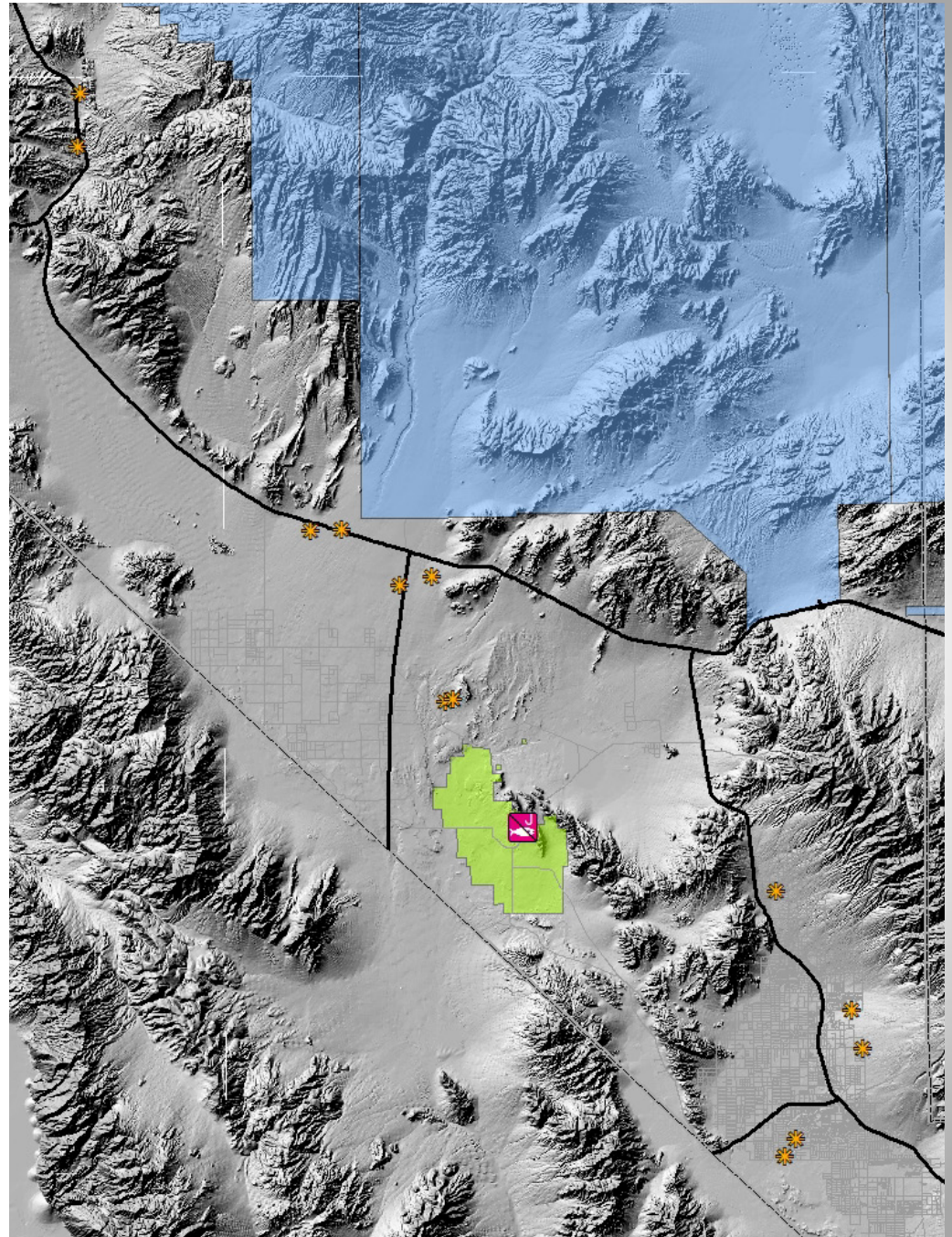
Drilling Program Objectives

- In general, the objectives were to infill data gaps in the water level measurement program, better understand geologic controls on ground water flow, and determine aquifer characteristics
- Specific objectives:
 - Pahrump Valley – infill data gaps in WLMP, especially on the Pahrump Fan
 - Amargosa Desert – determine head relationships near the Gravity Fault, collect baseline flow and chemical data
 - Oasis Valley – collect baseline flow and chemical data in areas (far) down gradient from previous nuclear tests
- Provide data to assist Nye County Water District with basic water resource characterization in southern Nye County

Borehole Locations

Location	Number of Wells
Pahrump Valley	5
Amargosa Desert	7
Oasis Valley	2

- Hydro Resources, Inc.
- 14 boreholes - 4,600 feet total drilled
- Two phases of drilling:
 - Phase I – May 2010 to June 2010
 - Phase II – November 2010 to January 2011

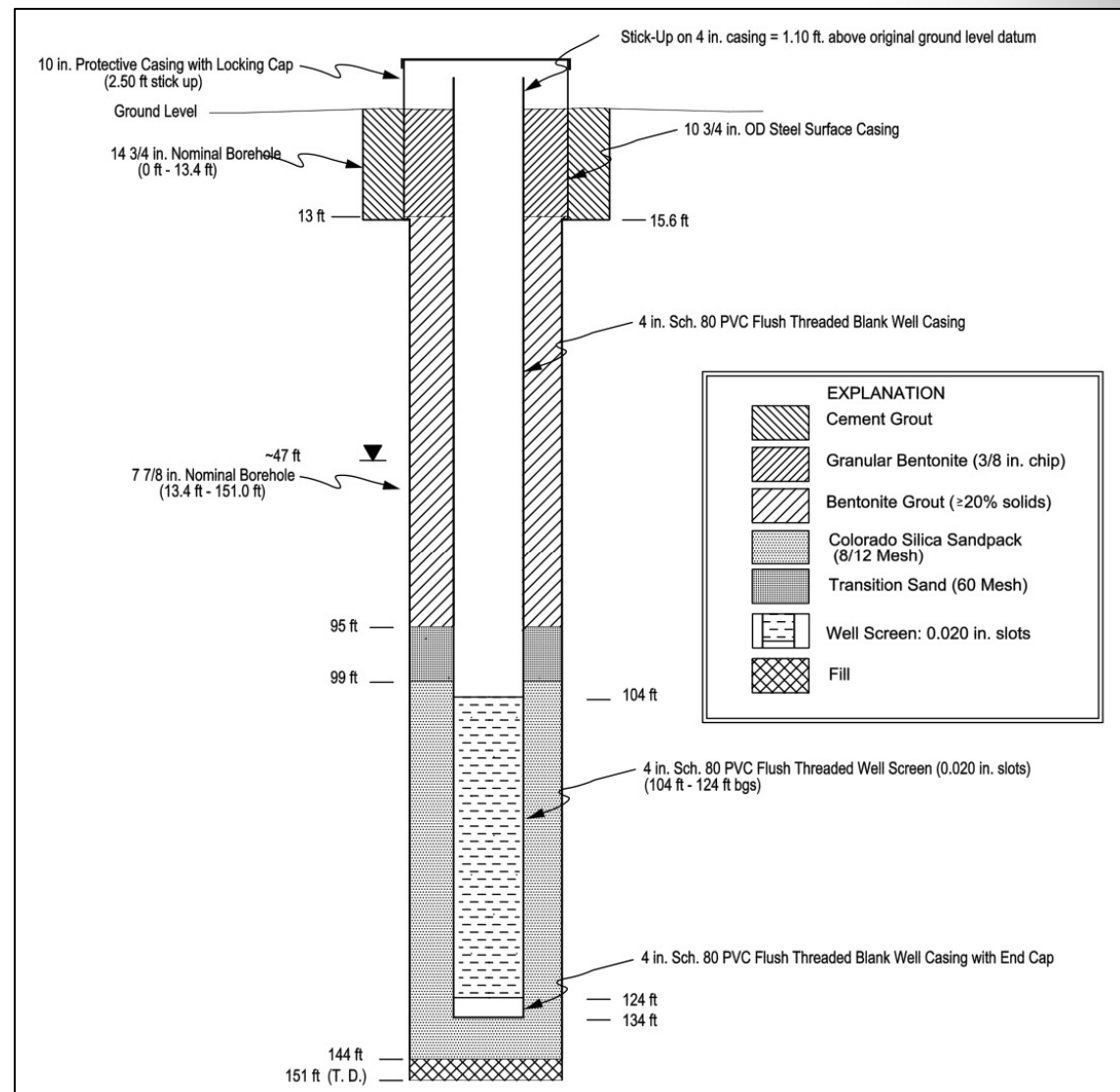


Drilling and Borehole Data Collection

- All data collected under NWRPO Quality Assurance Program
- Drilling
 - All boreholes located on private lands or existing EWDP sites
 - Air foam, conventional circulation
 - 10-inch surface casing set to 20 feet, 8-inch borehole drilled to total depth
 - Boreholes drilled to approximately 100 feet below water table
 - Shallowest borehole was OV-2 (119.8 feet), deepest was PV-1 (610 feet)
- Borehole data collection
 - Cuttings samples collected every 5 feet
 - Sediments logged using USCS descriptions
 - Consolidated rock logged using quantitative descriptions
 - Borehole geophysical logs
 - Open-hole (gamma, resistivity, temperature, caliper)
 - Completion (gamma, temperature, fluid resistivity, density)

Well Completion

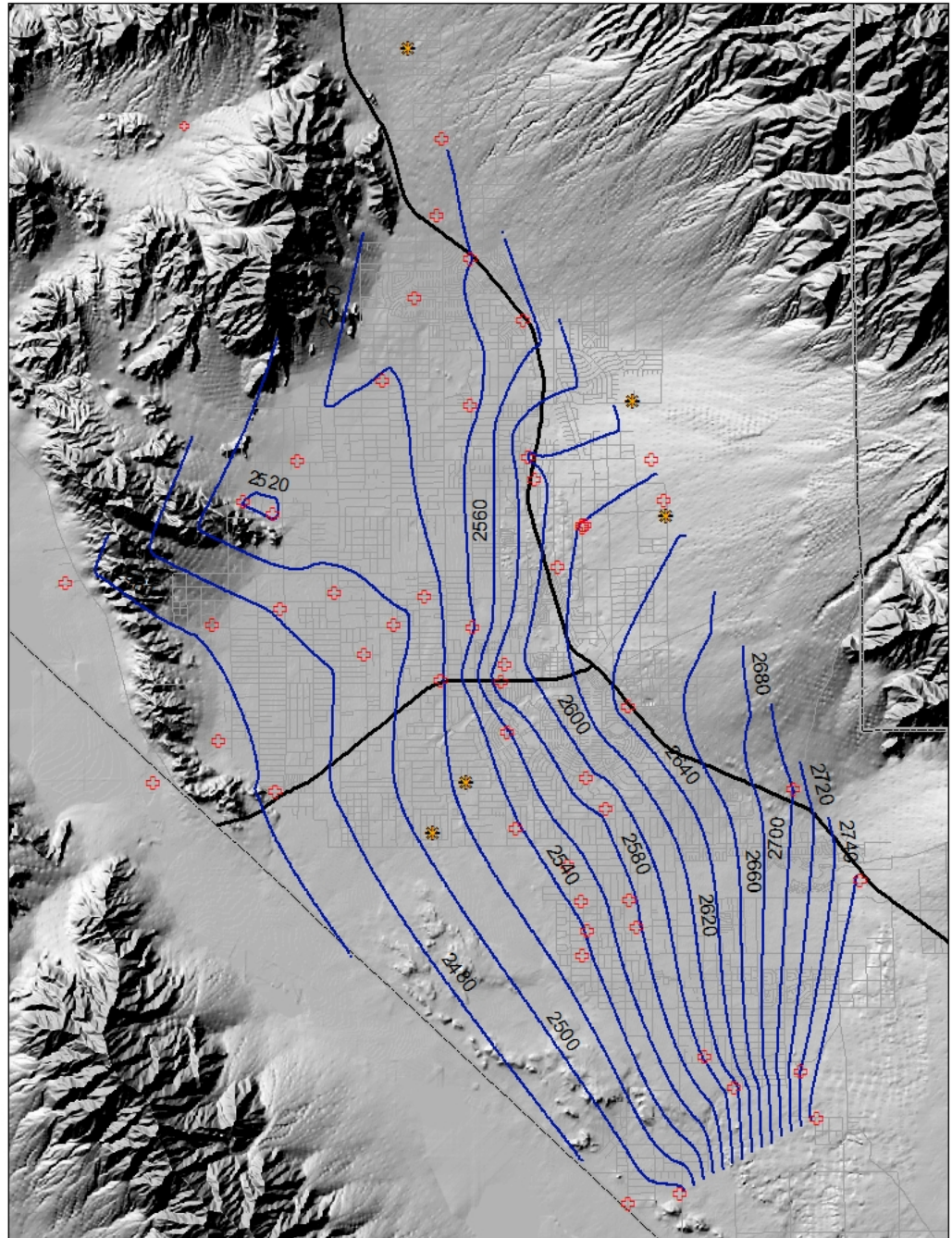
- Monitor well completion
 - Wells completed with 4-inch Schedule 80 PVC
 - Original plan was to complete with 4.5-inch PVC, allowing use of higher capacity 4-inch pump during pump testing
 - Sandpack and grout emplaced using tremmie methods
 - Surface completion with protective steel casing, concrete pad, and locking well cap



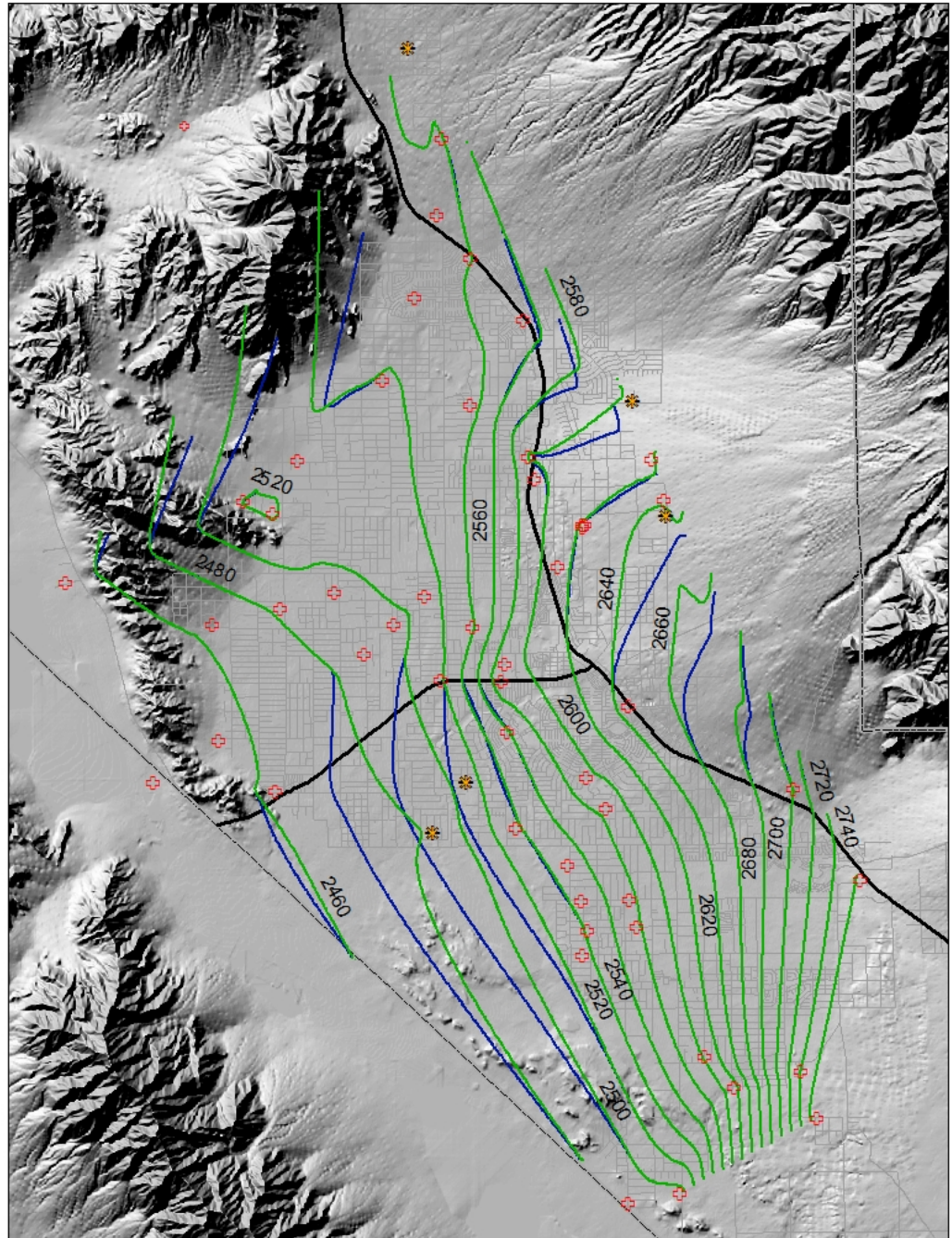
Pump Testing and Water Sampling

- Work being conducted now
- Pump tests
 - 4-inch casing limited us to use of 3-inch pumps (low flow rates and very little aquifer stress)
 - Step testing
 - Constant discharge testing
- Water chemistry
 - Working with DRI (Reno), DRI (Las Vegas), BYU, and other independent labs to analyze water samples for the following:
 - Major anions and cations
 - Metals
 - Selected isotopes
 - Tritium
 - Strontium
 - Noble gases

Pahrump Water Table Elevation – no GWE wells



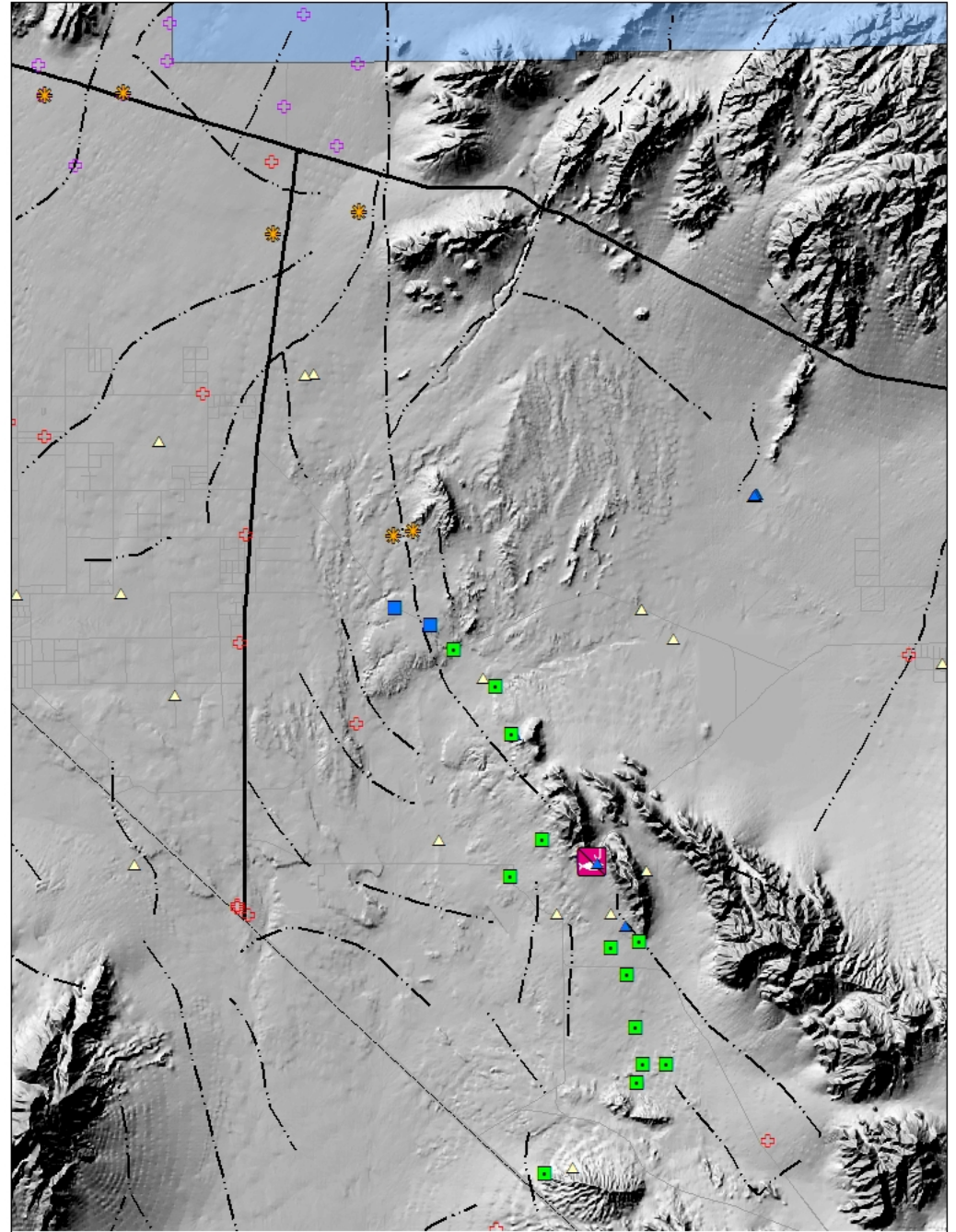
Pahrump Water Table Elevation – with GWE wells



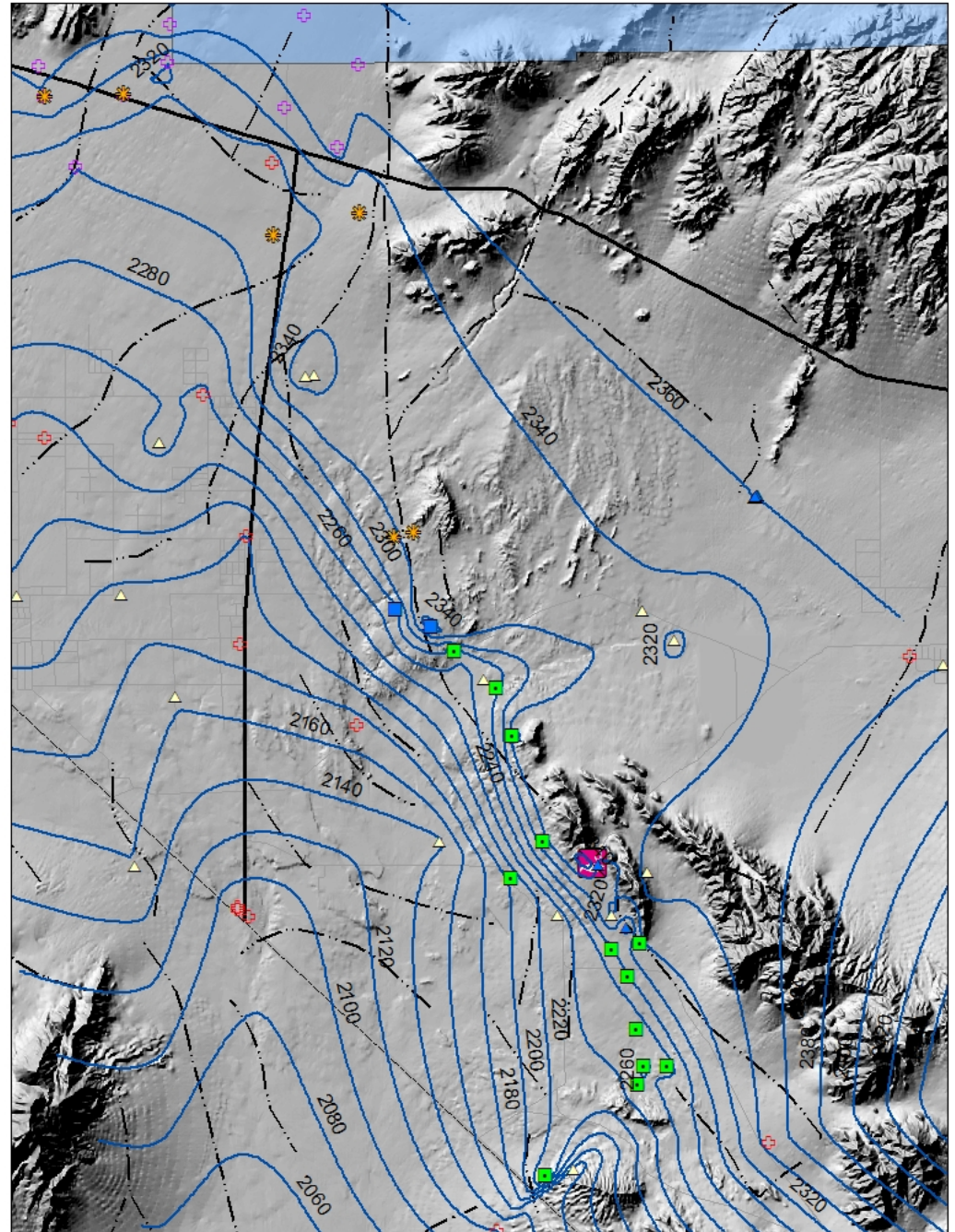
Results – Pahrump Valley

- Infill data gaps in water level wells
 - GWE wells and WLMP wells help to refine water level contours within Pahrump Valley
- Pump testing conducted in GWE wells provides additional aquifer information that is lacking in data gap areas
- Water chemistry data will expand on existing regional data set

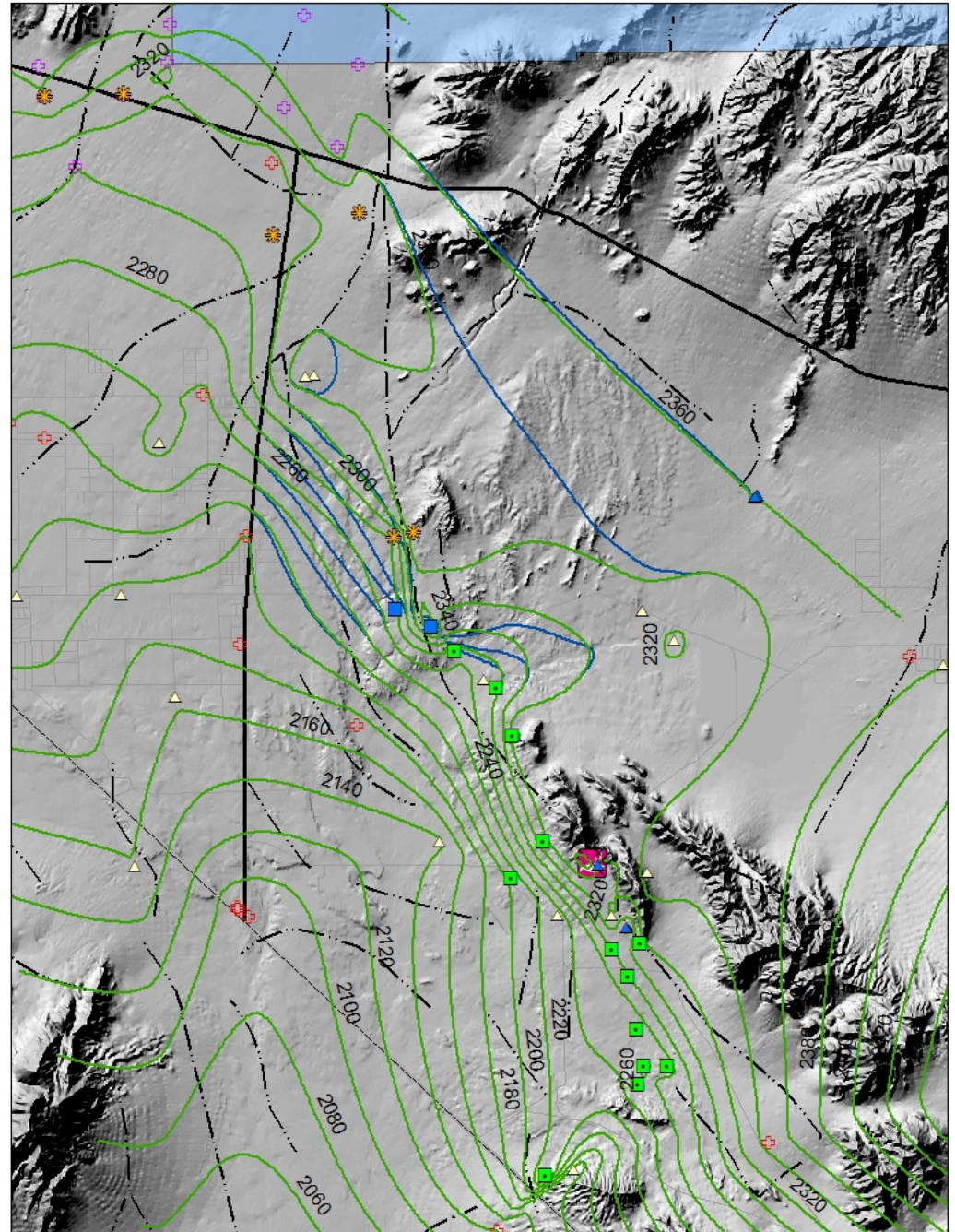
Amargosa Area Wells and Springs



Amargosa Water Table Elevation – no GWE wells



Amargosa Water Table Elevation – with GWE wells



Results – Amargosa Desert

- Gravity Fault
 - Thicker sequences on the west side (hanging wall) of the fault, presumably due to accumulation of sediments in down-dropped basins
 - Thinner stratigraphic sequences on the east side
 - Water table elevation on the east side of the Gravity Fault (GF-4) is 74 feet higher than on the west side (GF-3PA)
 - Similar relationships seen in USGS wells to the south where water table elevation at GF-2A on the east side of the Gravity Fault is 87 feet higher than GF-1 located west of the fault
 - Compartmentalized stratigraphy
 - At GF-4 water production at 110 feet in coarse-grained permeable sediments was 75 gpm and at GF-4PA at same depth in less permeable clayey sediments production was 25 gpm
 - Possibly graben-like features bounded by high angle structures act as barriers between sedimentary units with contrasting permeabilities
 - At GF-4 the sediments contain 200 feet of coarse-grained gravel and sand that is absent 60 feet to the west at GF-4PA
- Caution should be taken when generalizing hydrogeologic properties along the trace of the Gravity Fault!
- Need more wells to the north along the Gravity Fault
- Water table elevation contour refinement
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Results – Oasis Valley

- Artesian conditions at OV-1
 - OV-1 is a flowing artesian well with a head approximately 2 ft above ground surface
 - Located in Oasis Valley spring discharge area
- Problems with OV-1 completion
 - Artesian pressure compromised the integrity of grout seal
 - Efforts to contain leak were unsuccessful
 - Current plan is to plug back and abandon
- OV-2 is a viable well situated within prominent discharge area within Amargosa River channel

Future Work

- Geophysical survey (TEM, CSAMT, resistivity) transects across the Gravity Fault
- Additional wells straddling the Gravity Fault to examine head relationships
- Incorporate geologic and hydrologic data into SAMM framework as appropriate
- Examine connection between surface water infiltration and groundwater

Acknowledgements

- Drilling and sampling crew from Nye County and Hydro Resources
- John Klenke, Bob Wilcoxon, and Jamie Walker
- Nye County management
- Department of Energy and Bruce Stolte for continued support
- Tom Buqo – for starting the whole GWE grant program

Questions?

