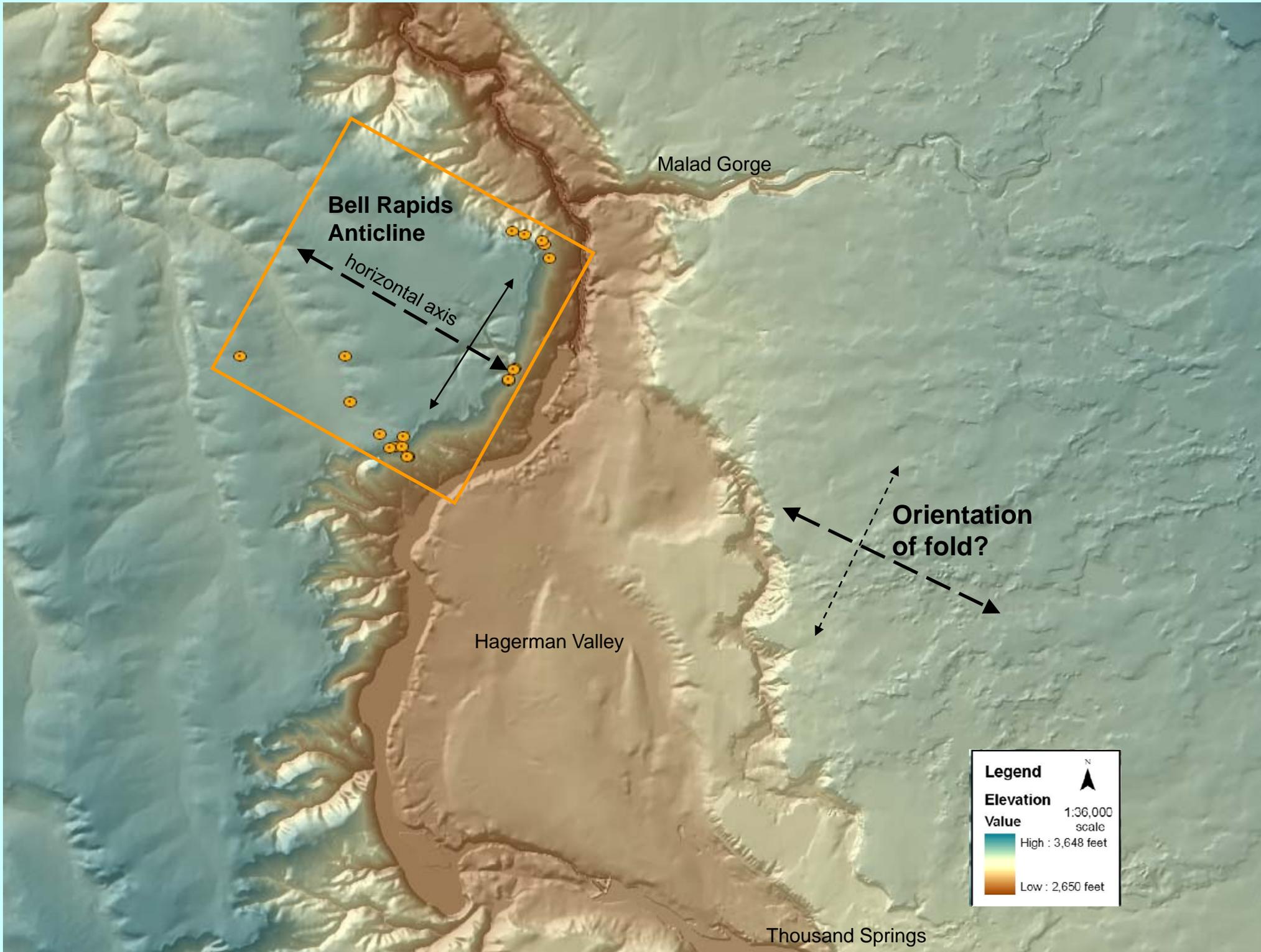


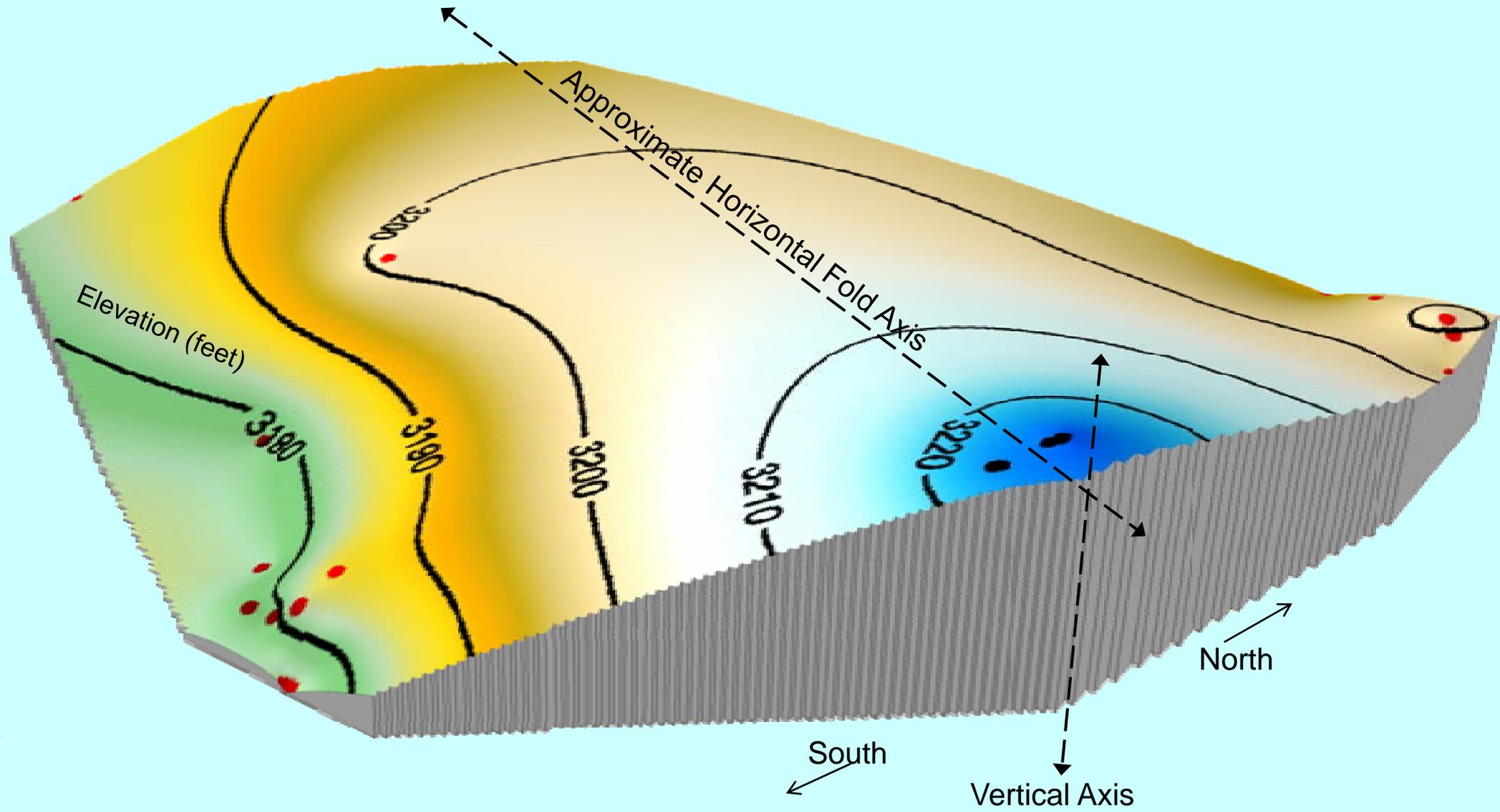
# Dye Tracer Tests in the Lower ESPA

(Malad Gorge State Park)

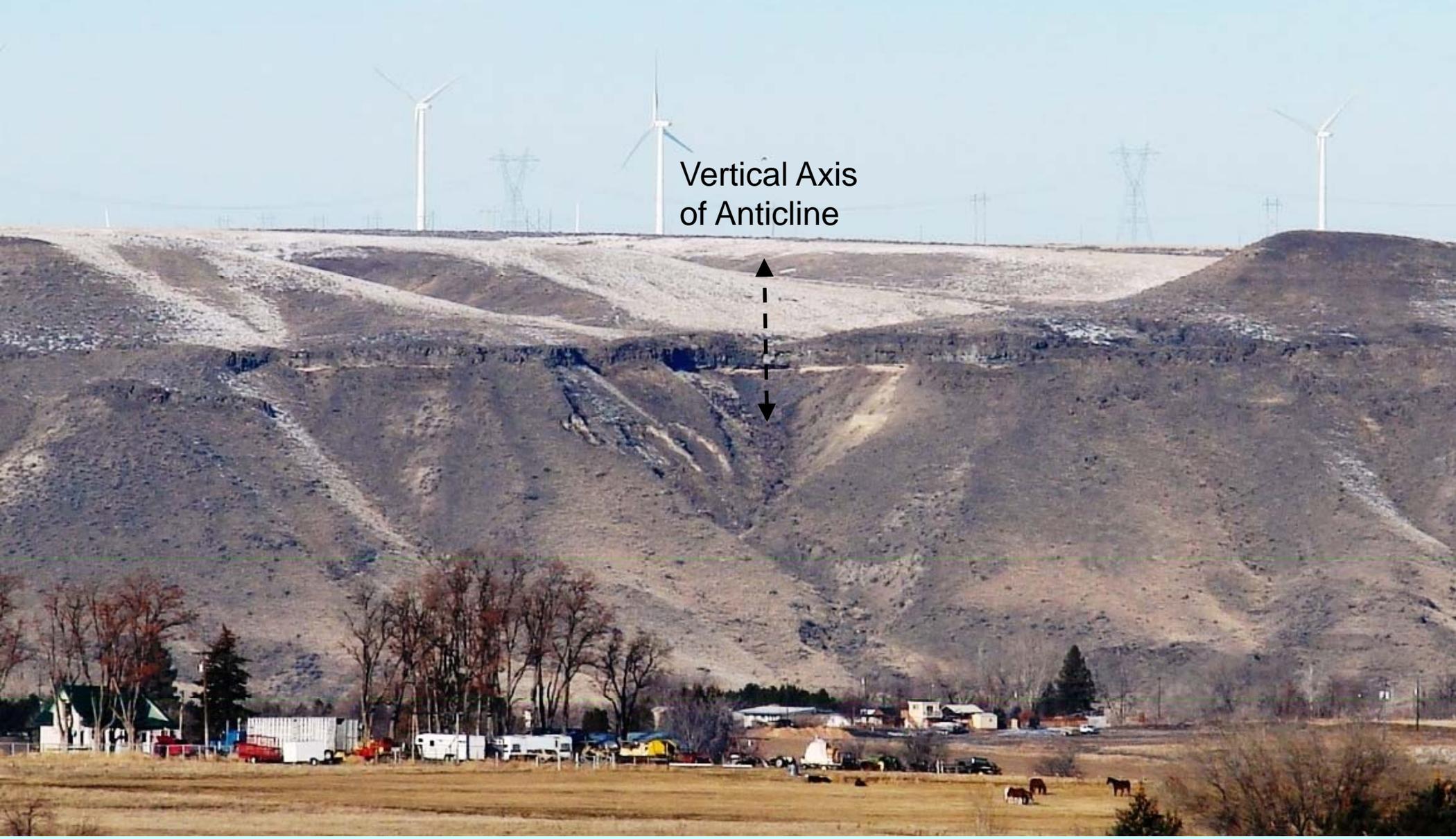




# Bell Rapids Anticline



# Bell Rapids Anticline



Vertical Axis  
of Anticline



View Angle is West



Bliss

Malad Gorge

Tuttle

Hagerman

Thousand Springs

Box Canyon

Clear Lakes

Buhl

Snake River

Wendell

Jerome

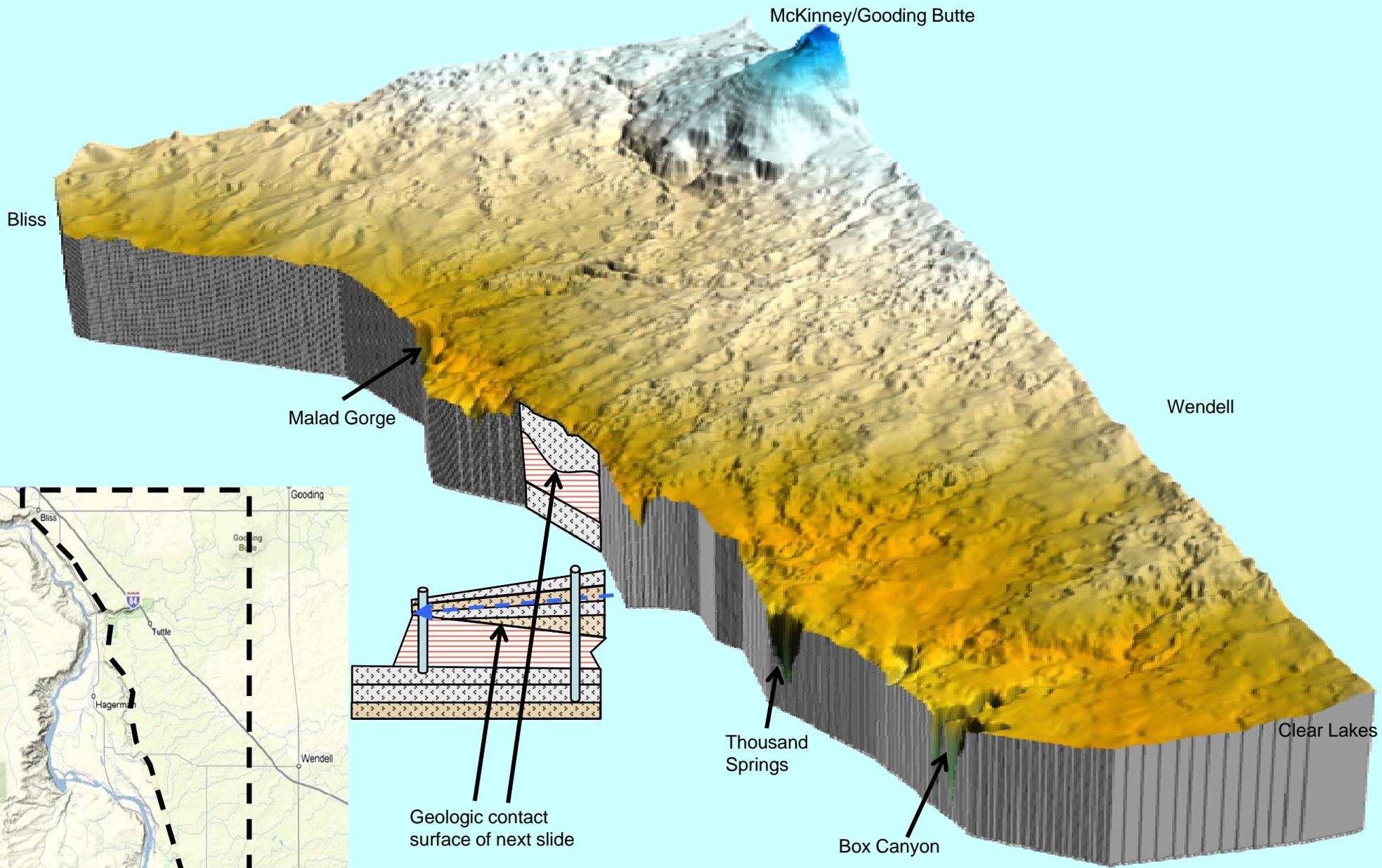
Sonnicksen Butte

North

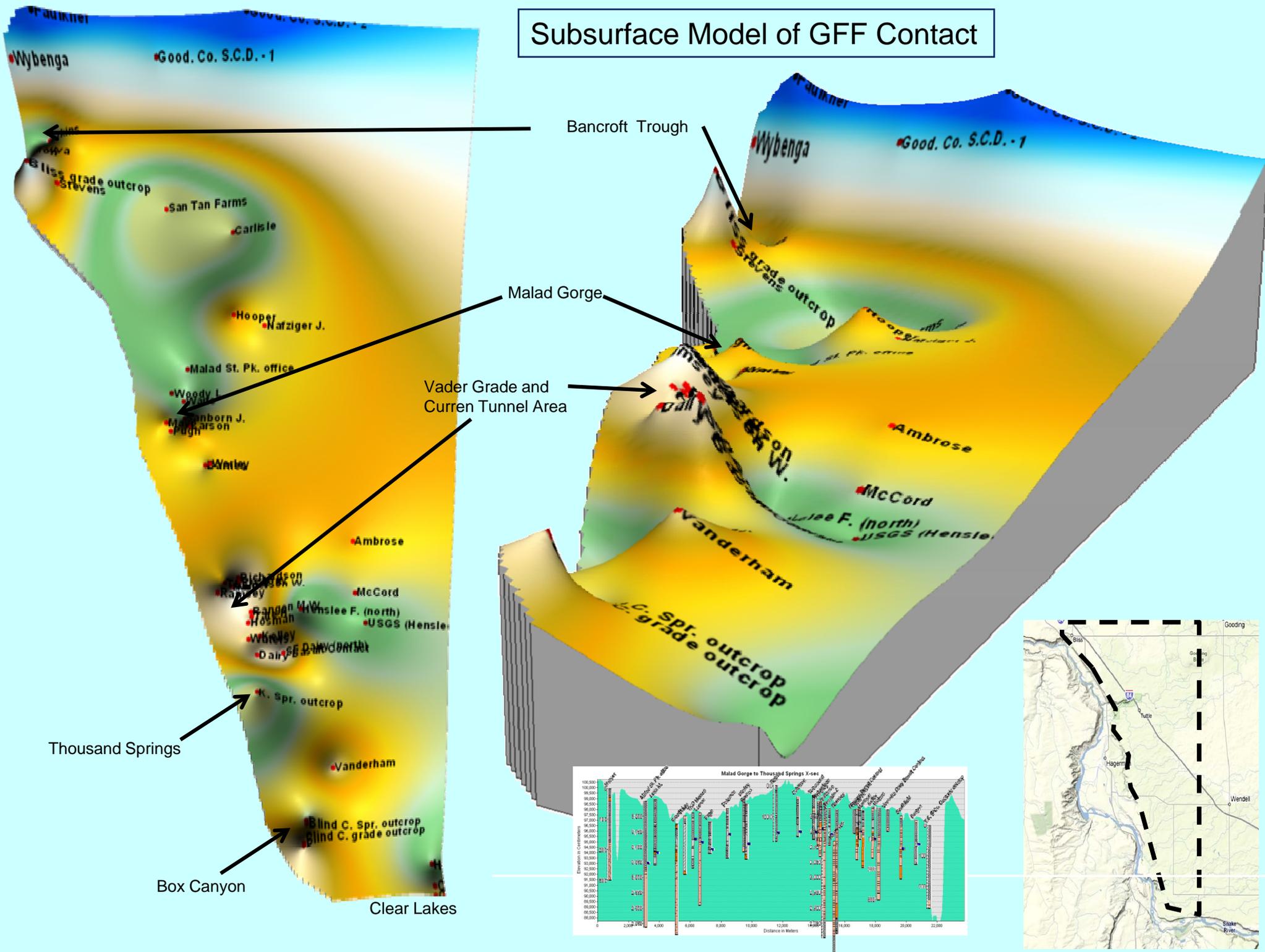
Gooding

Gooding Butte

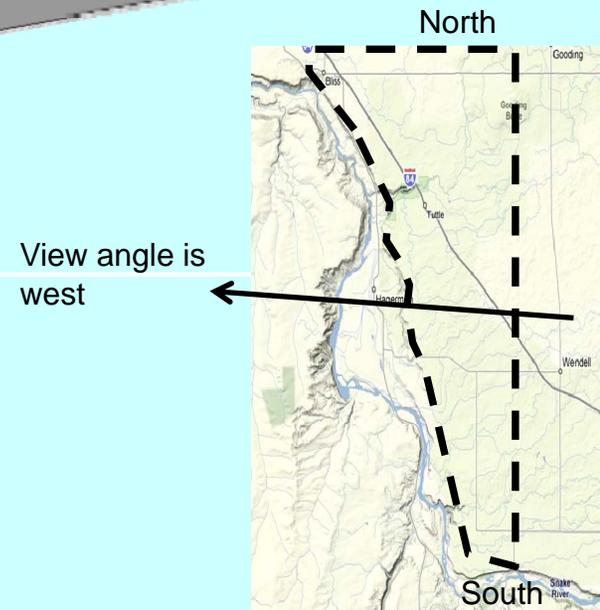
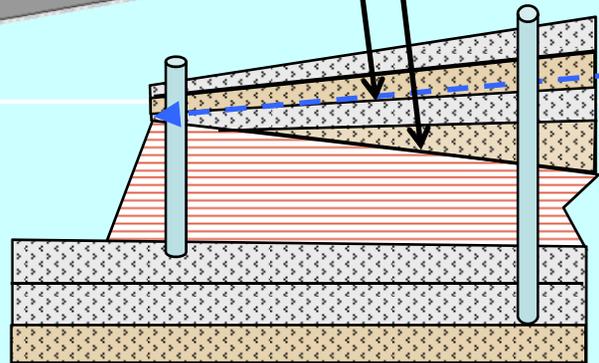
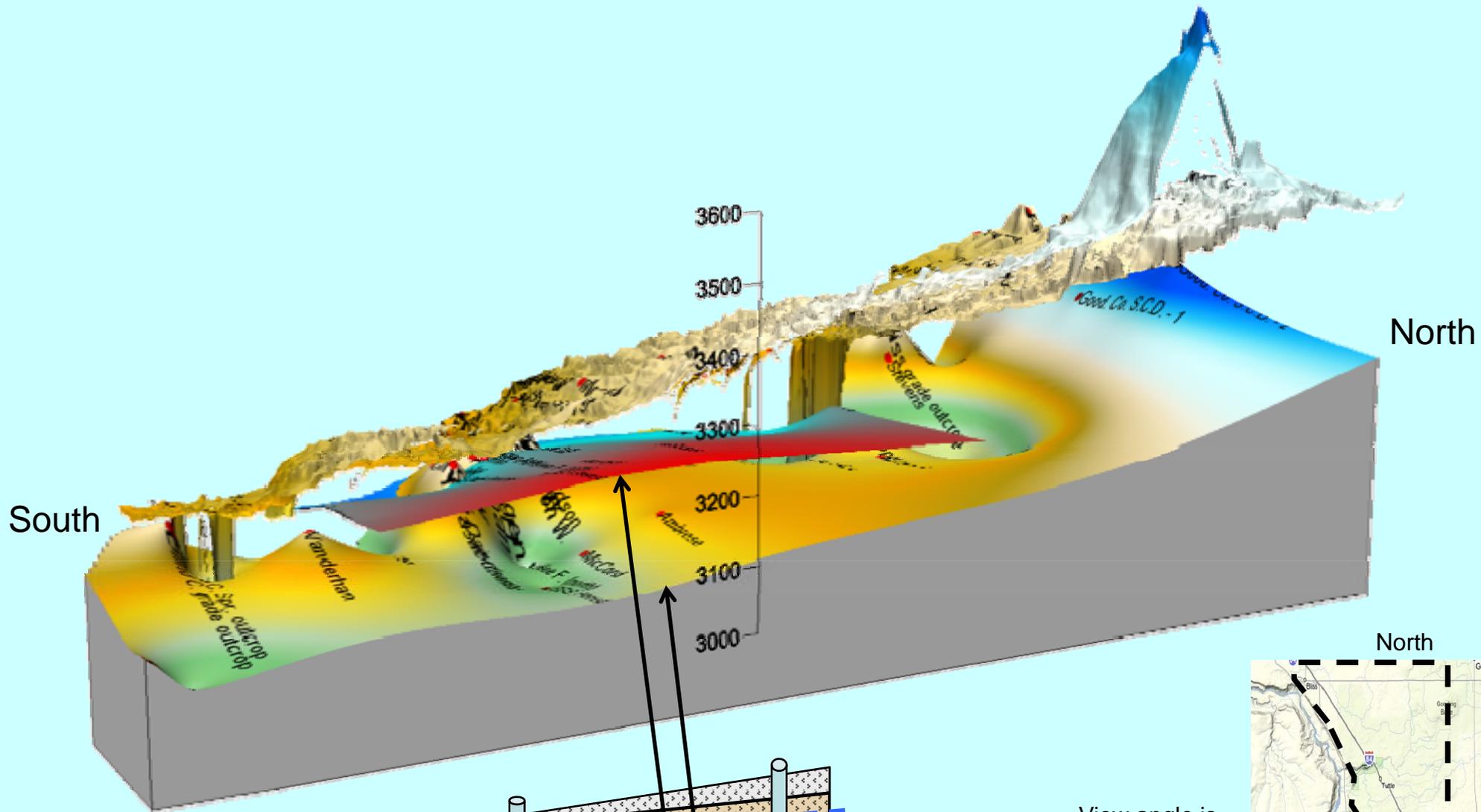
# Land Surface Model



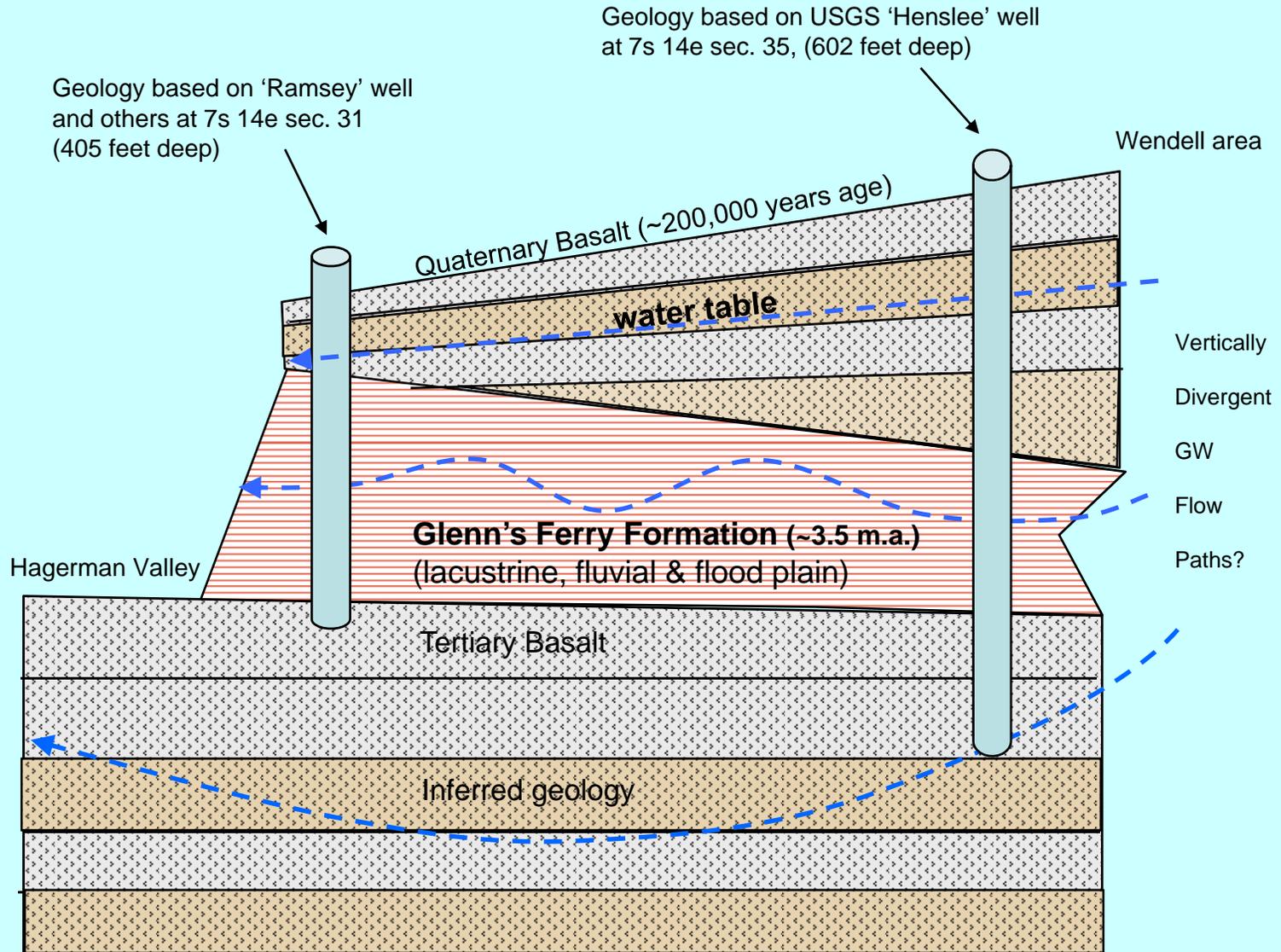
# Subsurface Model of GFF Contact



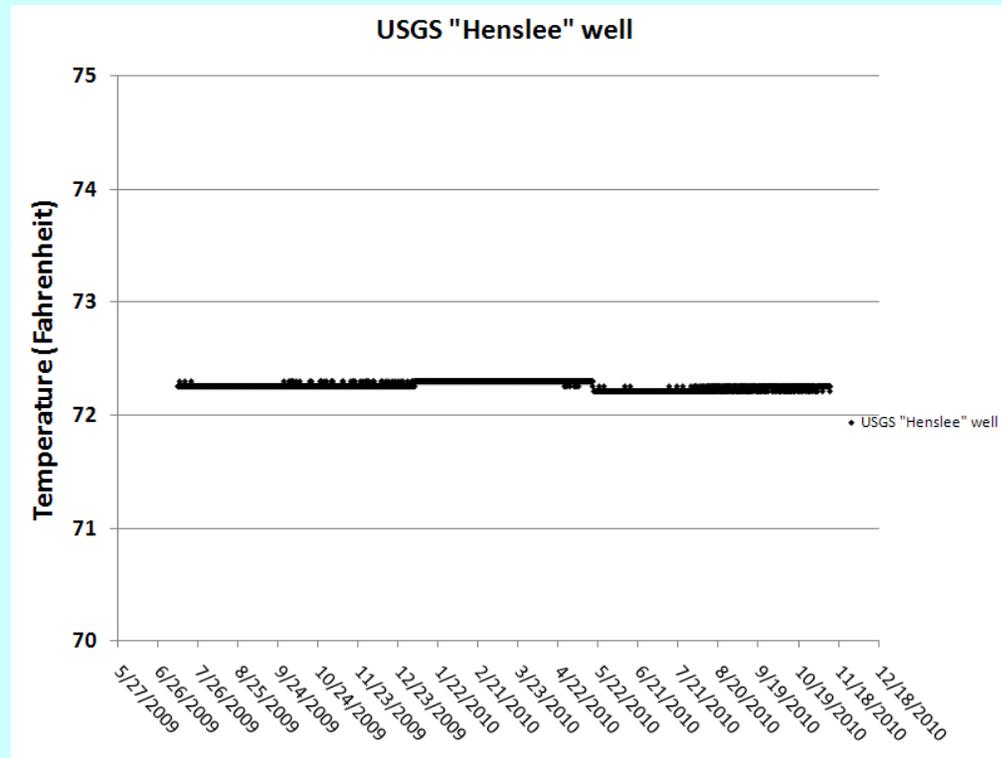
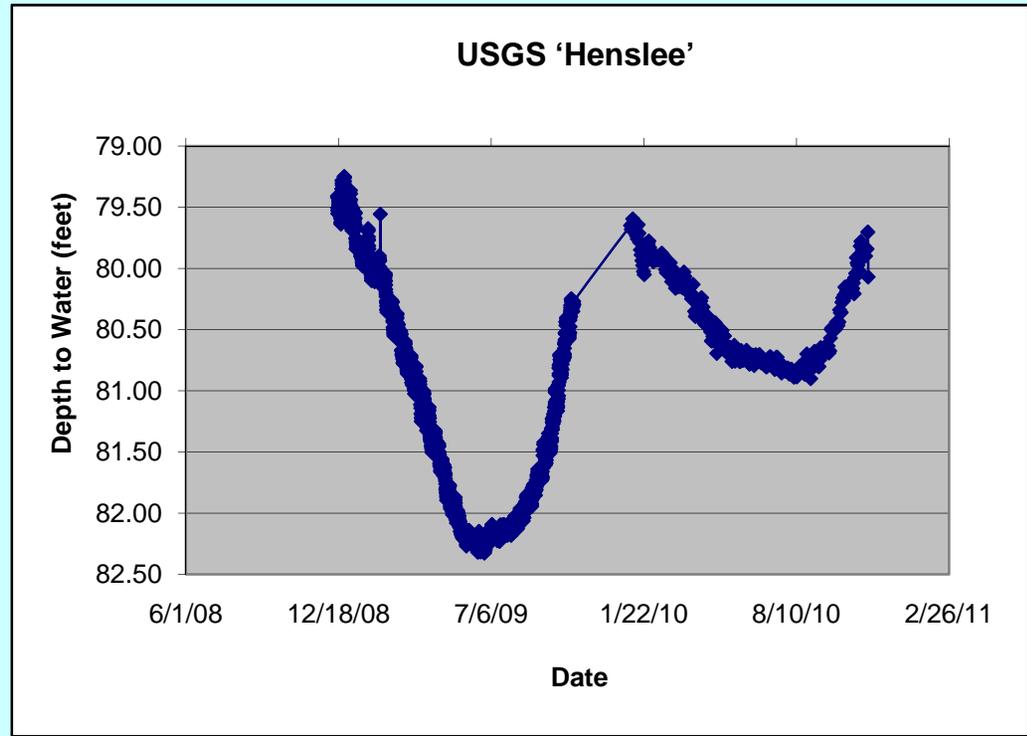
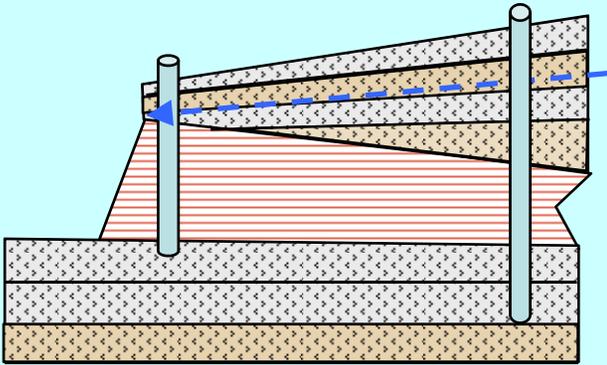
# Subsurface Model



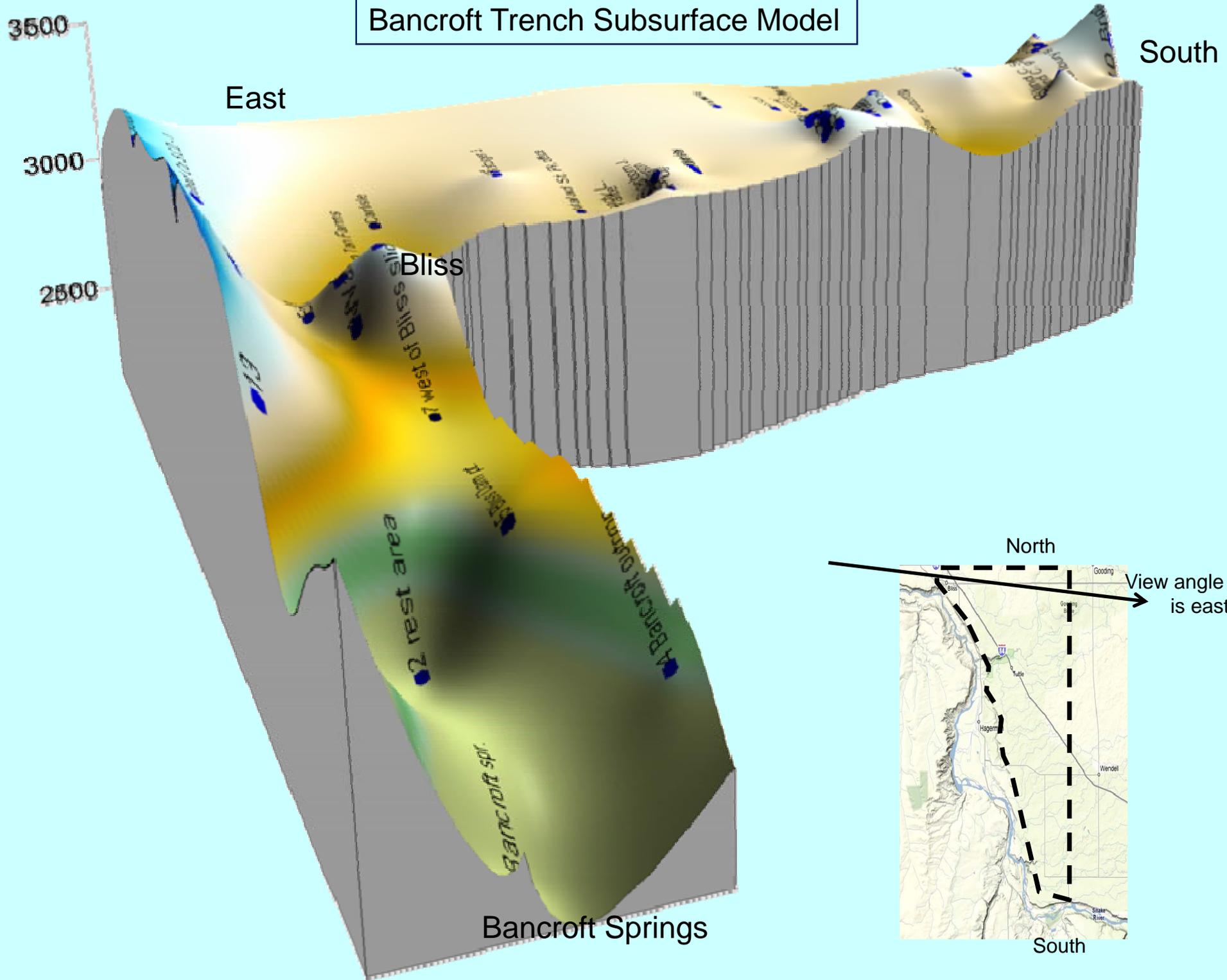
# Cross Section Geologic Model

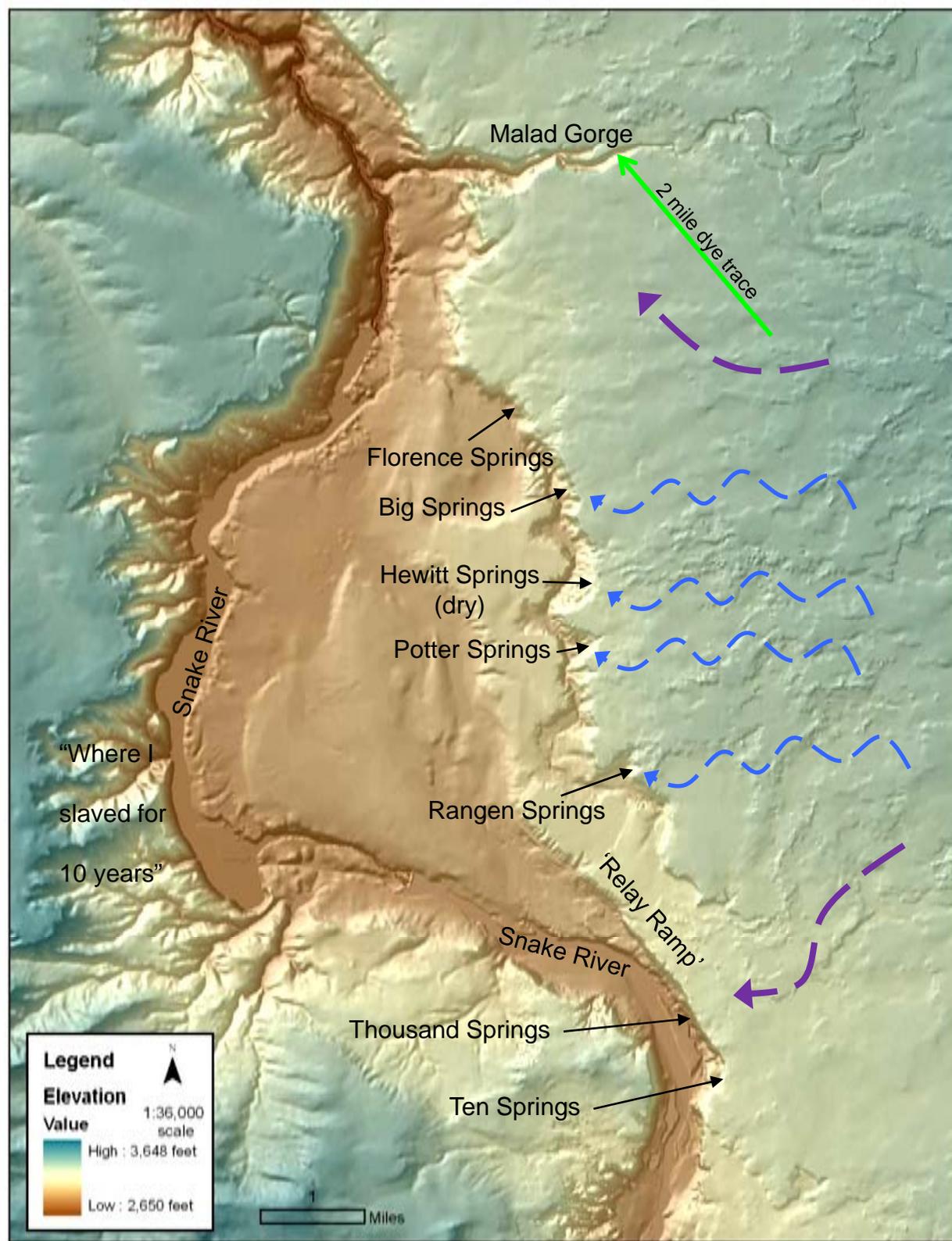
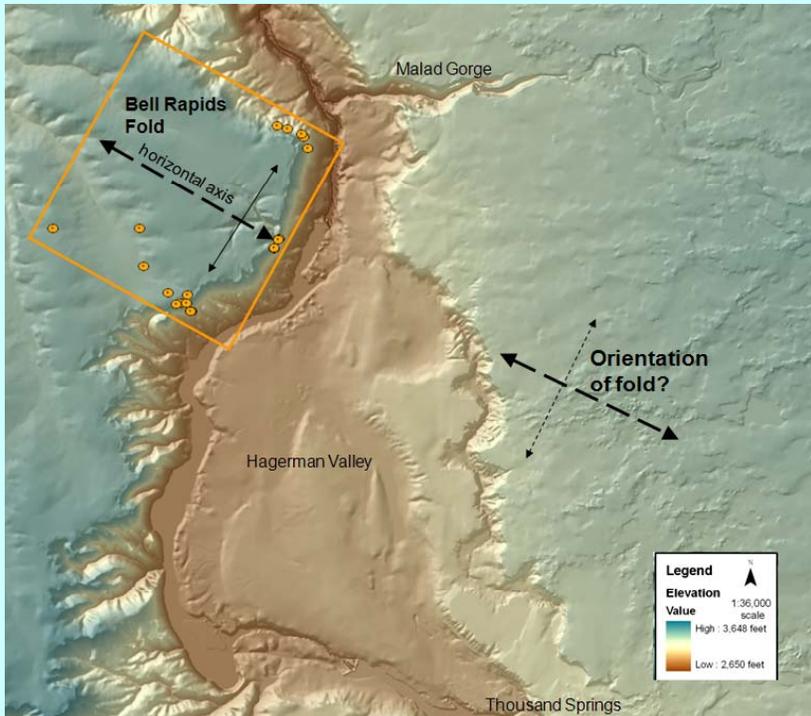


USGS 'Henslee' well

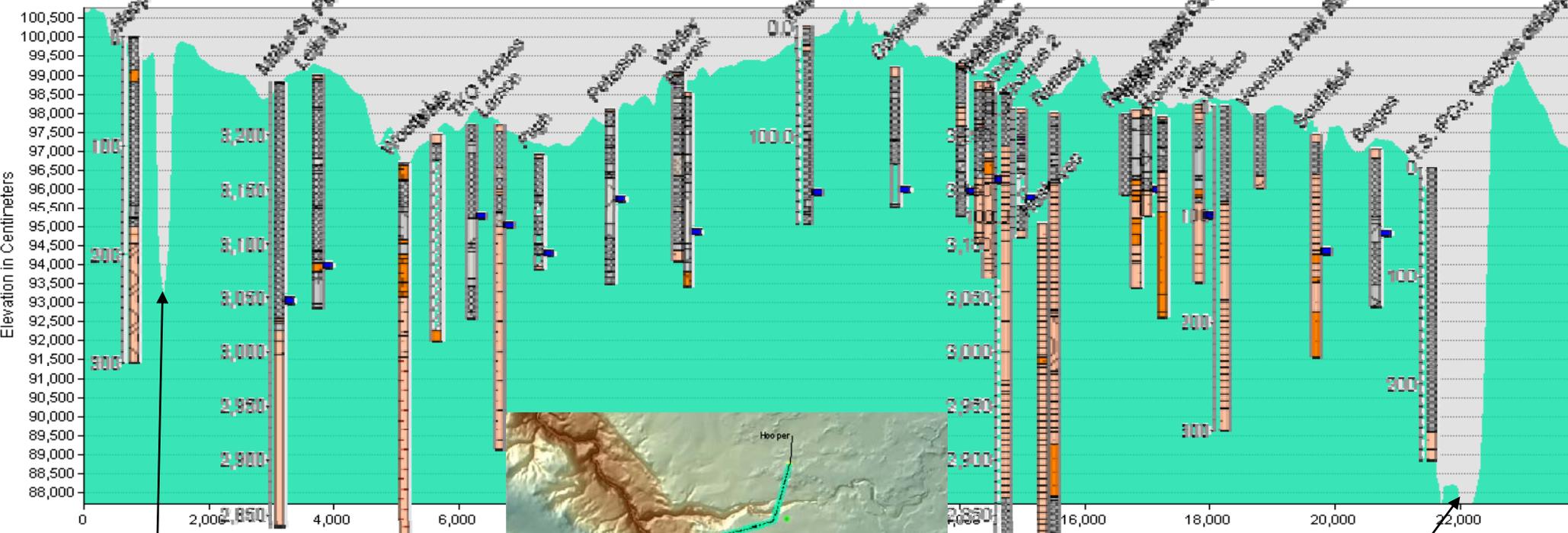


# Bancroft Trench Subsurface Model





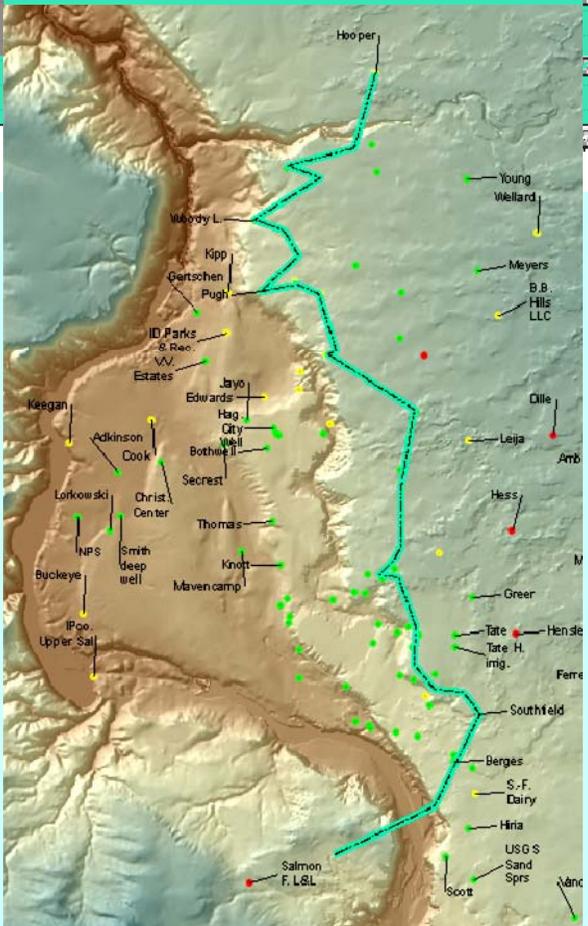
### Malad Gorge to Thousand Springs X-sec



Malad River

~ 400 feet deep wells

Snake River



# Conceptual Model for Geologic Structural Architecture

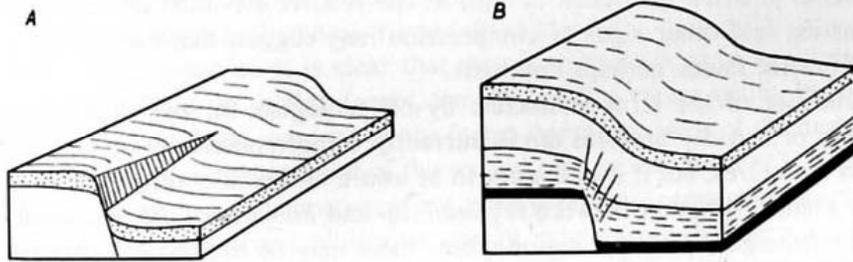


FIG. VIII-9. RELATION OF MONOCLINES TO FAULTS

- A. Monocline passes laterally into fault.
- B. Monocline passes downwards into fault.

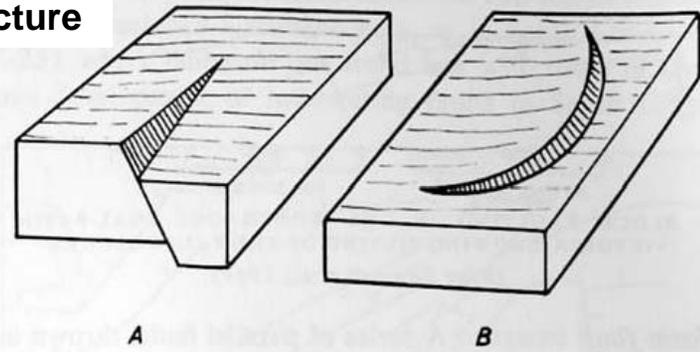
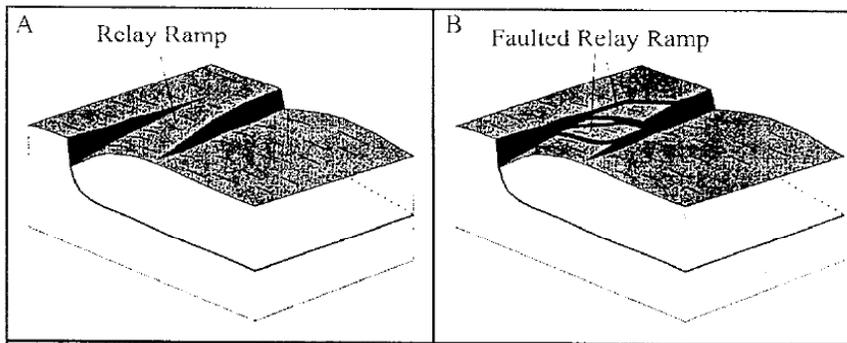
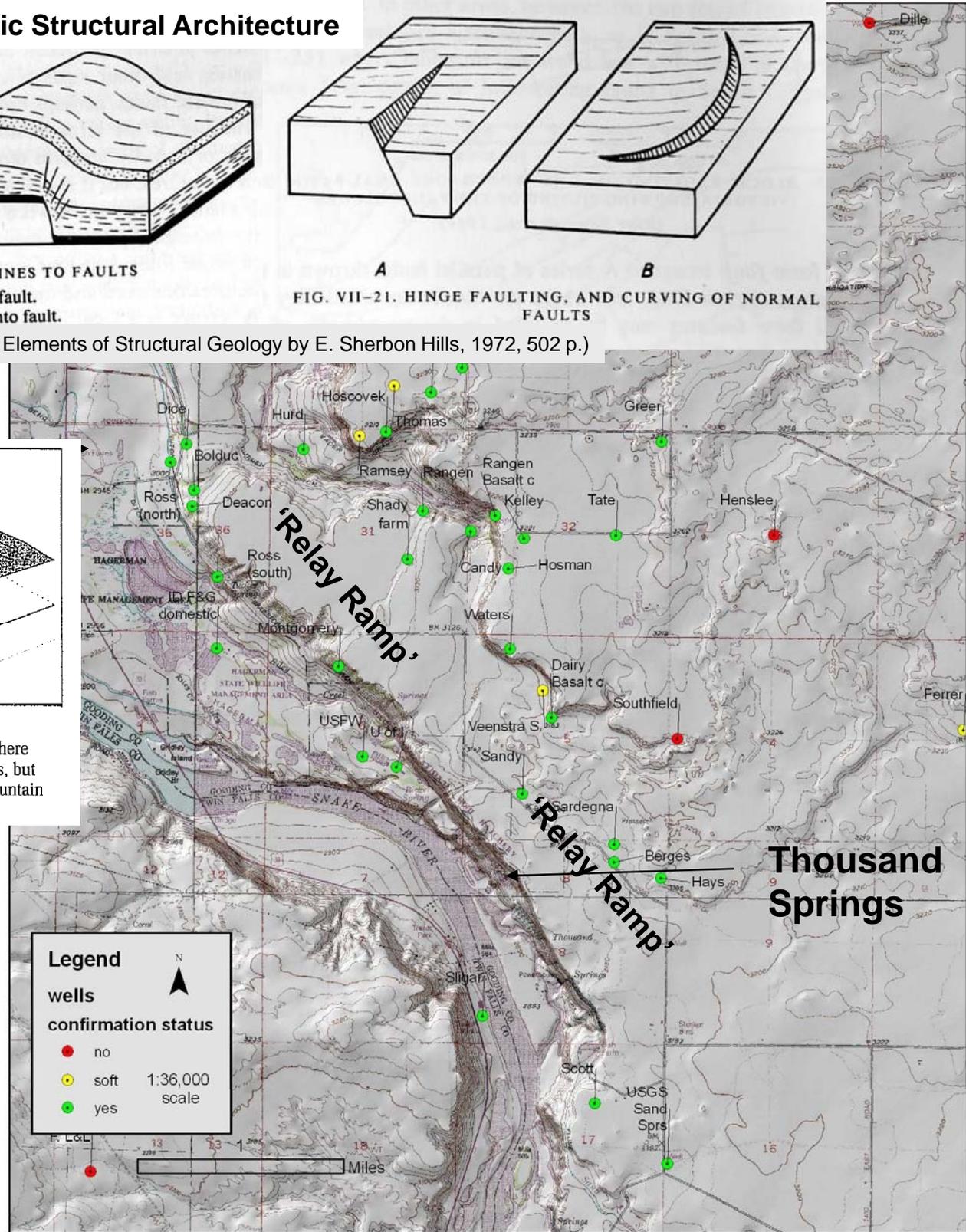


FIG. VII-21. HINGE FAULTING, AND CURVING OF NORMAL FAULTS

(Source: Elements of Structural Geology by E. Sherbon Hills, 1972, 502 p.)



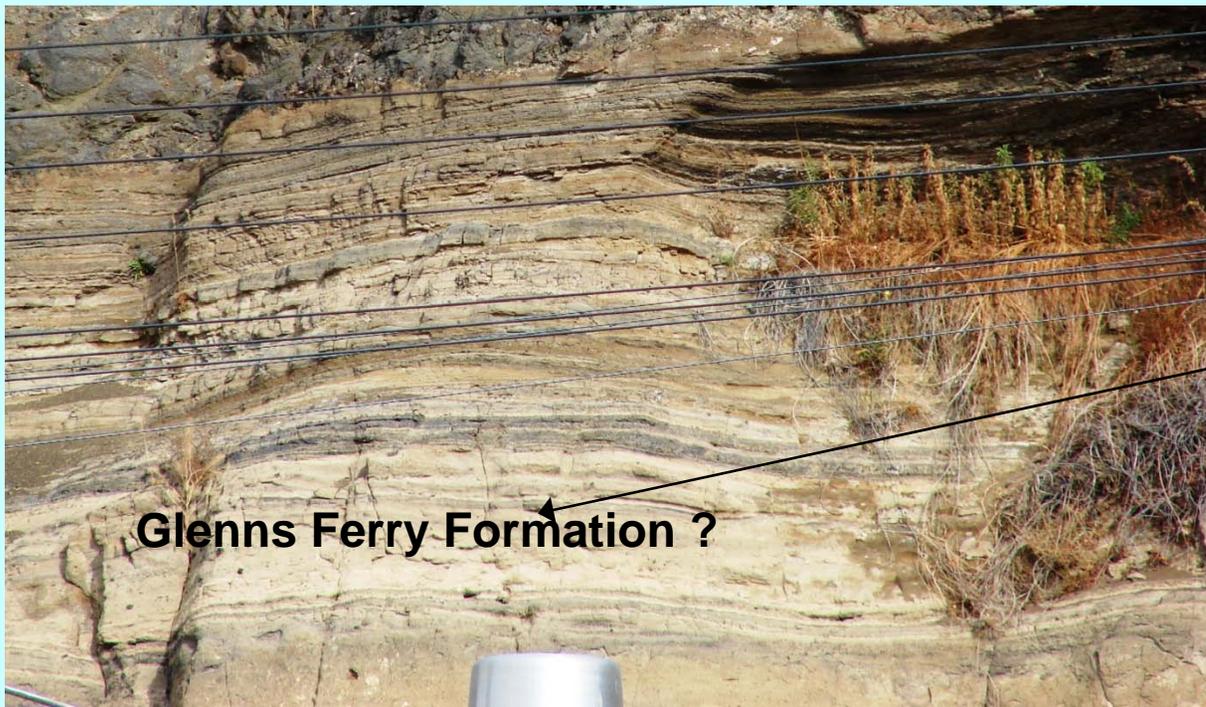
**Figure 30:** Block diagrams from Faults and Varga (1998), showing relay ramp classification. The Wasatch fault relay ramp is classified as breached or faulted. There are no exposed faults in the relay ramp that connect the two Wasatch fault segments, but there is a fault inferred under Malad Valley, at the northern tip of the Clarkston Mountain segment, that is predicted to have this geometry.



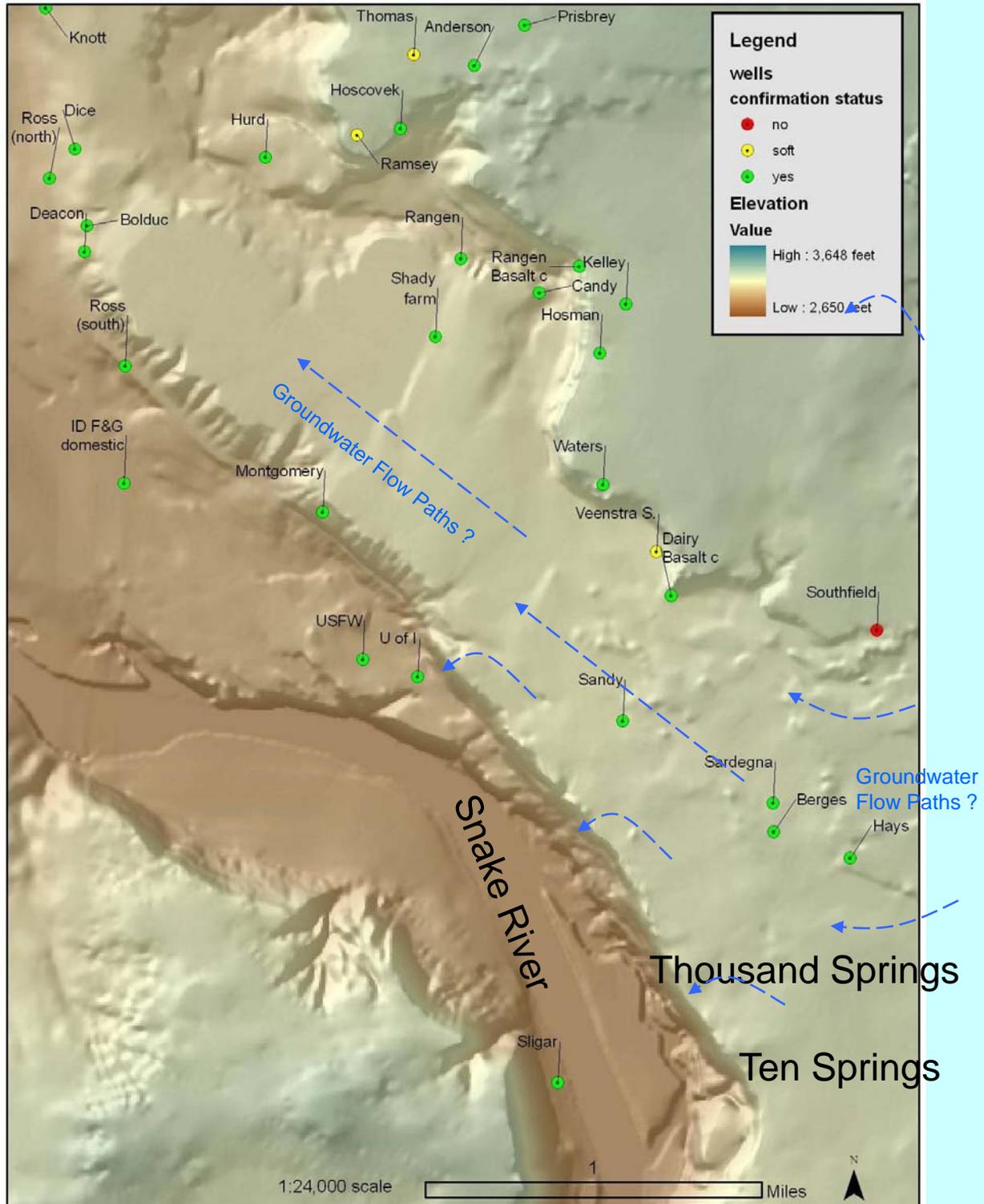
# Conceptual Block Diagram of Geology A-A' (vertical and horizontal are not to scale)

A'  
South East

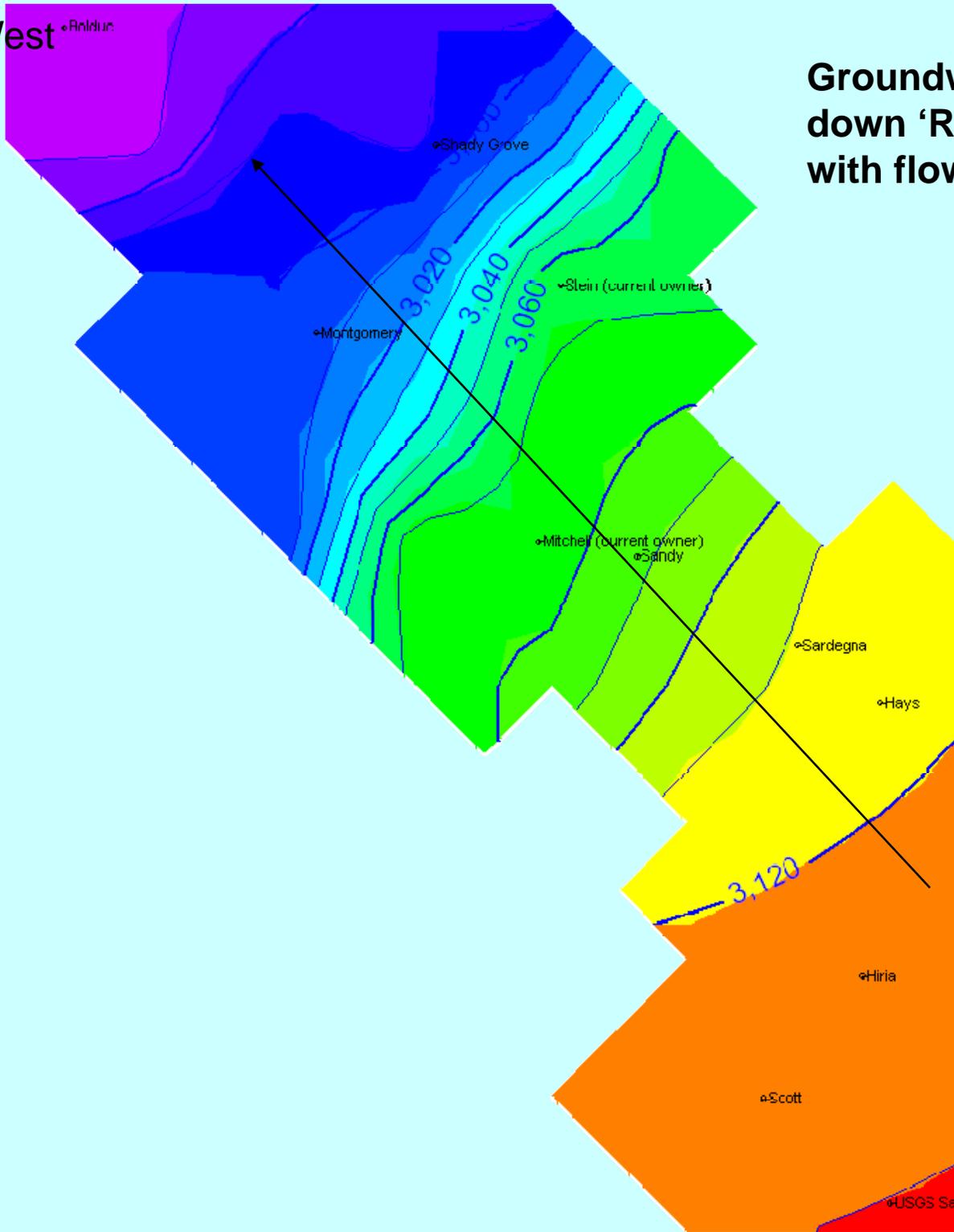
North West



# 'Ramp' Area Wells



North West



**Groundwater Contours  
down 'Ramp' Structure  
with flow line.**



South  
East 17

USGS Sand Springs



Idaho Department of Water Resources

## Open File Report



### FLUORESCENT DYE TRACER TESTS AT THE MALAD GORGE STATE PARK

By

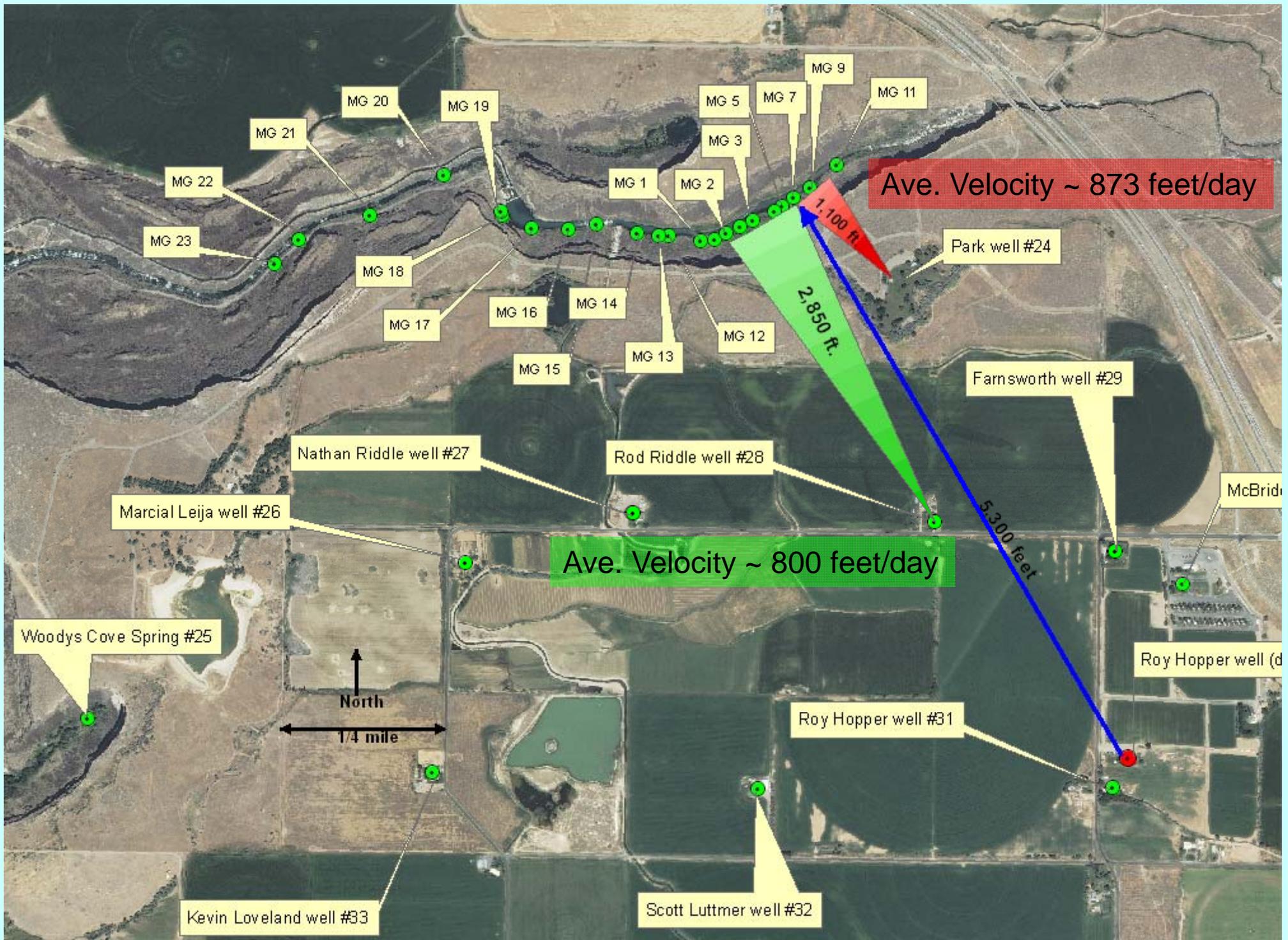
Neal Farmer  
Idaho Department of Water Resources

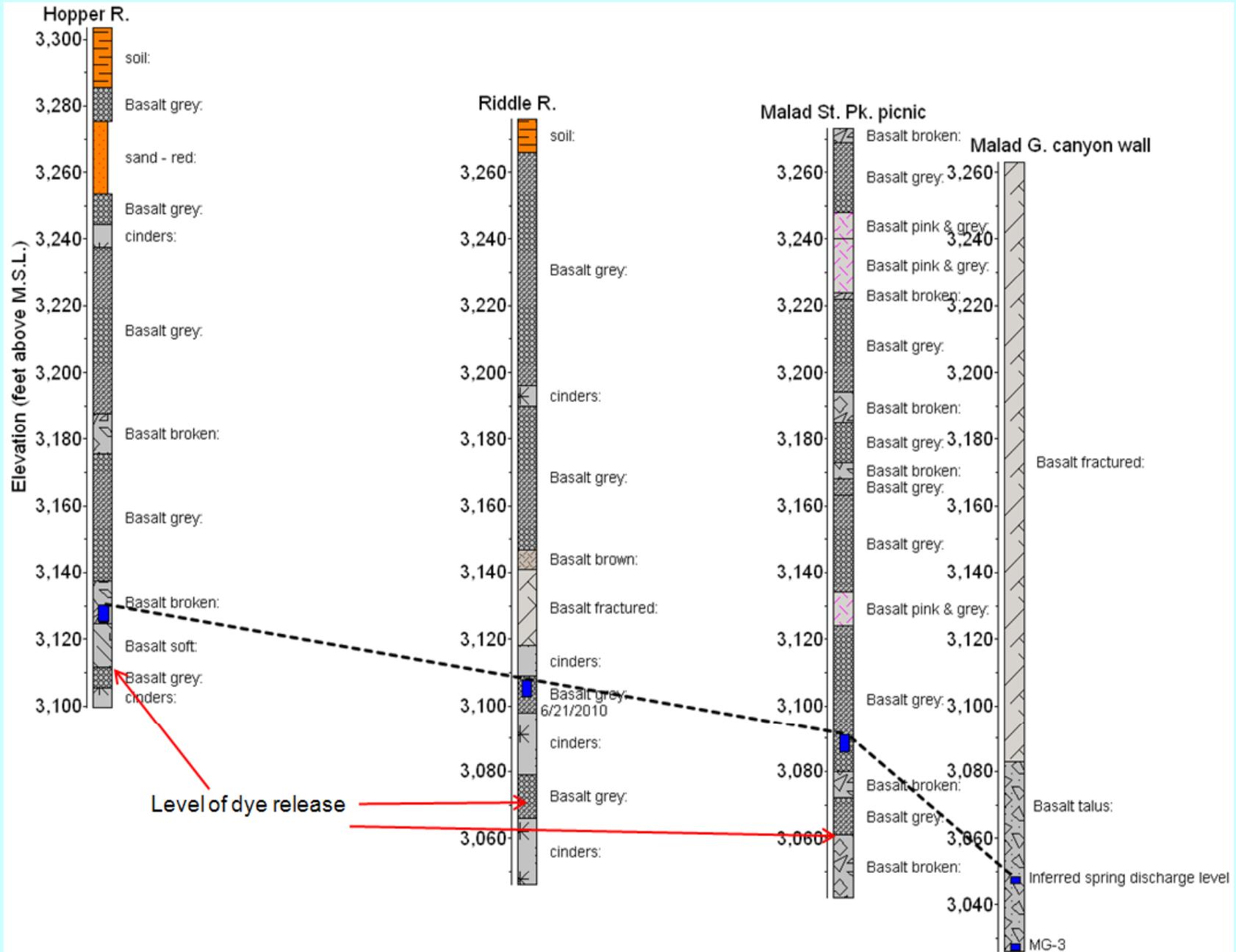
and

Dave Blew  
Idaho Power

September 30, 2009

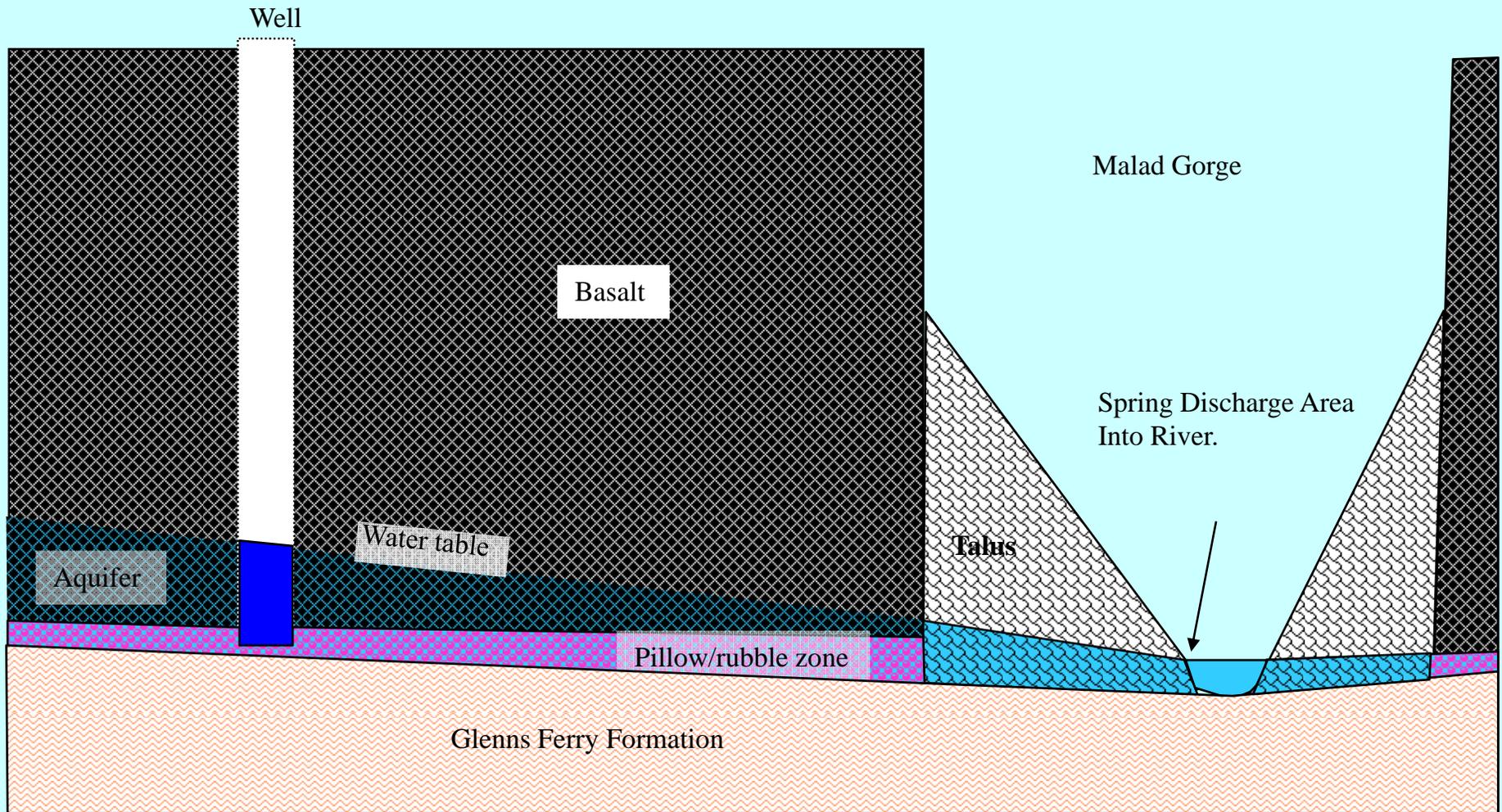
# Malad Gorge Tracer Tests

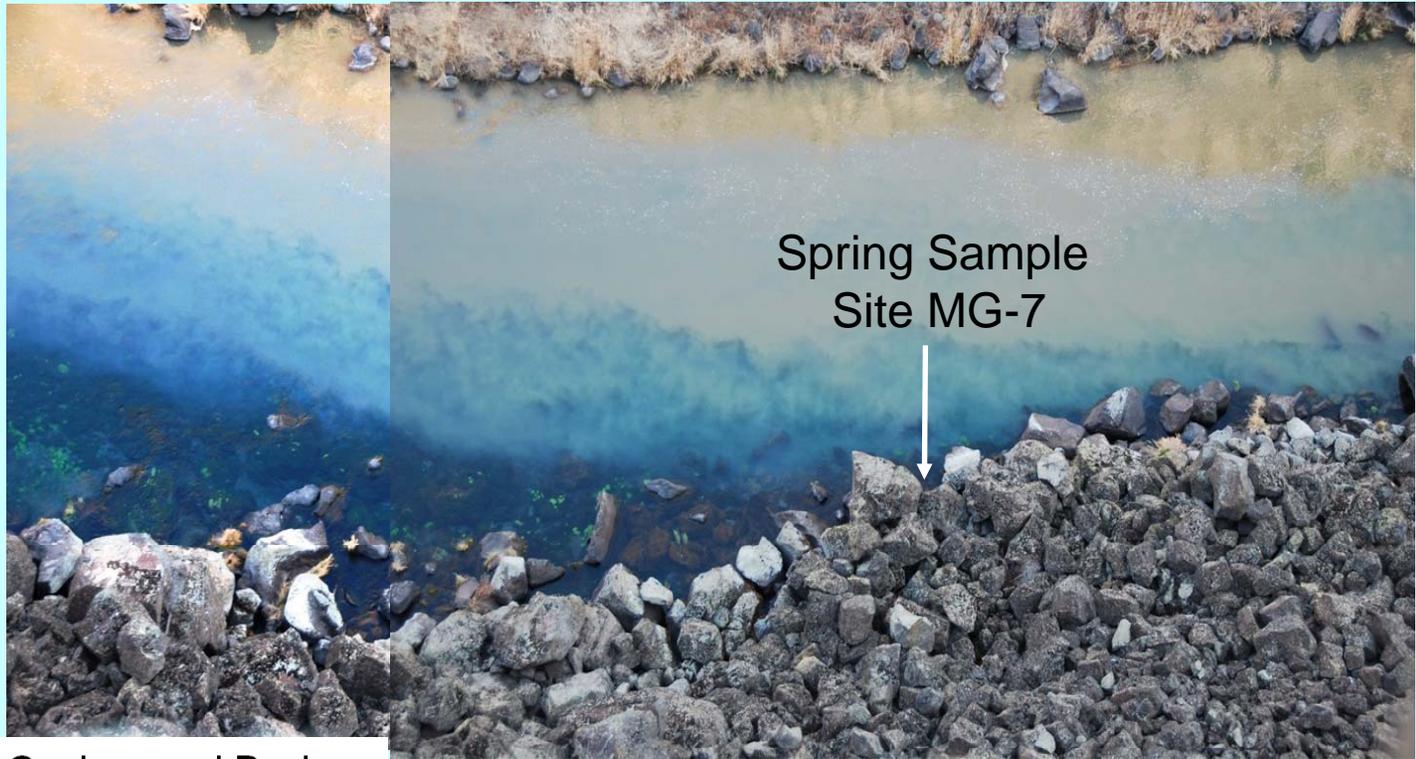
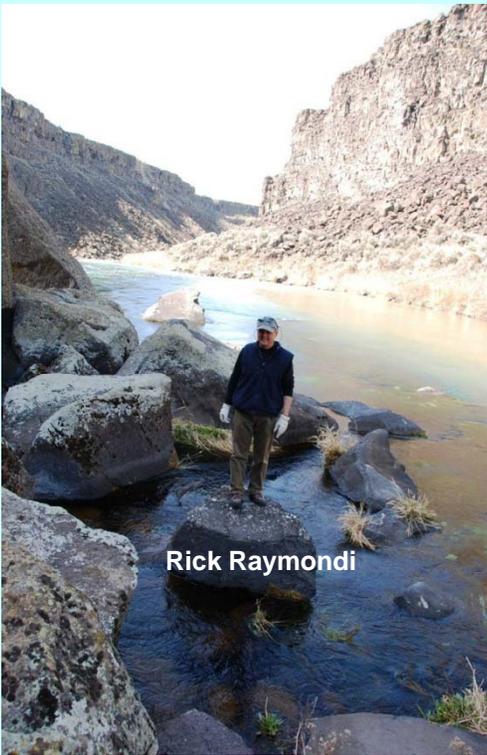




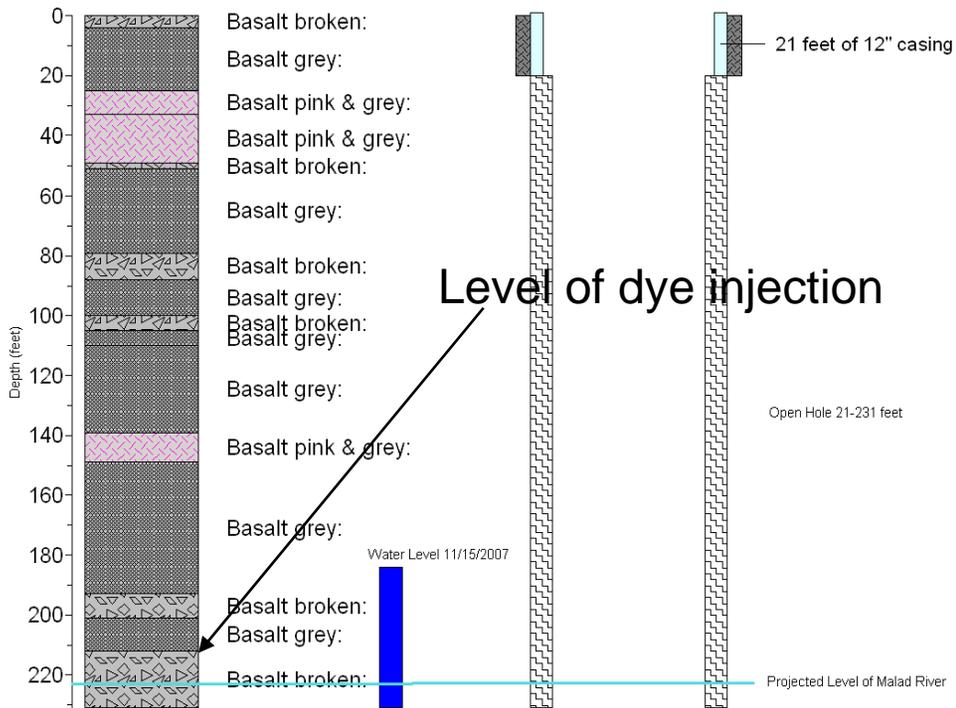
South

North

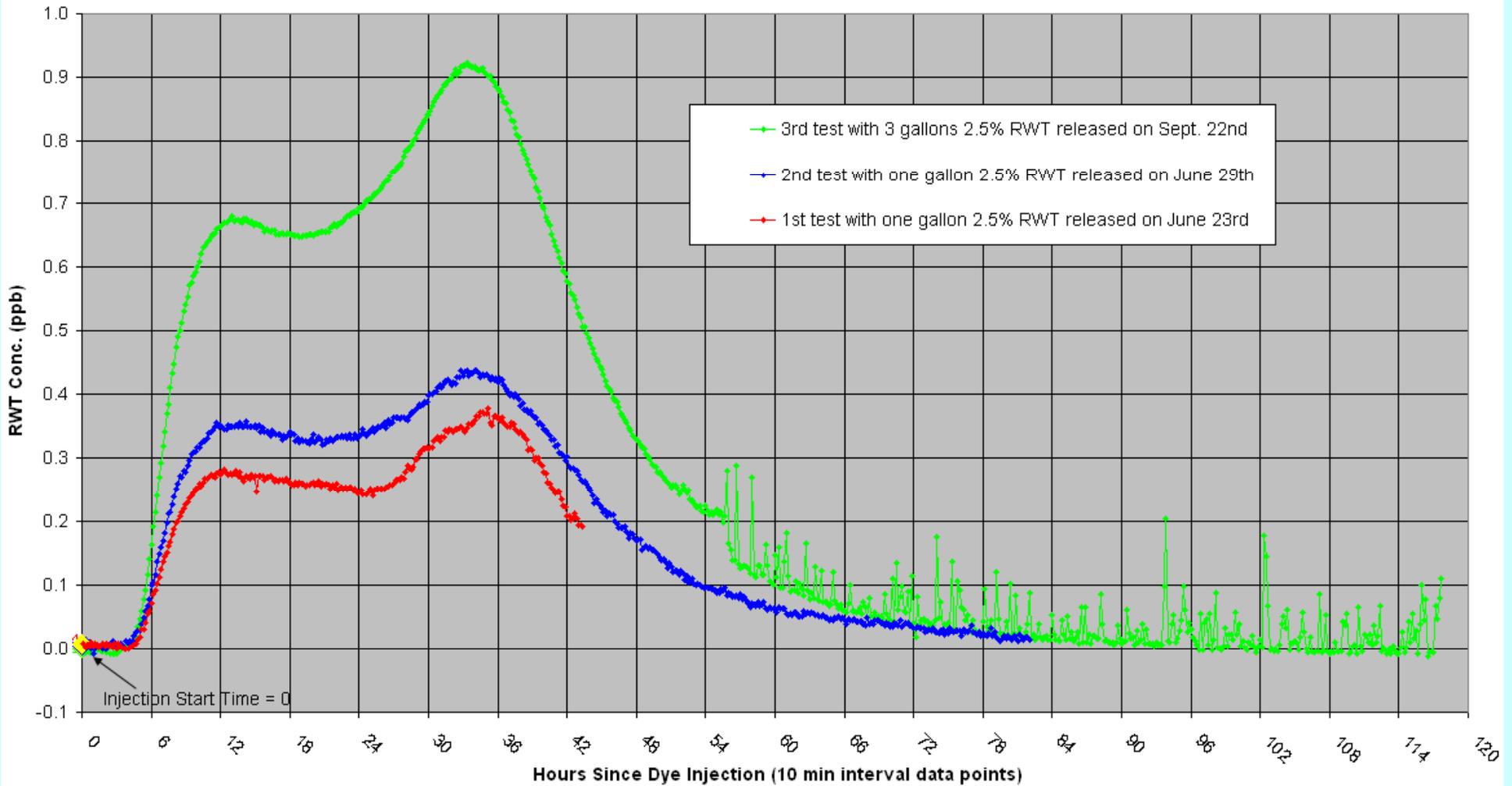




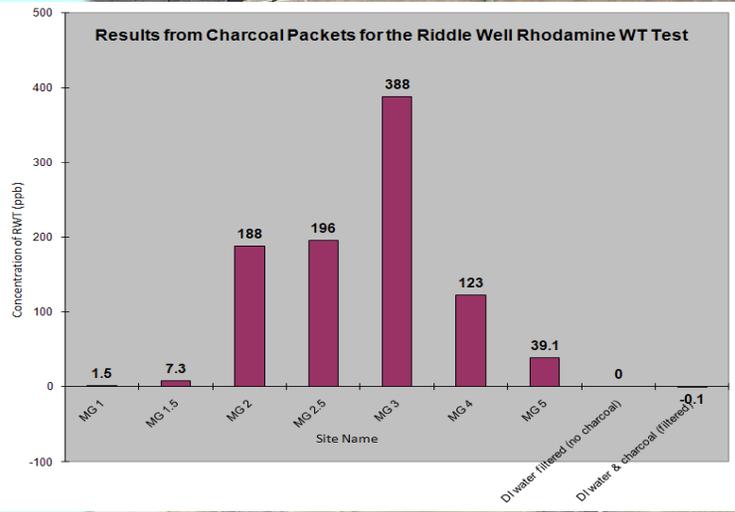
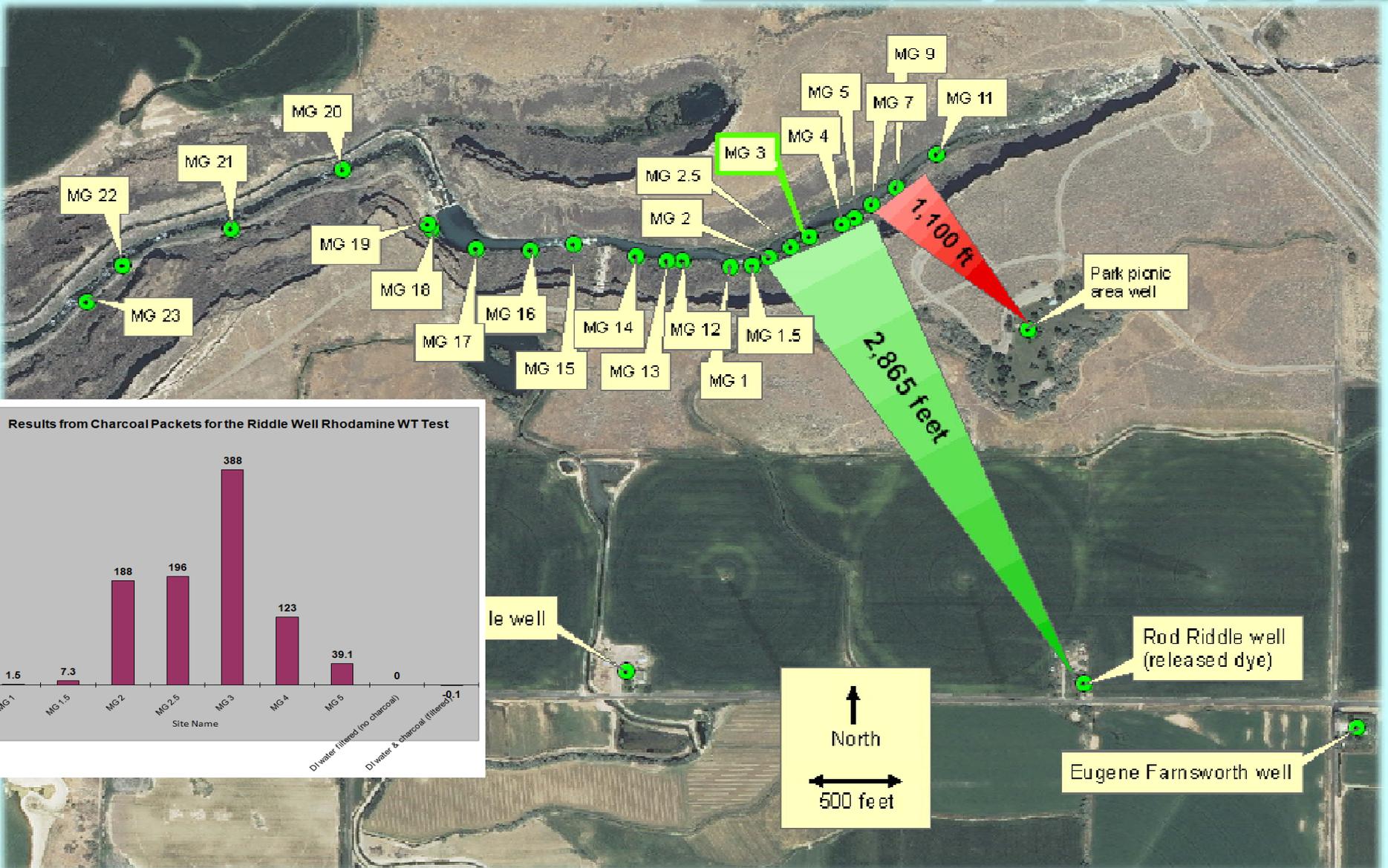
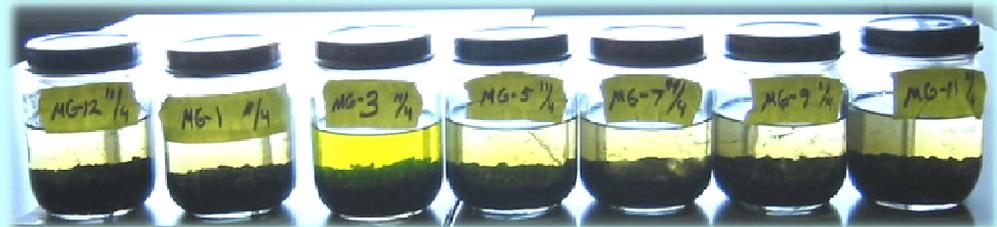
### Malad St. Pk. Picnic Area Well Geology and Design



### Three Separate RWT Tests at Malad Gorge Showing Reproducibility



- initial breakthrough in 4.5 hours.
- 1st peak in 13.5 hours.
- 2<sup>nd</sup> peak in 34 hours.
- Center of mass 30.3 hours.
- Ave. Linear Vel. ~ 873 feet / day



Riddle Well Test



## Instrument Loan from NPS Water Resource Division

- RWT, turbidity, temperature
- Detection limit = 0.04 ppb



~ \$6,000

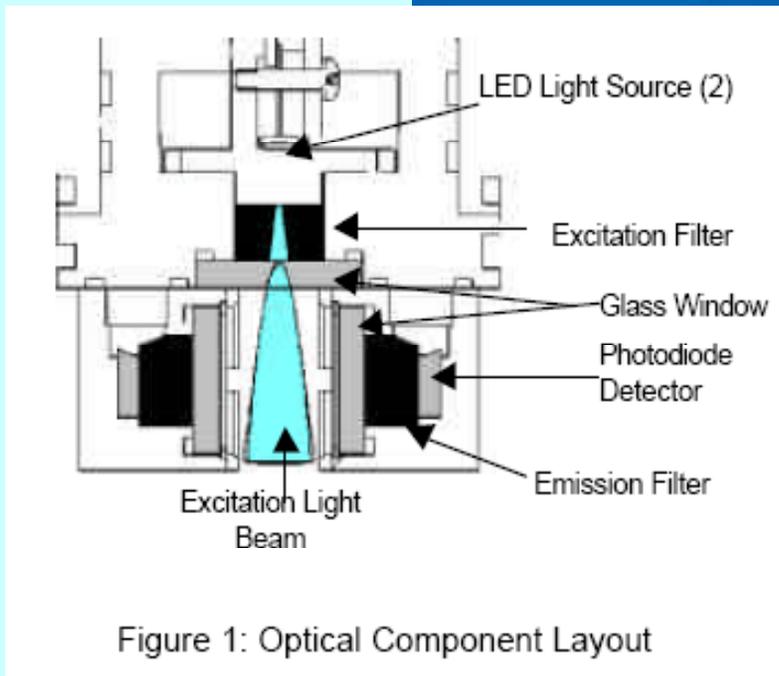
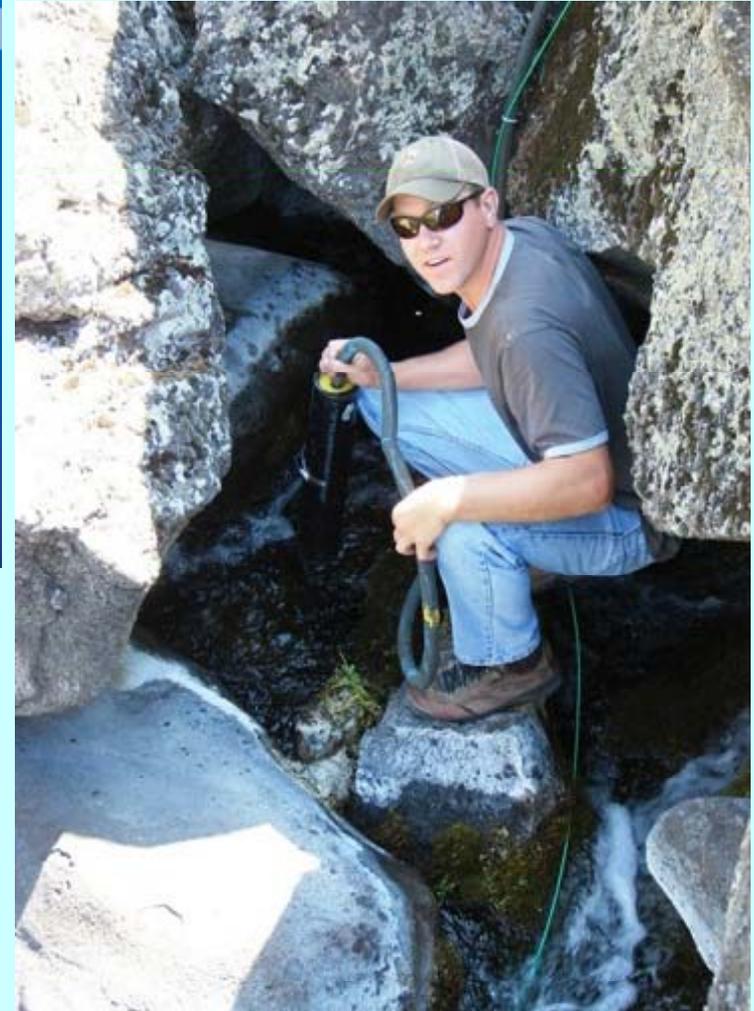


Figure 1: Optical Component Layout

## New submersible Fluorometer



2 units at \$7,800 each purchased by Idaho Power for the project (~ \$15,600)

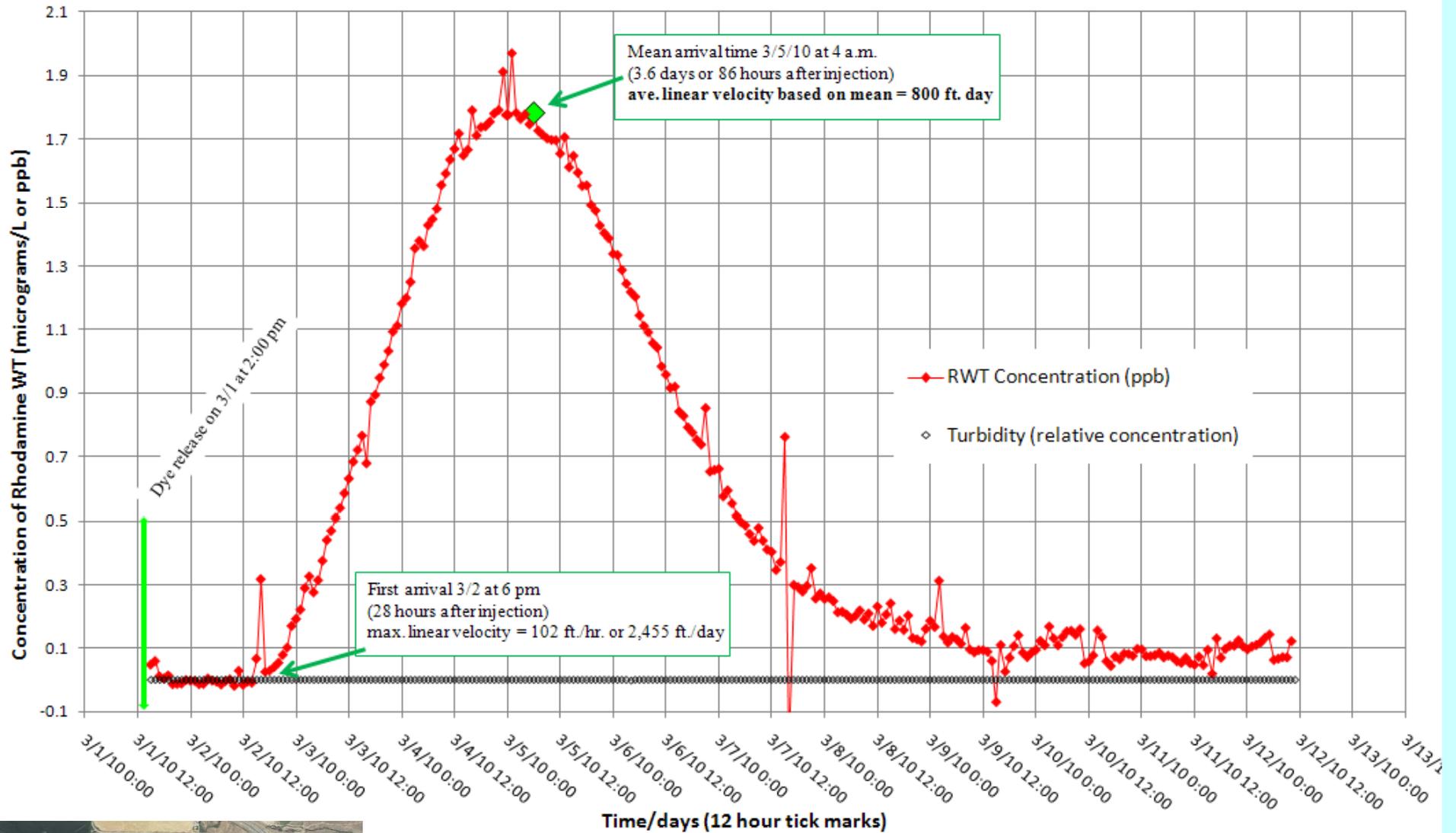
### Three Onboard Senors

**Turbidity 0.05 NTU 0-3000 NTU**

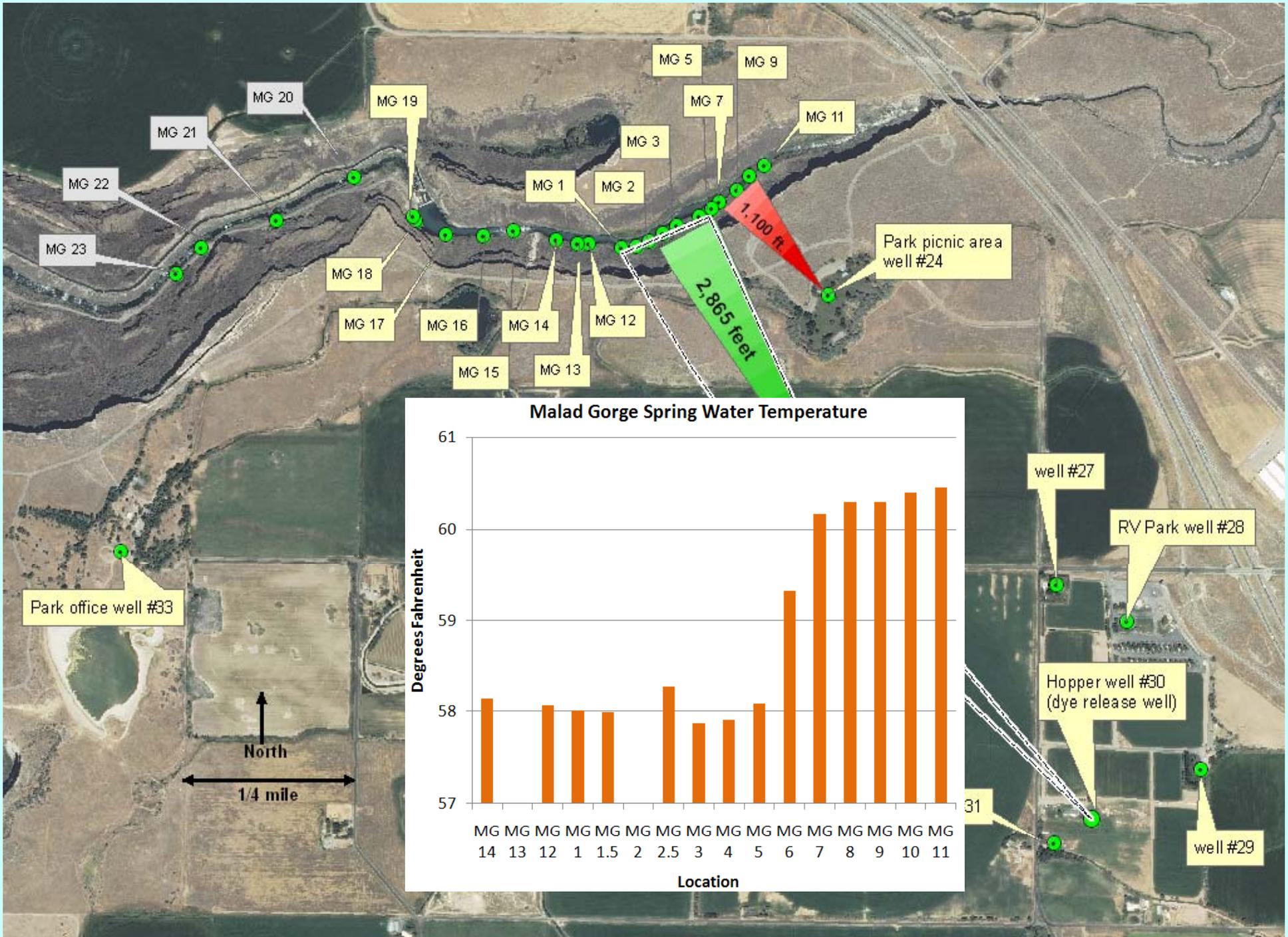
**Fluorescein Dye 0.01 ppb 0-500 ppb**

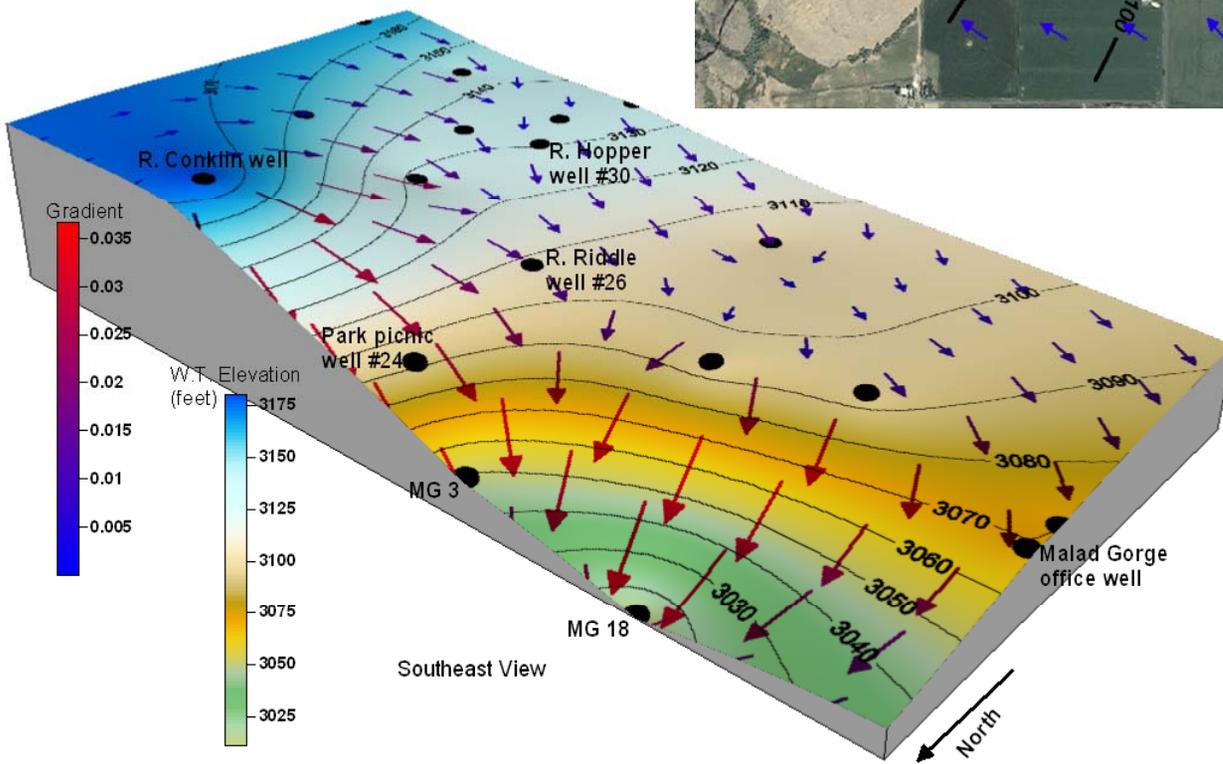
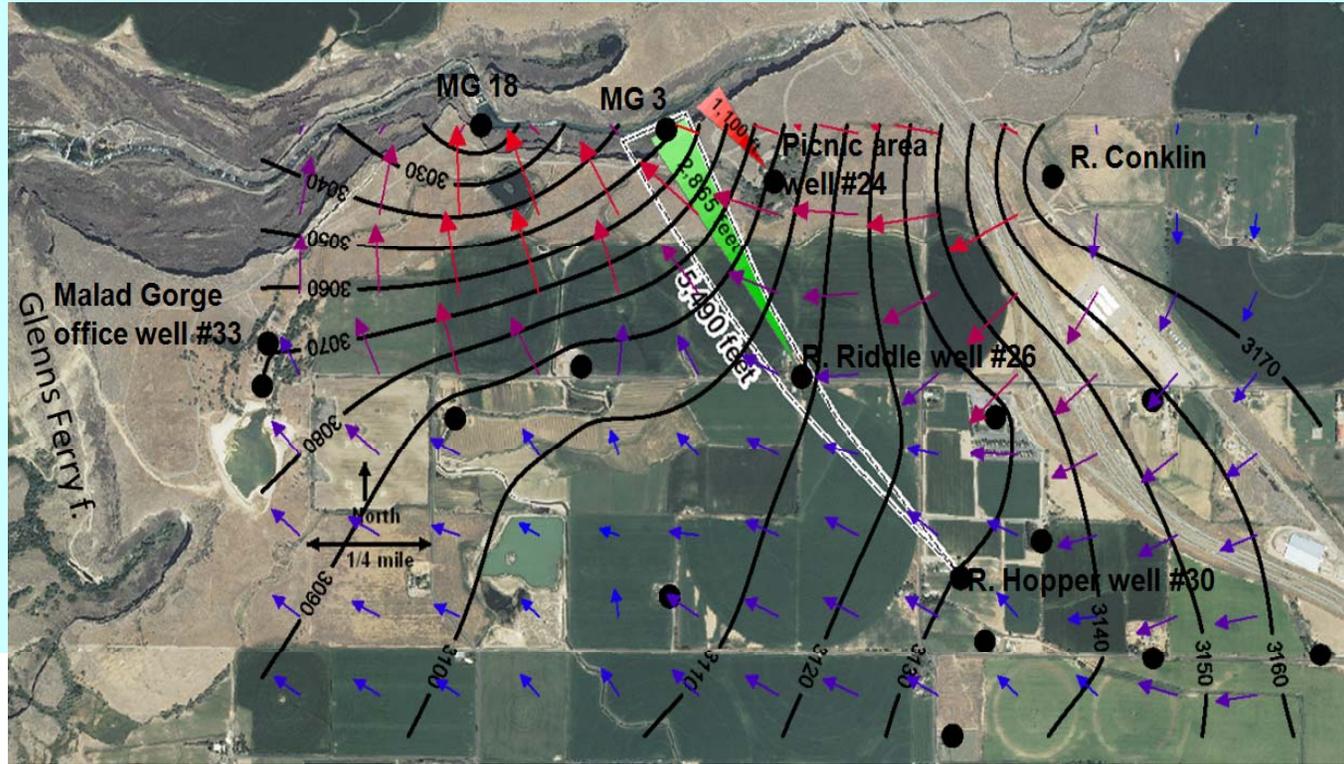
**Rhodamine Dye 0.01 ppb 0-500 ppb**

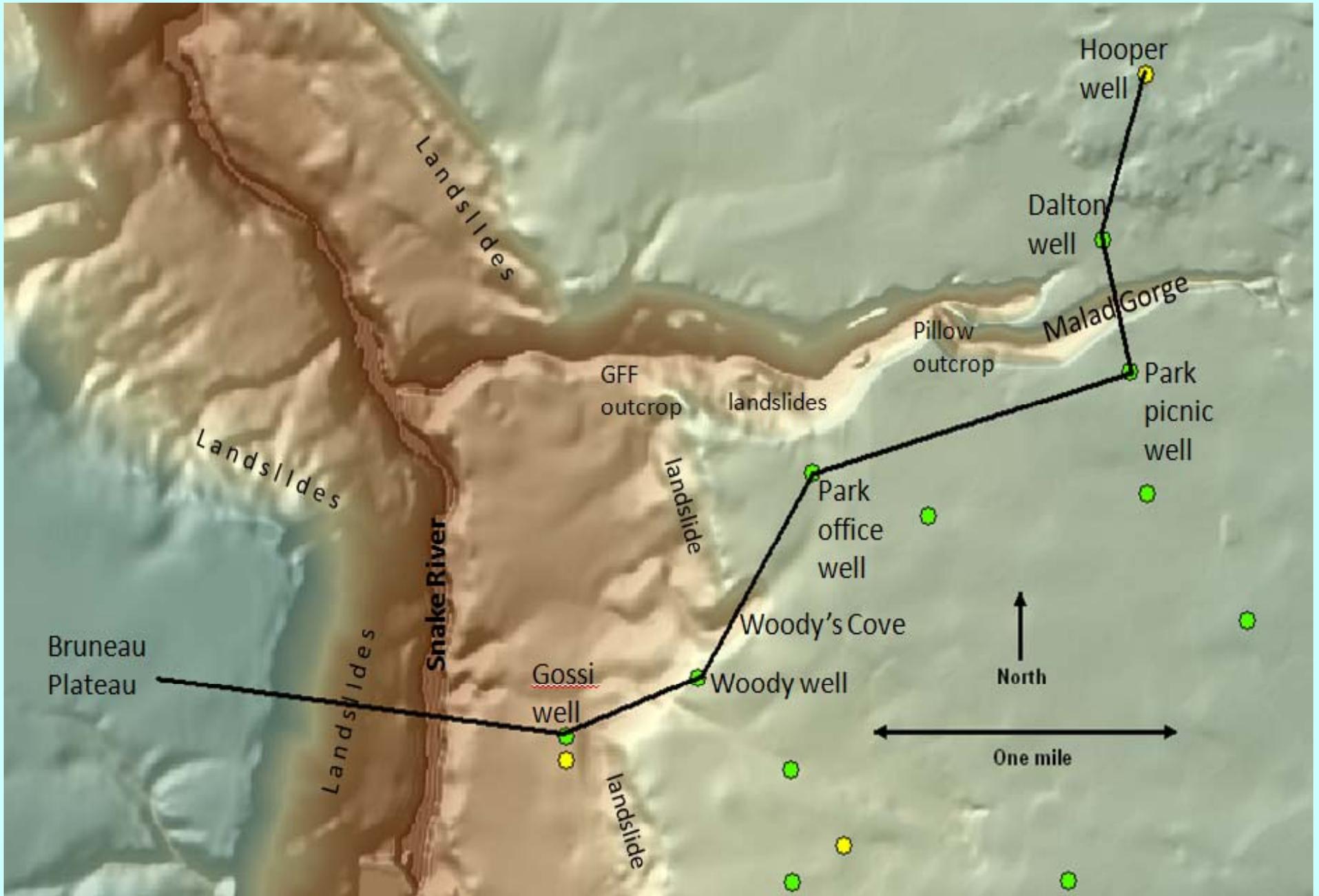
## RWT Concentration Breakthrough Curve for the Riddle Well Tracer Test



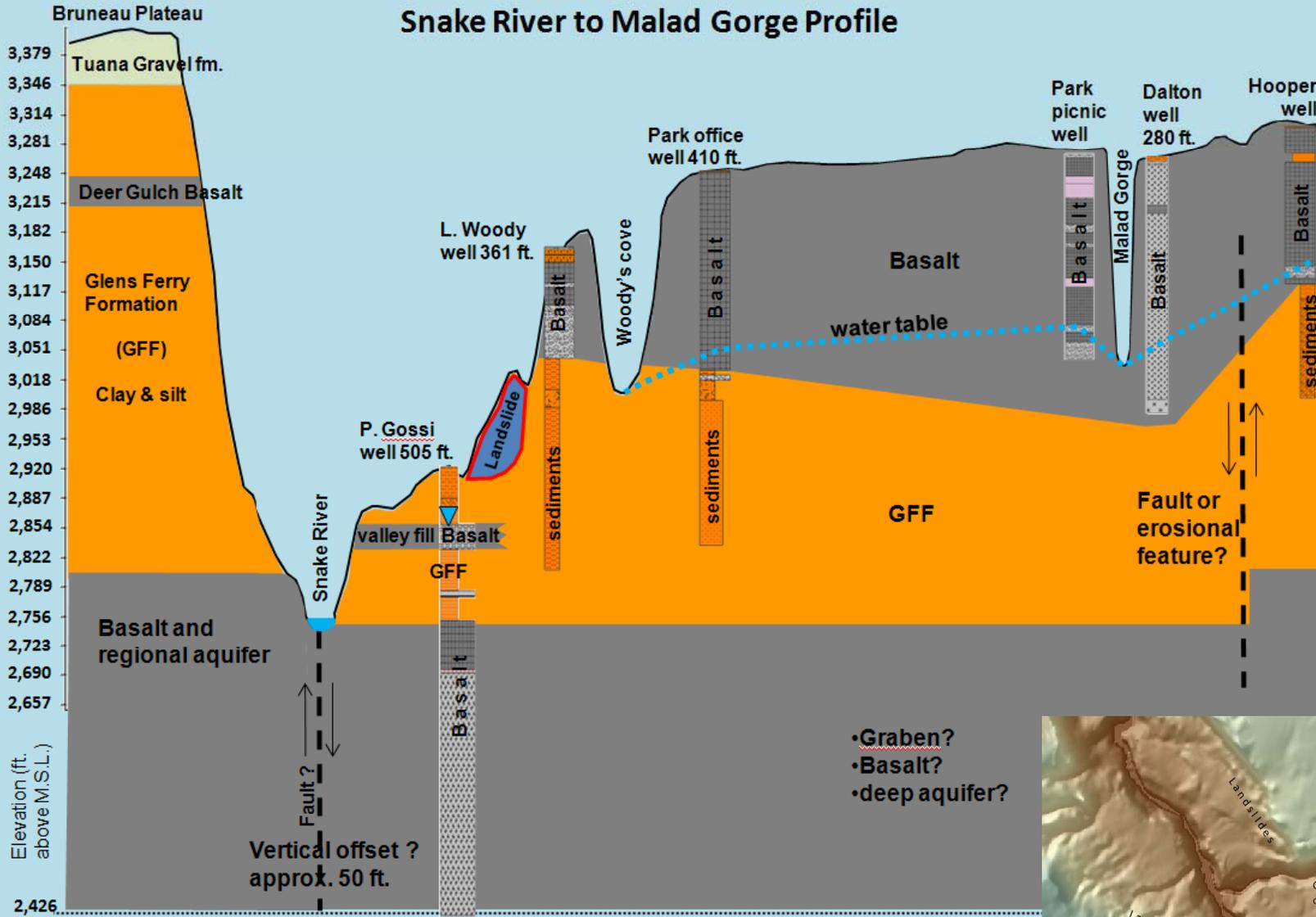
- If  $P_e$  is 15% then  $K$  is approximately 5,000 feet per day.
- or,
- If  $P_e$  is 30% then  $K$  is approximately 10,000 feet per day.



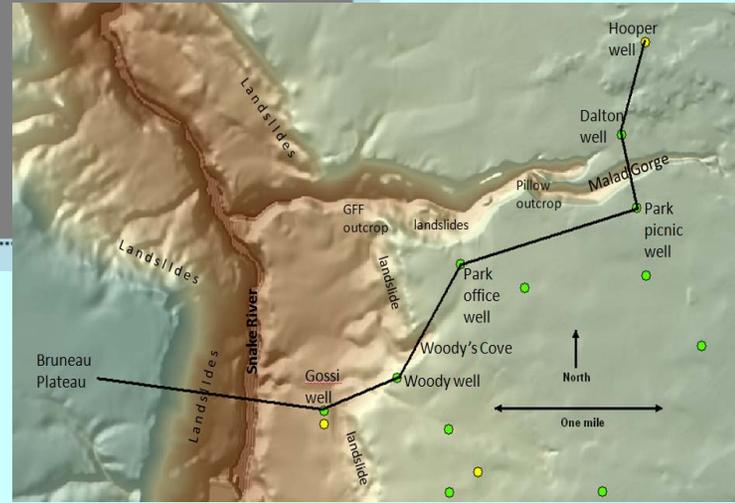




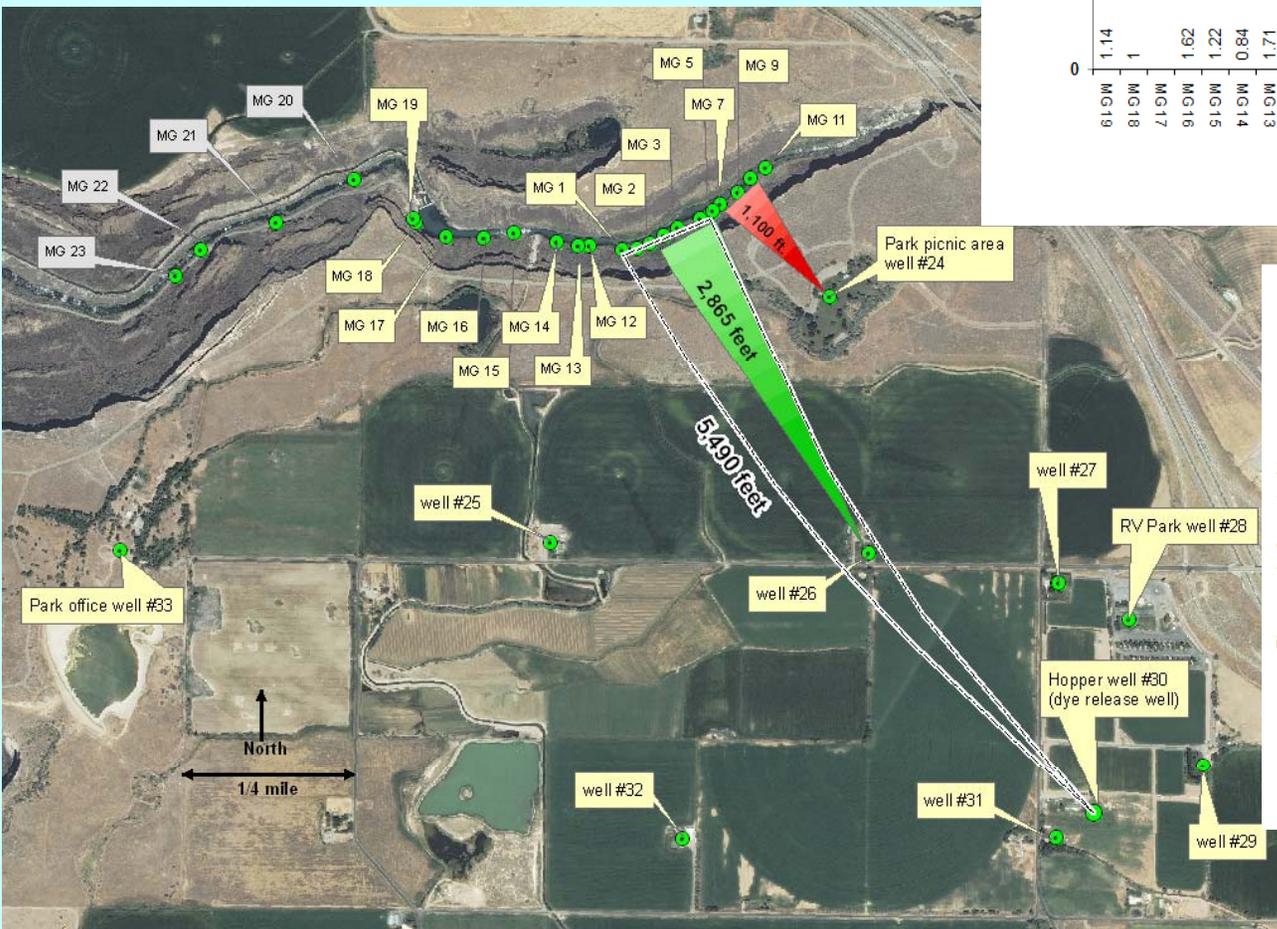
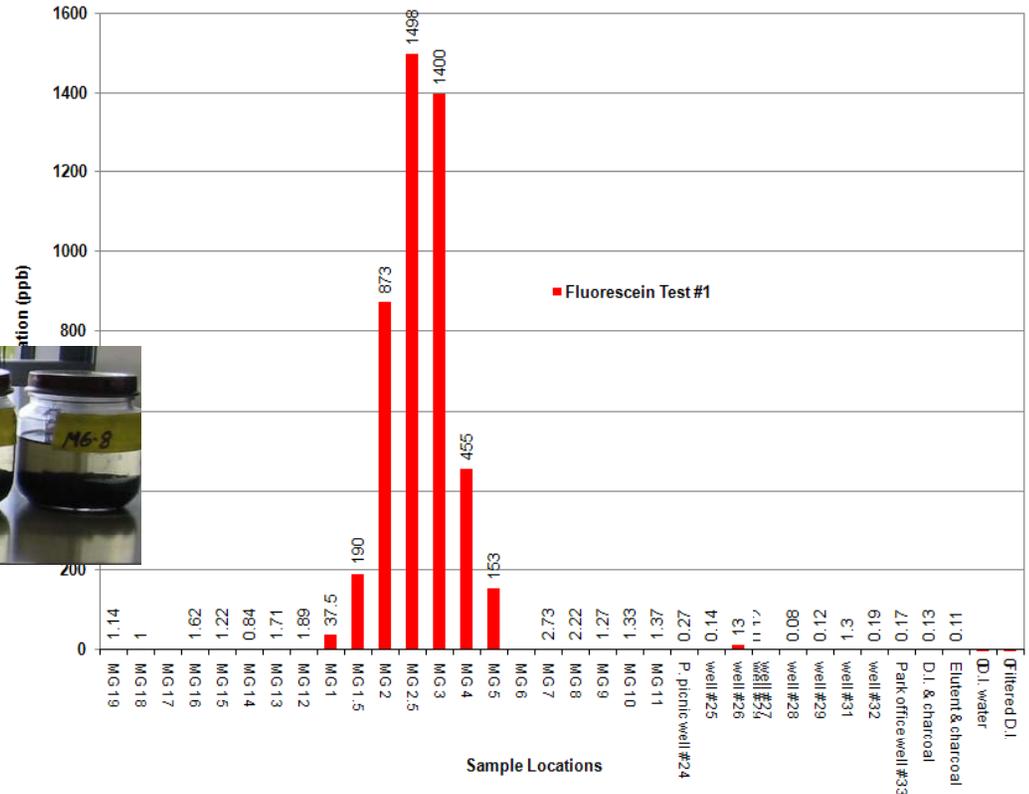
### Snake River to Malad Gorge Profile



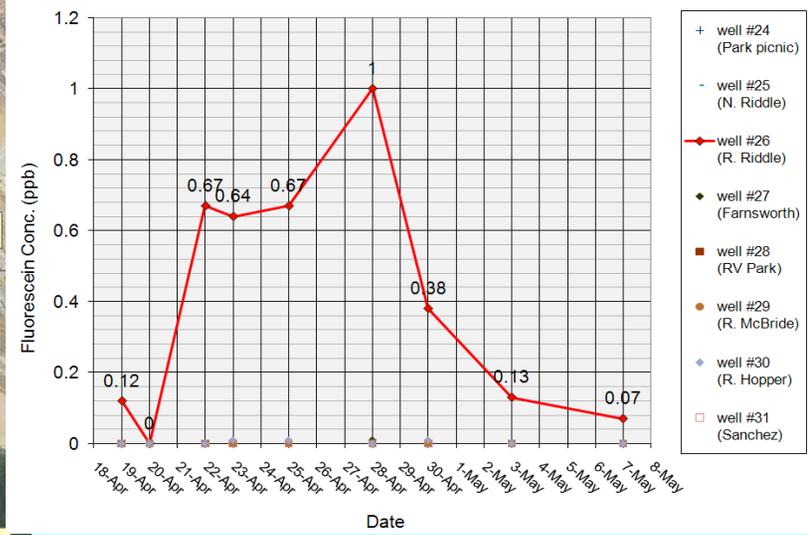
- Graben?
- Basalt?
- deep aquifer?



### Charcoal Sampler Results for Hopper Well Fluorescein Dye Test

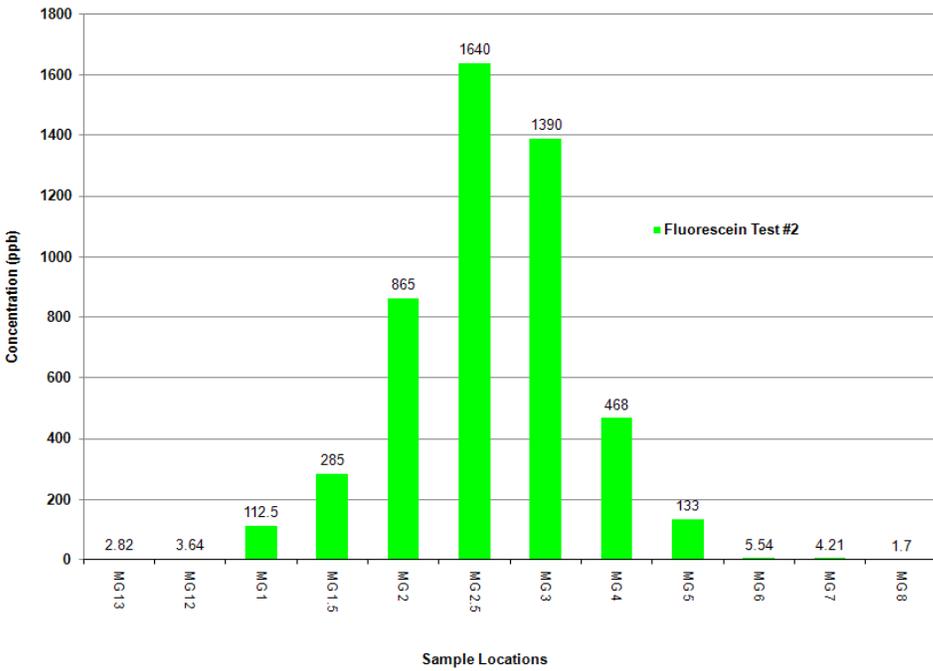


### Hopper Well Fluorescein Dye Trace Results from Well Water Samples

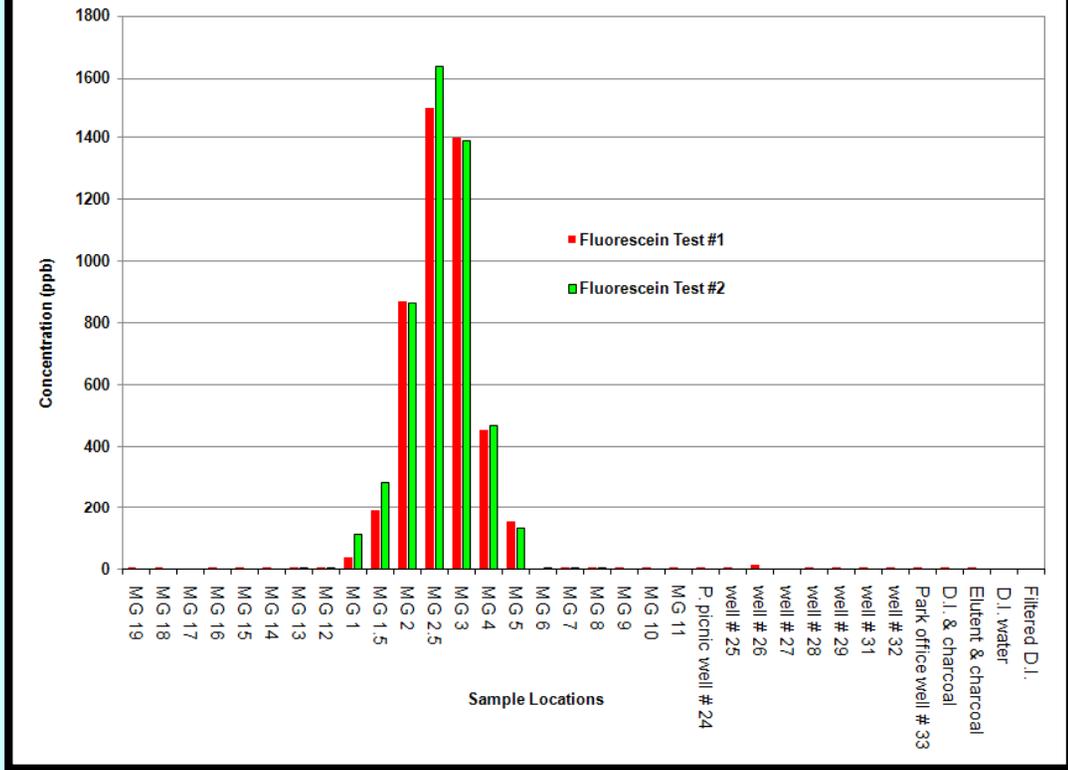




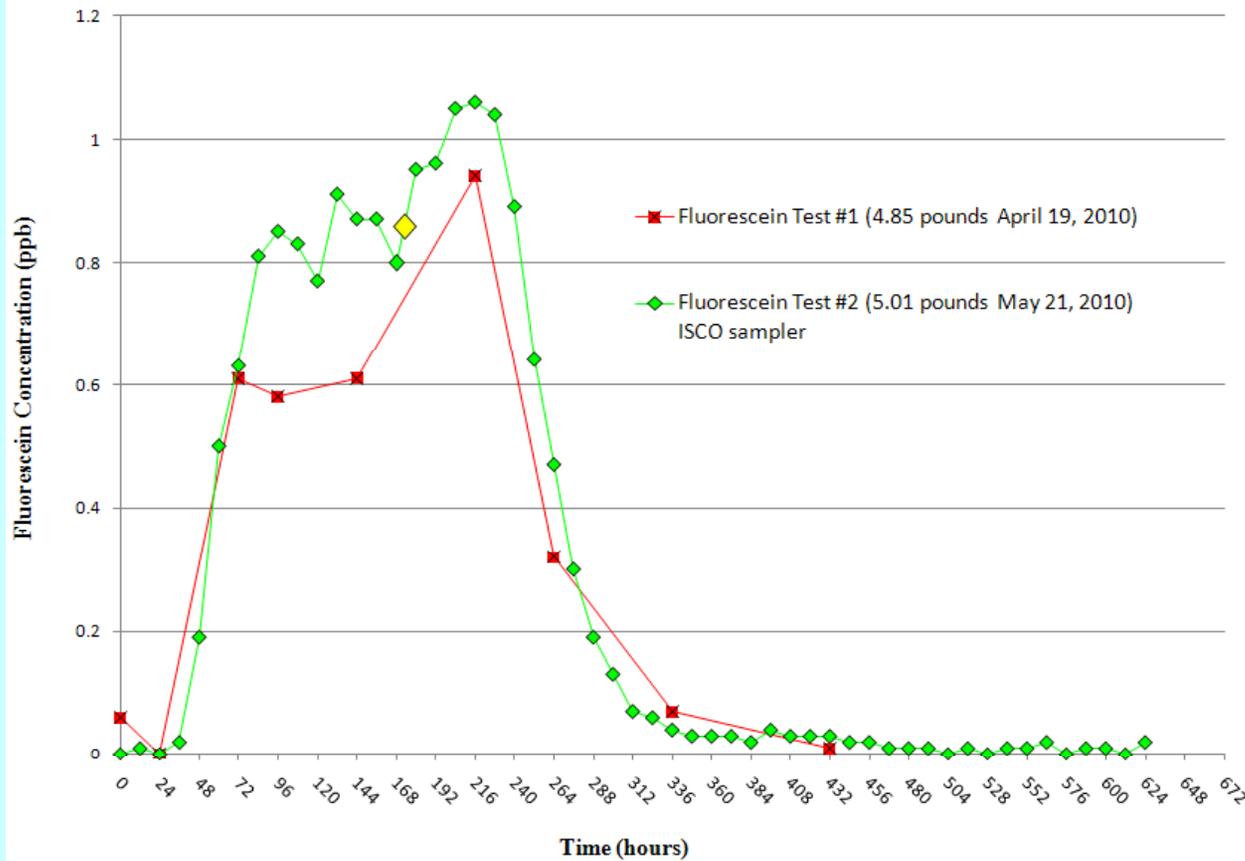
Charcoal Sampler Results for Hopper Well Fluorescein Dye Test



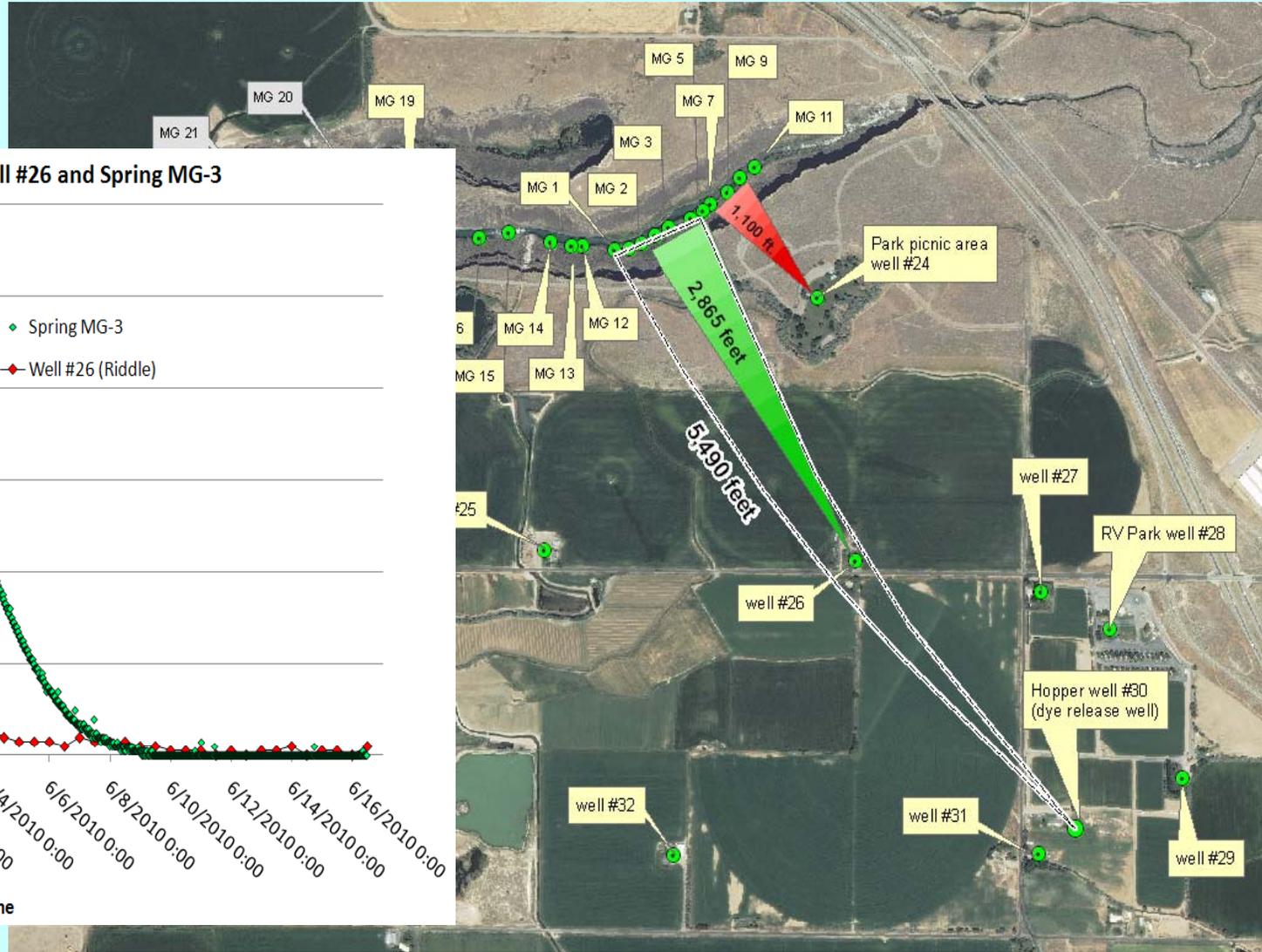
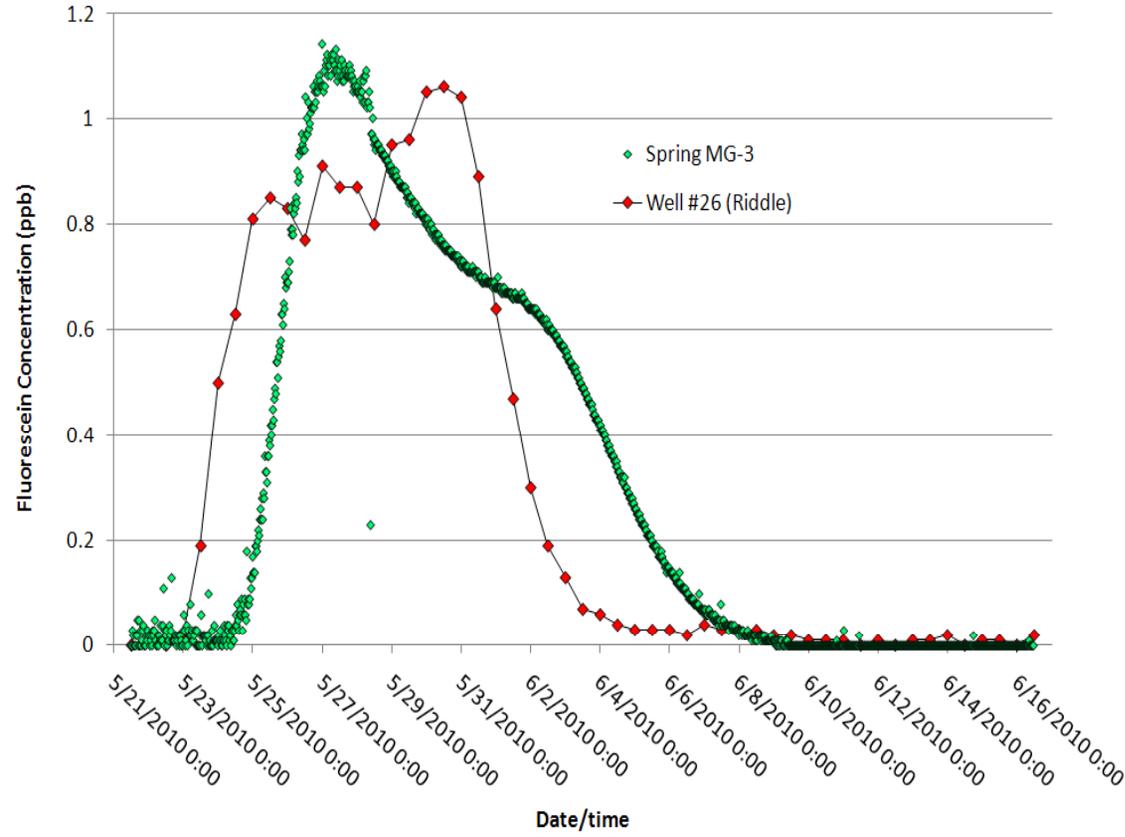
Charcoal Sampler Results for Hopper Well #30 Fluorescein Dye Test



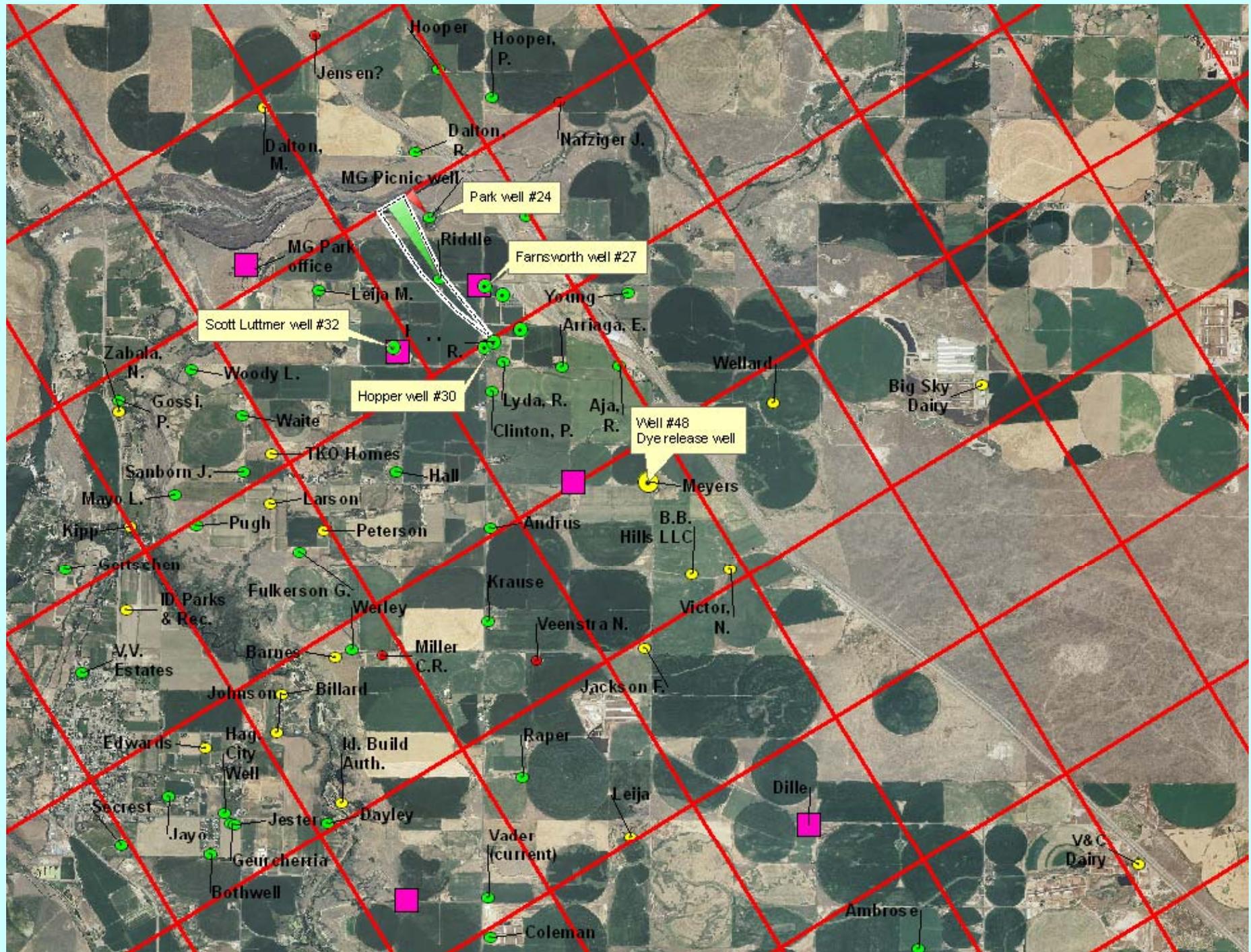
**Concentration Breakthrough Curves for Well #26**



**Breakthrough Curves from Well #26 and Spring MG-3**



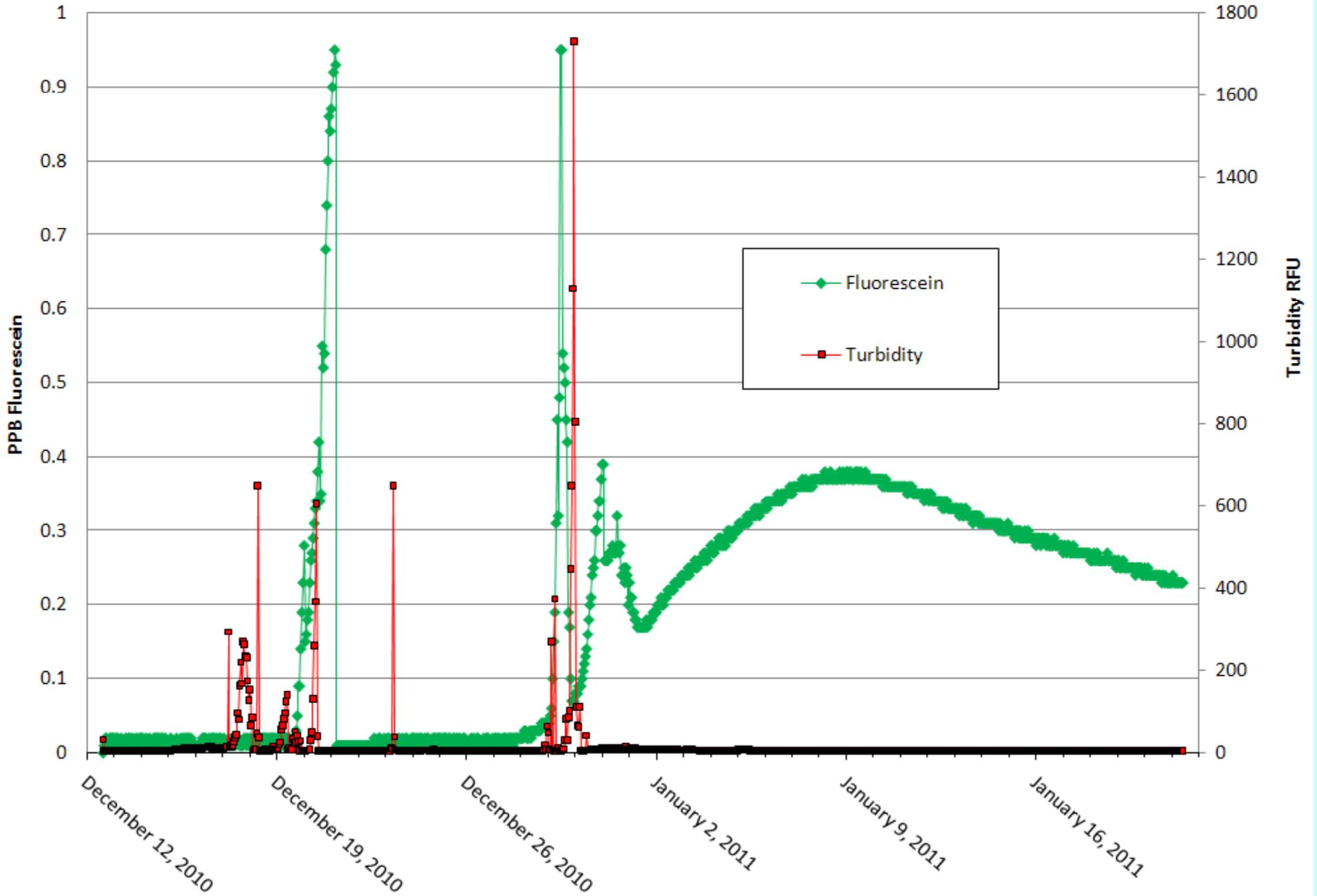


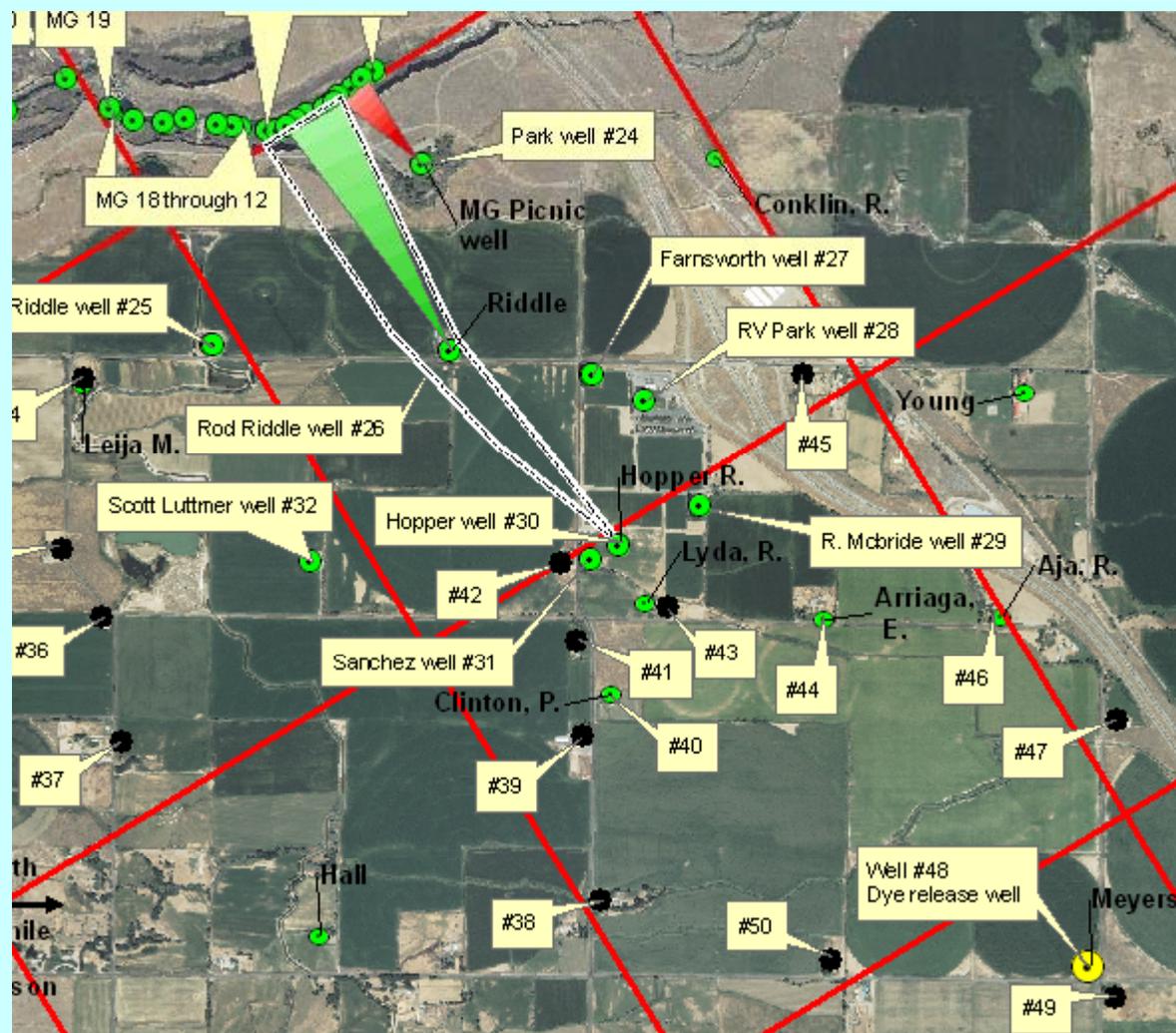






### Preliminary Results - Two Mile Test





Dye Test Location/Name	Distance/scale (feet)	Average GW Velocity ft./day	Maximum GW Velocity ft./day
Park Picnic Well	1,100 (0.21 mi.)	880	5,640
Well #26 (Riddle)	2,865 (0.54 mi.)	800	2,455
Well #30 (Hopper)	5,490 (1.04 mi.)	664	2,000
Well #48 (Meyer)	11,800 (2.2 mi.)		~1,000