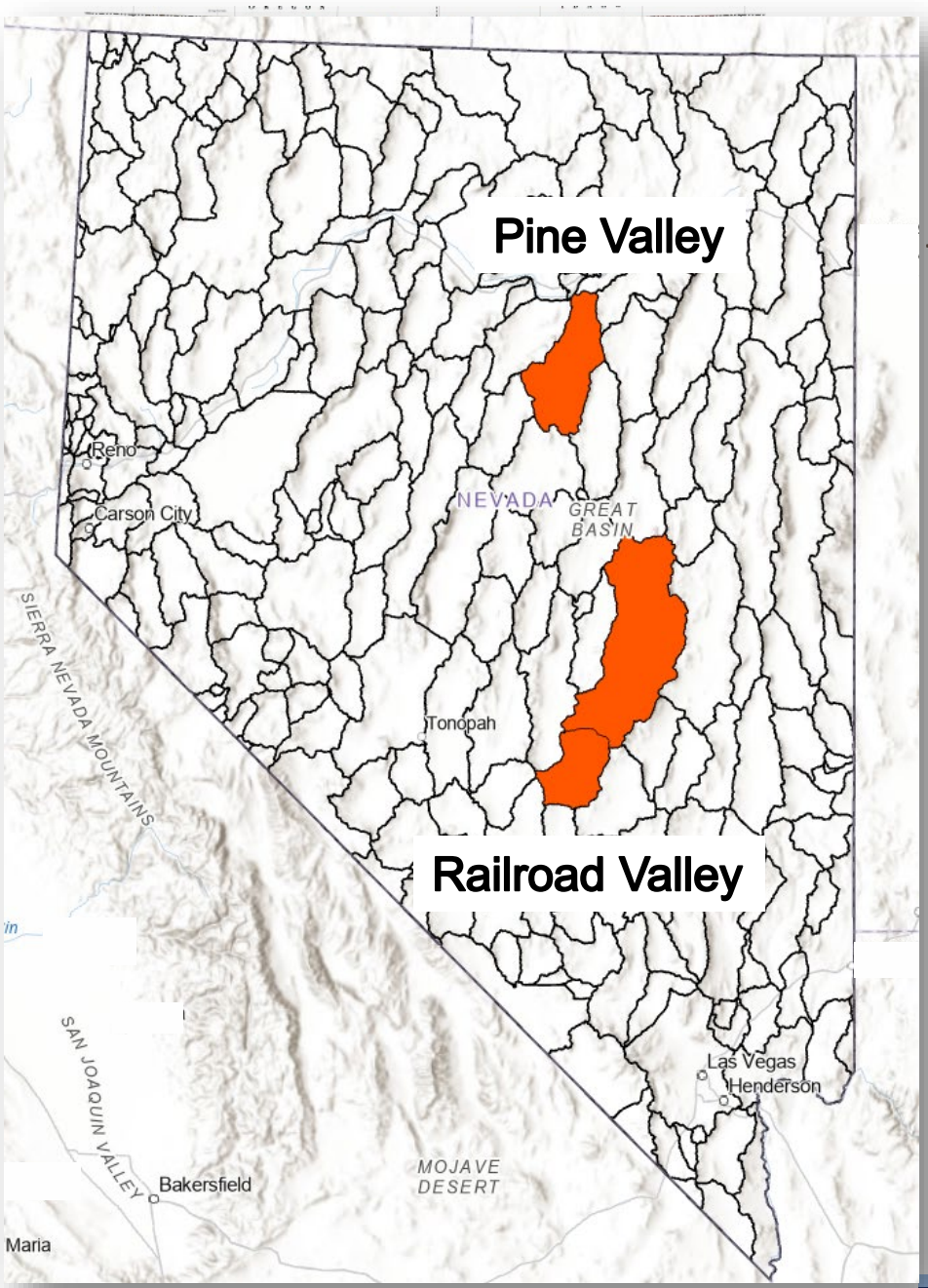


NEVADA DIVISION OF WATER RESOURCES

Nevada Department of CONSERVATION & NATURAL RESOURCES

The Nevada Water Resource Initiative: Updating estimates of Nevada's water availability

2023 Railroad Valley Community Outreach

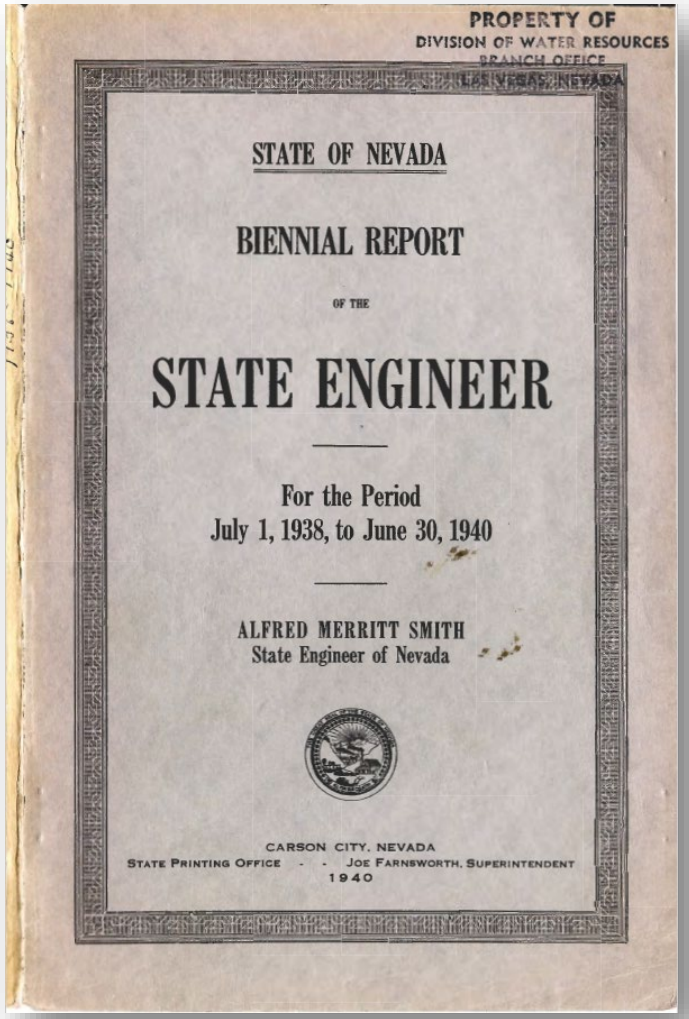
Currant, Nevada
June 14, 2023

Presented By:
Kip Allander, *Hydrogeologist*

ORIGIN OF GROUNDWATER MANAGEMENT IN NEVADA

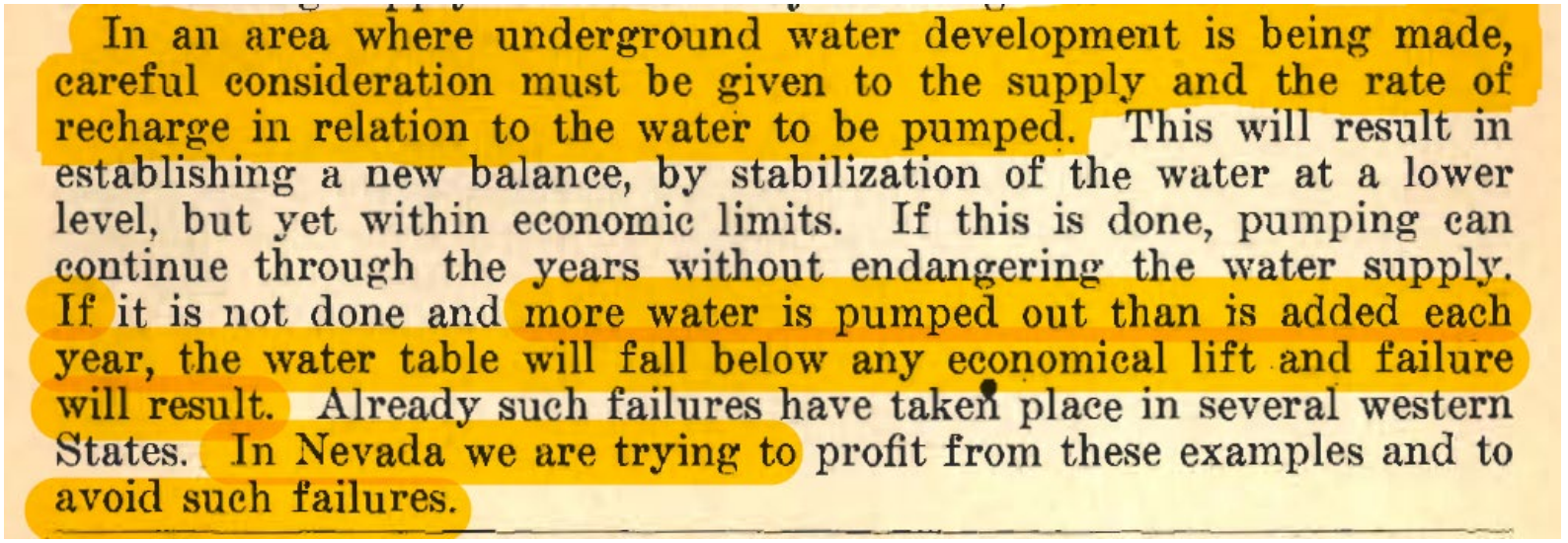
Underground Water Law of 1939 – NRS 534

- Clarified that all groundwater (GW), among other waters of the State, belongs to the Public.
- Gave State Engineer (SE) authority to manage groundwater.
- Established concept of basins, but did not define or delineate the basins.
- Did not establish Perennial Yield (PY) as basis for GW management.

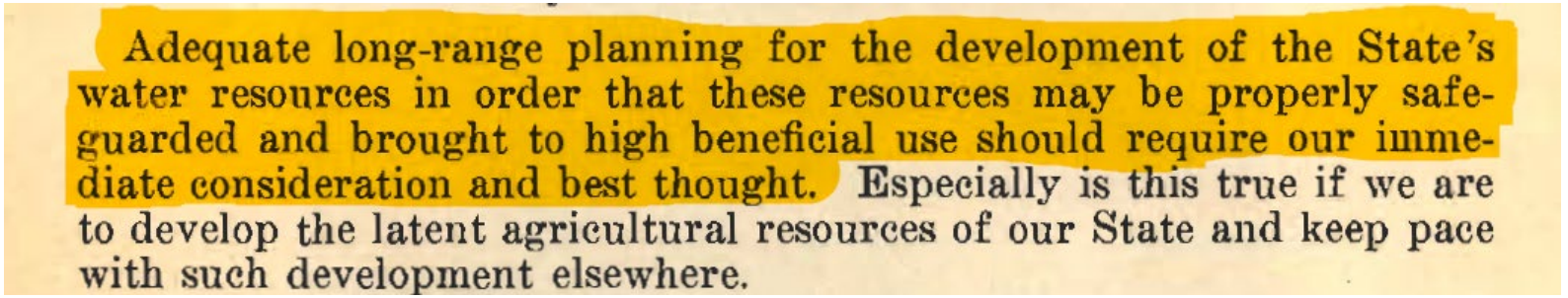


(SE Biennial Report 1938-40, 1940, pg 89)

THE STATE ENGINEER UNDERSTOOD THE NEED TO QUANTIFY WATER AVAILABILITY FOR SAFE DEVELOPMENT OF NV GROUNDWATER RESOURCES



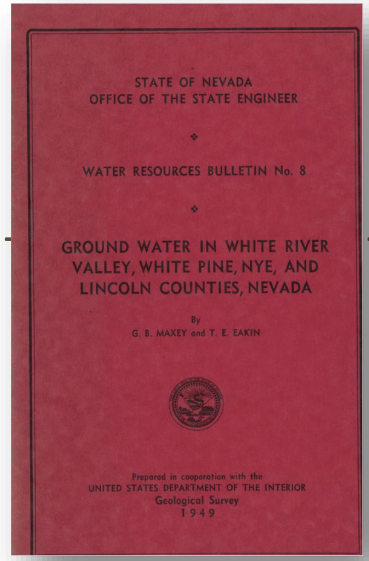
In an area where underground water development is being made, careful consideration must be given to the supply and the rate of recharge in relation to the water to be pumped. This will result in establishing a new balance, by stabilization of the water at a lower level, but yet within economic limits. If this is done, pumping can continue through the years without endangering the water supply. If it is not done and more water is pumped out than is added each year, the water table will fall below any economical lift and failure will result. Already such failures have taken place in several western States. In Nevada we are trying to profit from these examples and to avoid such failures.



Adequate long-range planning for the development of the State's water resources in order that these resources may be properly safeguarded and brought to high beneficial use should require our immediate consideration and best thought. Especially is this true if we are to develop the latent agricultural resources of our State and keep pace with such development elsewhere.

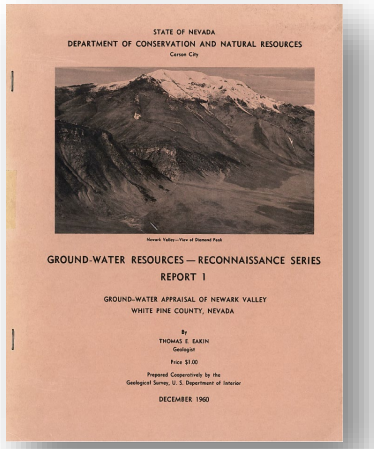
(SE Biennial Report 1944-46, 1946)

The Nevada Groundwater Program



http://water.nv.gov/bulletins.aspx

- 1945: Systematic investigation of Nevada GW began.
- 1946 - ~1976: Water Resources Bulletin Series.
- 1960 - ~1971: Groundwater Resources – Reconnaissance Series.
- Original estimates of Perennial Yield derived from these early reports.



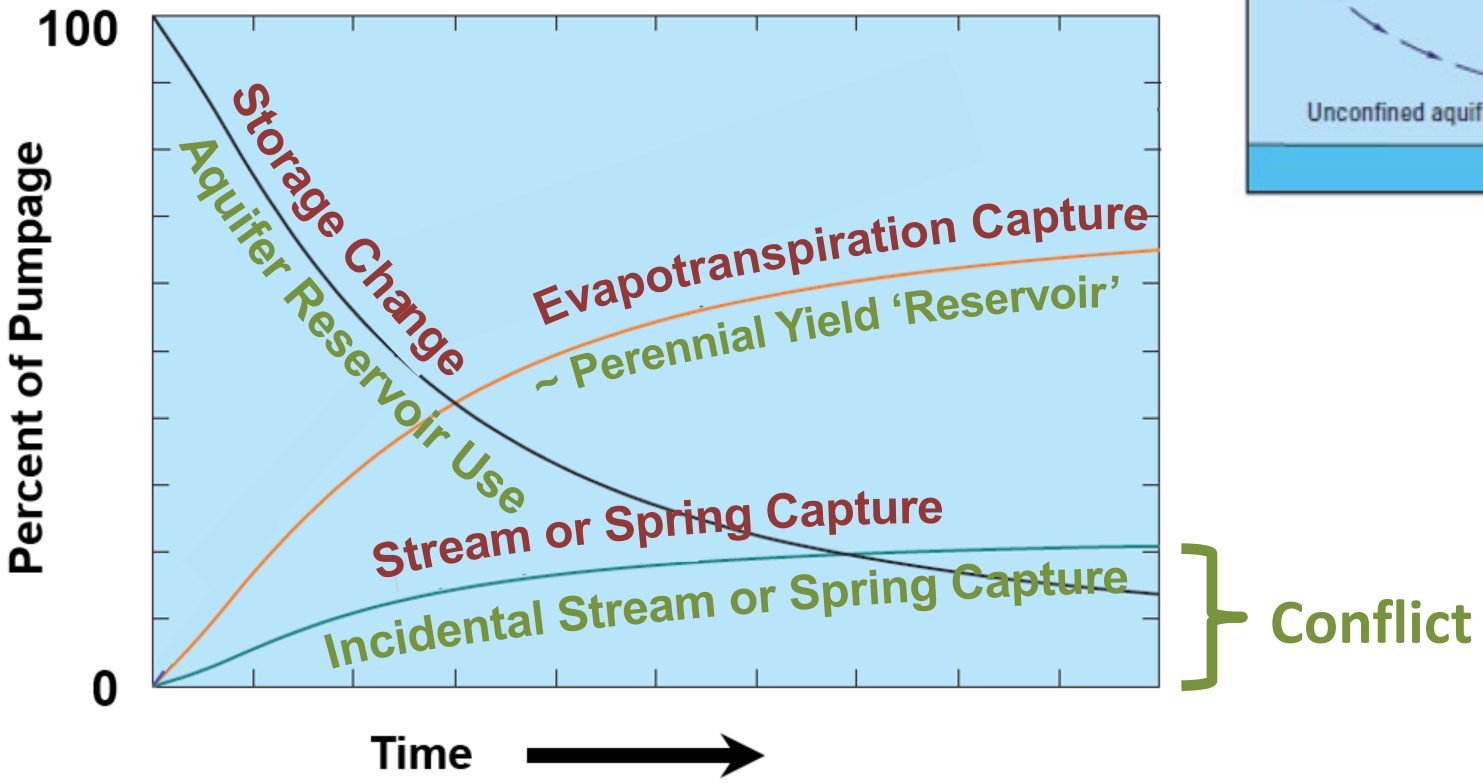
http://water.nv.gov/reconreports.aspx

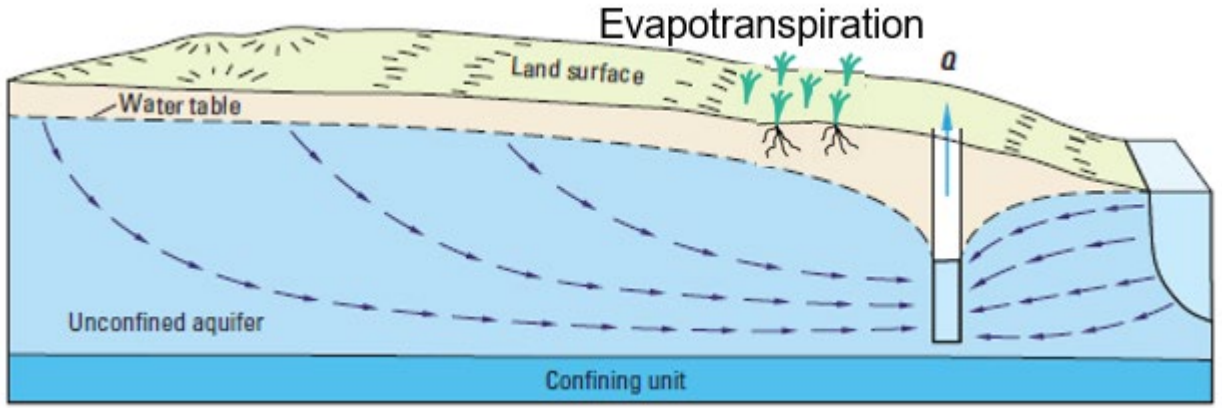
ADDITIONAL CONSIDERATIONS BEYOND PERENNIAL YIELD FOR GROUNDWATER MANAGEMENT

Limitations of Perennial Yield as Basis of GW management

Source of Water to a Well

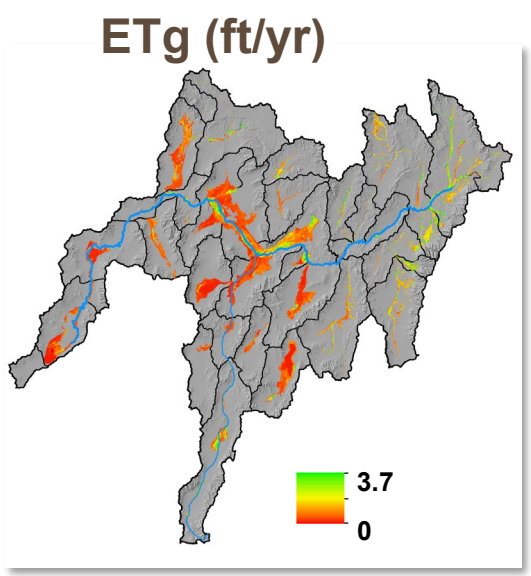
Groundwater Management Perspective

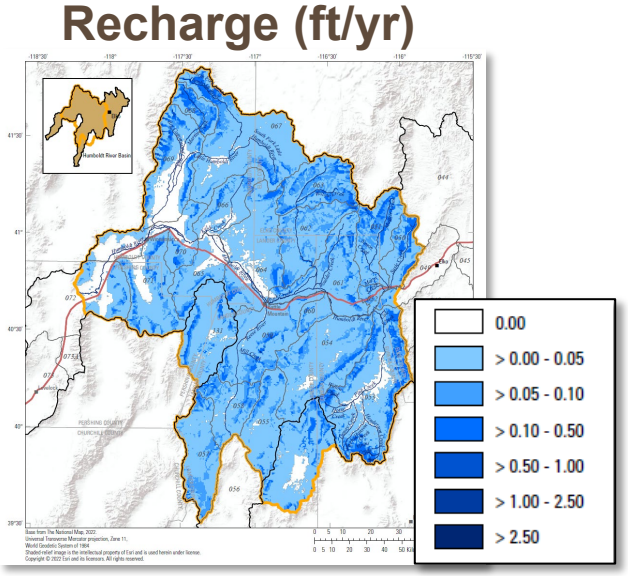


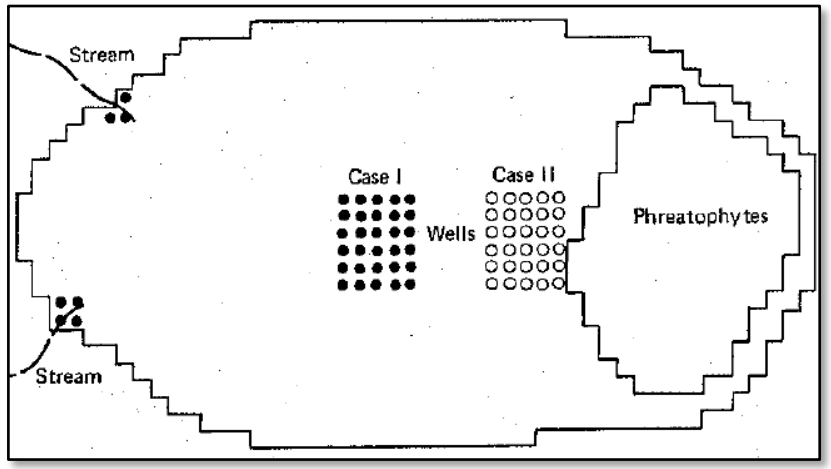


Limitations of Perennial Yield as Basis of GW management

- Perennial Yield establishes upper limit for GW development.
- To be sustainable, must know:
  - Where recharge and discharge occur.
  - Aquifer properties.
- Pumping needs to be strategically located:
  - To capture available discharge.
  - To avoid conflict with existing rights.
- Original estimates >50 years old.
  - Used old technology & methodologies







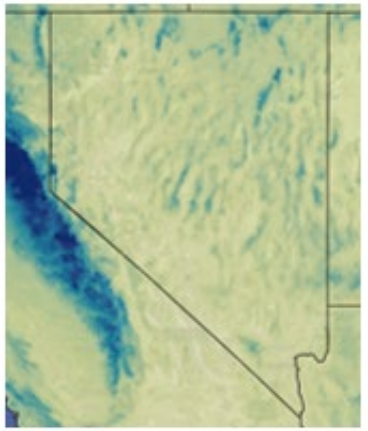
UPDATING ESTIMATES OF WATER AVAILABILITY WITH THE NEVADA WATER RESOURCES INITIATIVE

Nevada Water Resource Initiative – overview and vision

- 2020's version of the Nevada Groundwater Program.
- Use new technologies and data to update science and understanding of water resources.
- Re-estimate water budgets
- WHERE water enters and leaves our hydrographic basins.
- Develop the resources and tools for sustainable management.



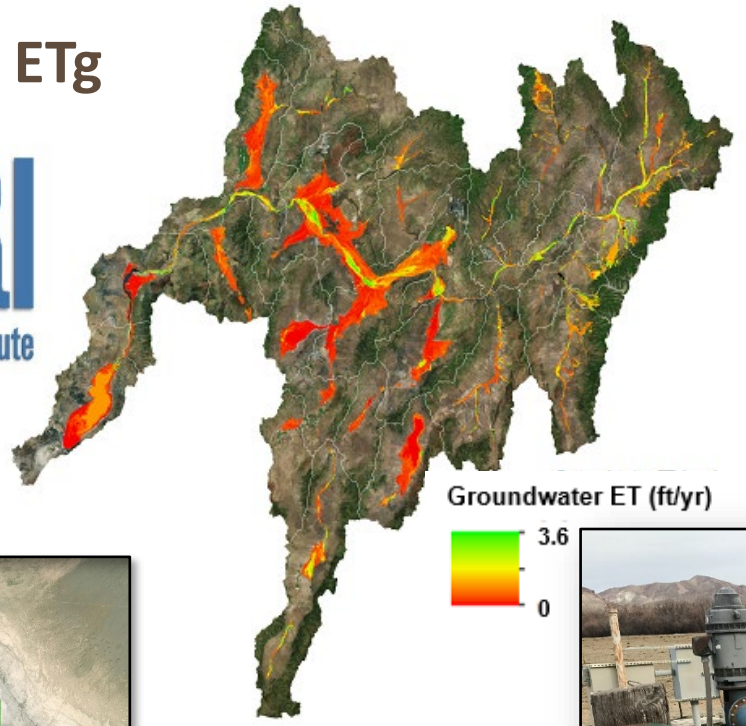




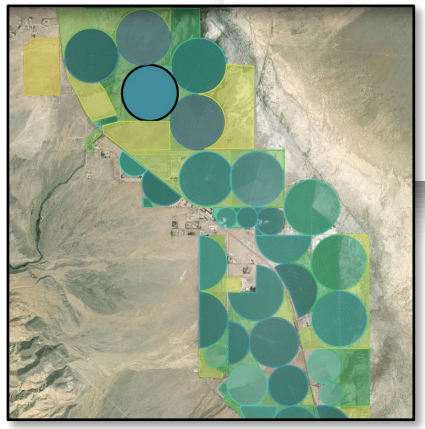
Nevada Water Resource Initiative – Components

Develop Statewide Discharge Datasets:

ETg



Desert Research Institute

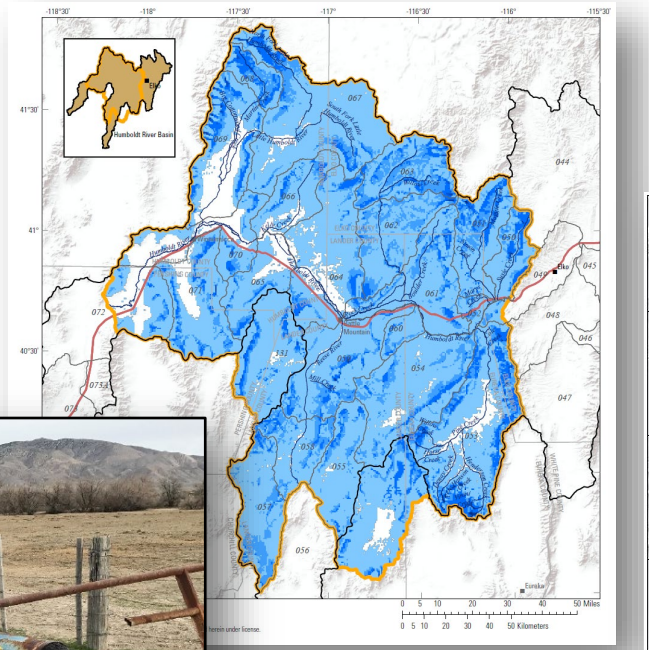


Pumping

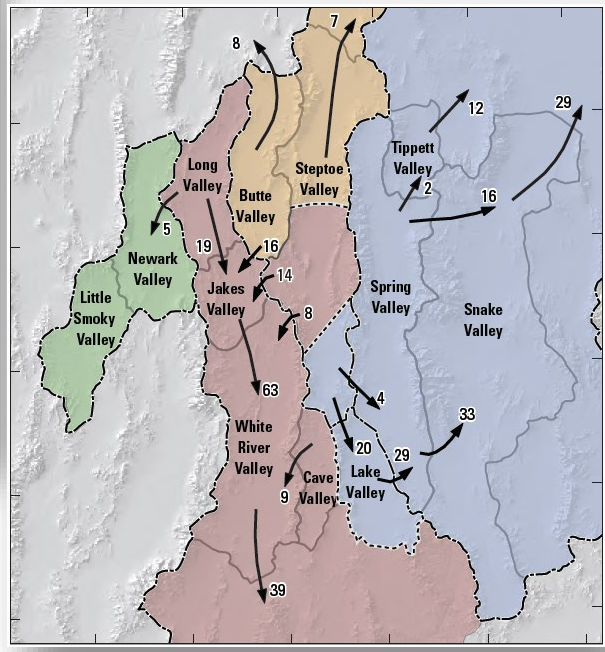
Develop Tools and Approaches for estimating:

USGS
science for a changing world

Recharge

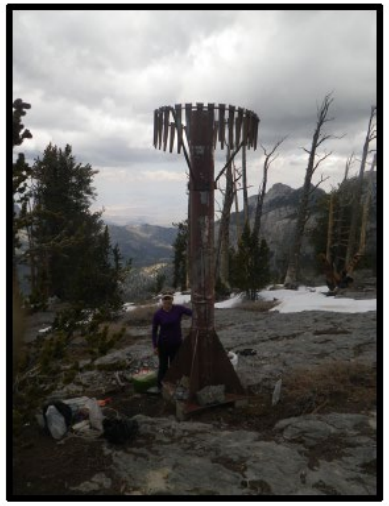


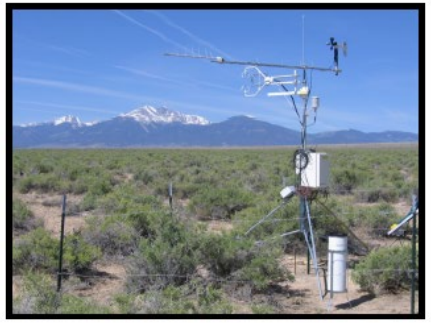
Interbasin Flow



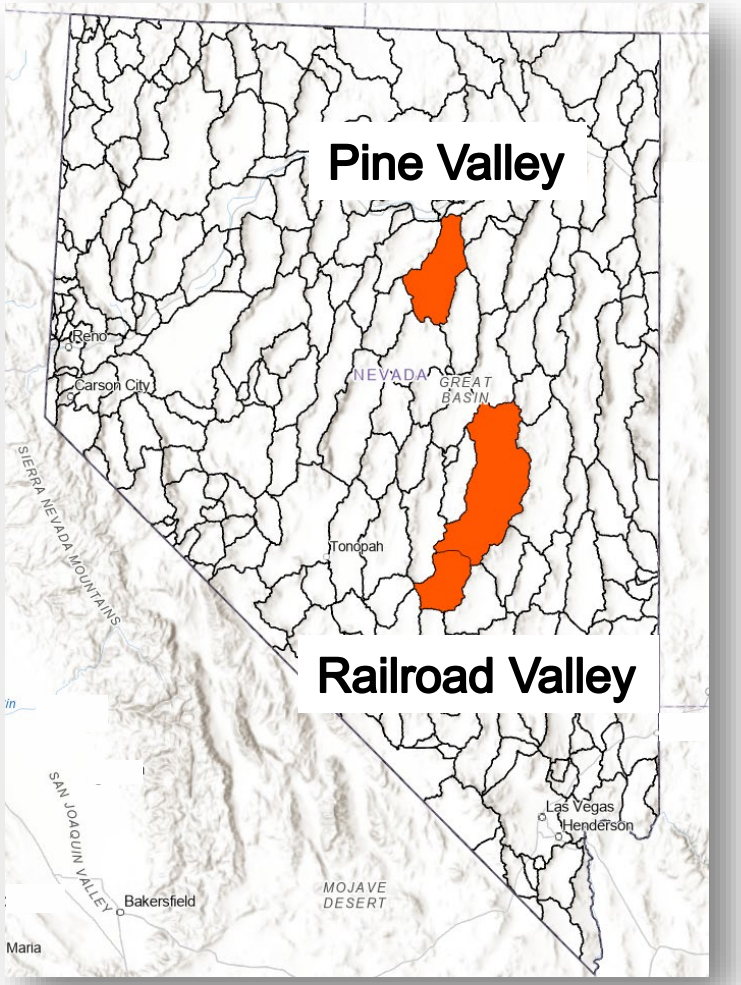
Nevada Water Resource Initiative – Components (continued)

Increased Hydrologic Monitoring





Application of Methods in Demonstration Basins



Nevada Water Resource Initiative – Summary

For Water Resource Community

- Updated science and understanding.
- New useful tools and approaches.
- Additional data and resources.
- Data needed for GW models.
- Who benefits:
  - Municipalities & Water Authorities, Mines & Industry, Consultants, Irrigators/Irrigation Districts, State & Federal Agencies, Universities & Schools, Non-Governmental Organizations
  - Public

For NDWR

- Perennial Yield will remain important constraint for GW appropriations.
  - Update of Perennial Yield when warranted.
  - Potential for increase in water availability in some basins.
- More effective management of water resources (water rights)
- Inform/Reduce existing conflict
- Conjunctive Management of GW & SW
- Sustainable Development of our Water Resources

Questions?

Contact

Kip Allander, Hydrogeologist
Division of Water Resources
Phone: 775-684-2853
Email: kallander@water.nv.gov

The Nevada Water Resources Initiative

Advancing the Science and Understanding of Nevada's Groundwater Systems

Justin Huntington & Murphy Gardner

Desert Research Institute

Justin.Huntington@dri.edu

Railroad Valley Stakeholder Meeting,
June 14, 2023

STATE ENGINEER STATE OF NEVADA

USGS science for a changing world

DRI Desert Research Institute

The Nevada Water Resources Initiative

Proposed activities

- As a first stage to a larger and long-term effort, DRI will provide data and guidance designed to make systematic statewide updates to…
  - Agricultural Consumptive Use Inventory
  - Groundwater Discharge Area and ET Updates
  - Meteorological Monitoring and ET Intercomparisons

Eagle Valley

DRI
Desert Research Institute

The Nevada Water Resources Initiative

Proposed activities

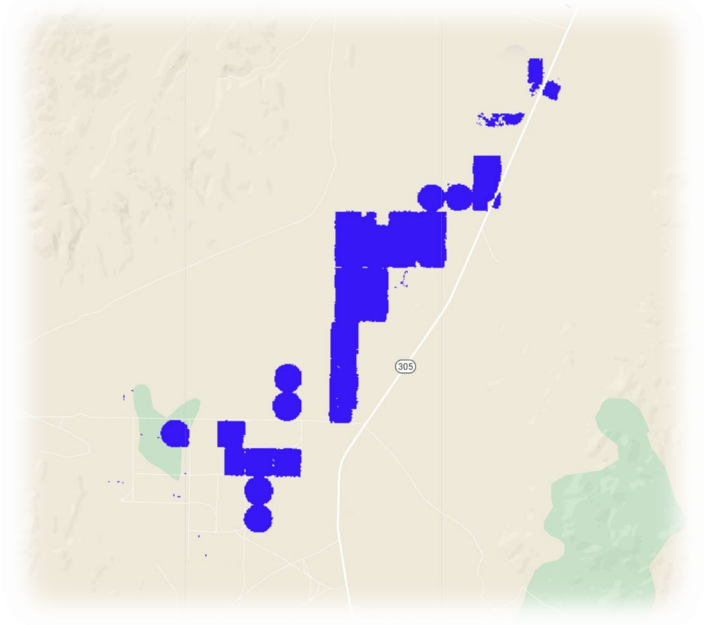
- Support USGS in developing the statewide pumping database (agricultural consumptive use)
- Collaborate with USGS on development of input datasets and methods for recharge estimation
- Assess GCM projections in precipitation, evaporative demand, and hydrologic states and fluxes
- Refine and apply techniques and datasets in “Demonstration Basins”

Snake Valley

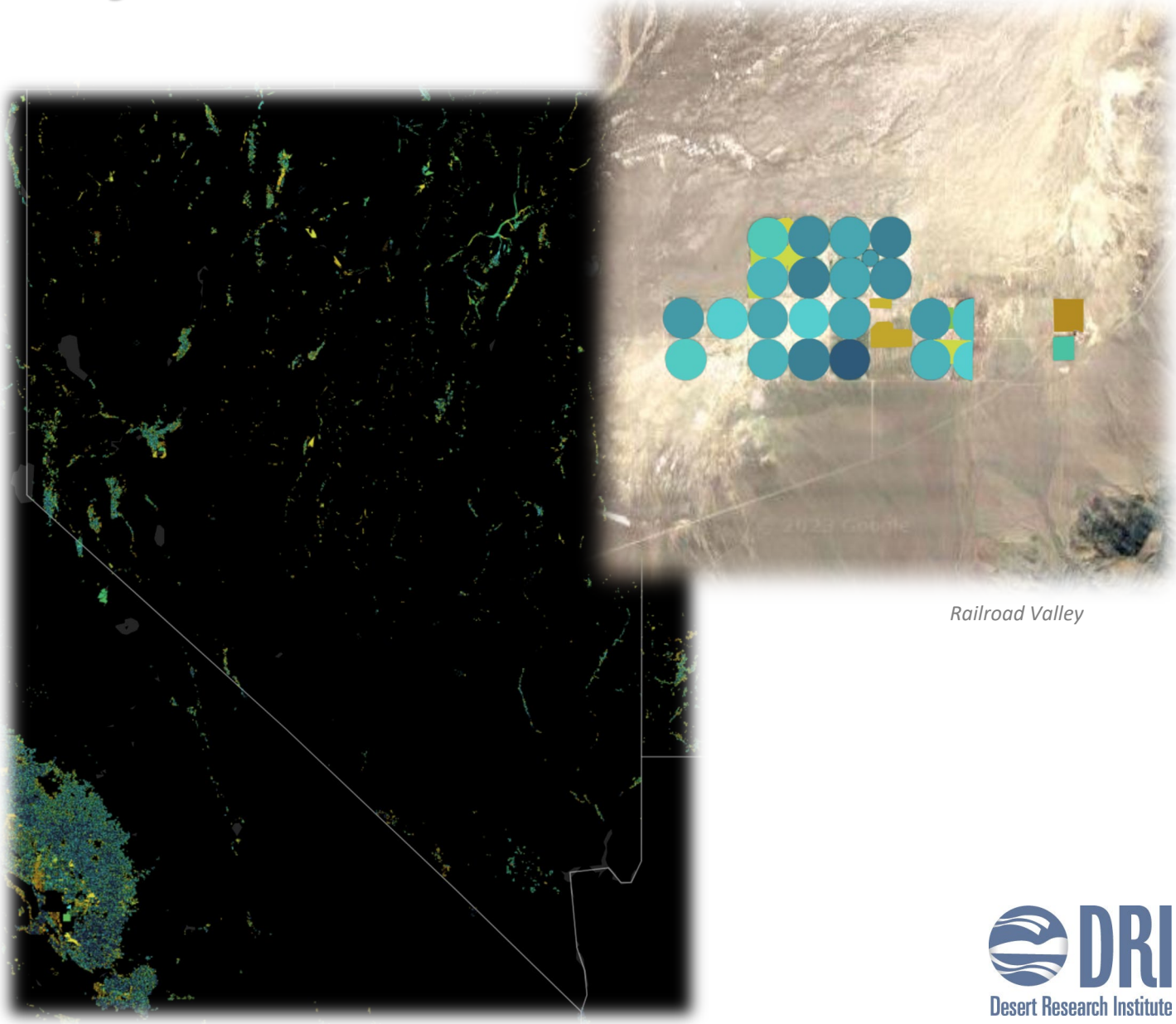
DRI
Desert Research Institute

Consumptive Use Inventory & Database

- Comprehensive database
  - Through time (Landsat archive)
  - Field boundaries
  - Irrigation Status



Middle Reese River 2020 & 1990

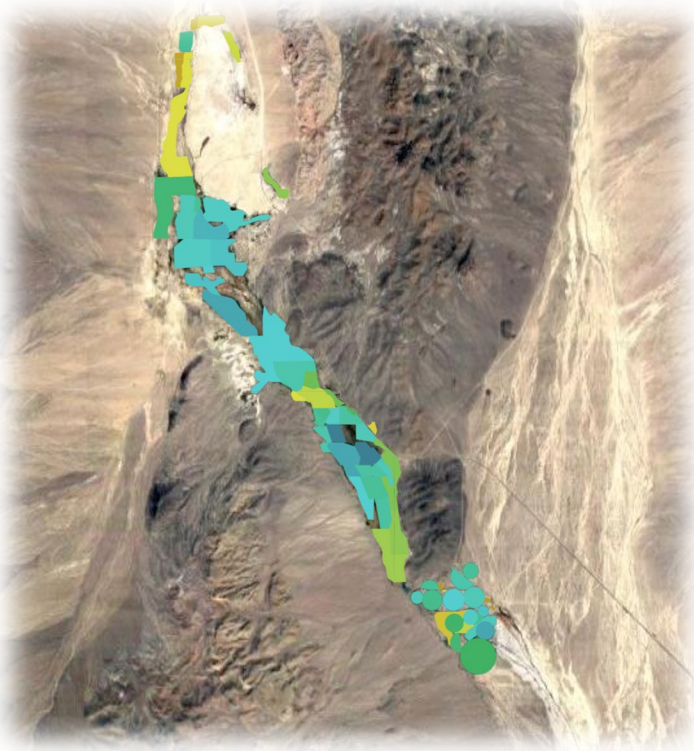


Railroad Valley

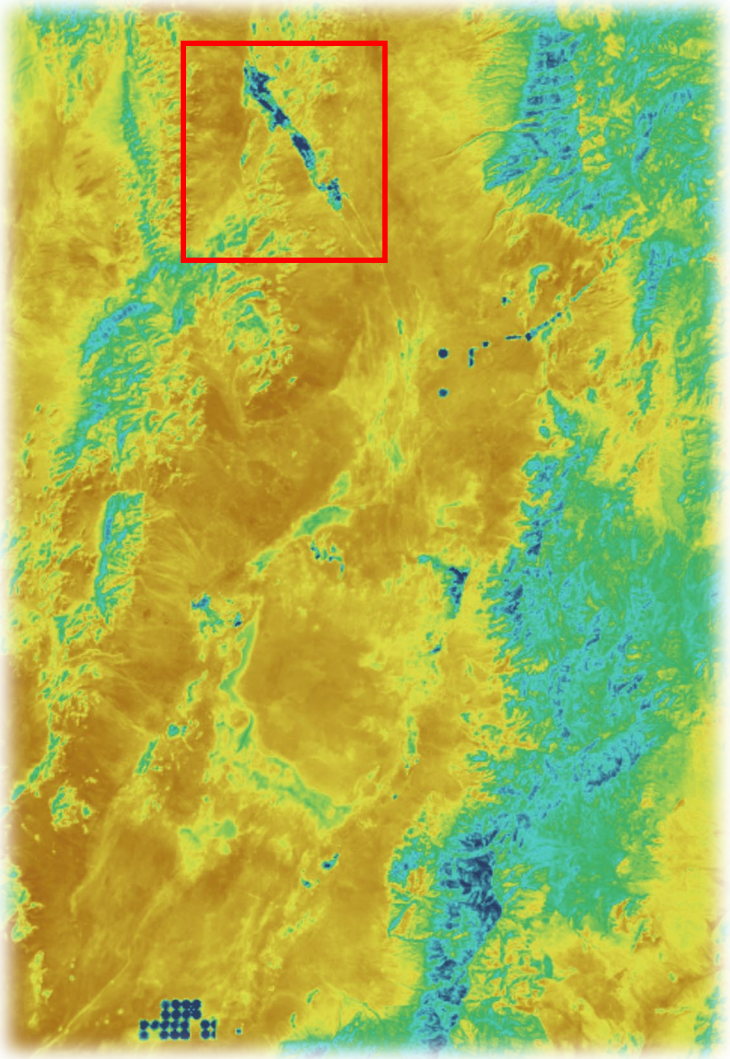
DRI
Desert Research Institute

Consumptive Use Inventory & Database

- Comprehensive database
  - Through time (Landsat archive)
  - Field boundaries
  - Irrigation status mapping
  - Irrigation system type
  - Water source mapping
  - Net ET (ET less precipitation)



Duckwater

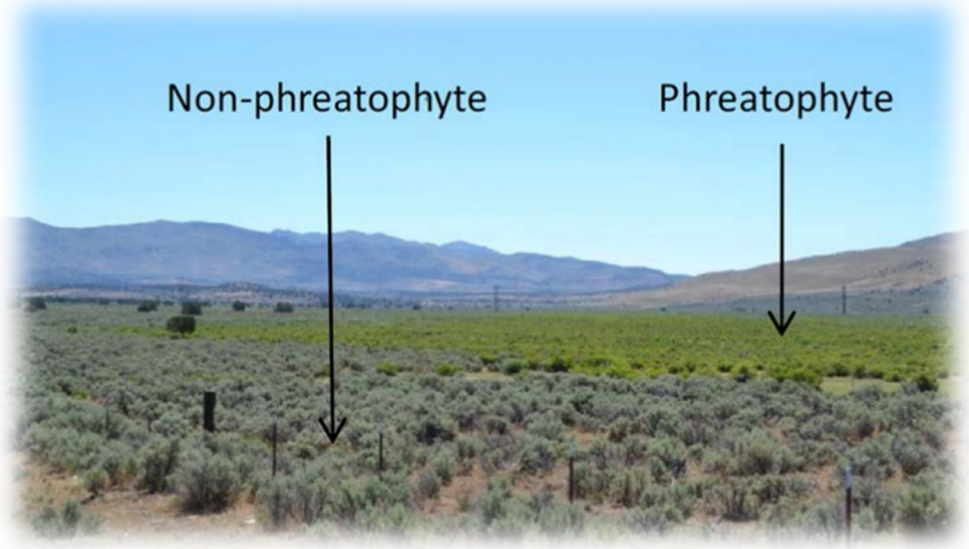


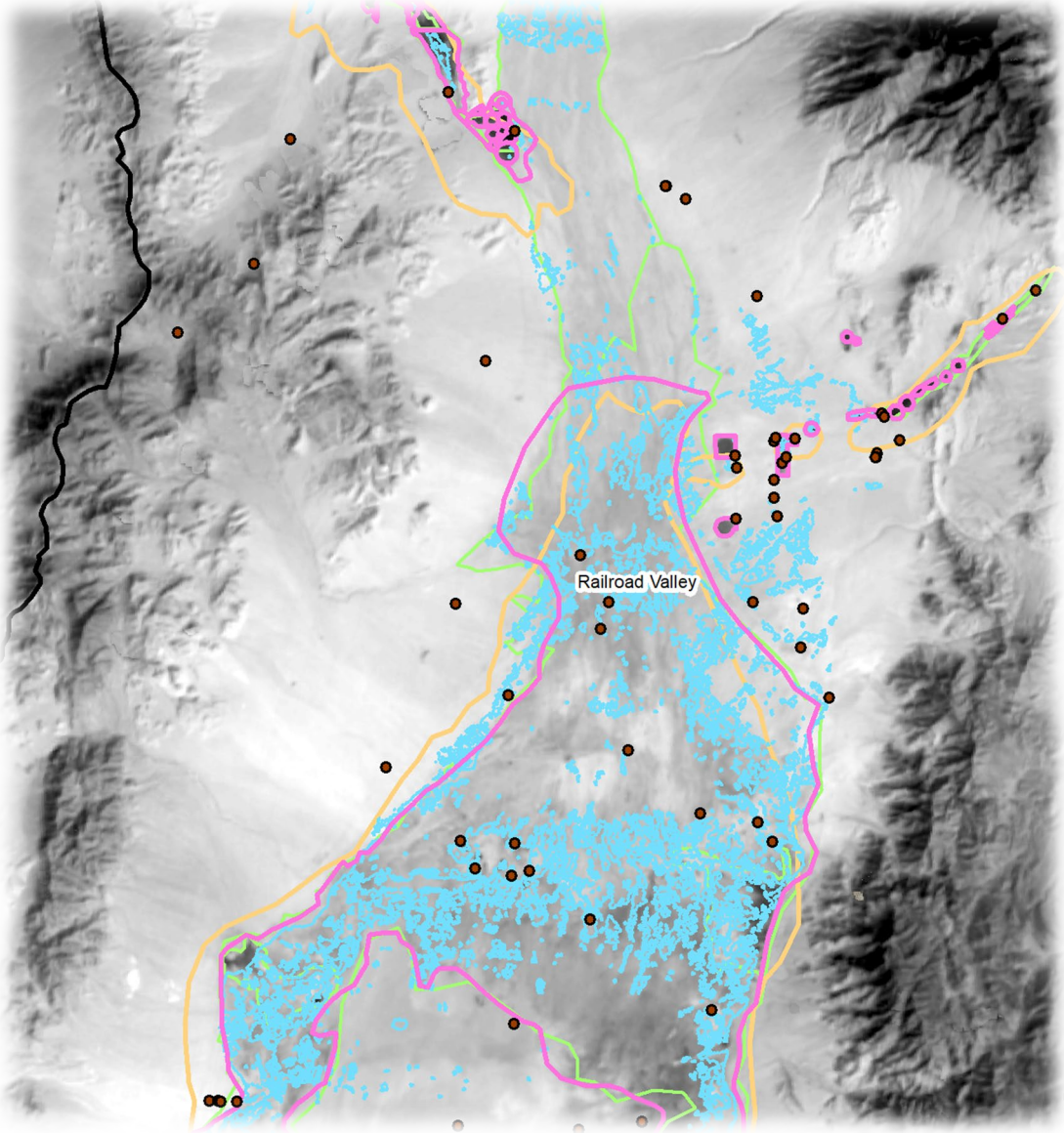
Railroad Valley

DRI
Desert Research Institute

Groundwater Discharge Database

- Comprehensive database
  - State-wide
  - Potential areas of groundwater discharge



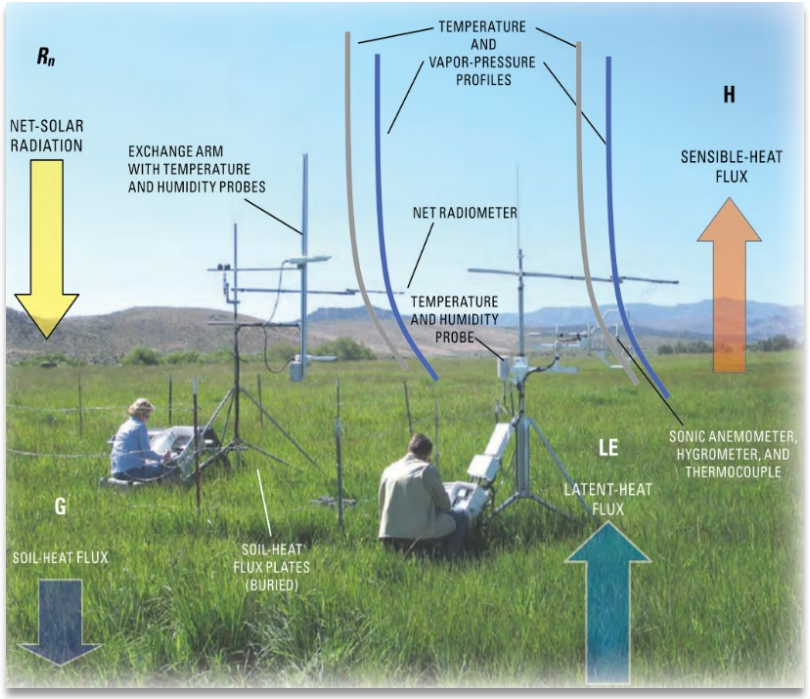


Railroad Valley

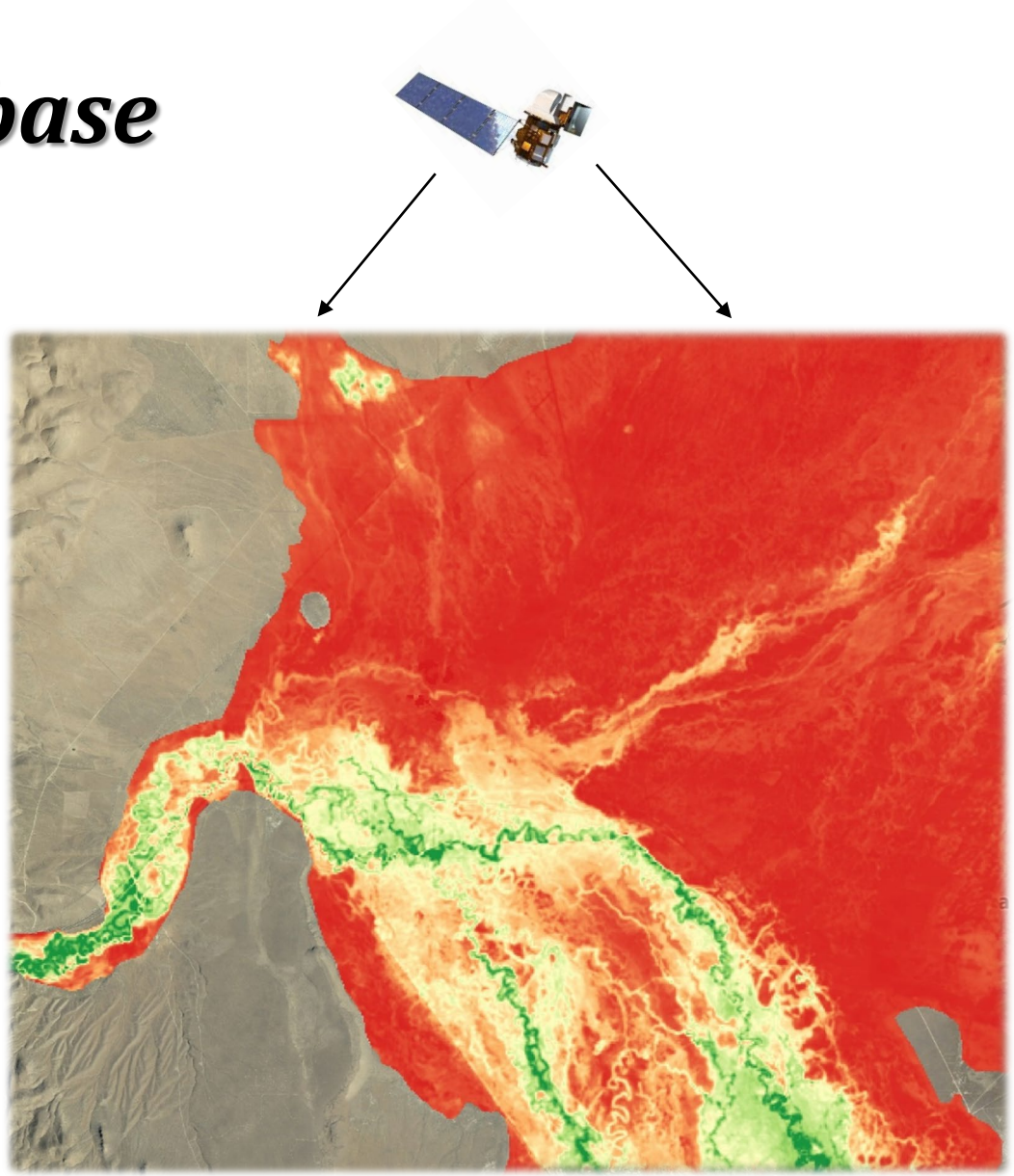
Desert Research Institute

Groundwater Discharge Database

- Comprehensive database
  - State-wide
  - Potential areas of groundwater discharge
  - Groundwater ET rates and volumes



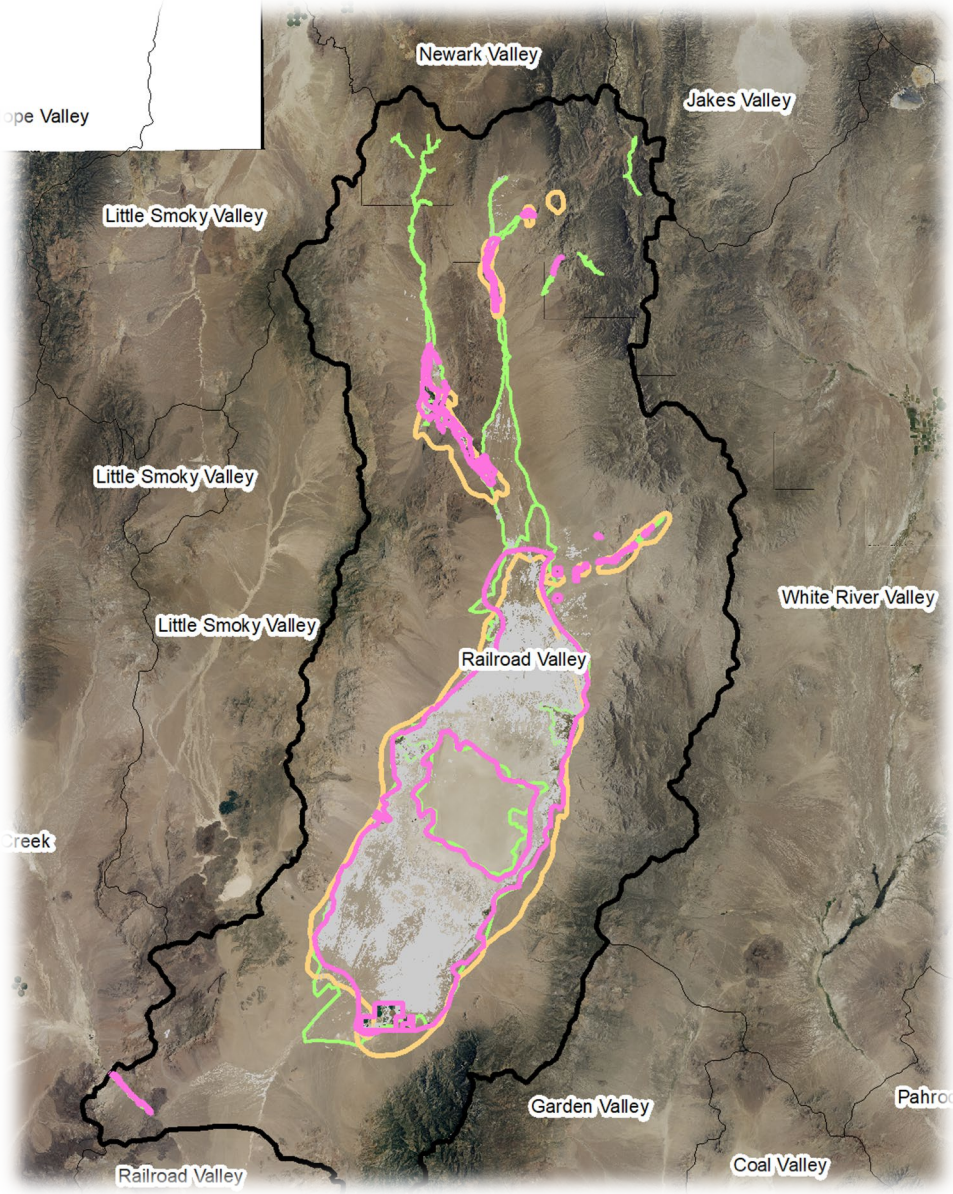
Maurer and others (2005)



DRI
Desert Research Institute

Groundwater Discharge Database

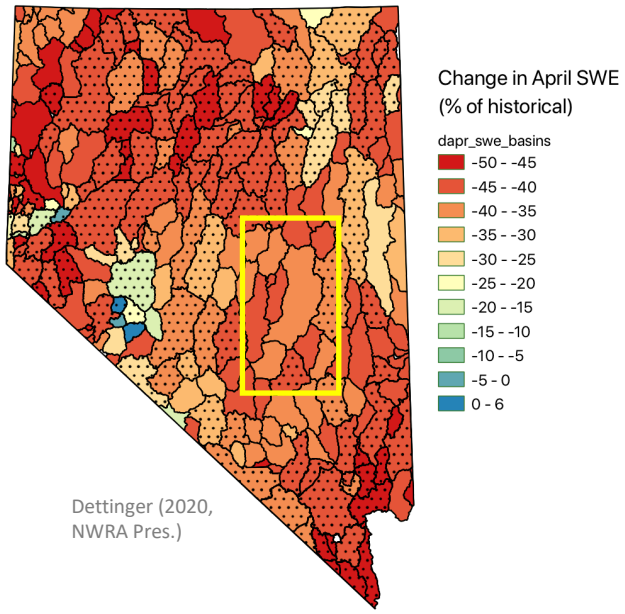
- Comprehensive database
  - State-wide
  - Potential areas of groundwater discharge
  - Groundwater ET rates and volumes
  - Comparison to micrometeorological data & previous estimates (phreatophyte & *playa discharge*)



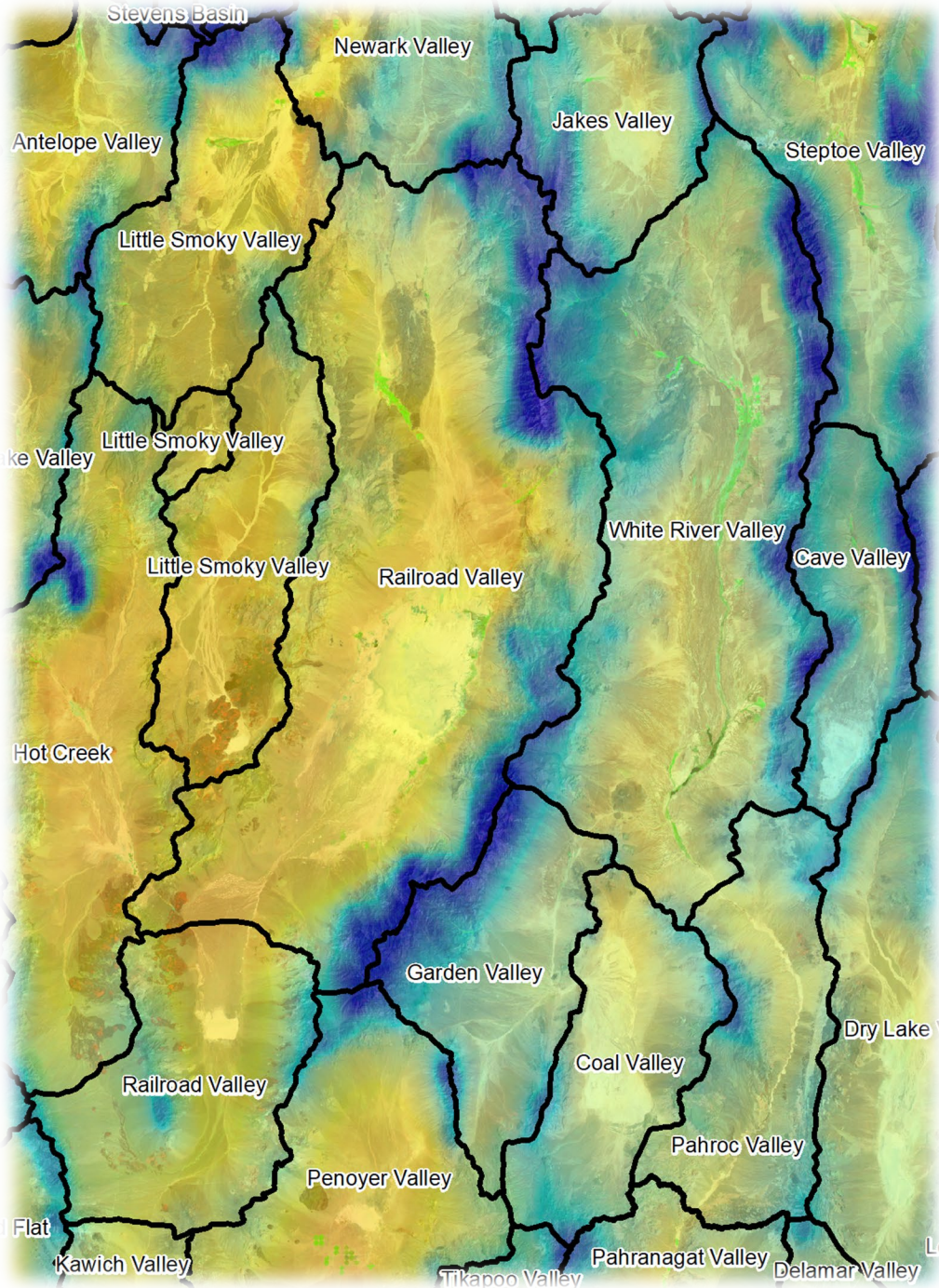
Desert Research Institute

Water Resource Evaluations

- Supporting recharge estimates, comparing to discharge, and assessing climate projection Information
  - Spatial precipitation, ET (uplands), water demand demand, vegetation, geology, soils, stream properties information
  - Global Climate Model (GCM) projection information to assess potential changes in precipitation, evaporative demand, and hydrologic states and fluxes



Dettinger (2020, NWRA Pres.)



NWRI – DRI Activity Summary

- Support development of historical pumping database (Agricultural consumptive use inventory)
  - Agricultural water use methods → document toolbox
- Groundwater ET database
  - Groundwater ET methods → document toolbox
- Meteorological monitoring & data collection
- Water resource evaluations & GCM projections
- “Demonstration Basins”
  - Multiple teams, several projects
  - Timeline, Spring 2023 – CY2026

The Nevada Water Resources Initiative

Advancing the Science and Understanding of Nevada's Groundwater Systems

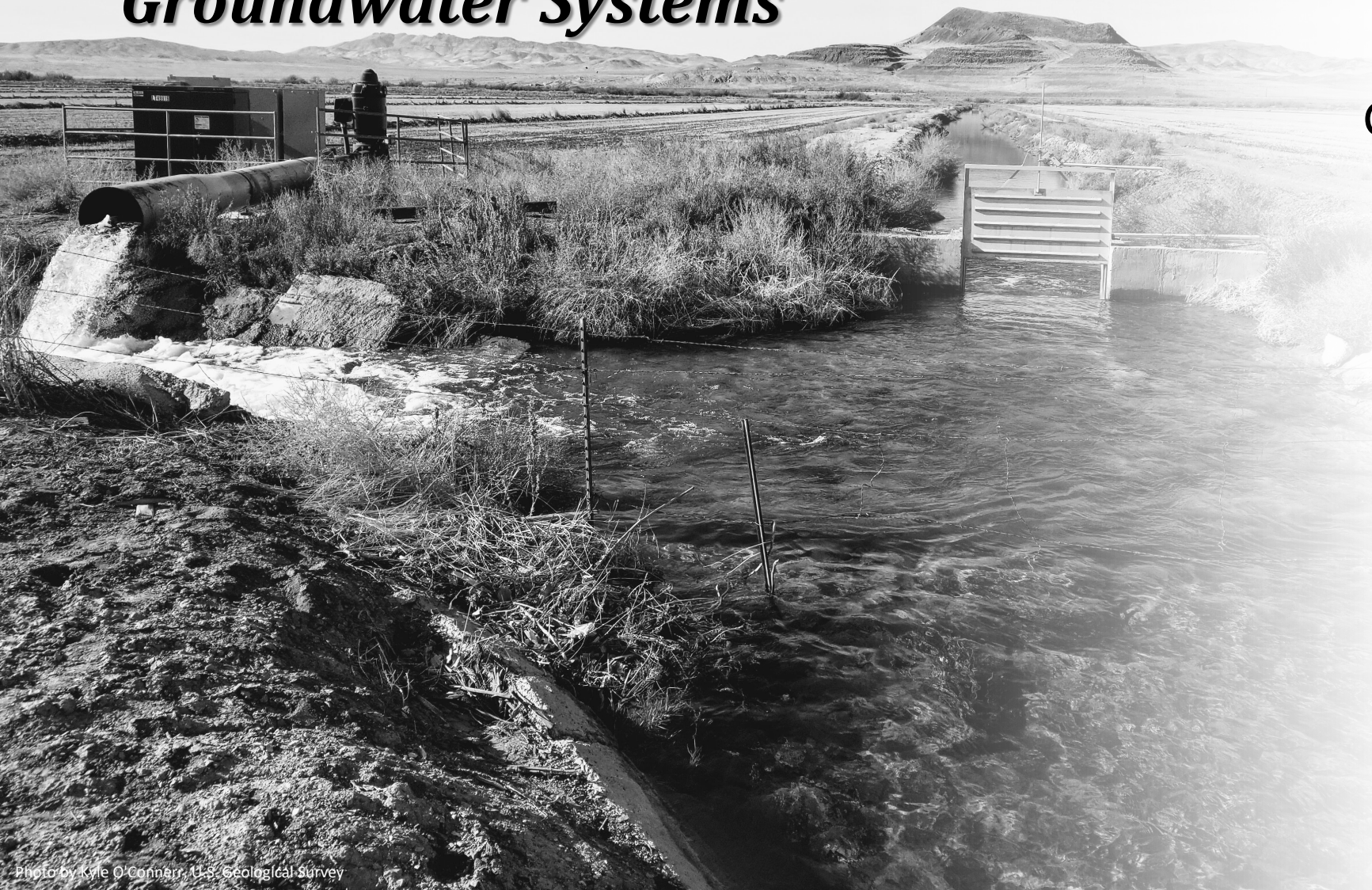


Photo by Kyle O'Connerr, U.S. Geological Survey

Gwen Davies & Phil Gardner

US Geological Survey

Nevada Water Science Center

gdavies@usgs.gov

pgardner@usgs.gov

Railroad Valley stakeholder's meeting
June 14th, 2023
Currant, NV

STATE ENGINEER STATE OF NEVADA

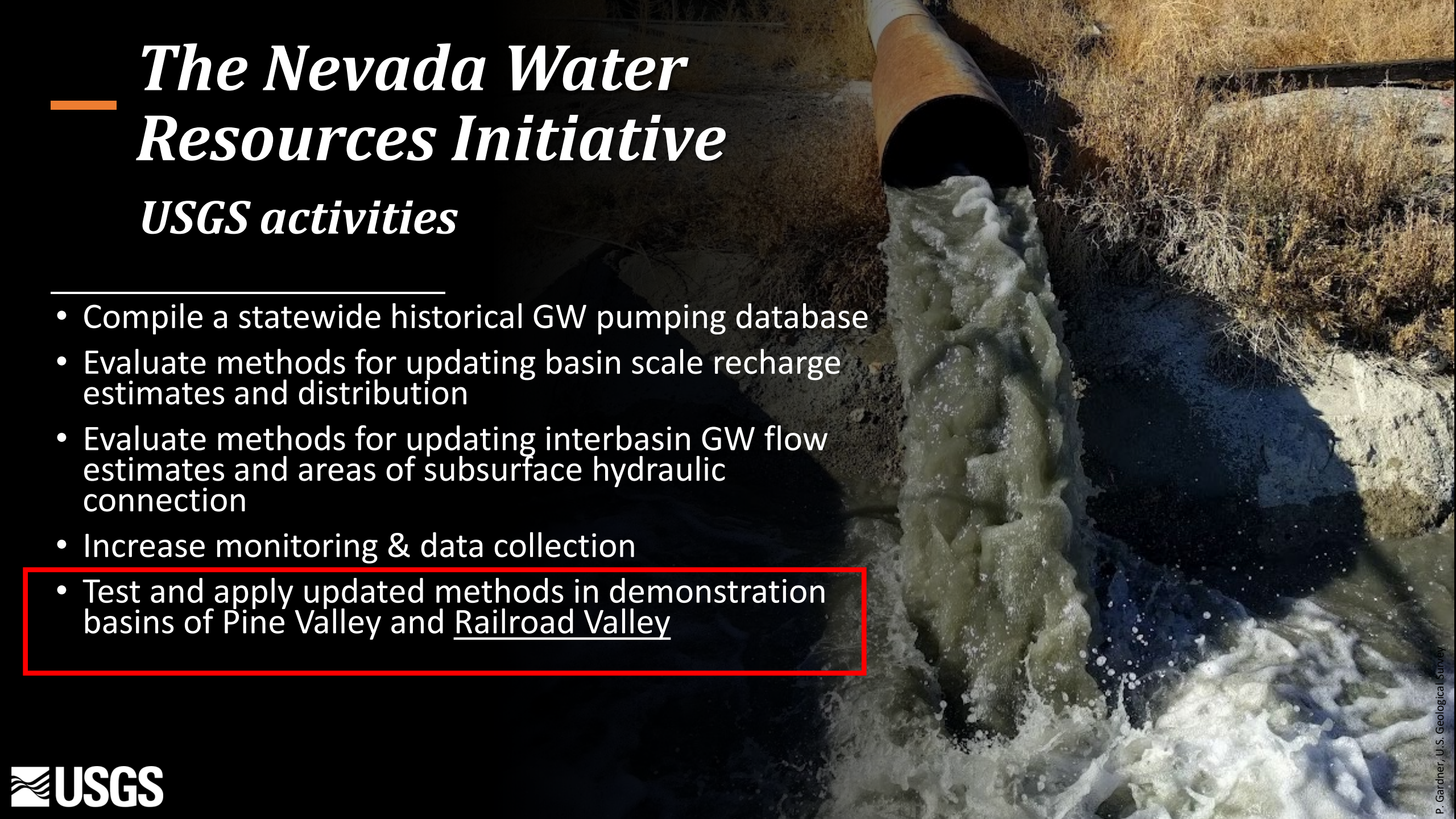
USGS science for a changing world

DRI Desert Research Institute

The Nevada Water Resources Initiative

USGS activities

- Compile a statewide historical GW pumping database
- Evaluate methods for updating basin scale recharge estimates and distribution
- Evaluate methods for updating interbasin GW flow estimates and areas of subsurface hydraulic connection
- Increase monitoring & data collection
- Test and apply updated methods in demonstration basins of Pine Valley and Railroad Valley

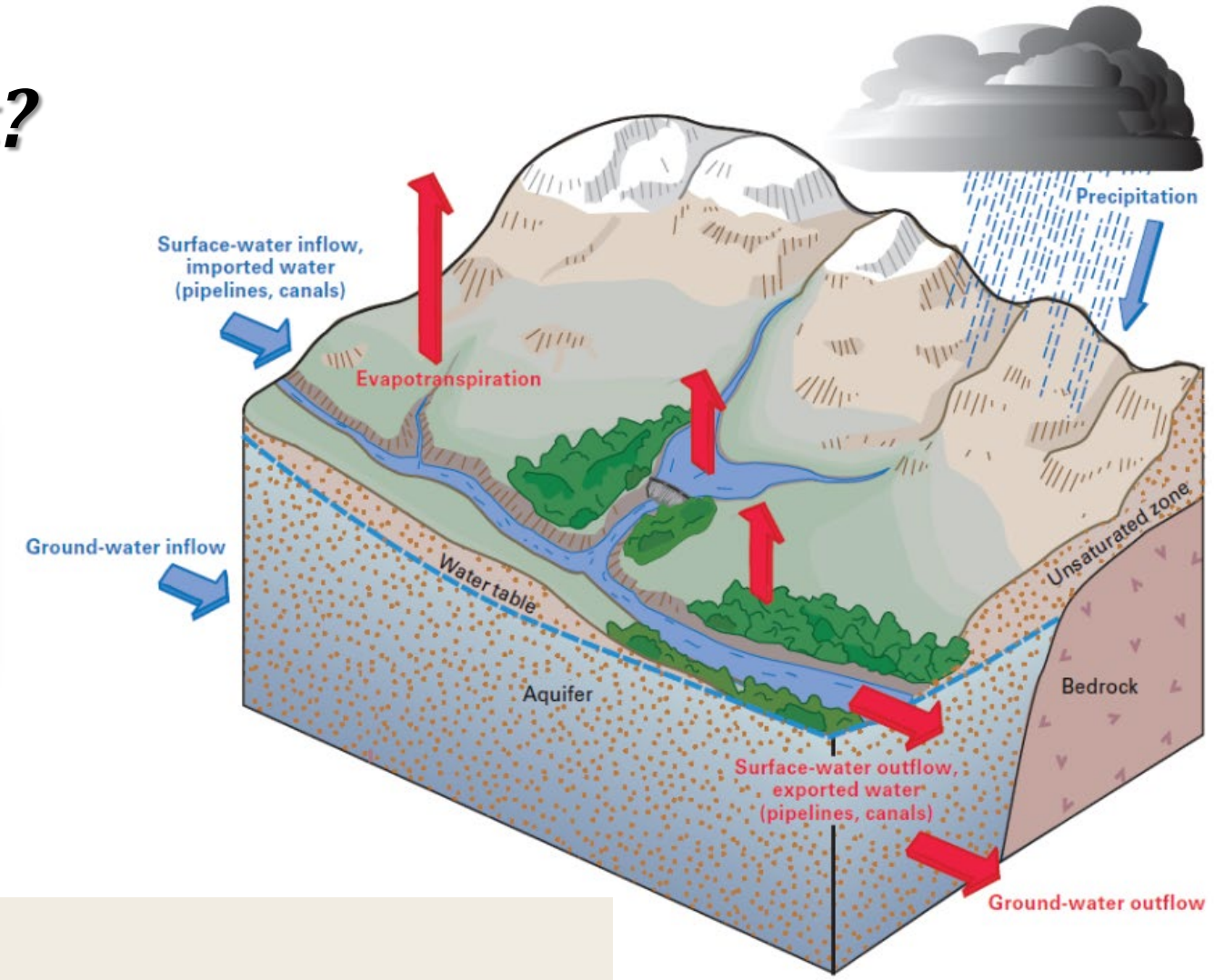


P. Gardner, U.S. Geological Survey

USGS

What is a water budget?

$$P + Q_{in} = ET + \Delta S + Q_{out}$$



where

P	is precipitation,
Q_{in}	is water flow into the watershed,
ET	is evapotranspiration (the sum of evaporation from soils, surface-water bodies, and plants),
ΔS	is change in water storage,

and

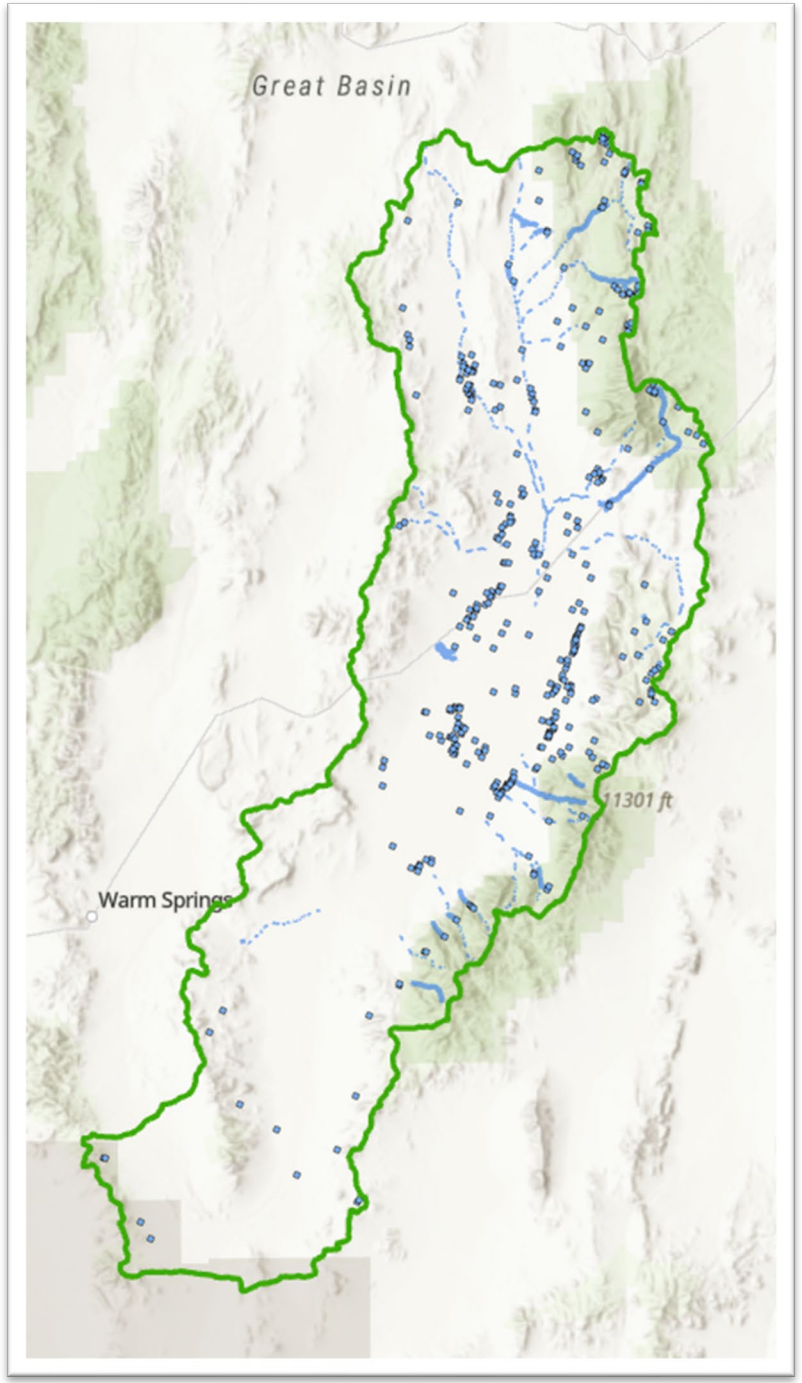
Q_{out}	is water flow out of the watershed.

Healy and others (2007)

Demonstration basin – Railroad Valley

$$P + Q_{in} = ET + \Delta S + Q_{out}$$

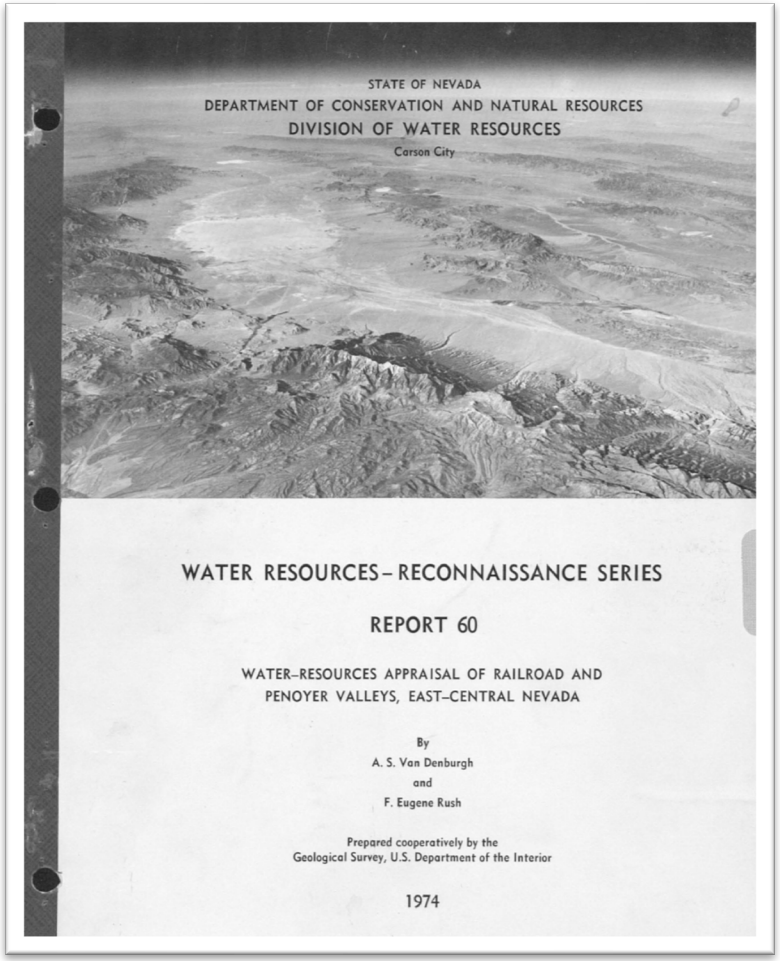
Conceptual model



Demonstration basin – Railroad Valley

USGS Objectives:

1. Estimate water budgets in Railroad Valley for a 3-year period, from 2024 to 2026.
2. Develop conceptual model for GW system and generate water table map(s).
3. Characterize trends of ground and surface water resources, earliest period of record to 2026.
4. Publish data in summary report in 4th year of the study in 2027.


STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
Carson City

WATER RESOURCES–RECONNAISSANCE SERIES

REPORT 60

WATER-RESOURCES APPRAISAL OF RAILROAD AND PENOYER VALLEYS, EAST-CENTRAL NEVADA

By
A. S. Van Denburgh
and
F. Eugene Rush

Prepared cooperatively by the
Geological Survey, U.S. Department of the Interior

1974

NDWR original perennial yield of 77,800 acre/yr (Van Denburgh and Rush, 1974)

USGS

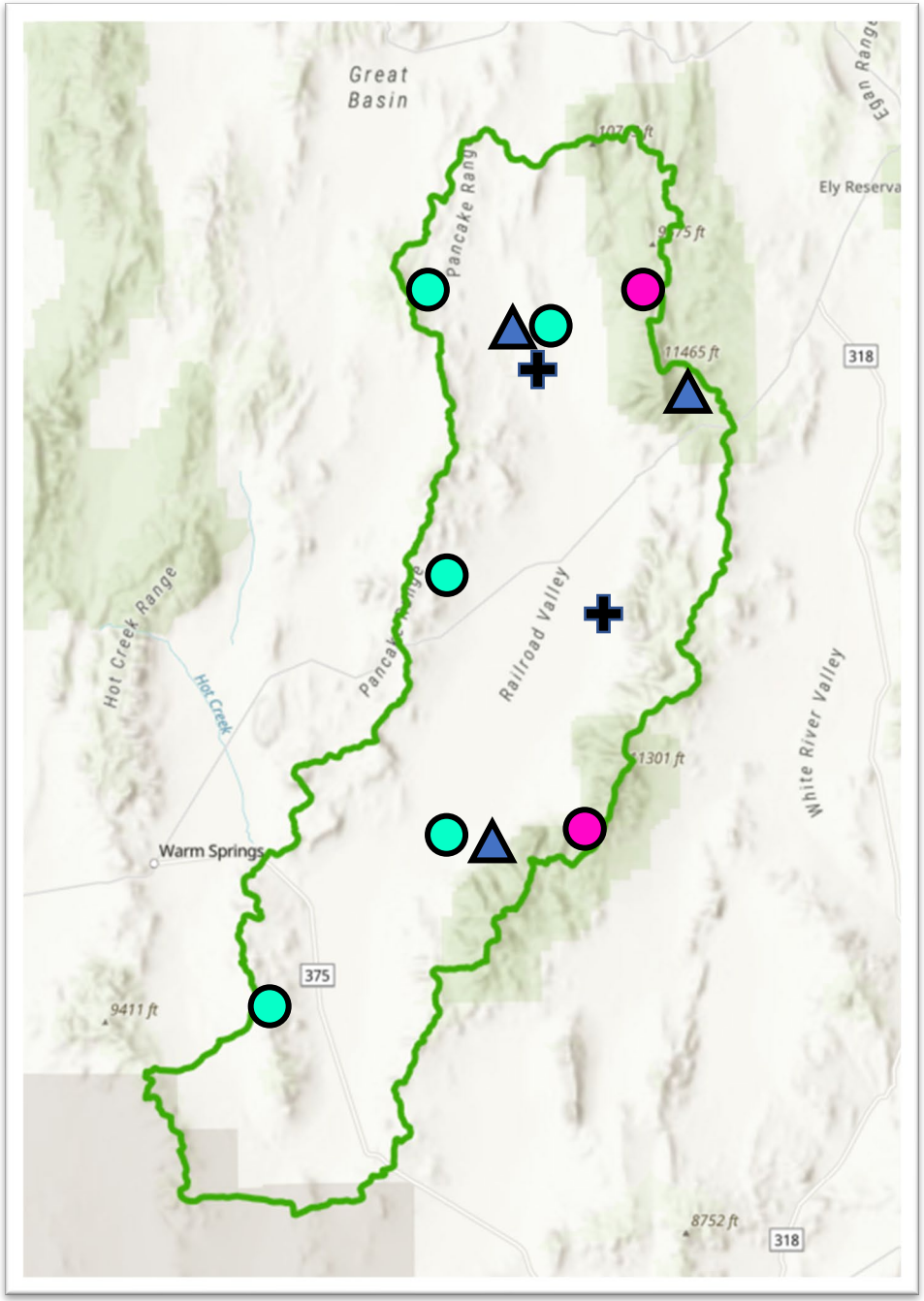
Demonstration basin – Railroad Valley

USGS Data Collection:

- Surface water in/out
  - -Minor surface inflow into valley
  - -No surface water outflow
  - ▲ Continuous flow data:
    - Little Currant Creek, Big Creek, Big Springs
- Precipitation
  - ● Weighing gage w/ heat source
  - ● Bulk gage
- Water chemistry
  - ✚ Discrete sampling

Example bulk precip gage, photo USGS

Example weighing precip gage, photo G. Davies



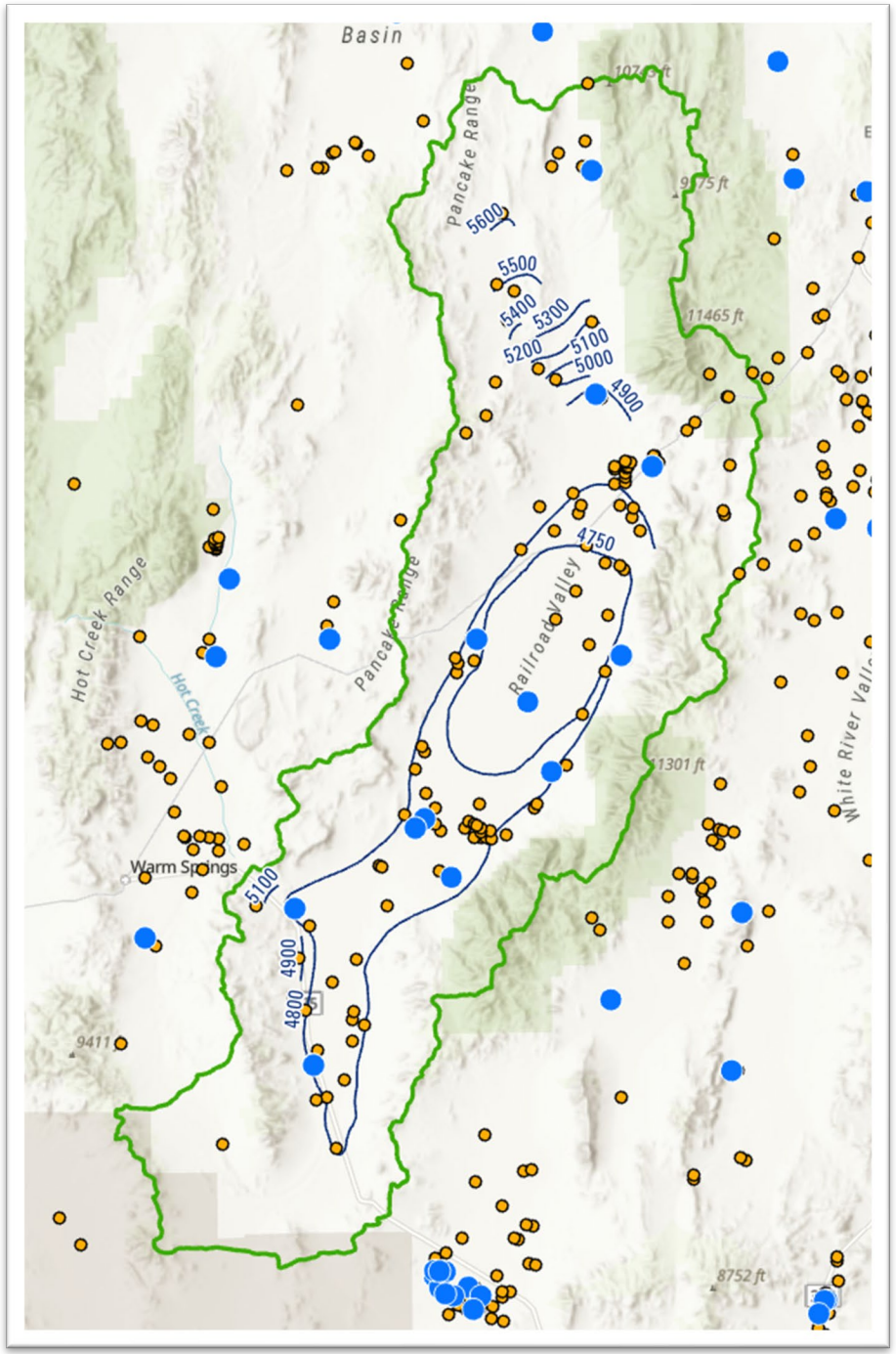
USGS

Demonstration basin – Railroad Valley

USGS Data Collection:

- Groundwater in/out
  - Measure water-levels
  - Make water-table maps
  - Characterize treads

- Currently, only 11 wells measured routinely
- Measure 15-25 wells quarterly
- Measure 40+ wells 1-2 time during study

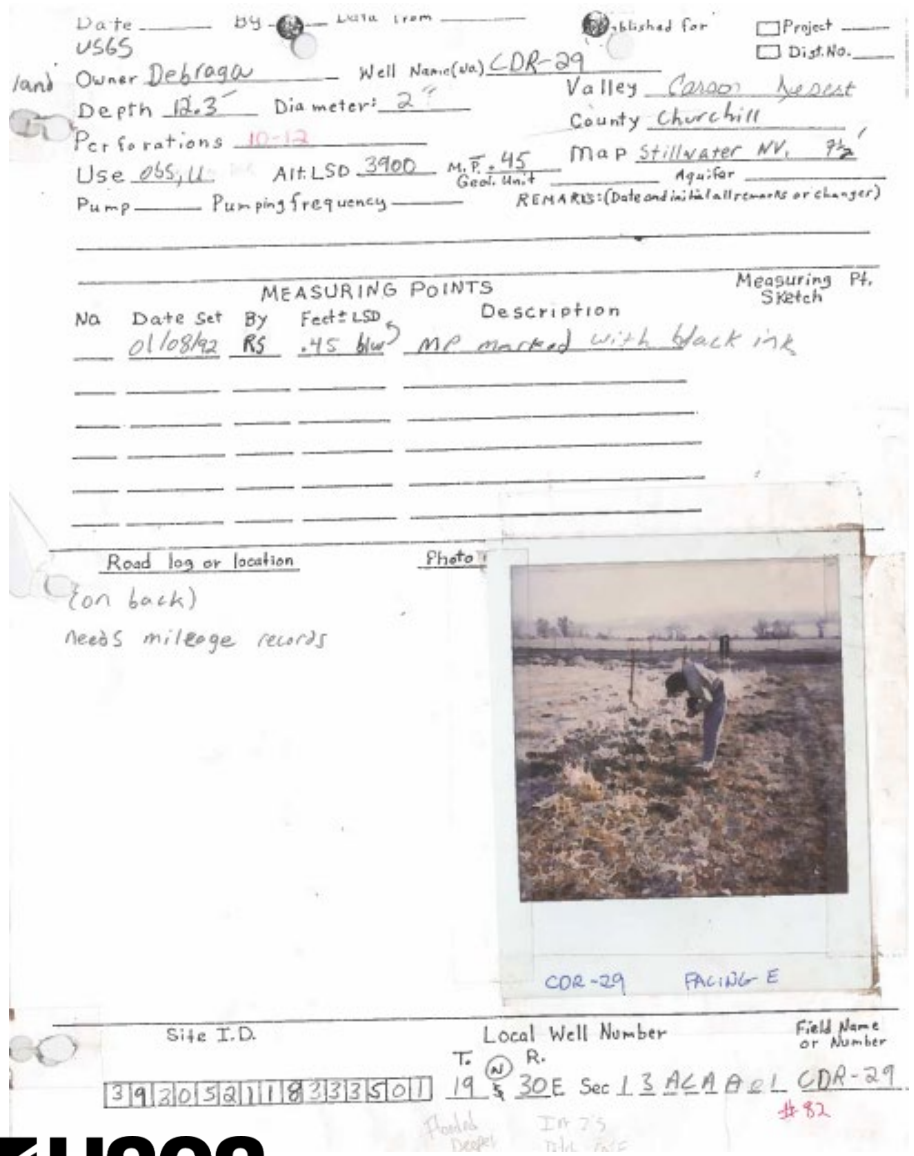


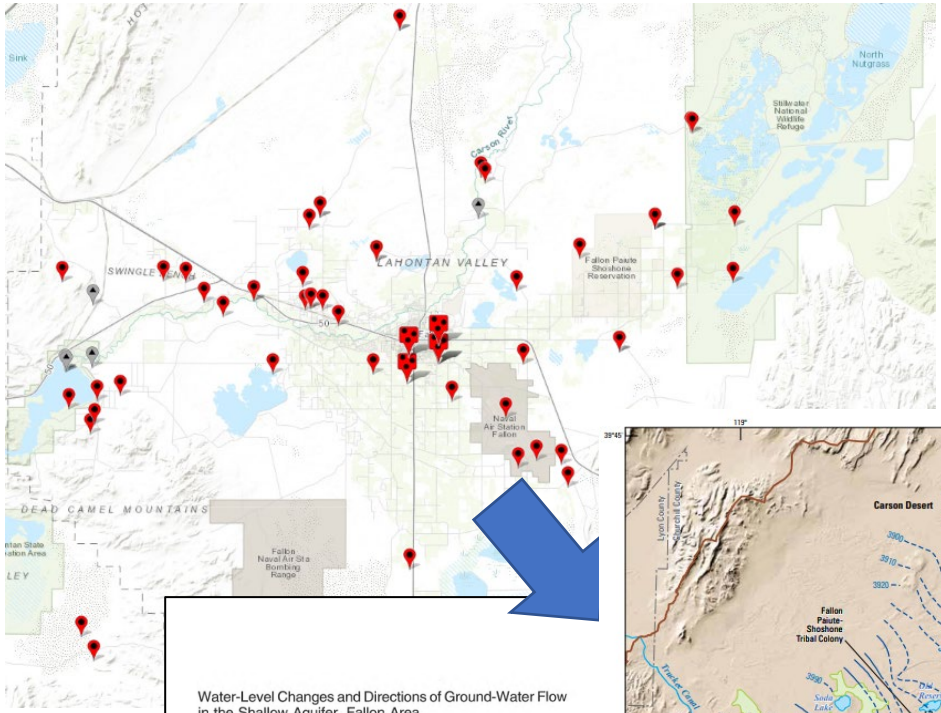
Active GW monitoring

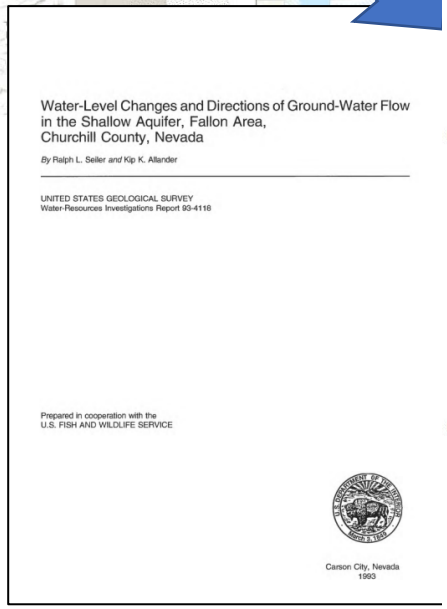
Well location from NDWR well database

Water-level contours from Lopes and others, 2006 (digitized from Bedinger and others, 1984)

Example of GW data collection and use: Lahontan Valley


Date ____ By ____ Data from ____ Published for ☐ Project ☐ Dist. No.
USGS
Owner Debraga Well Name(No.) CDR-29
land
Depth 12.3' Diameter 2" Valley Carson Desert
County Churchill
Perforations 10-12
Use obs, U Alt. LSD 3900 M.P. +45 Geol. Unit Map Stillwater NW, NE Aquifer
Pump ____ Pumping Frequency ____ REMARKS: (Date and initial all remarks or changes)
MEASURING POINTS
No Date Set By Feet ± LSD Description Measuring Pt. Sketch
01/08/92 RS .45 blw MP marked with black ink
Road log or location Photo
(on back)
needs mileage records
COR-29 FACING E
Site I.D. Local Well Number Field Name or Number
T. 19 N R. 30E Sec 13 ACAABL CDR-29
#82



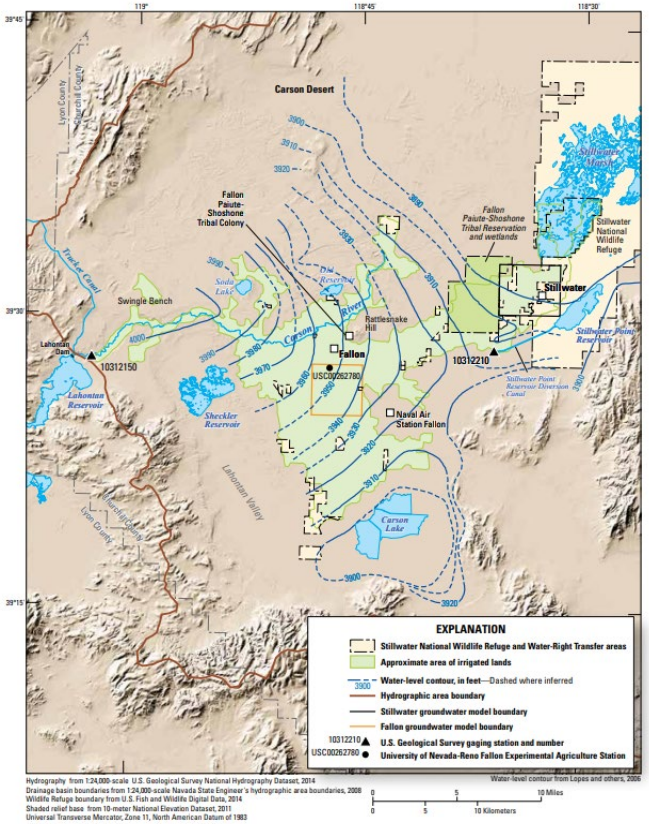

Water-Level Changes and Directions of Ground-Water Flow in the Shallow Aquifer, Fallon Area, Churchill County, Nevada

By Ralph L. Seiler and Kip K. Allander

UNITED STATES GEOLOGICAL SURVEY
Water-Resources Investigations Report 93-4116

Prepared in cooperation with the U.S. FISH AND WILDLIFE SERVICE

Carson City, Nevada
1993



Example of GW measurement to publication of water-table map (Seiler and Allander, 1992).

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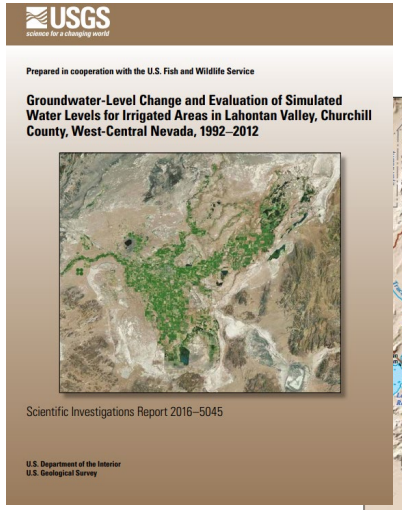
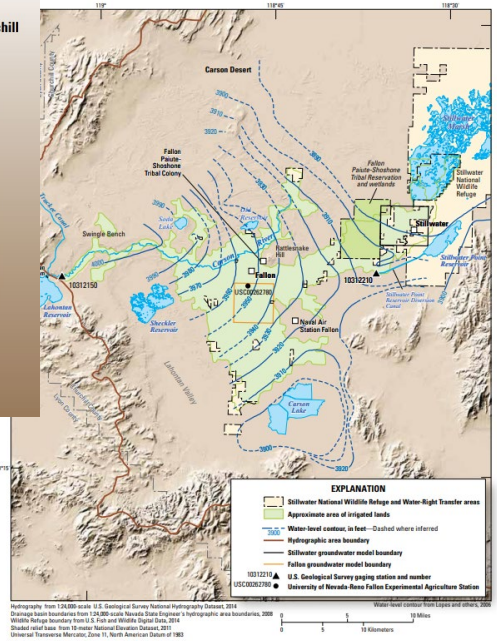
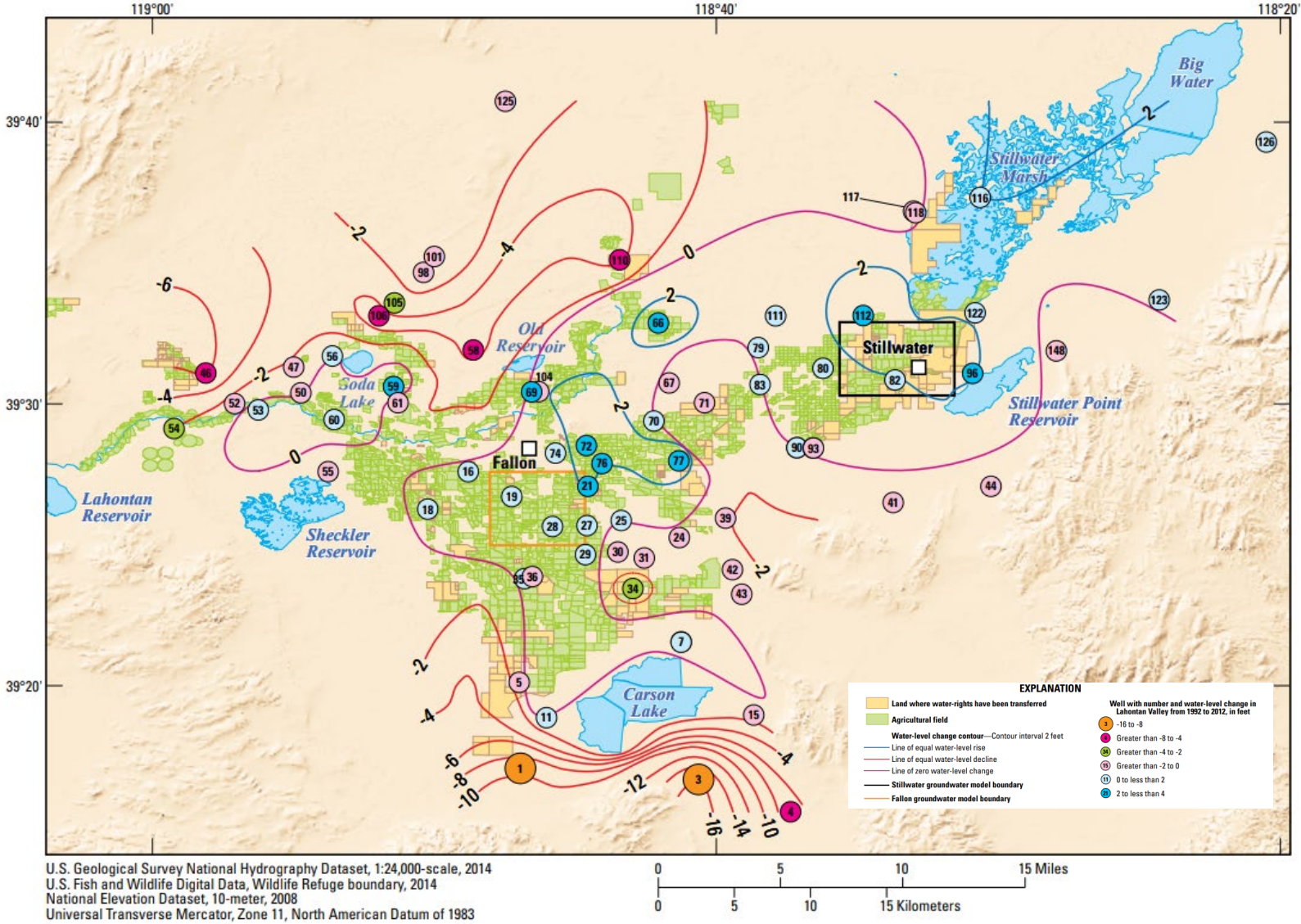
Example of GW data analysis: Lahontan Valley





- Recreate water-table map in 2012
- We used the difference between 1992 and 2012 maps to create a water-level change map (Smith and others, 2015)



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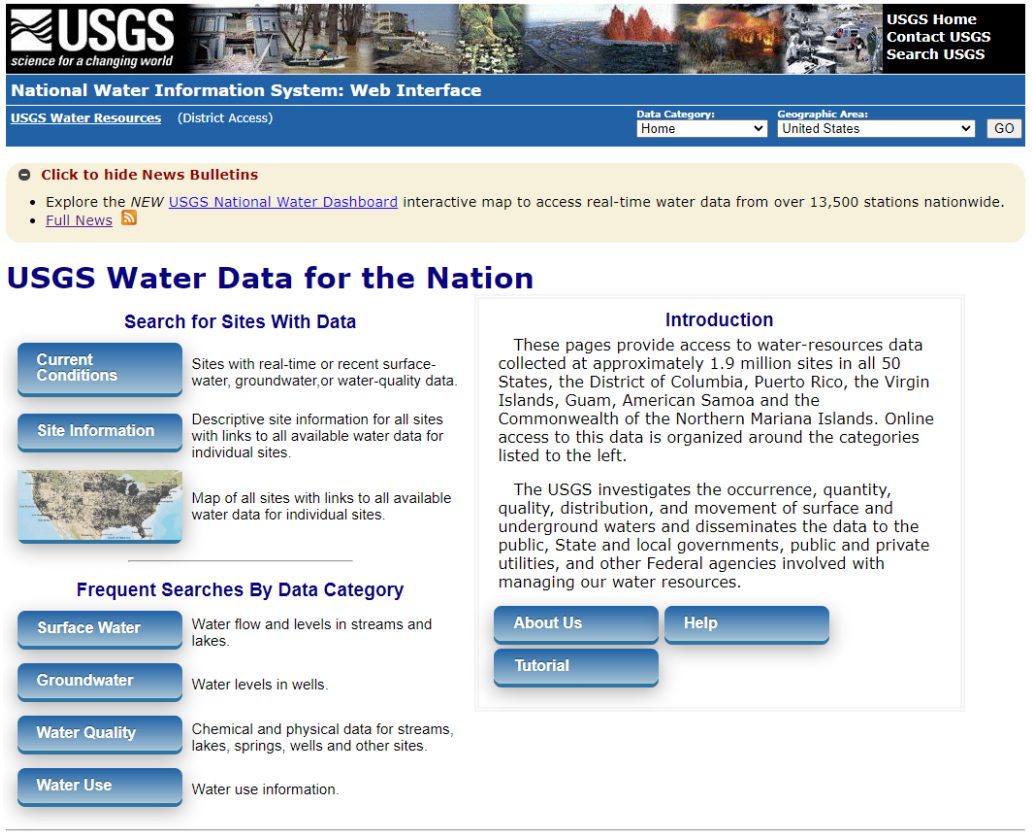
Demonstration basin – Railroad Valley

- All data collected by the USGS is public data, available to everyone.
- To add the necessary data, we will need permission from private owners to collect more data and improve our understanding of the Railroad Valley GW system.

Please talk with us after the meeting! Sheet to share contact information in the front.



https://waterdata.usgs.gov/nwis


Please contact
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for additional information.
RAM 2500
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science for a changing world
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P. Gardner, U.S. Geological Survey

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