

# PIONEER

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## NATURAL RESOURCES

### A Raton Basin Geothermal Prospect

Hal Macartney

#### Geothermal in the Oilfield

Symposium Sponsored by RMOTC, GTP, NREL, & SMU  
Casper WY August 19, 2010

NYSE: PXD  
[www.pxd.com](http://www.pxd.com)



*Opportunity to test an Enhanced Geothermal System (EGS) in a hot sedimentary basin, which if successful would roll over to many other hot basins in the US and break from the traditional hydrothermal model for EGS.*

Proposed is a pilot test to:

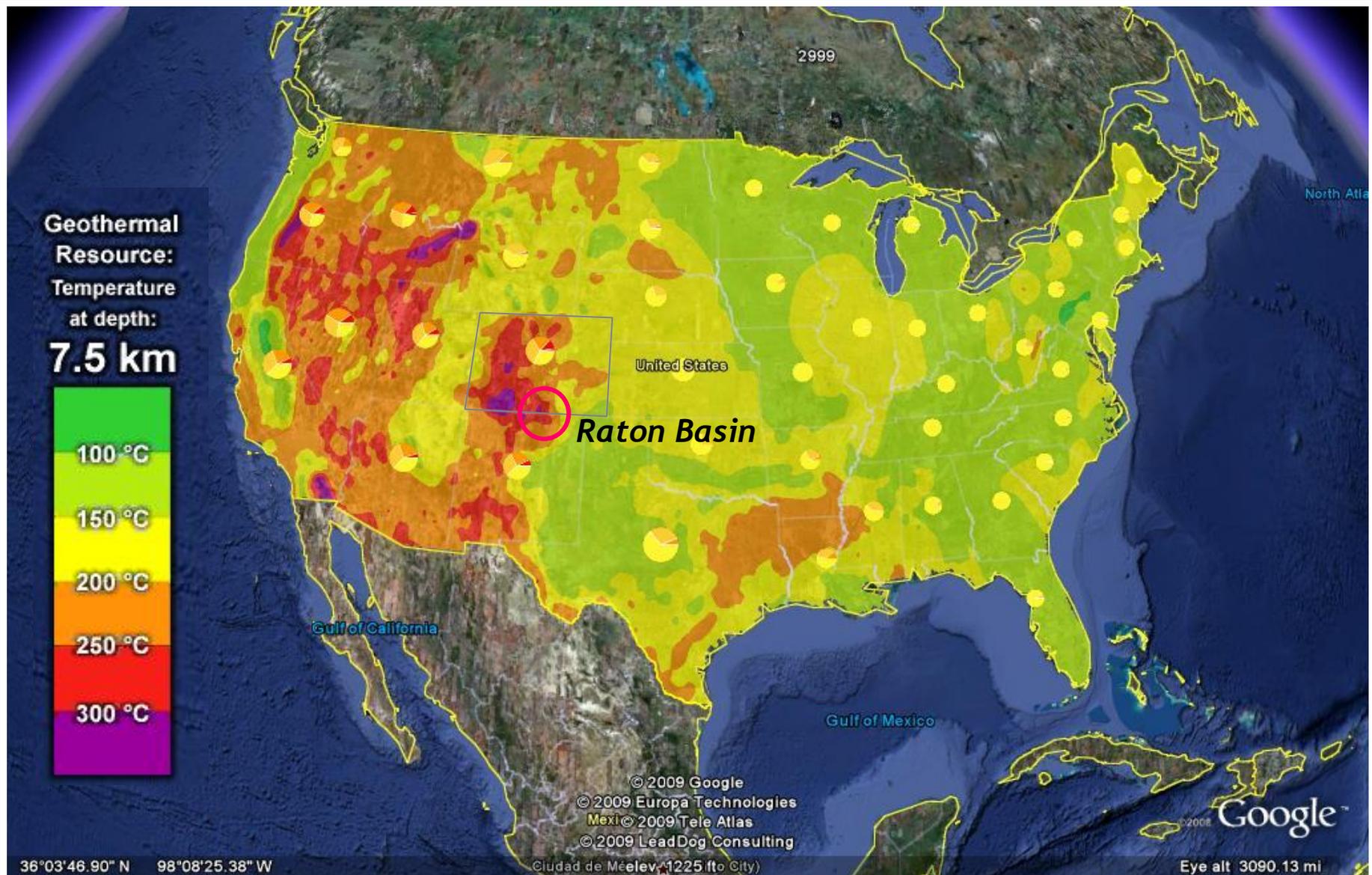
1. Ascertain subsurface potential and reservoir performance
2. Apply oilfield expertise in drilling and hydraulic fracturing

*(The pilot is not designed to test surface electrical generation from hot fluids)*

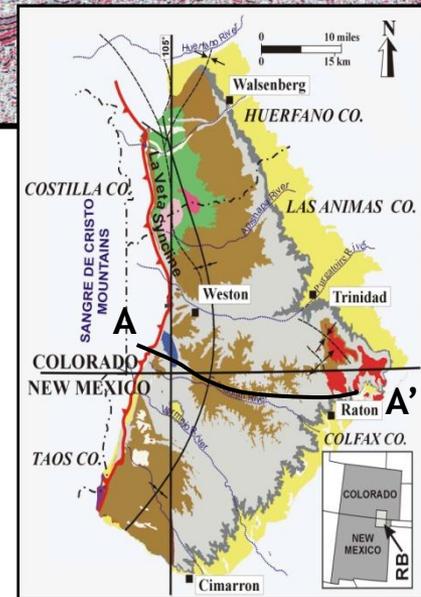
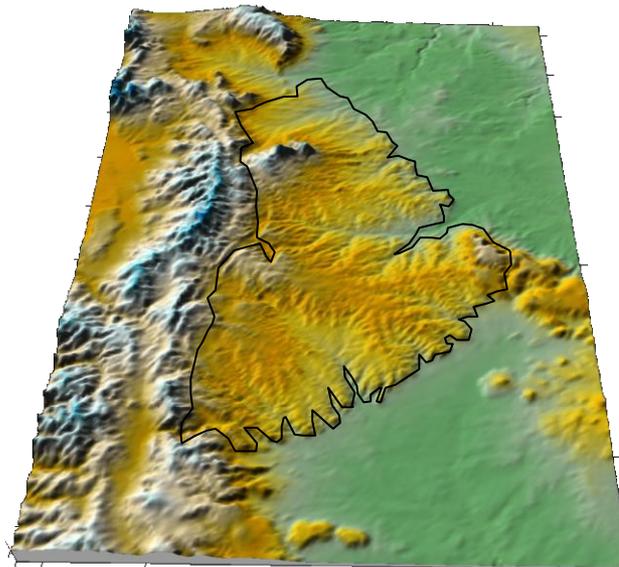
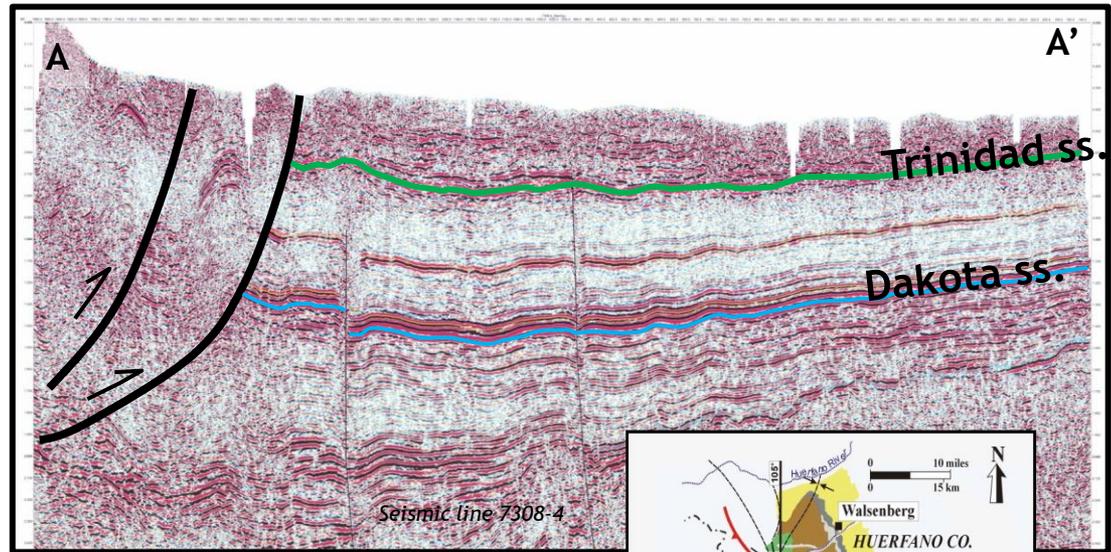
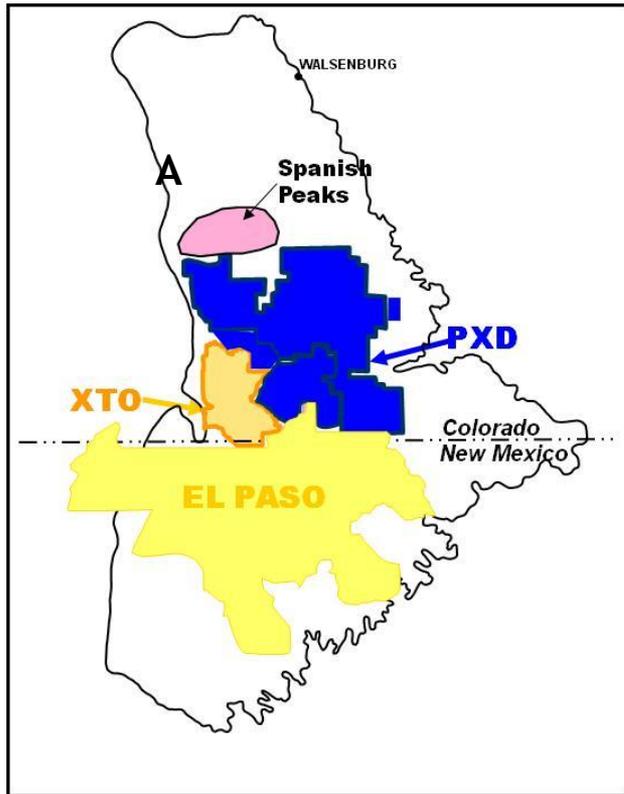
**Why Pioneer? Why Raton Basin?**

Pioneer has local in-house drilling and fracturing expertise and equipment, land (mineral and surface rights), and ample water from its CBM operations. Pioneer is also a large energy consumer. Raton Basin is close to infrastructure and potential markets, and has a well defined heat anomaly (2000+ wells). Partners: CO Geol. Survey, Sch. Of Mines, DOE

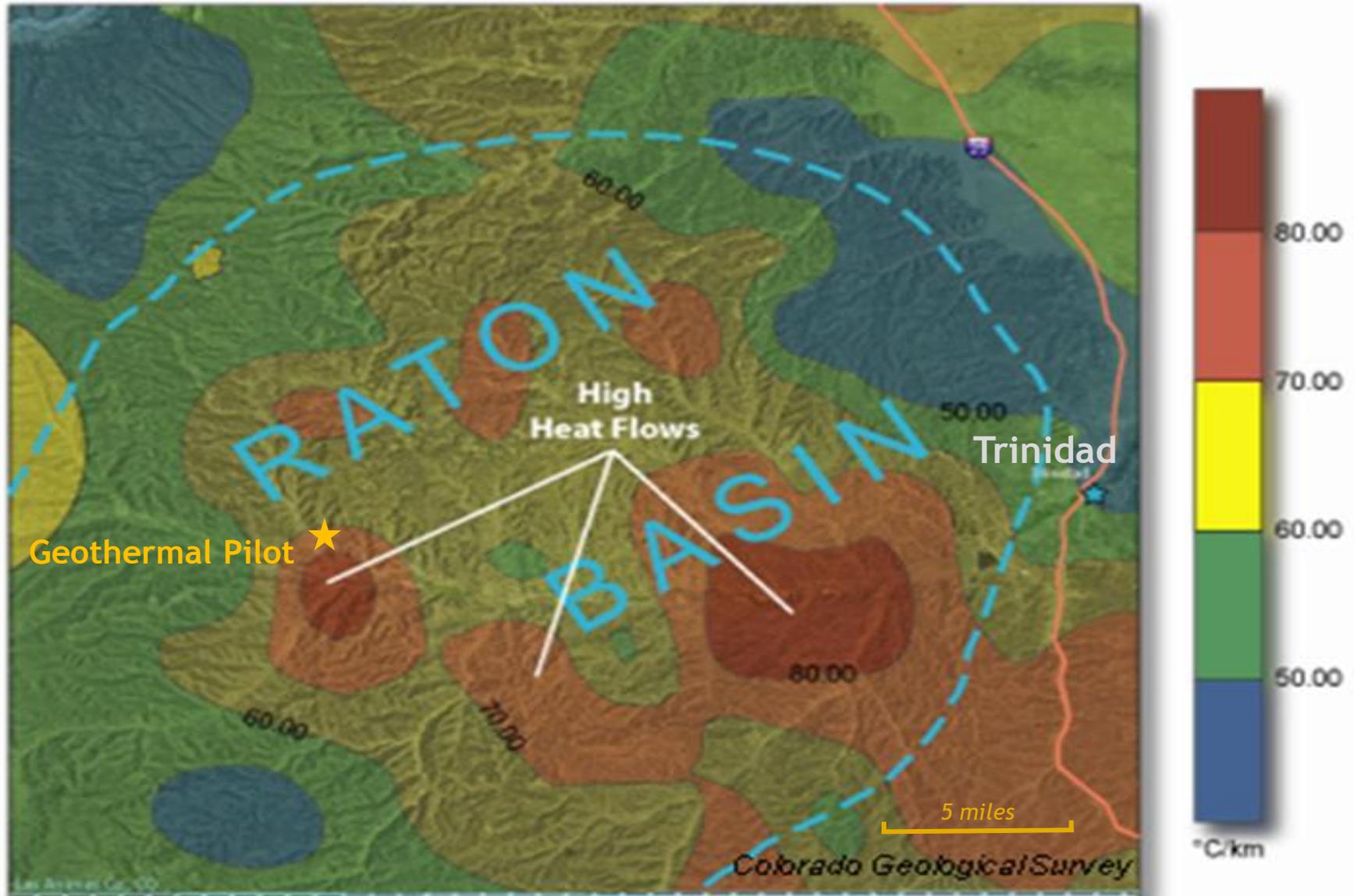
# US Geothermal Resources



# Raton Basin: Location and Attributes

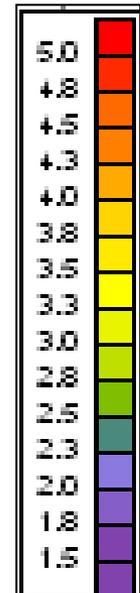
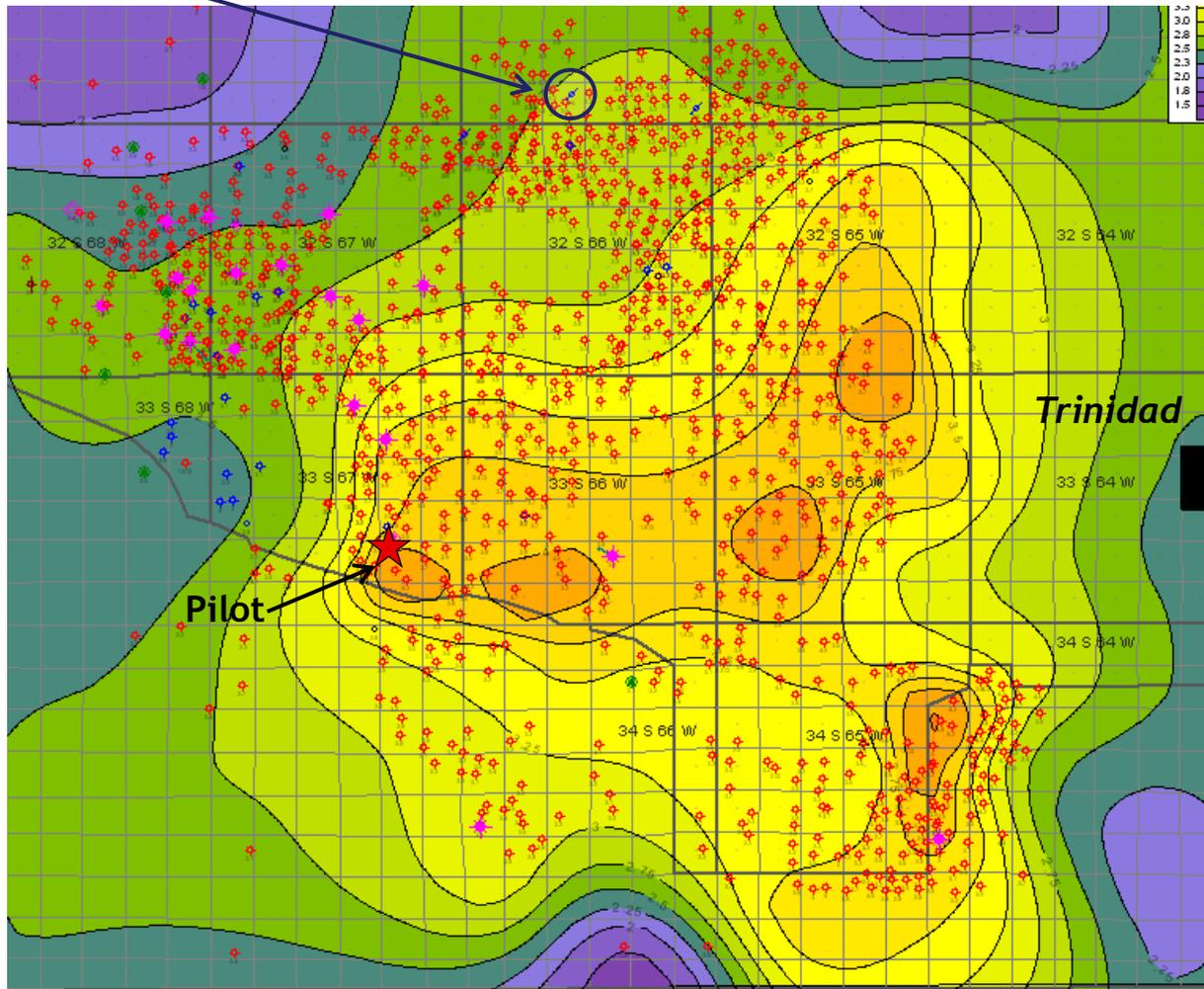
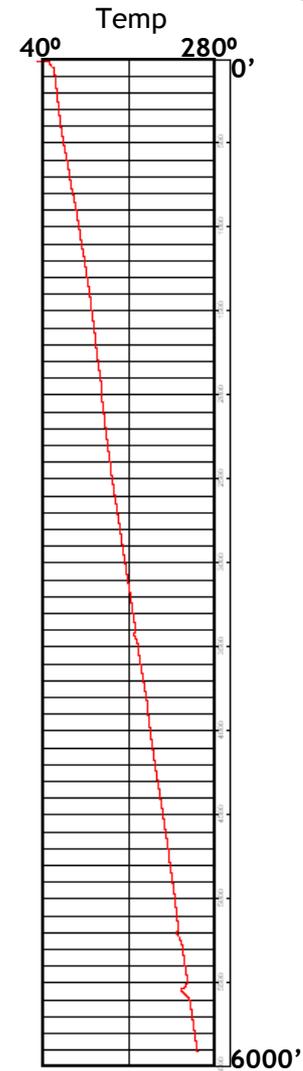


# Raton Thermal Anomaly



# Geothermal Gradient

Jarosa 32-33 WDW



°F / 100'

## Identify Geothermal Lead

- *CGS & SMU mapping*

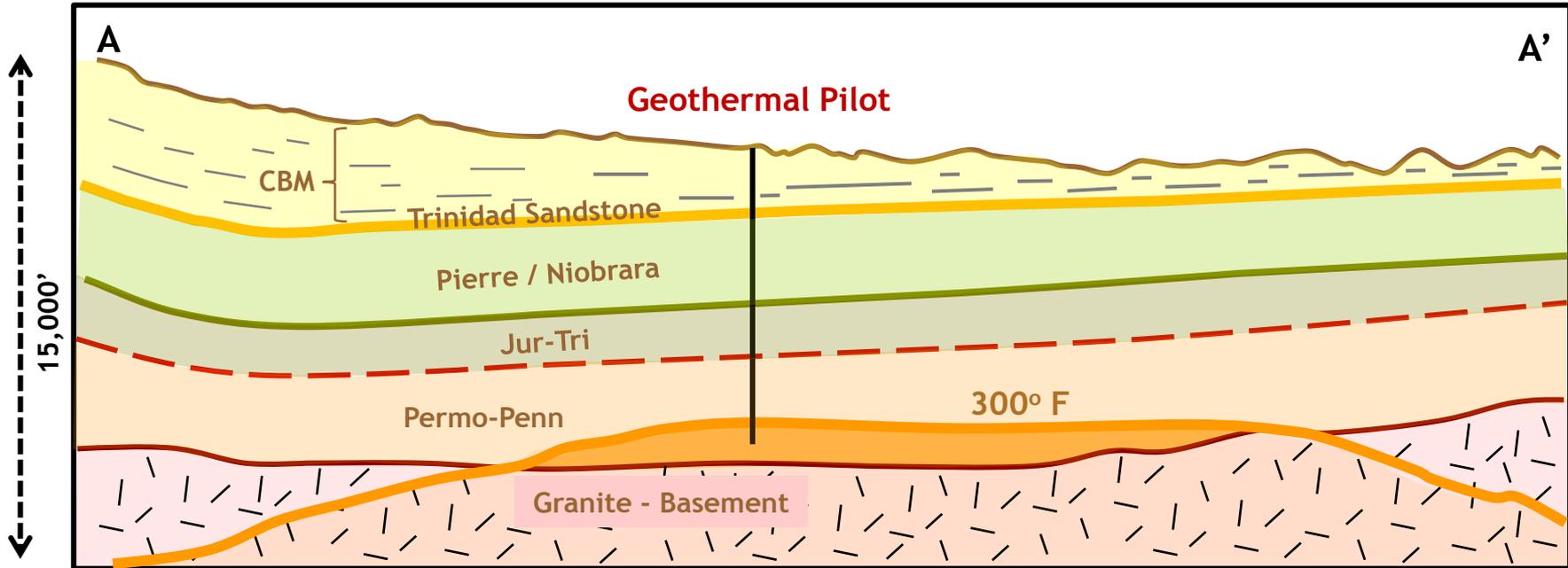
## Project Feasibility Analysis

- Heat confirmation - in-house mapping
- Thermal modeling - extraction and depletion, rock volumes
- Sub-surface engineering - well design, frac design, costs
- Surface engineering - pumps, coolers, and infrastructure
- Energy balance - net gain?
- Scoping economics
- Management approval & DOE funding request

## Implementation

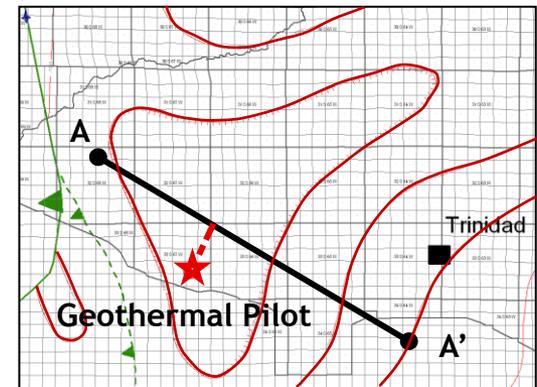
- 3 phases: Analysis & drilling - Stimulation - Flow & monitor

# Resource Assessment - Mapping

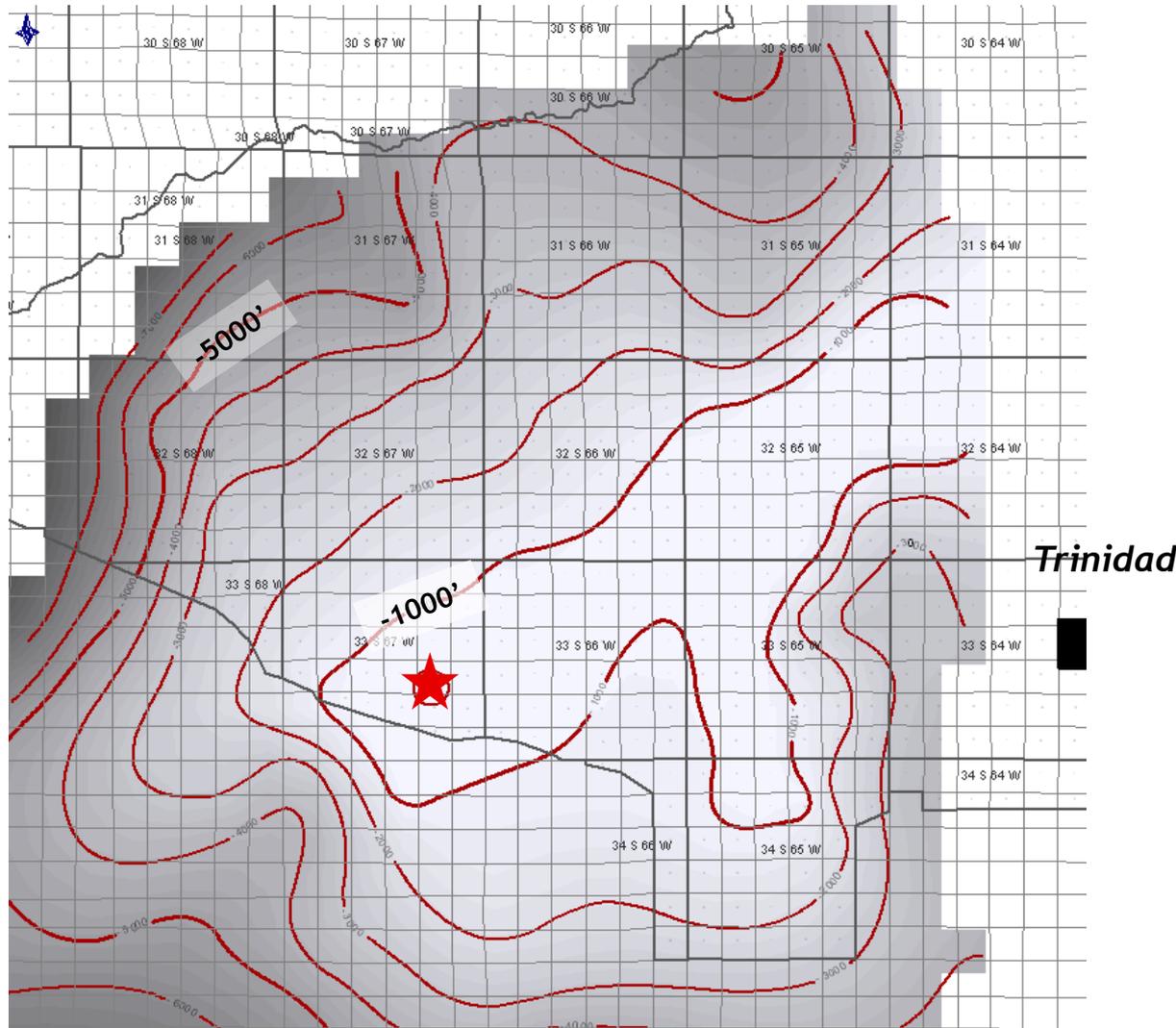


~10:1 Vertical Exaggeration

- Basement
- 300° F Isotherm Surface
- Sedimentary package > 300° F

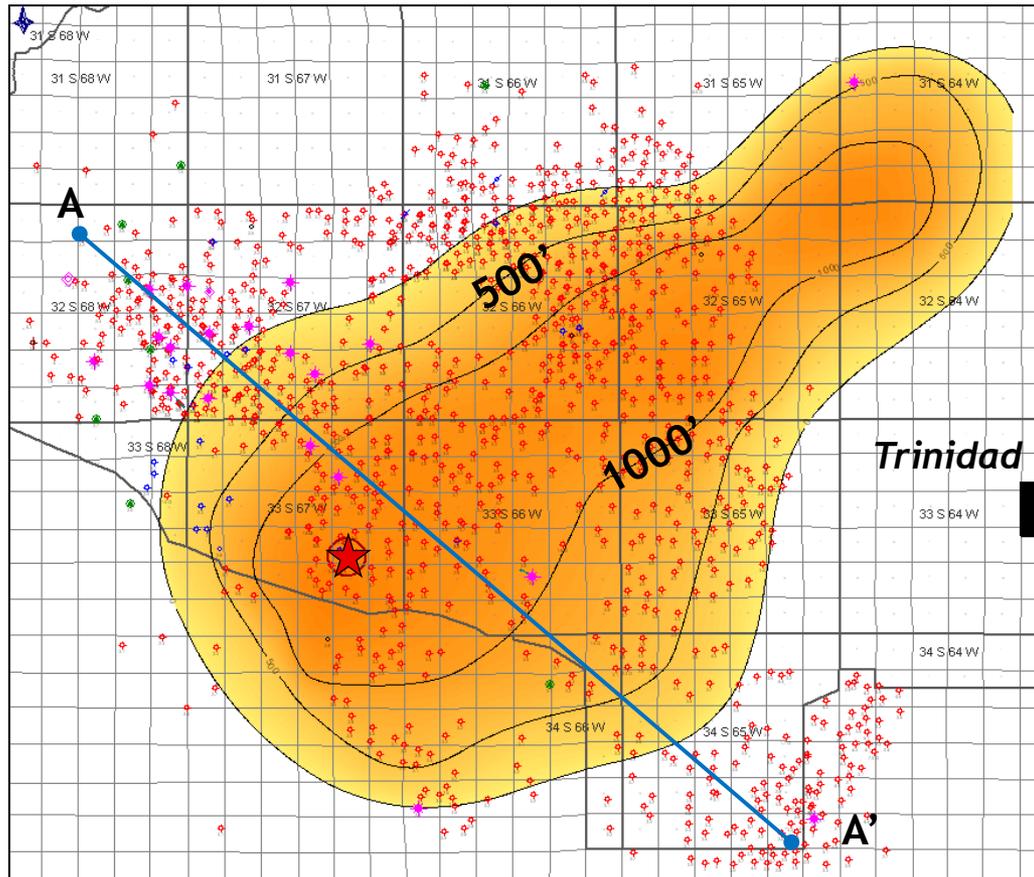


# 300° F Isotherm Surface

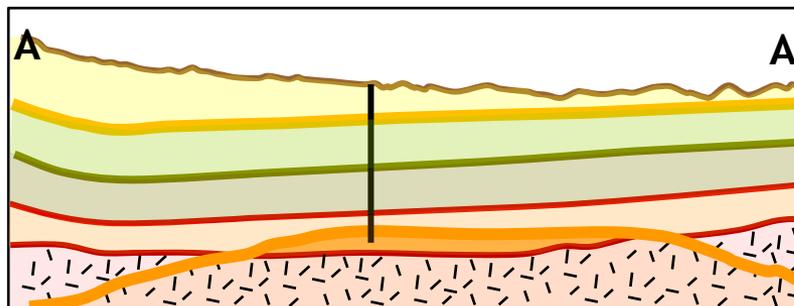


Surface of T=300°F  
CI = 1000'

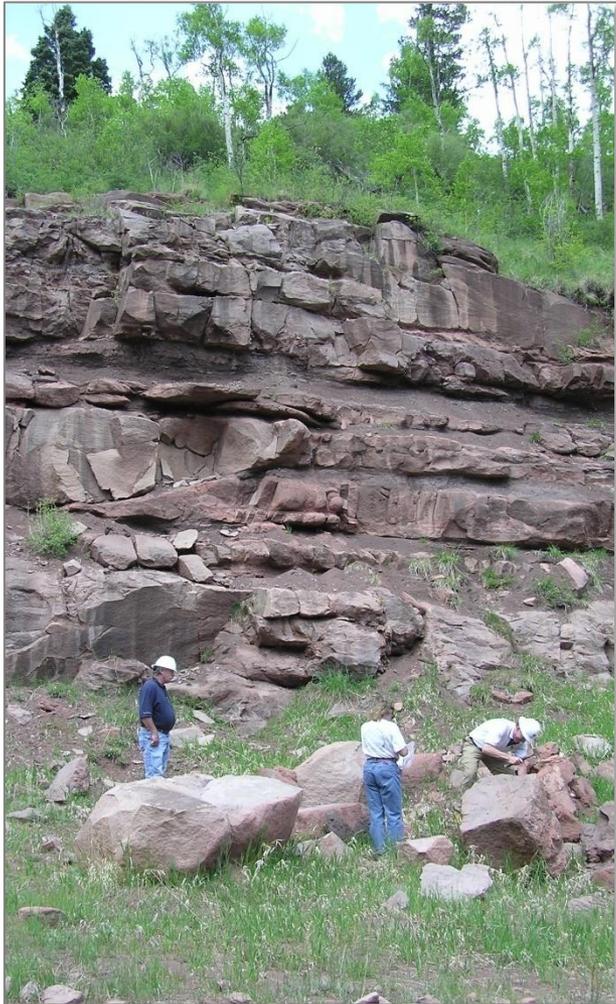
# Isochore of Sedimentary Rock >300° F



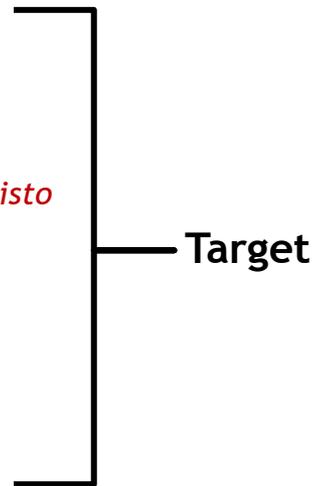
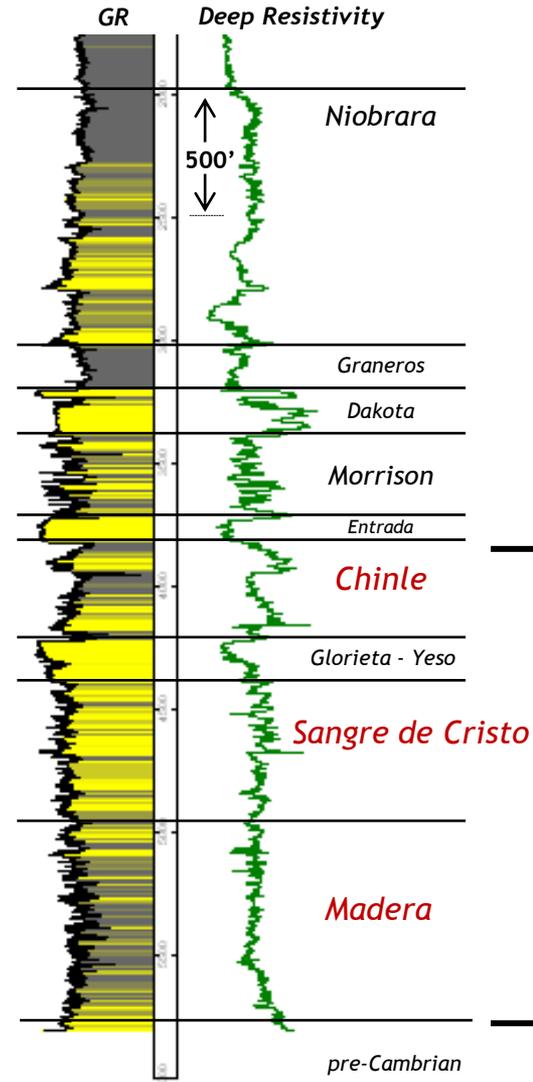
Thickness (ft.)

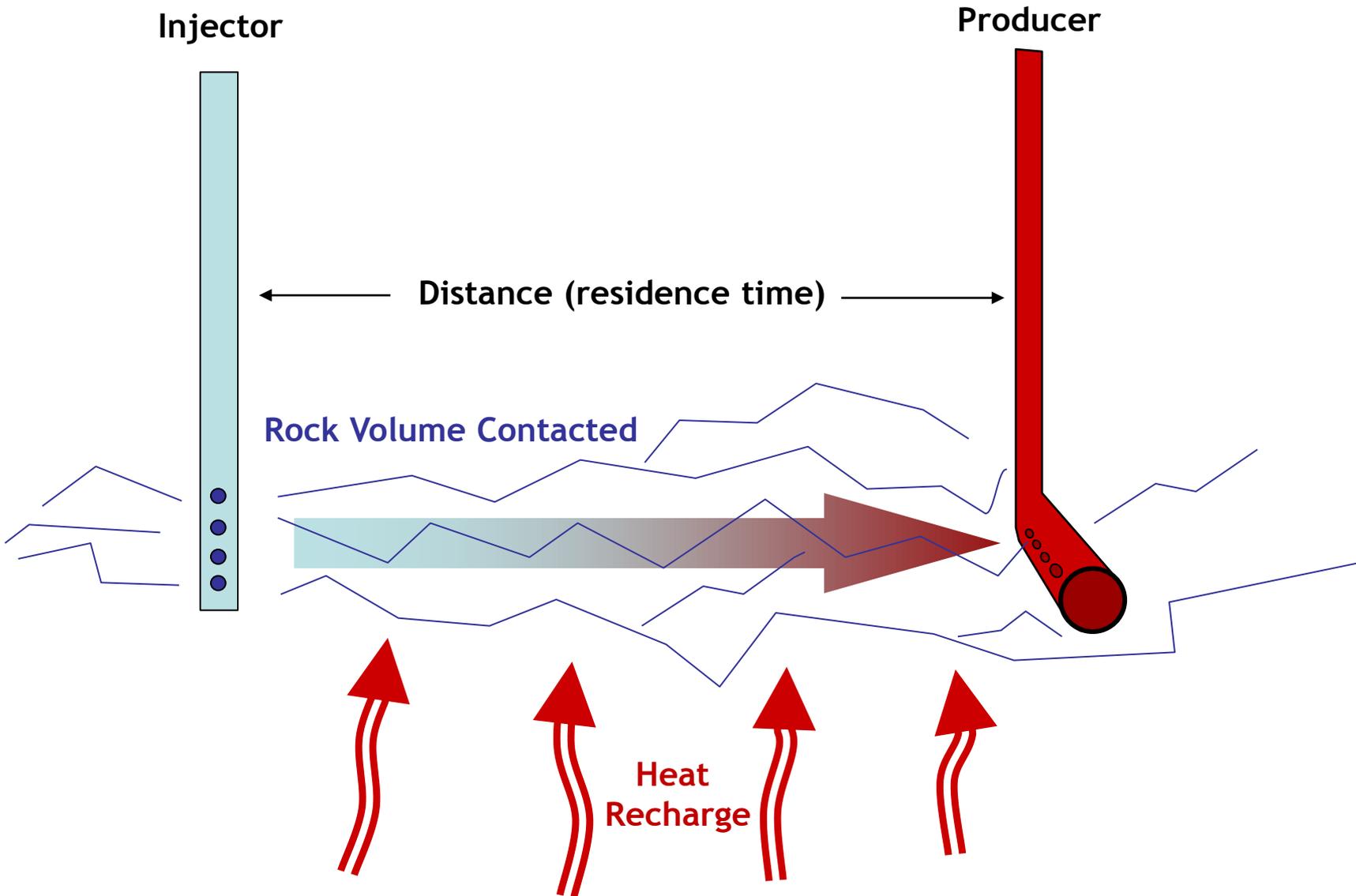


# Reservoir/Resource Targets

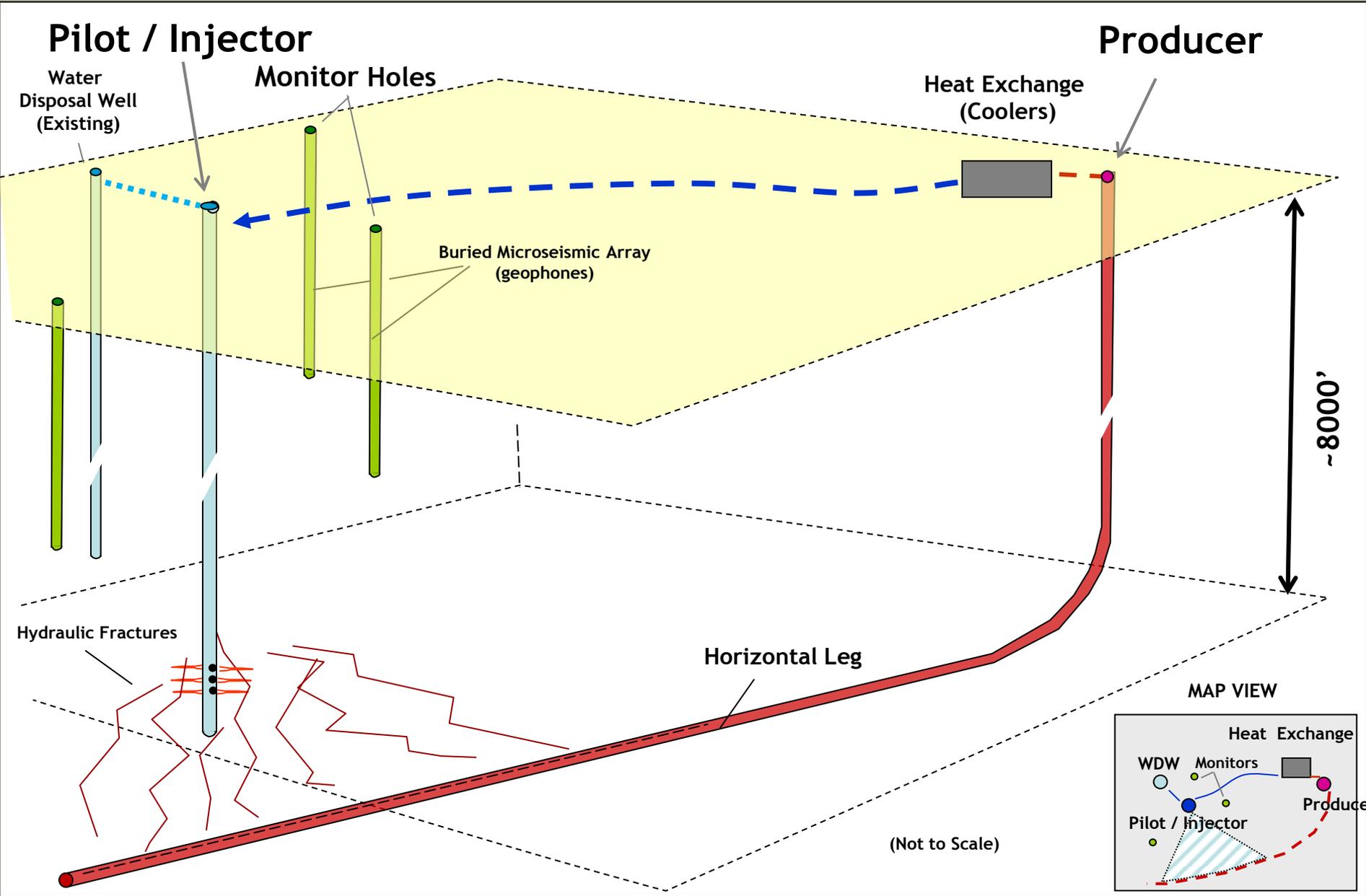


Phelps Dodge #1  
Sec 21, T26N R22W  
Colfax Co. NM

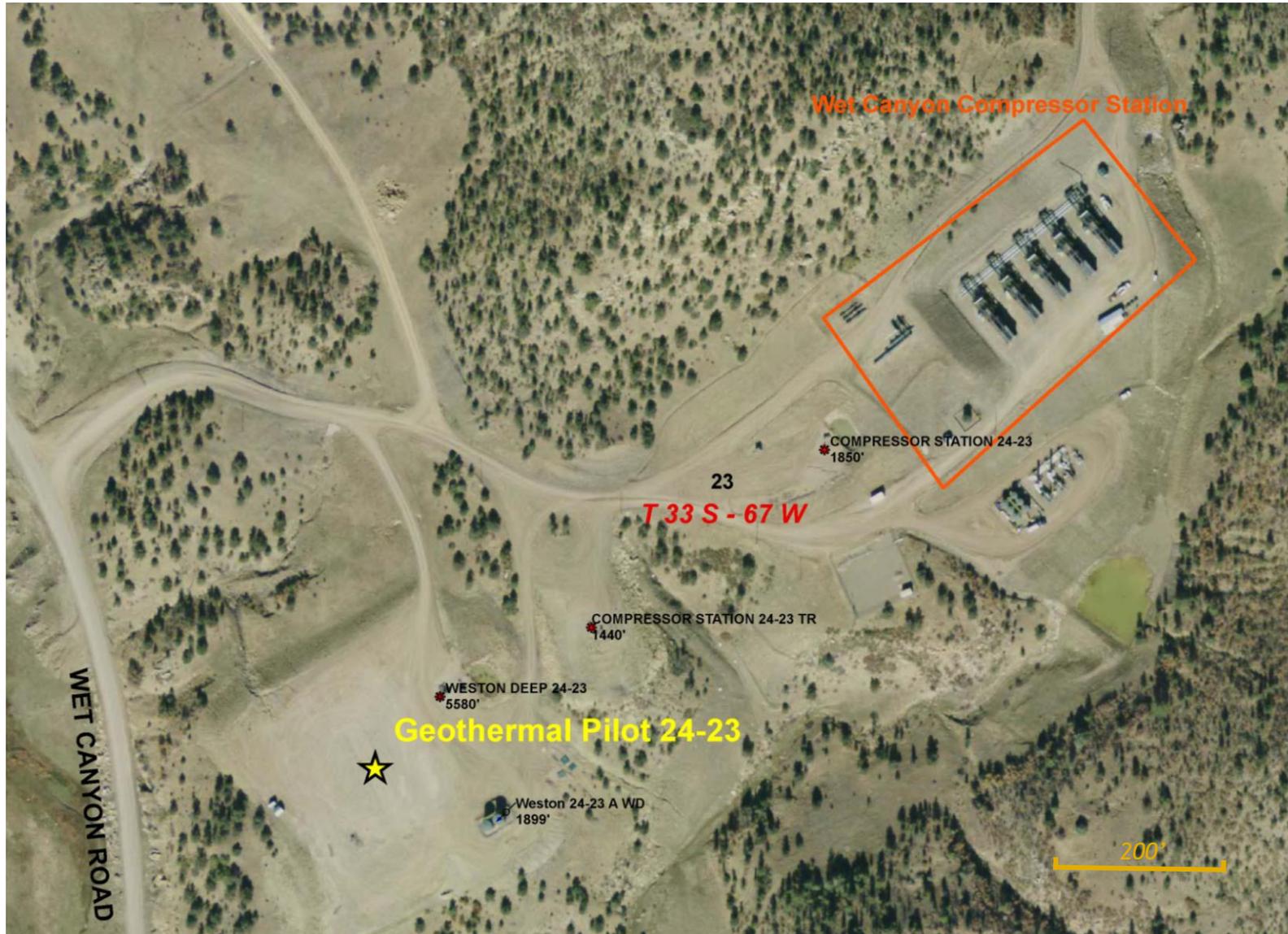




# Project Schematic - 3D View



# Proposed Wet Canyon Site



- Thermal modeling
- Energy balance analysis
- Economic analysis

