

**Presentation to:  
U.S. Nuclear Waste Technical Review Board**

**Inyo County, California  
Regional Ground Water Monitoring Program**

**by: Andrew Remus, Inyo Co. Planning  
Michael King, R.H.G., Hydrodynamics  
Dr. John Bredehoeft, Hydrodynamics**



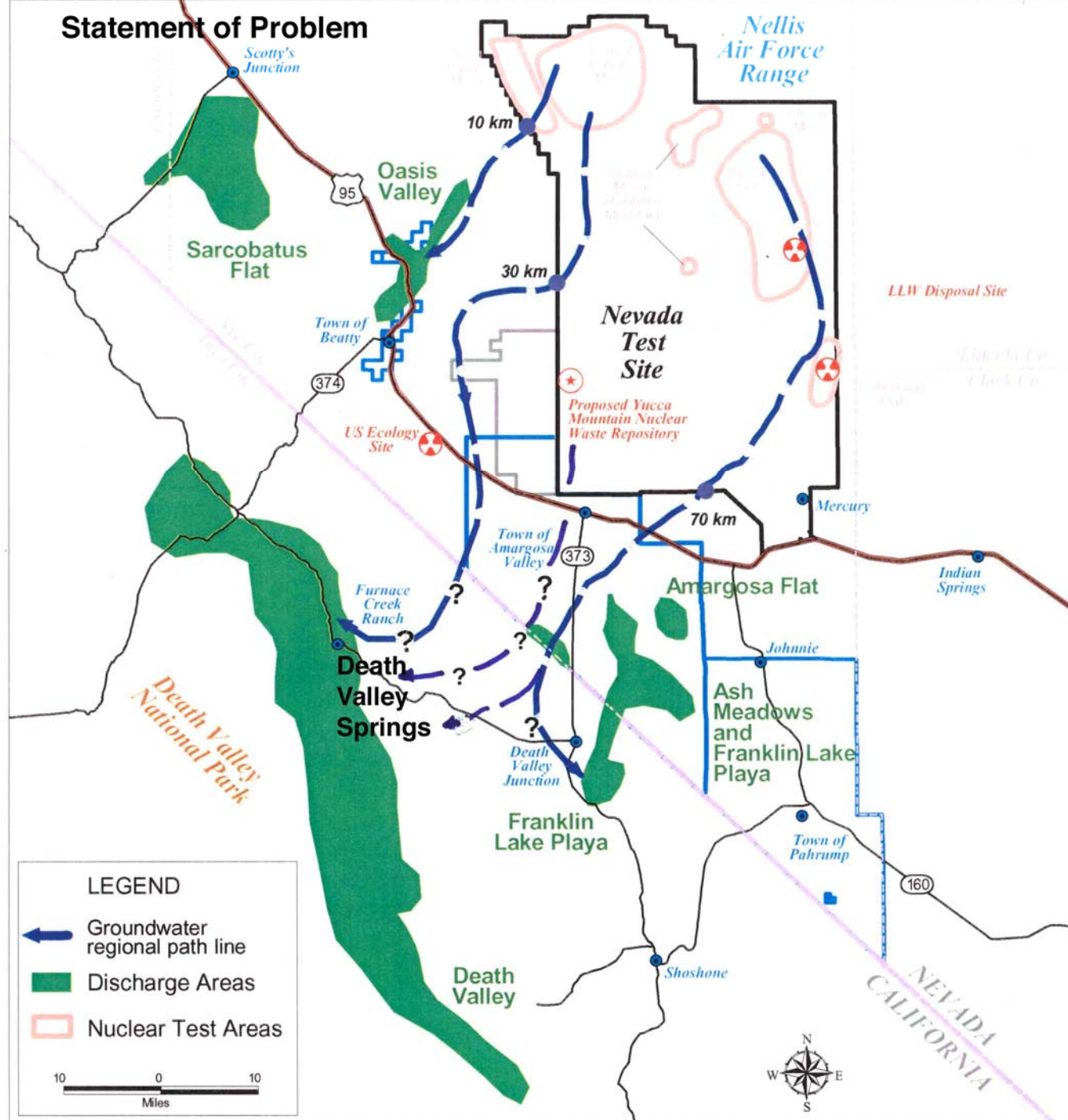
The  
**HYDR****dynamics**  
Group, LLC

*Studies in Mass & Energy Transport in the Earth*

# Inyo County Concerns

- Radioactive nuclide transport through the LCA into the Death Valley springs.
- Degradation of the upper gradient in the LCA impact on Furnace Creek spring flows, and on the potential of inducing radioactive nuclide transport from Yucca Mountain.

# Statement of Problem

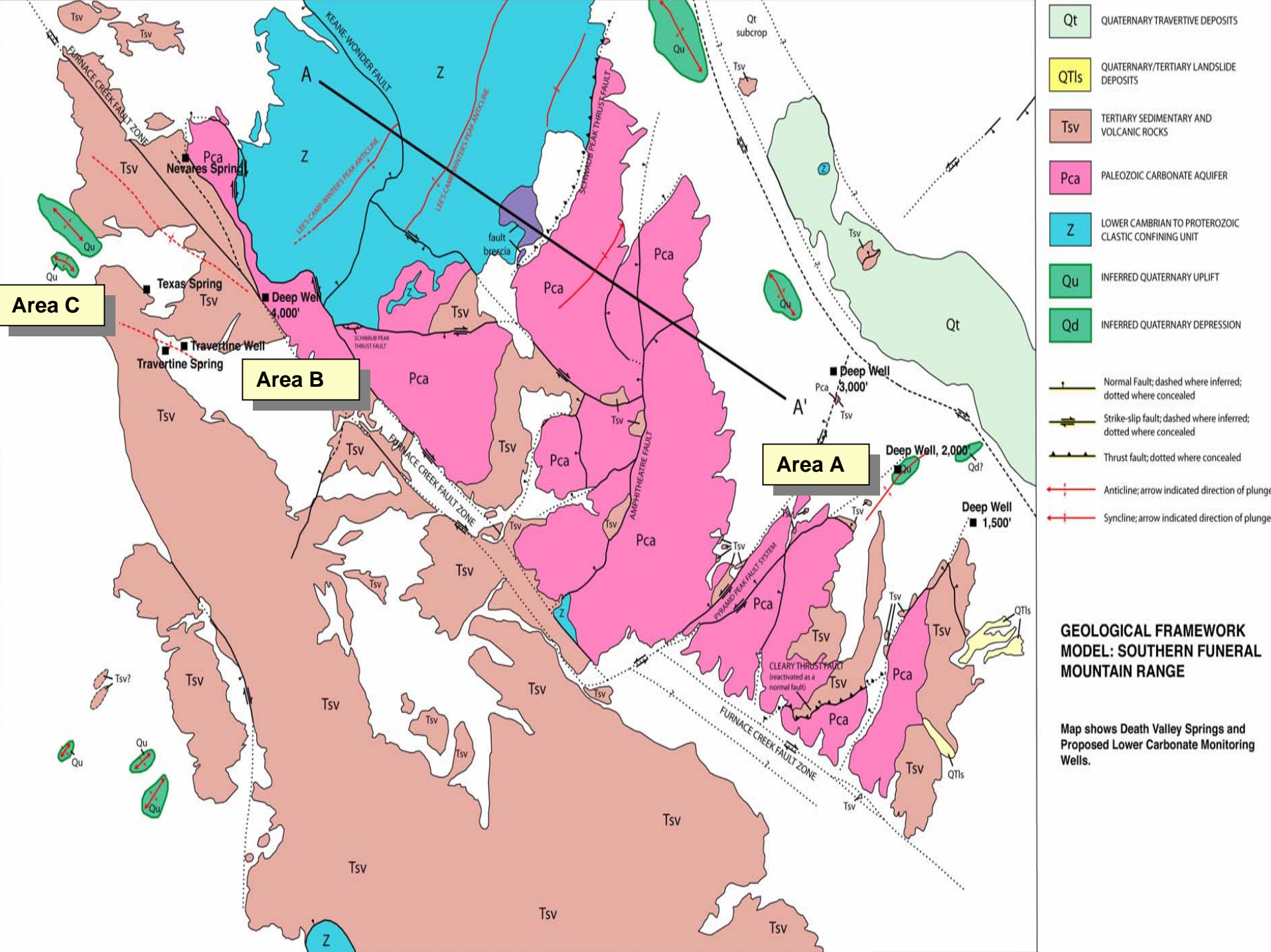


**LEGEND**

- ← Groundwater regional path line
- Discharge Areas
- Nuclear Test Areas

10 0 10  
Miles





**Area C**

**Area B**

**Area A**

Pca  
Nevares Spring

Tsv  
Texas Spring

Deep Well  
4,000'

Travertine Well  
Travertine Spring

Deep Well  
3,000'

Deep Well  
2,000'

Deep Well  
1,500'

KEANE-WONDER FAULT

LEES CAMP-WINTERS PEAK ANTICLINE

LEES CAMP-WINTERS PEAK SYNCLINE

fault  
breccia

SCHUBAU PEAK  
THRUST FAULT

FURNACE CREEK FAULT ZONE

AMPHITHEATRE FAULT

PYRAMID PLAIN FIELD SYSTEM

CLEARY THRUST FAULT  
(reactivated as a normal fault)

FURNACE CREEK FAULT ZONE

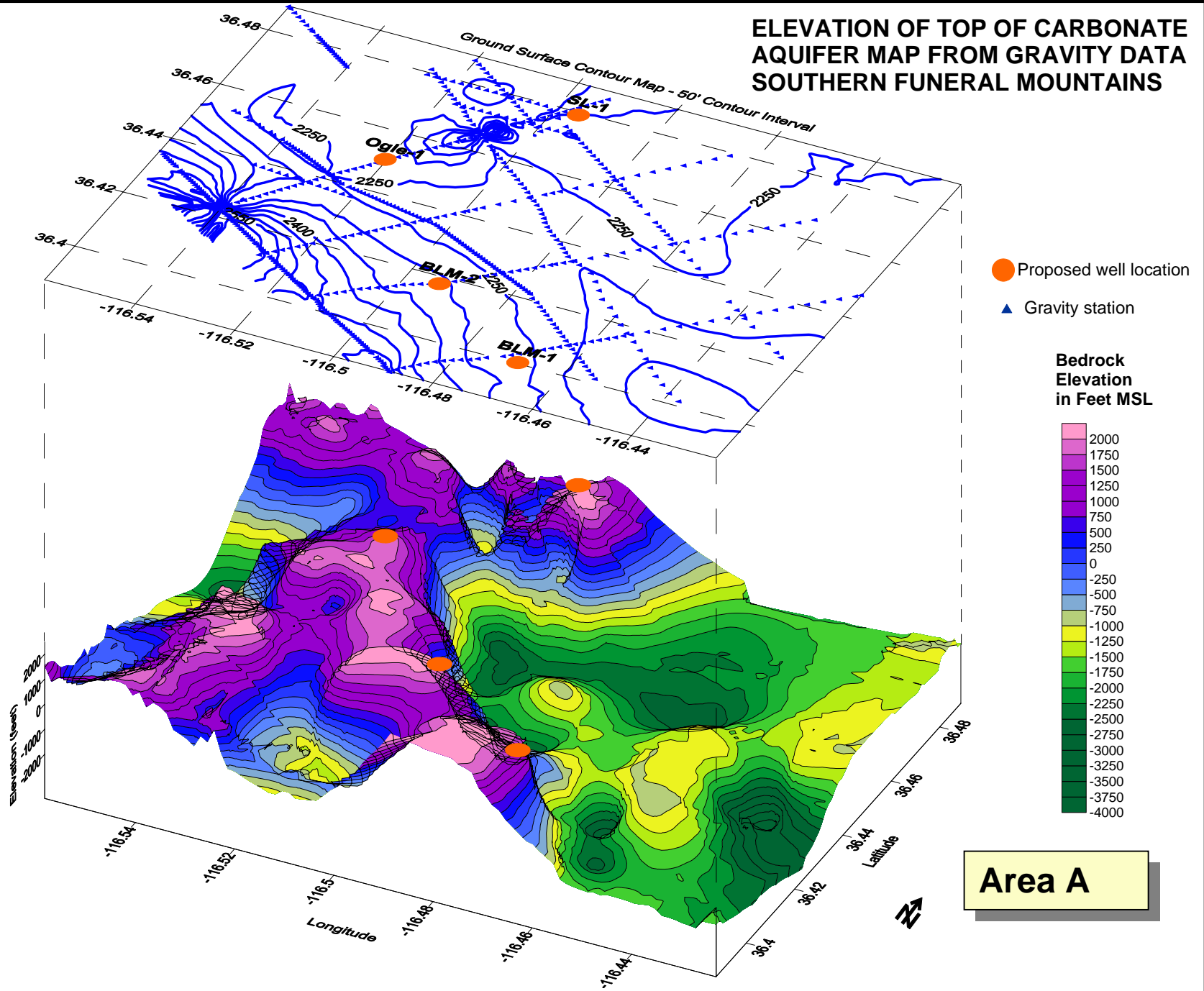
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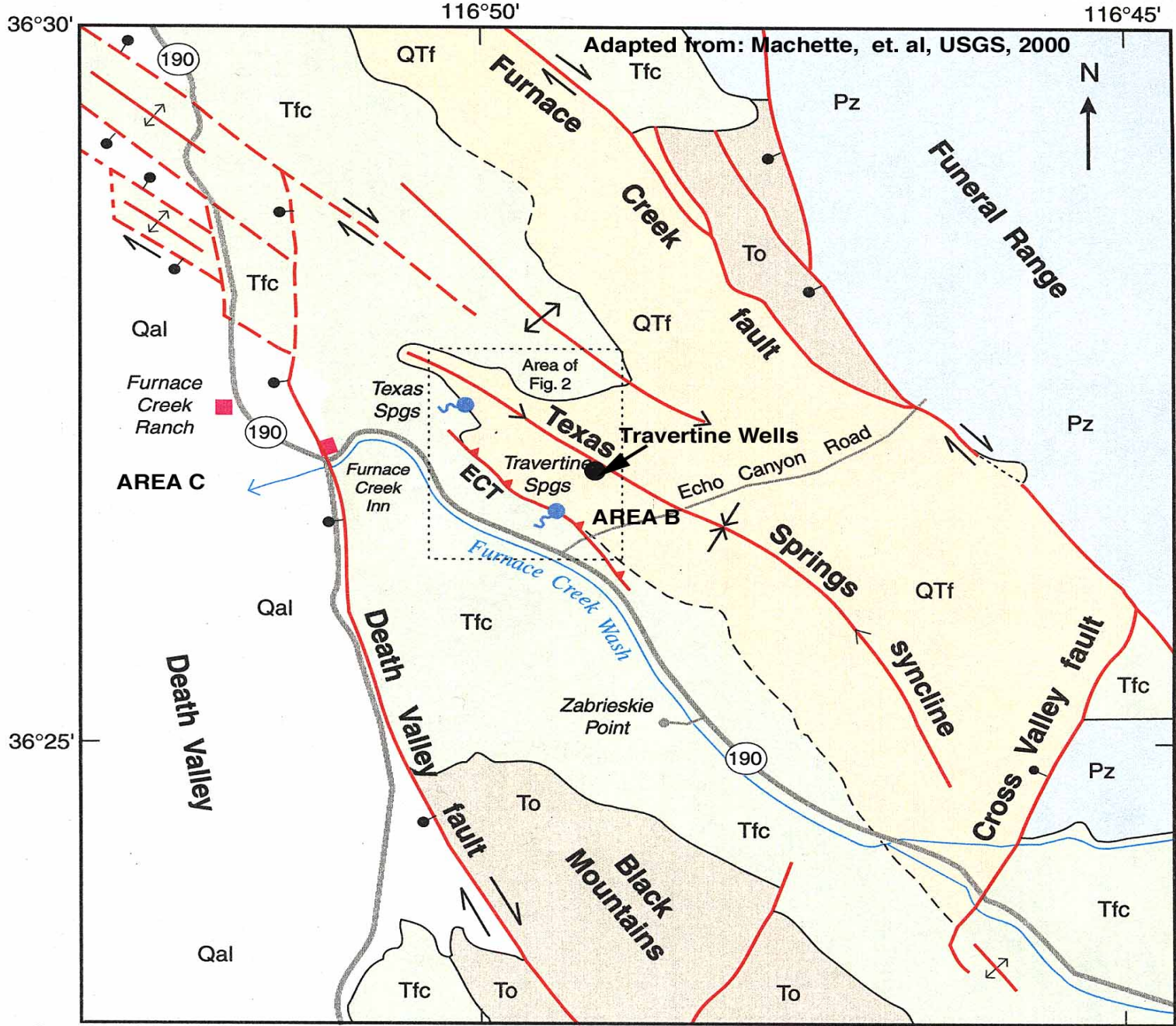
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# ELEVATION OF TOP OF CARBONATE AQUIFER MAP FROM GRAVITY DATA SOUTHERN FUNERAL MOUNTAINS





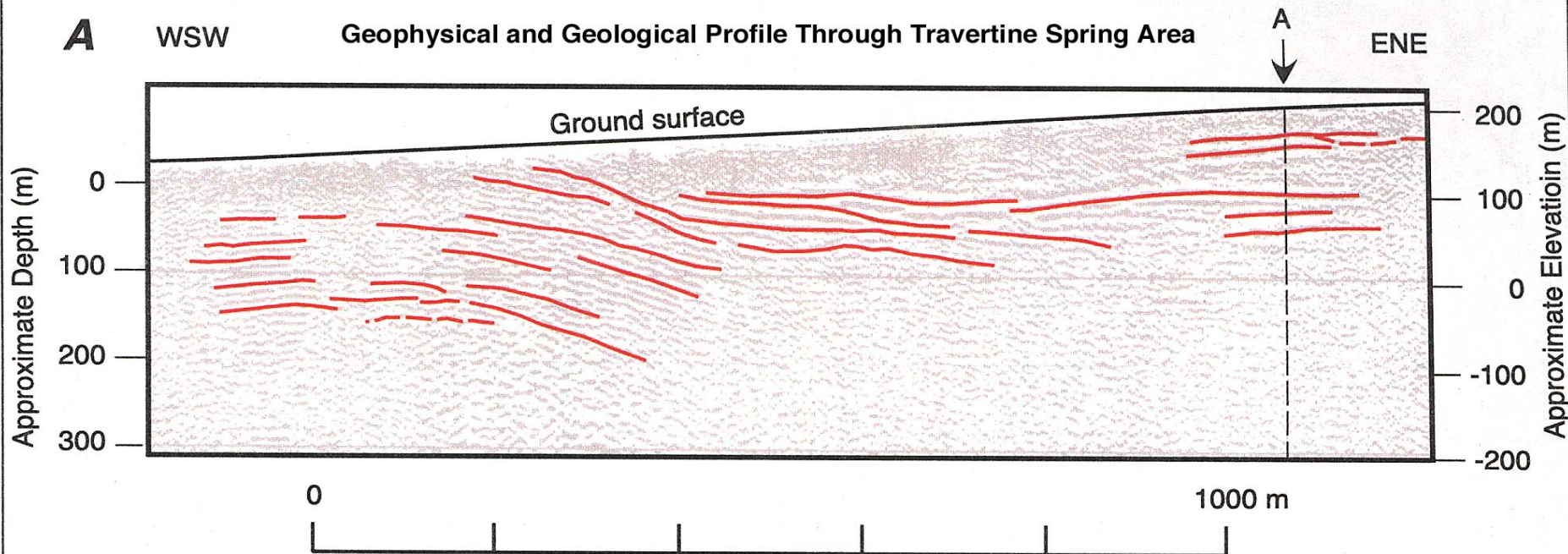


**GEOLOGY OF FURNACE CREEK AREA**

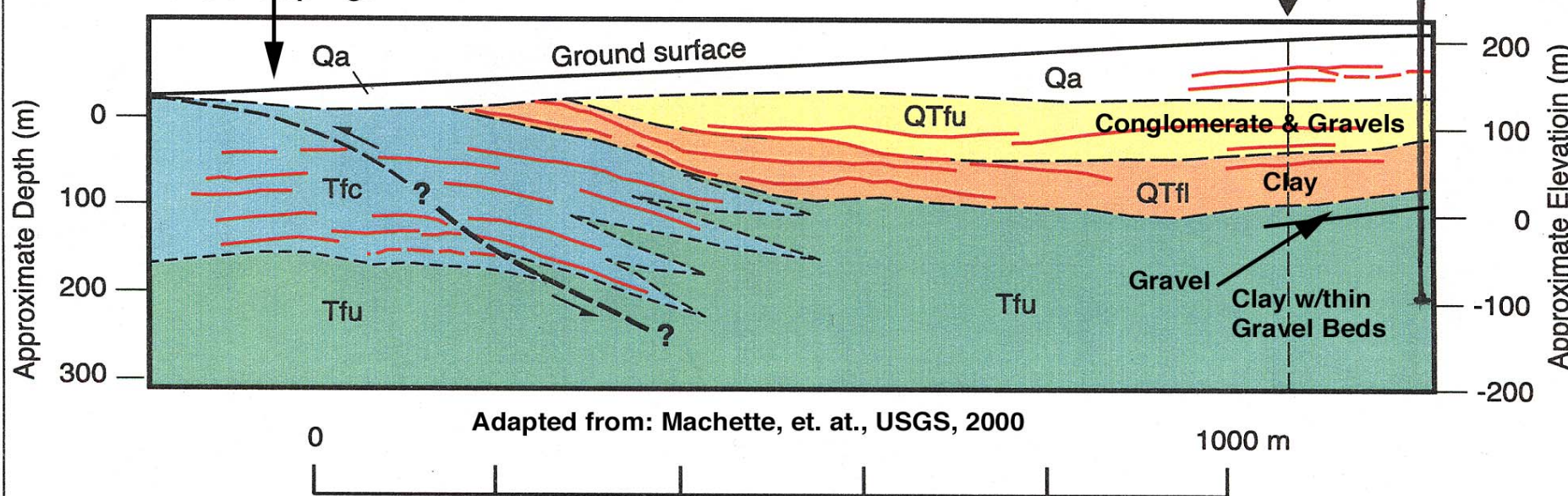




**A** WSW Geophysical and Geological Profile Through Travertine Spring Area ENE

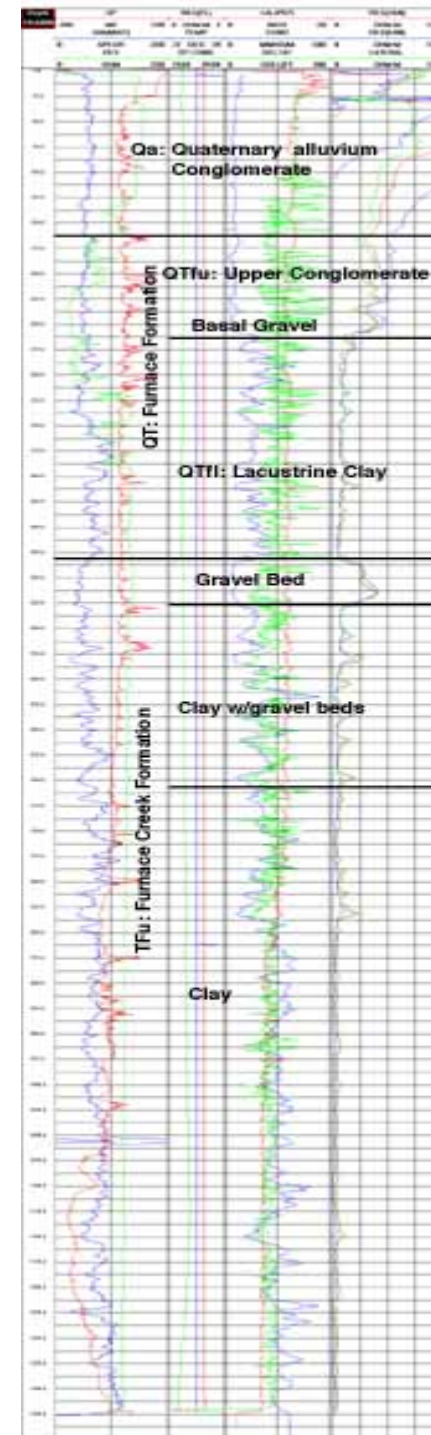


**B** Approximate Location of Travertine Springs Travertine #2 Well



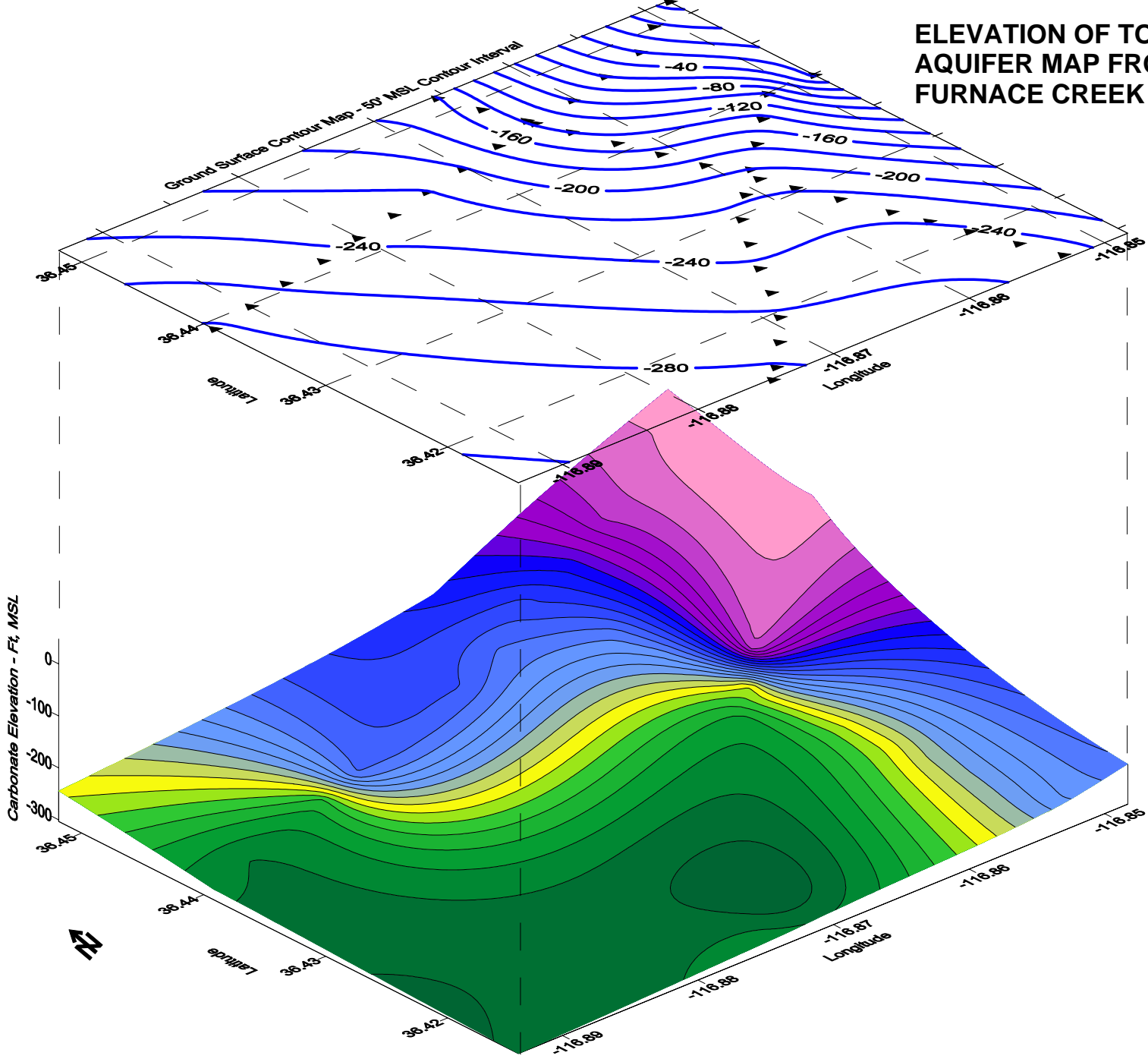
# Travertine #2 Well Log

- Geological Formations
  - Qa: Quaternary Alluvium
  - QTfu: Furnace Formation
    - Upper Conglomerates
    - Lower Lacustrine Clay
  - Tfu: Furnace Creek Formation
    - Upper Gravel Bed
    - Clay w/Gravel Beds
    - Clay



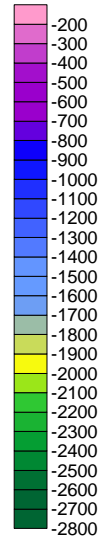


# ELEVATION OF TOP OF CARBONATE AQUIFER MAP FROM GRAVITY DATA FURNACE CREEK



▲ Gravity station

**Bedrock Elevation in Feet MSL**



DEATH VALLEY

AMARGOSA FARMS AREA

NW LIMIT OF Pca  
NEVARES SPRING  
SALT SPRING  
TEXAS SPRING  
TRAVERTINE SPRING

Spring Discharge @  
Approximately Sea Level

ECHO CANYON  
SPILLWAY

Water Table @  
Approximately 2,200' Elevation

PATHWAY 1  
PATHWAY 2  
PATHWAY 3  
PATHWAY 4

OUTCROP OF  
CLASTIC  
CONFINING UNIT  
PLEISTOCENE GROUNDWATER DISCHARGE AREA

LOWER PERMEABILITY  
FAULT ZONE

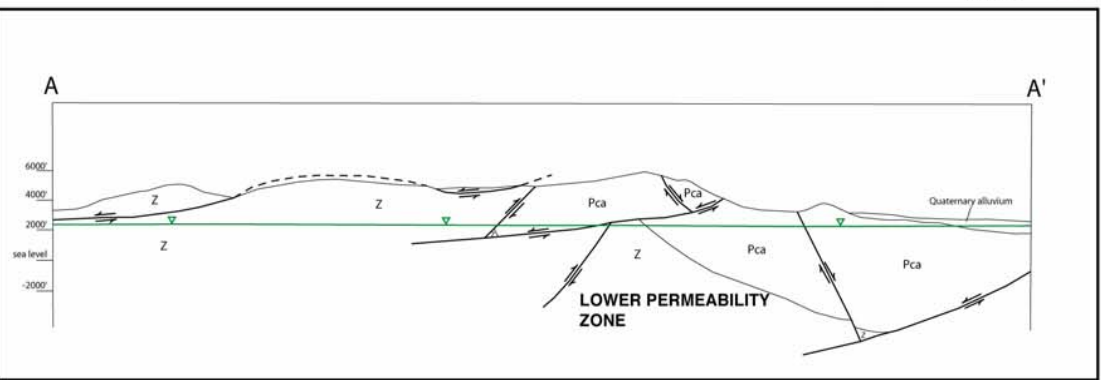
NAVEL SPRING  
TRAVERTINE POINT  
Pleistocene  
Discharge Area

TRAVERTINE  
SPILLWAY

LIMIT OF Pca  
at 2400' bsl  
SURFACE LIMIT OF Pca

HYDRAULIC DAM: Base of Pca  
is above the water table  
DAM OR SPILLWAY?

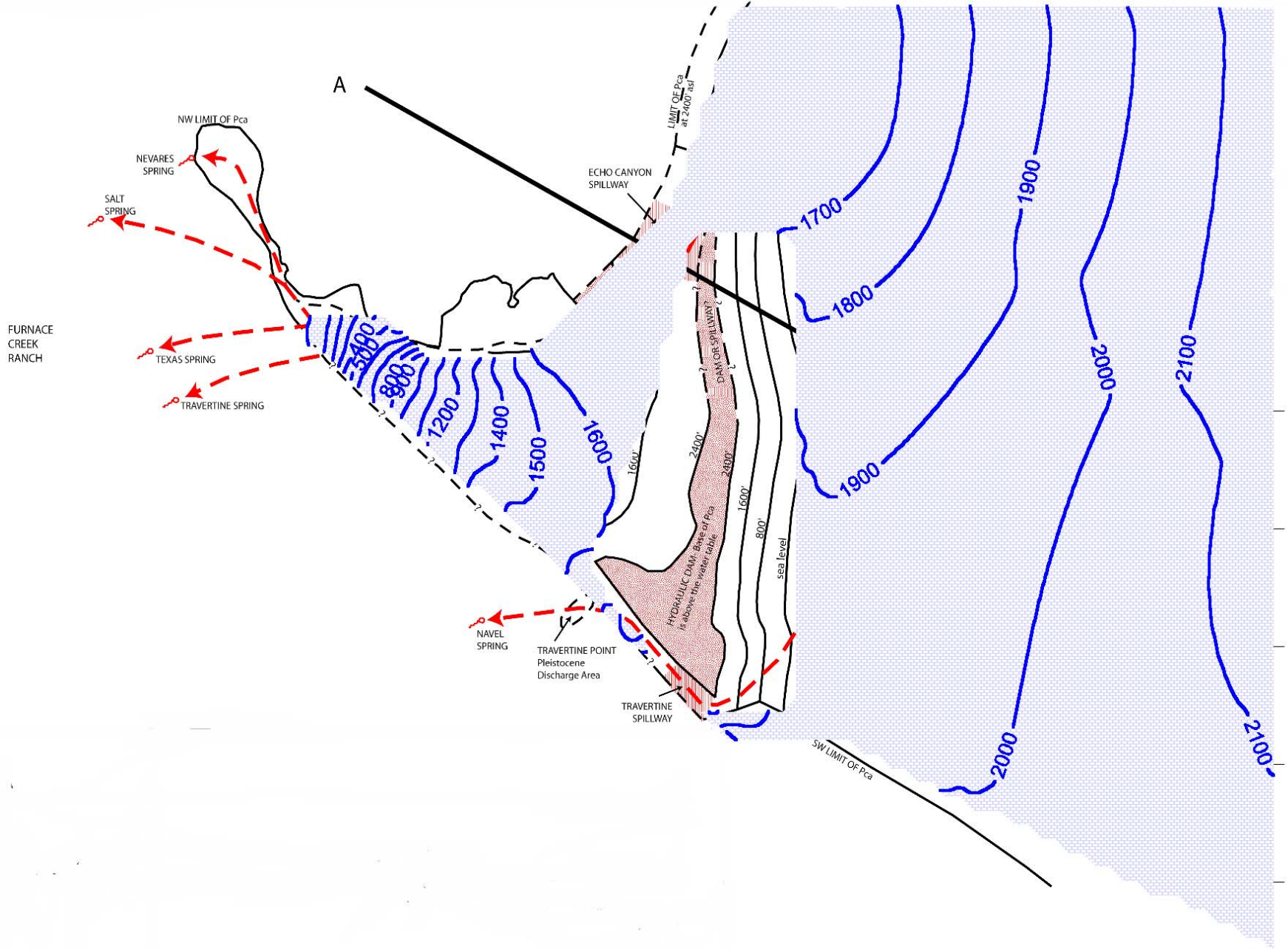
SW LIMIT OF Pca



# CONCEPTUAL HYDROGEOLOGY FRAMEWORK MODEL OF SOUTHERN FUNERAL MT. RANGE

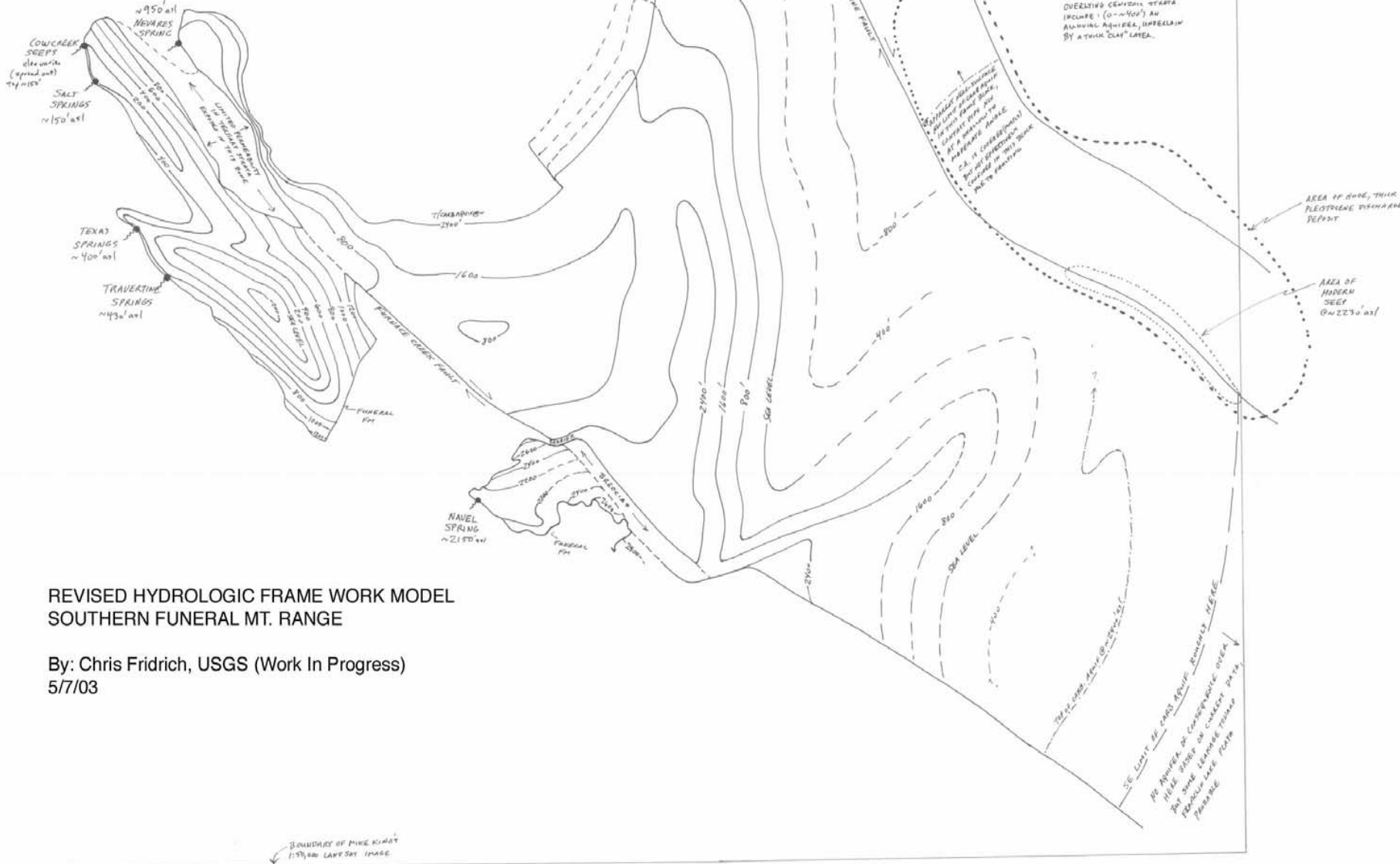
DEATH

VALLEY



27 CHRIS FRIDRICH  
USGS, DENVER  
5/4/2003

### MAP SHOWING BASE AND LIMITS OF CARBONATE AQUIFER AND FUNERAL FORMATION, SOUTHEAST FUNERAL MTNS, NV & CA



AQUIFER PROBABLY UNDERLIES ONLY THE DE/C OF THIS FORMATION AND IS TOTALLY CAPPED. THE OVERLAPPING GEOMORPHIC FEATURES INCLUDE (1) 100-1500' AN ALLUVIAL AQUIFER, UNDERLAIN BY A THICK 'CLAY' LAYER.

THESE ARE THE SANDSTONE FORMATION AND SHALE. THE SANDSTONE IS COARSE GRAINED AND THE SHALE IS MEDIUM GRAINED. THIS IS CHARACTERISTIC OF THE FUNERAL FORMATION.

AREA OF HOPE, THICK PLEISTOCENE DISCONFORM DEPOSIT

AREA OF HOPEAN SEEP @ ~2250' ASL

### REVISED HYDROLOGIC FRAME WORK MODEL SOUTHERN FUNERAL MT. RANGE

By: Chris Fridrich, USGS (Work In Progress)  
5/7/03

BOUNDARY OF MINE CLAIM  
1/2 MILE EAST OF IMAGE

SE LIMIT OF SANDSTONE FORMATION IS HERE.  
THE FUNERAL FORMATION IS COMPOSED OF COARSE GRAINED SANDSTONE AND SHALE.  
THIS IS CHARACTERISTIC OF THE FUNERAL FORMATION.

# Inyo County's Main Issues

- A LCA ground water flow path most likely exists thru the Southern Funeral Mt. Range.
- Maintenance of upward gradient in LCA critical to supporting spring flows, and prevention of radioactive nuclide transport from Yucca Mt.
  - Very fragile hydraulic system in Southern Funeral Mt. Range.
  - A 50 foot change in hydraulic head would significantly impact Furnace Creek Springs.



# Inyo County's Yucca Mountain Regional Groundwater Program

- Construct three (3) monitoring wells in LCA on eastside of Southern Funeral Mt. Range
- Construct Echo Canyon monitoring well in LCA in Death Valley National Park
- Construct Travertine Spring monitoring well in Death Valley National Park
- Conduct a water balance analysis of Furnace Creek alluvial fan area to determine total discharge from major Furnace Creek springs