

## USGS/DRI BARCASS Project Public Meetings

Ely and Baker, Nevada  
Trout Creek, Utah  
October 4-5, 2005



## Meeting Agenda

- History and Goals – Kimball Goddard, USGS
- Project Elements and Progress – Jim Thomas, DRI, and Alan Welch, USGS
- USGS Plans for GSLB GW study – Vic Heilweil and Pat Lambert, USGS
- Geology Task – Don Sweetkind, USGS



Water Resources of the **B**asin and  
**R**ange **C**arbonate **A**quifer **S**ystem  
in White Pine County Nevada, and  
adjacent areas in Nevada and Utah

**BARCAS** Study  
or  
**BARCASS**



## BARCASS

- Present study mandated by Lincoln County Conservation, Recreation, and Development Act of 2004 (short title)
- Funding of \$6 million provided by amendments to SNPLMA
- Draft Report – June 1, 2007
- Final Report – December 1, 2007



## Lincoln County Land Act

- “(1) IN GENERAL – The Secretary, acting through the **United States Geological Survey**, the **Desert Research Institute**, and a **designee from the State of Utah** shall conduct a study to investigate ground water quantity, quality, and flow characteristics in the deep carbonate and alluvial aquifers of White Pine County, Nevada, and any groundwater basins that are located in White Pine County, Nevada, or Lincoln County, Nevada, and adjacent areas in Utah”.



## Study Team Participants

- United States Geological Survey
  - Water Resources Nevada Science Center
  - Water Resources Utah Science Center
  - Geology Denver
  - Geology Menlo Park
- Desert Research Institute – Reno and Las Vegas
- Designee from Utah – Utah State Engineers Office



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## BARCASS Area



## Lincoln County Land Act

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## Lincoln County Land Act

- “The study shall–
  - (A) focus on a review of existing data and may include new data;
  - (B) determine the approximate volume of water stored in the aquifers in those areas;
  - (C) determine the discharge and recharge characteristics of each aquifer system;
  - (D) determine the hydrogeologic and other controls that govern the discharge and recharge of each aquifer system; and
  - (E) develop maps at consistent scale depicting aquifer systems and the recharge and discharge areas of such systems.”



## BARCASS is/will Not

- An Environmental Impact Study
- Produce a calibrated transient ground-water flow model
- Directly address ground-water development or water resource sustainability issues



## Public meetings

- Evening meetings every three months
  - Present progress
  - Present overall activities and goals of different work elements, or workpackages
  - Geology will be this evening
- Full day meetings - Ely
  - Late November, 2005 - details of all workpackages
  - Early June 2007 after release of draft report



## BARCASS work packages

- Recharge and Discharge
- Ground-Water Flow
- Geochemistry
- Data Synthesis and Evaluation
- Geology



## Recharge and discharge

- Purpose:
  - Mean-annual rates of basin recharge and discharge
    - Ranges of values
    - Develop basin water budgets
  - Distributions of recharge and discharge
    - Develop water-level map
    - Improve conceptual understanding of aquifer system



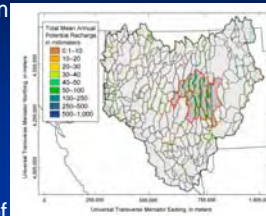
## Concepts of regional recharge

- Develop a conceptual understanding of the mechanisms that lead to recharge
  - Based on real world experience
  - Based on data from multiple sources or methods
- Develop a mathematical model that allows extrapolation of these concepts to the area of interest



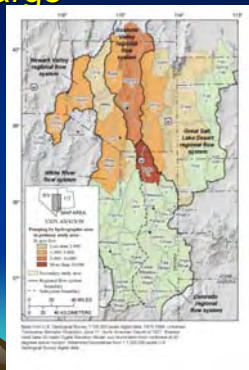
## Recharge

- Data is being compiled from a wide variety of sources
  - Precipitation
  - Soils
  - Geology
  - Vegetation
- Data will be included in an internally consistent model of recharge amounts and distribution



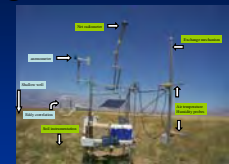
## Discharge

- Ground-Water pumpage –Need to determine consumptive use
- Spring Discharge – Upland, local, and regional springs; used in conjunction with ET
- Ground-water evapotranspiration




## Discharge


- Select Representative Vegetation Groups: Density and Type
- Collect Field ET Data – Dome and Micrometeorological Stations
- Distribute ET over Areas of GW Discharge Using Remote Sensing Information



Six eddy-flux towers installed and now operational



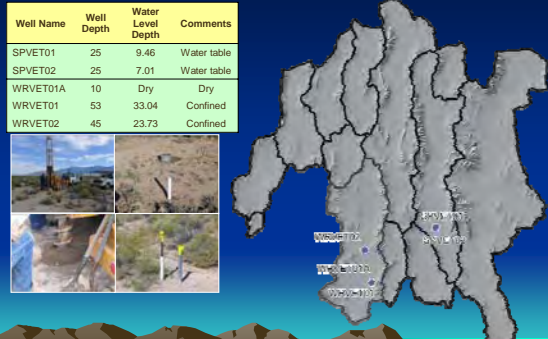
Different vegetation types and densities



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Five wells installed at four ET sites

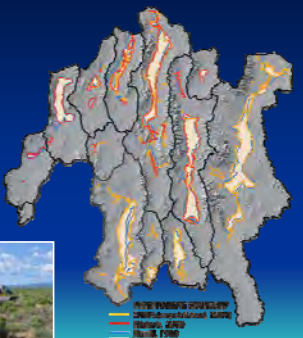
Well Name	Well Depth	Water Level Depth	Comments
SPVET01	25	9.46	Water table
SPVET02	25	7.01	Water table
WRVET01A	10	Dry	Dry
WRVET01	53	33.04	Confined
WRVET02	45	23.73	Confined



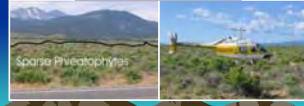
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REFINEMENT OF PHREATOPHYTE BOUNDARY: Integration of previous mapping work, TM imagery, and field reconnaissance

Thematic Mapper imagery



Phreatophyte Boundary

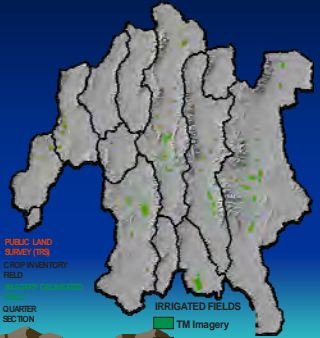


Sparse Phreatophytes

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WATER USE: Irrigation withdrawals estimated from Thematic Mapper imagery verified with Crop Inventory data

FIELD ID	IMAGERY	CROP INVENTORY
ACREAGE	100	100
HA	100	100
CROP TYPE	WHEAT	WHEAT
TOWNSHIP	10N	10N
RANGE	10E	10E
SECTION	10	10
QUARTER SEC	1	1



IRRIGATED FIELDS

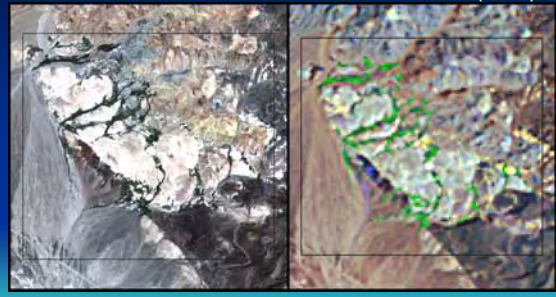
TM Imagery

Crop Inventory

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Imagry

IKONOS 4.5 M      TM 30 M (LS7)

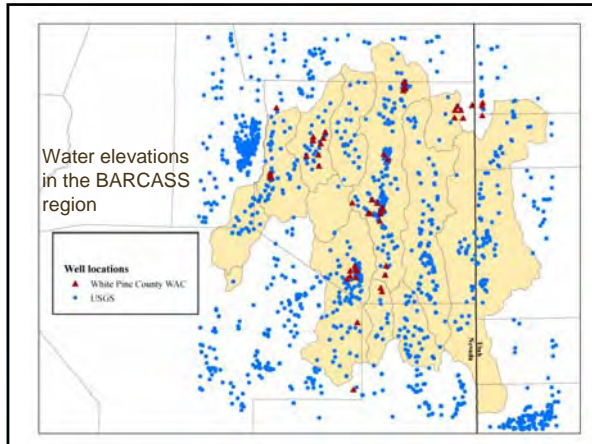


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Ground-water flow

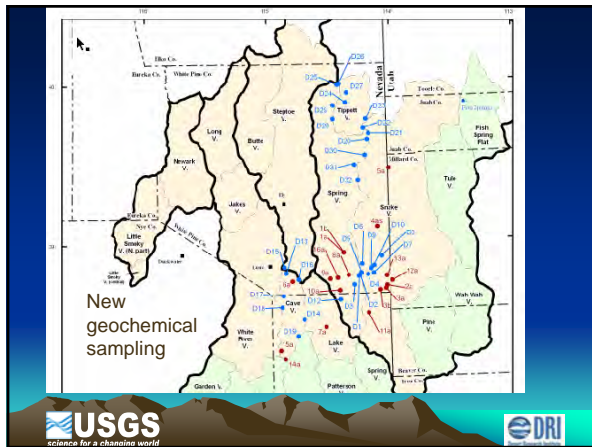
- Produce 50' contour maps for entire area
- More detailed maps in areas affected by pumping
  - Southern Spring Valley
  - Southern Snake Valley
  - Central Steptoe Valley

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## Geochemistry

- Support hydrologic evaluations
  - Principal ground-water flow paths and source areas
  - Recharge areas
  - Recharge rates
  - Interbasin flow



## Data synthesis and evaluation

- Basin water budgets
  - Attempt to quantify interbasin flow
    - Geology
    - Water levels
    - Geochemistry
  - Accounting model
    - Recharge
    - Discharge
    - Chemistry

## Data synthesis and evaluation

Conceptual 'Model'

- Hydrogeologic framework model of geology
- Series of maps showing recharge, discharge, and ground-water

Hydrogeology  
 Recharge  
 Discharge  
 GW Flow

**Conceptual Aquifer System**

## Data synthesis and evaluation

Report

- Document results of study
- Draft due June 2007 to Congress
- Public comment period
- Final report due December 2007

## Data synthesis and evaluation

- Recommendations for future monitoring
  - Water levels
  - Discharge
  - Water quality
  - Water use
  - ET
  - Drilling
  - Pump tests

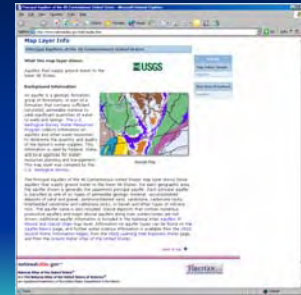


Lehman Creek near Baker, NV  
August 2007



## Data dissemination

- Web page dedicated to project
  - Background
  - Progress
  - Quality-assured point and spatial data
- Knowledge exchange meetings



<http://nevada.usgs.gov/barcass/index.htm>



## USGS Ground-Water Resource Programs Proposed Great Basin/Great Salt Lake Basin Ground-Water Availability Study, Utah and Nevada

Patrick Lambert, US Geological Survey,  
Utah Water Science Center, Salt Lake  
City



## USGS Ground-Water Resources Program

- The GWRP addresses the increasing complexity of the issues by using a multi-theme approach. Program goals are achieved through the implementation of the following ground-water science themes:
  - [Regional/National Ground-Water Evaluations](#)
  - [Field Methods and Models](#)
  - [Fundamental Data](#)
  - [US-Mexico Border Environmental Health Initiative](#)
  - [Technical Ground-Water Support](#)



## GWRP - Regional Ground-Water Evaluations

- Ground-Water Availability of Selected Principal Aquifers
  - Documented effects of recent increased ground-water withdrawals and droughts emphasize the need for updated status on the availability of the Nation's ground-water resources.
  - Assessing the current state of the ground-water flow systems necessary for evaluating ground-water availability under present conditions.

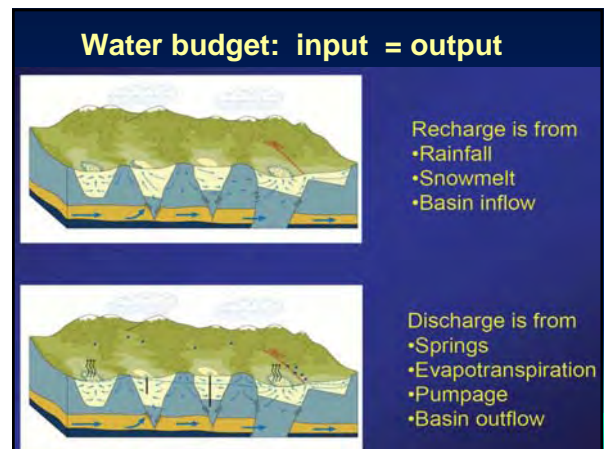
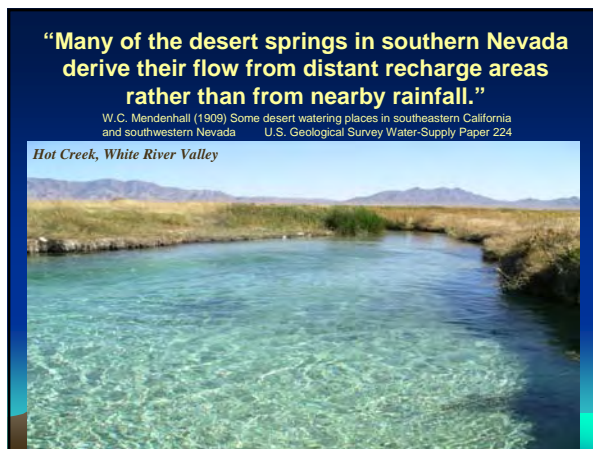
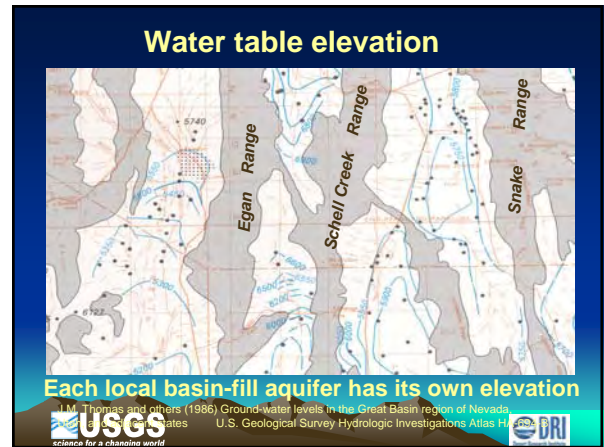
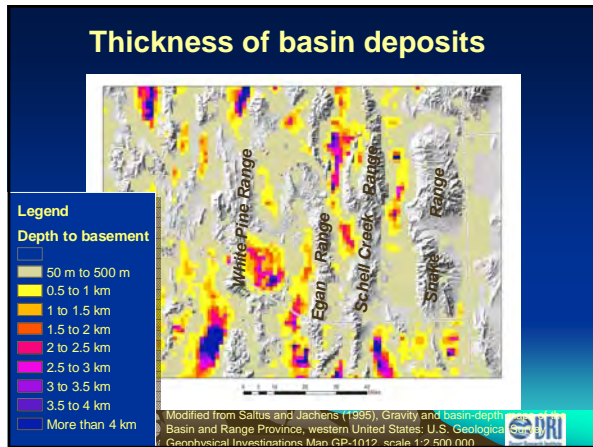
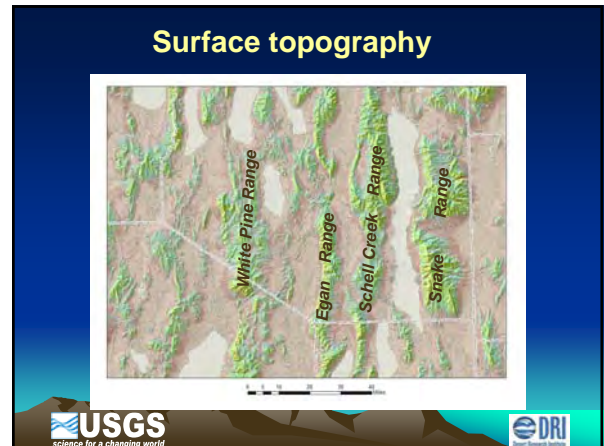
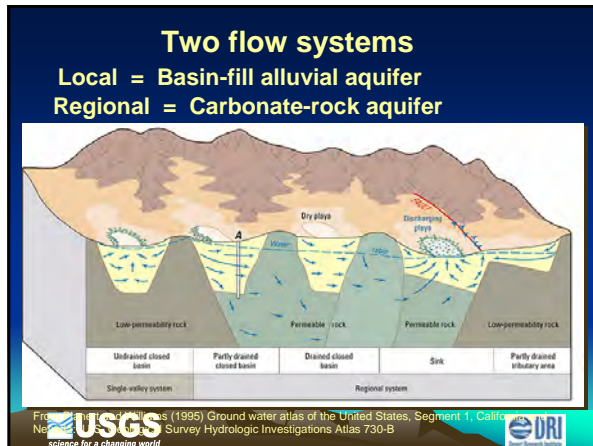


## GWRP - Ground-Water Availability of Selected Principal Aquifers

- Projects selected in 2003 -
  - Atlantic Coastal Plain aquifers in North and South Carolina
  - Denver Basin aquifer in Colorado
  - Central Valley aquifer in California
- Projects selected in 2005
  - Great Basin/Great Salt Lake Basin aquifers
  - Mississippi Alluvial and Sparta Aquifers









Nevada  
Roberts Mountain Thrust  
Great Basin carbonate rock province  
Utah

- Carbonate-rock province supports deep, regional flow
- Integrates recharge from numerous ranges and basins
- Ground-water resource availability

Looking E to southern Egan Range  
From Sunnyside

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## Geologic system is the “plumbing”

Karst solution

Faulting

Stratigraphy

Fracture permeability

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## Looking beneath the valley floors – the basin-fill alluvial aquifer

Looking S down Steptoe Valley  
from Monte Neva Road

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## Looking beneath the valley floors – the basin-fill alluvial aquifer

Looking S down Steptoe Valley  
from Monte Neva Road

**Gravity data and models**

**Shallow electrical geophysics**

**Seismic data**

**Well data**

**Geologic data**

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## Isostatic Gravity Map

Map of subtle variations in the earth's gravity field; related to the variations in density of the underlying rocks.

Data are reduced to isostatic anomalies to remove long-wavelength variations of gravity inversely associated with topography.

Data derived from an updated version (USGS et al., 2005) of the statewide compilation of Nevada (Porter and ...)

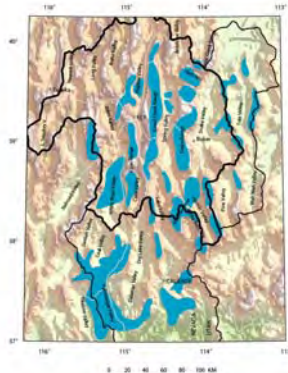
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### Gravity Data Coverage

Showing areas of poor data coverage:

Hamlin Valley  
Spring Valley  
White River Valley

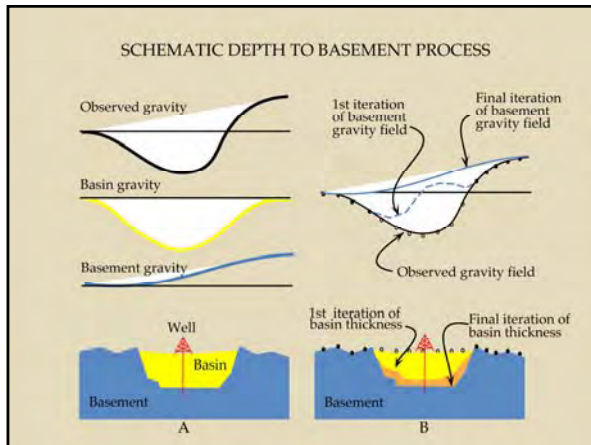
Many mountain ranges



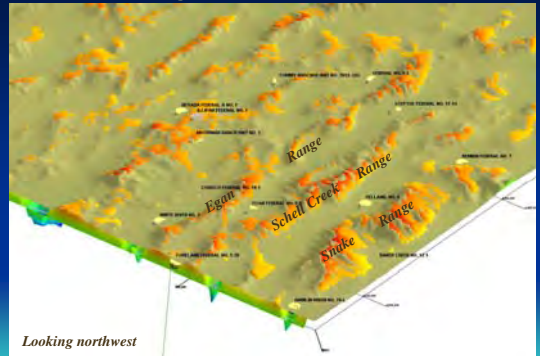
### Gravity Data Collection

Base stations

Field data 1/2 mi spacing



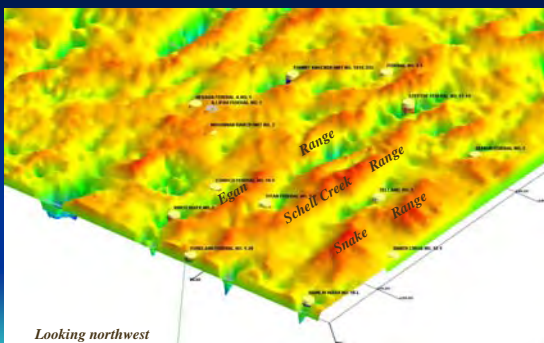
### Land surface – digital elevation model



Looking northwest



### Depth to basement model; land surface removed



Looking northwest

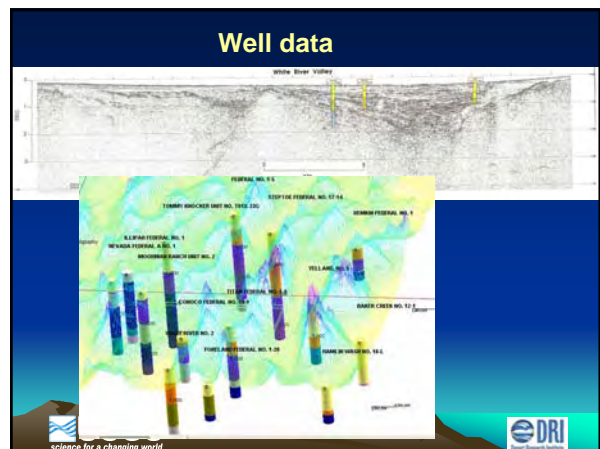
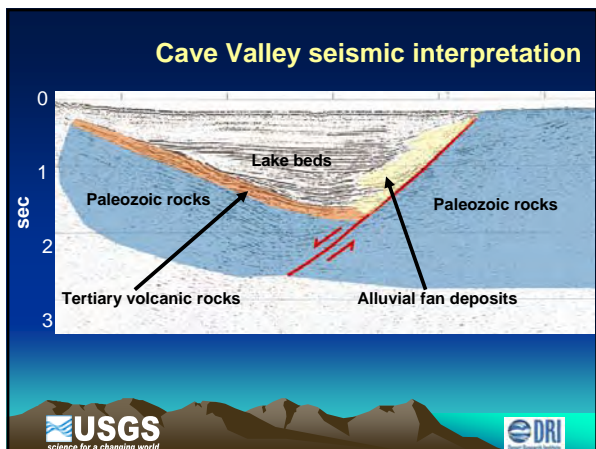
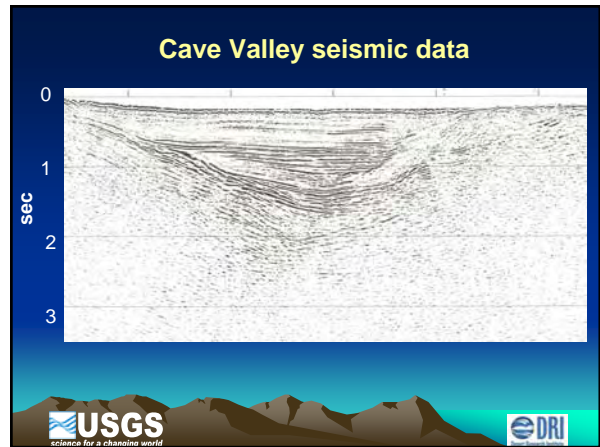
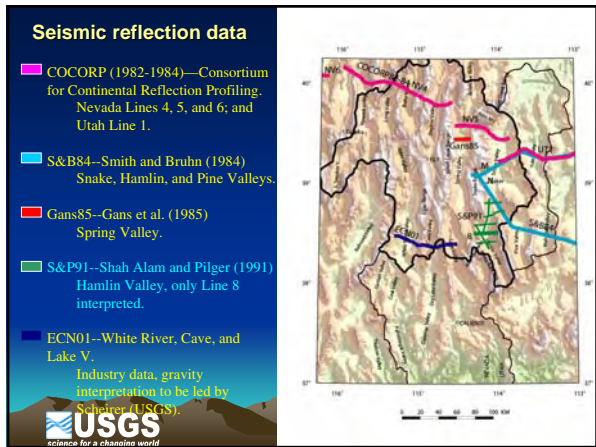
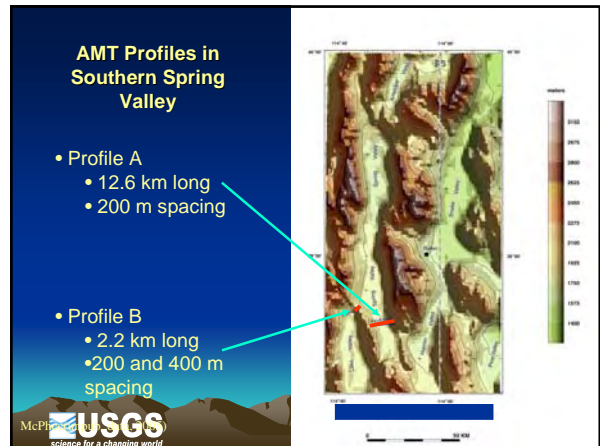
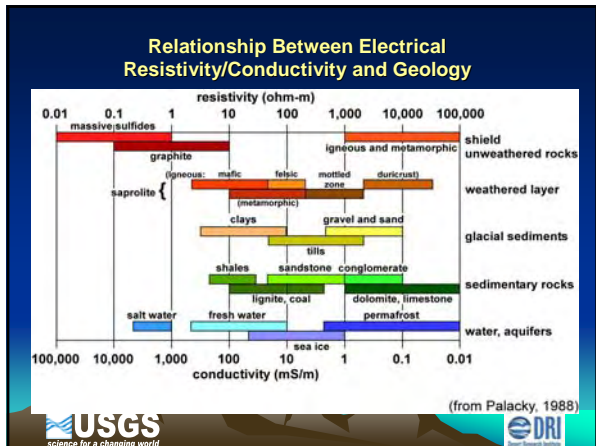


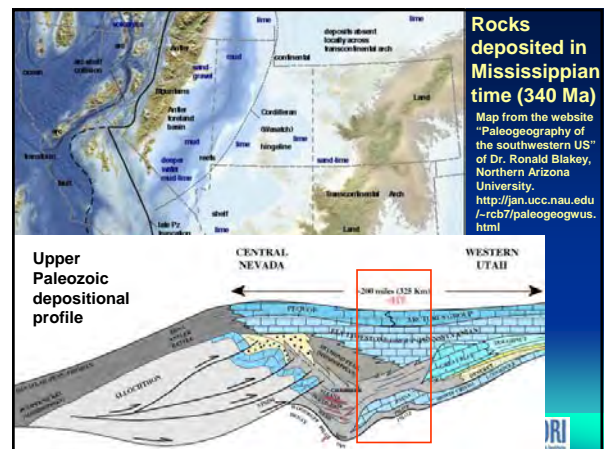
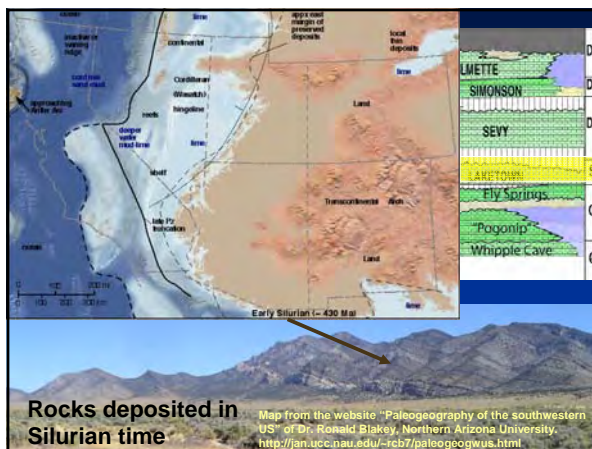
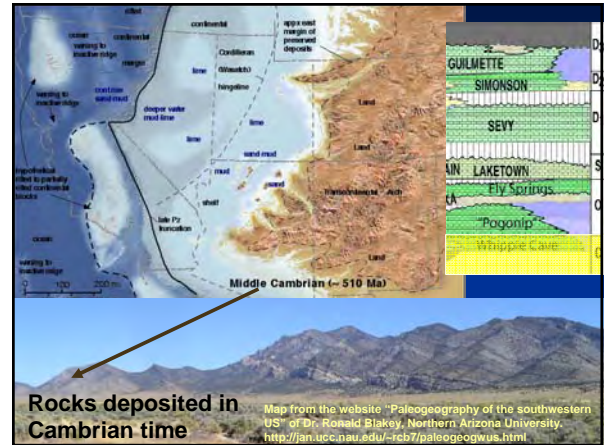
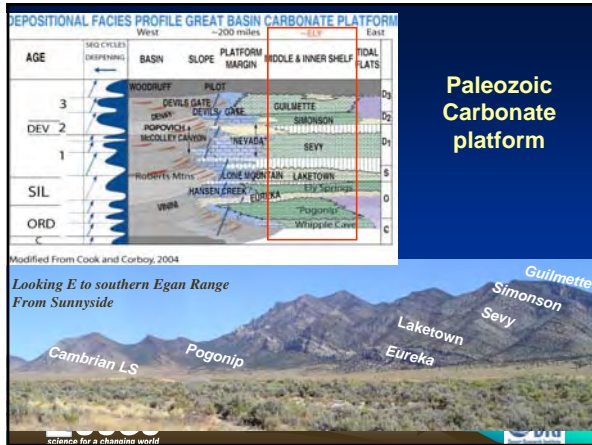
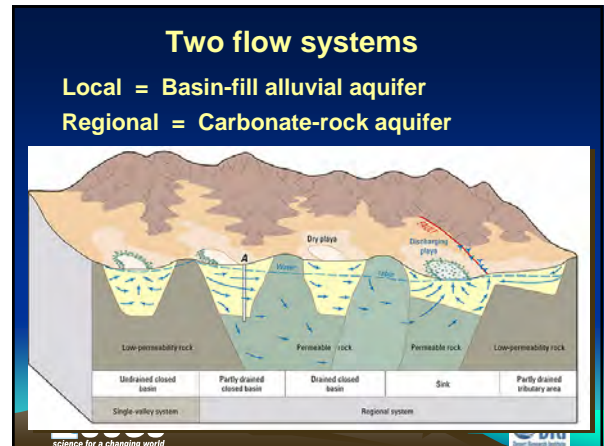
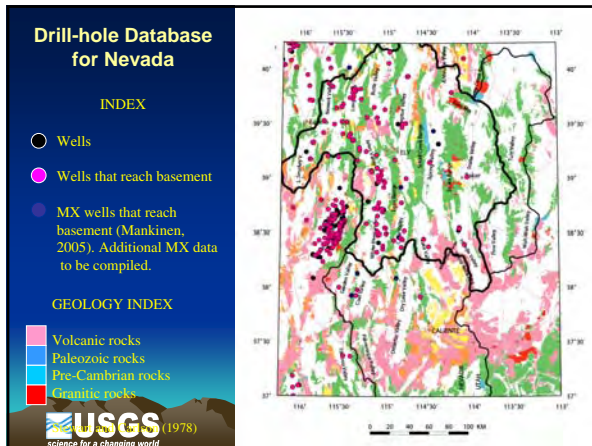
### Magnetotelluric Data Collection

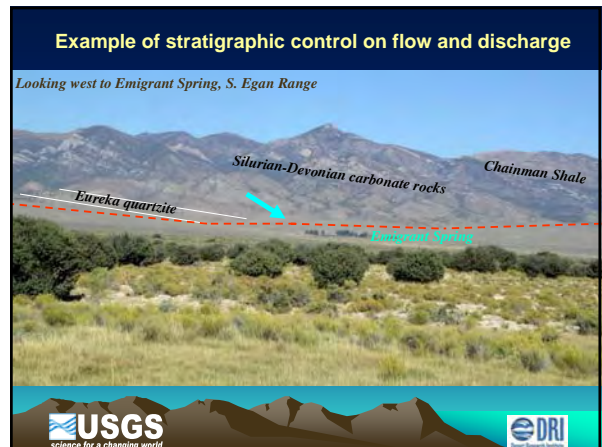
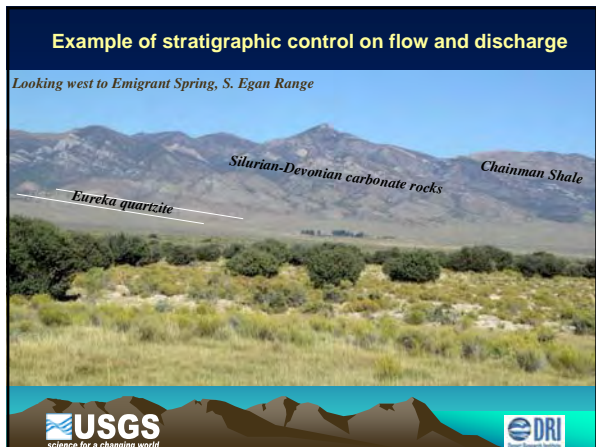
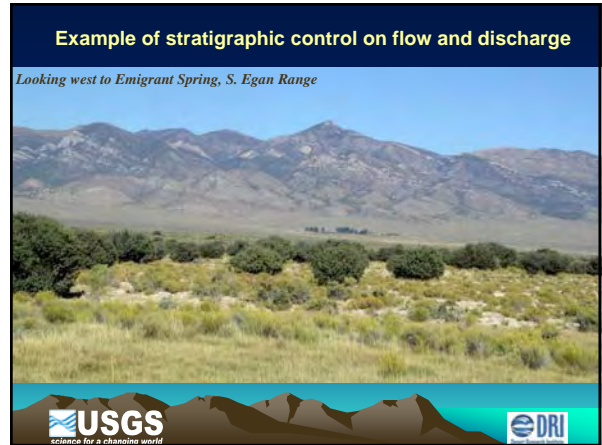
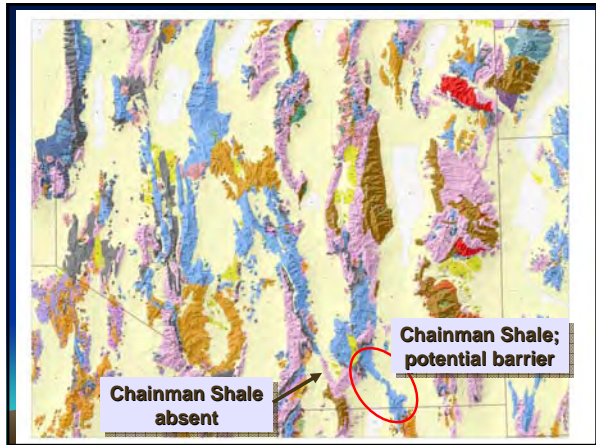
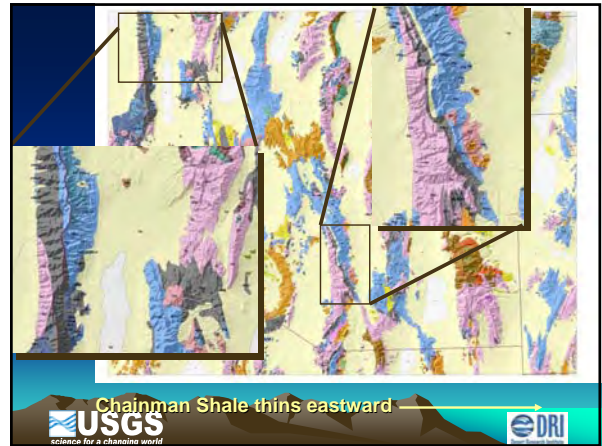
Various electrical methods

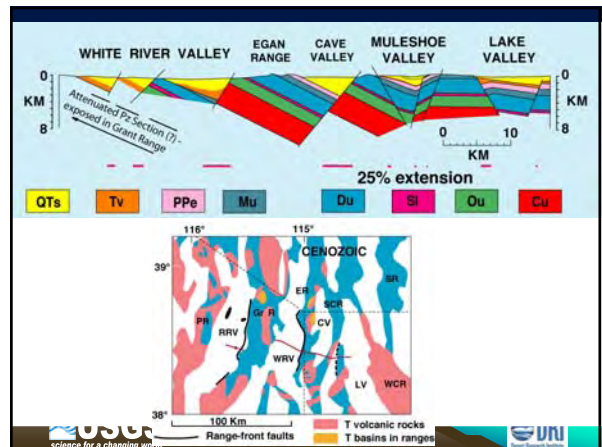
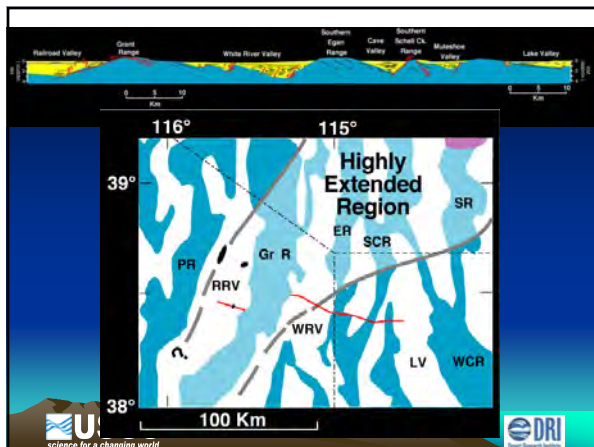
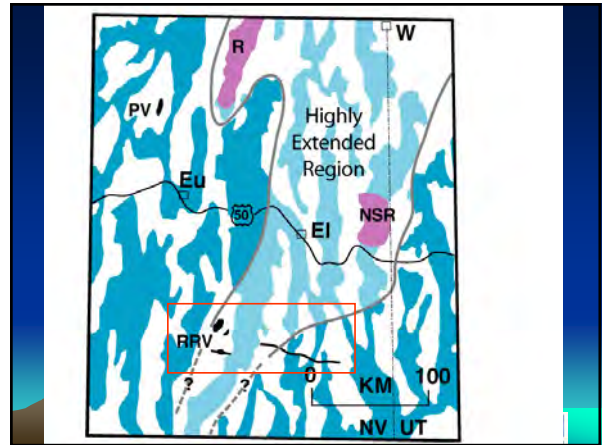
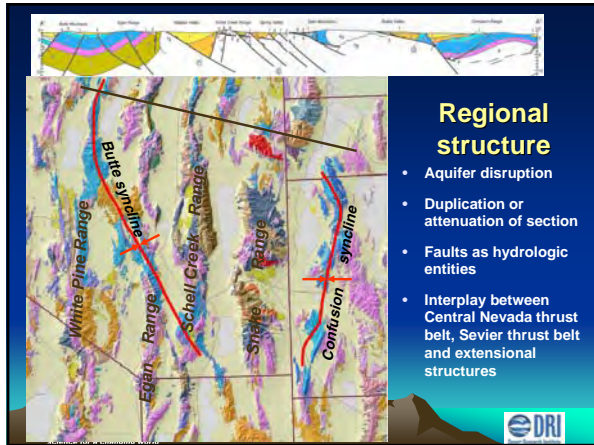
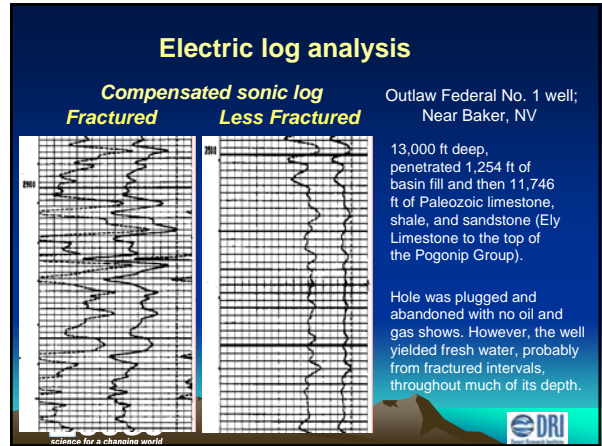
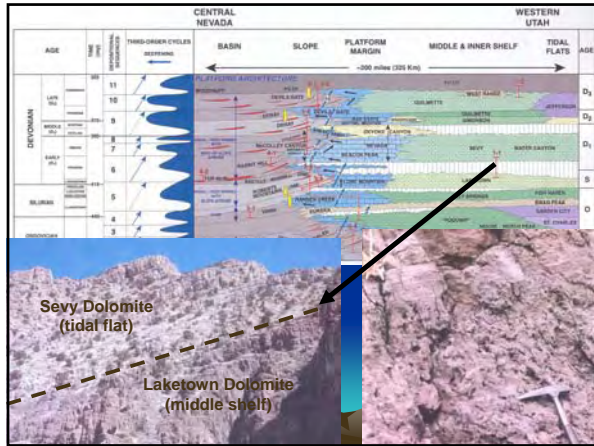
Long collection time



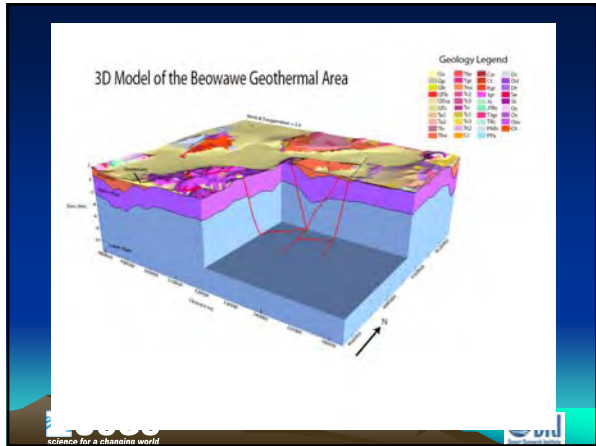












### Main objectives for geologic, geophysical, and hydrogeologic work

**Aquifer properties**

**Geologic characteristics**

**Measured hydraulic properties**

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### Main objectives for geologic, geophysical, and hydrogeologic work

**Structural controls on ground-water flow**

- Conduits, pathways, interbasin connections
- Barriers through unit juxtaposition or fault properties

**Geology**

**Hydrology**

**Geochemistry**

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### Main objectives for geologic, geophysical, and hydrogeologic work

- Framework configuration at important interbasin areas
- Overall conceptualization of geologic framework as it relates to flow

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# The End

• Questions?

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