New Mexico Tech
SCIENCE · ENGINEERING · RESEARCH · UNIVERSITY

Aquifer Mapping Program

Middle Rio Grande
Council of Governments
May 2018

Stacy Timmons

Hydrogeologist,
Aquifer Mapping Program Manager

[redacted]

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

[redacted]

BUREAU OF GEOLOGY AND MINERAL RESOURCES

New Mexico Bureau of Geology and Mineral Resources

We are a research and service division of New Mexico Tech (under Higher Education). We serve as the geological survey for the state.

Divisions of our agency

Energy
- Oil/Gas
- Geothermal

Mineral/Economic

Laboratories

Outreach and education
- Publications
- Archives and collections
- Geothermal

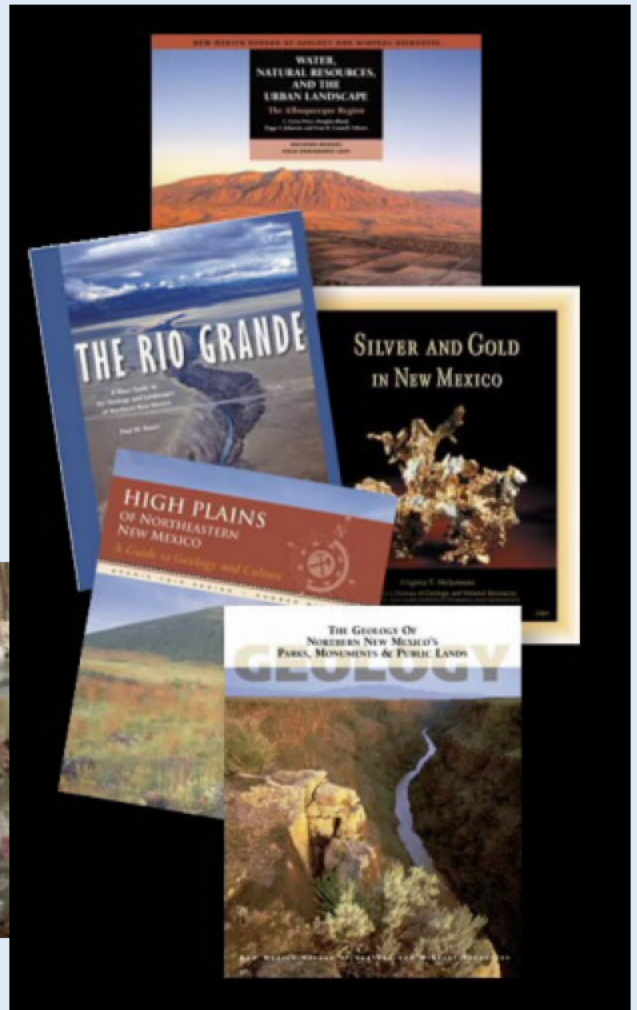
Geologic mapping & hazards

Hydrogeology

(Aquifer Mapping Program)







AQUIFER MAPPING PROGRAM

BUREAU OF GEOLOGY AND MINERAL RESOURCES

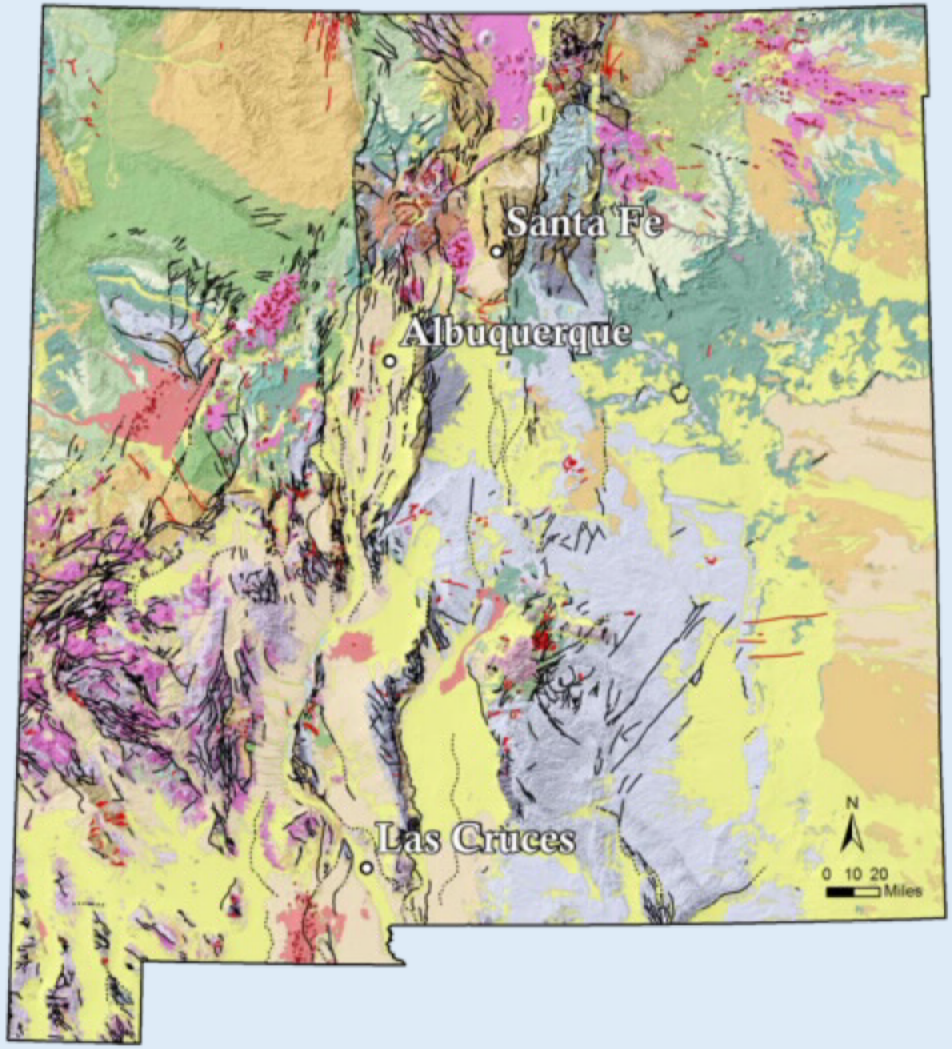
Aquifer Mapping Program

Frequently asked questions in New Mexico

- **Where is the groundwater?**
- **How much is there?**
- **What is the water quality?**

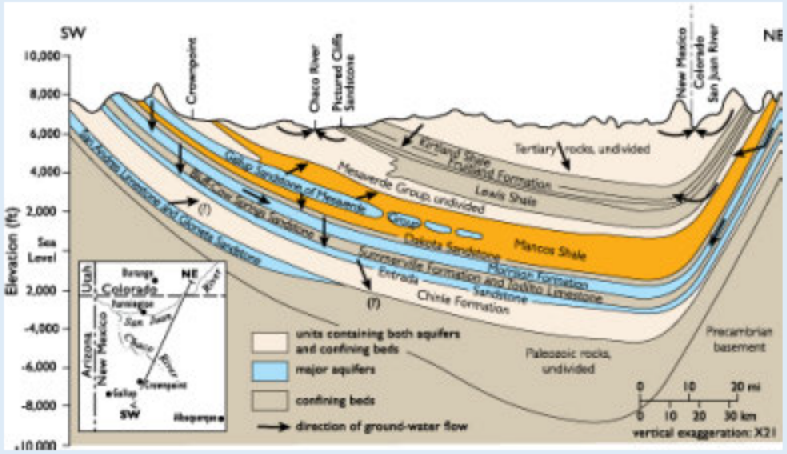
Answers require understanding of the **complex geology** of our state. We can address issues using NMBGMR resources:

- **Geologic mapping**
- **Drill hole data**
- **Geophysical surveys**
- **Hydrologic data**
- **Geochemistry**
- **Groundwater conceptual models**

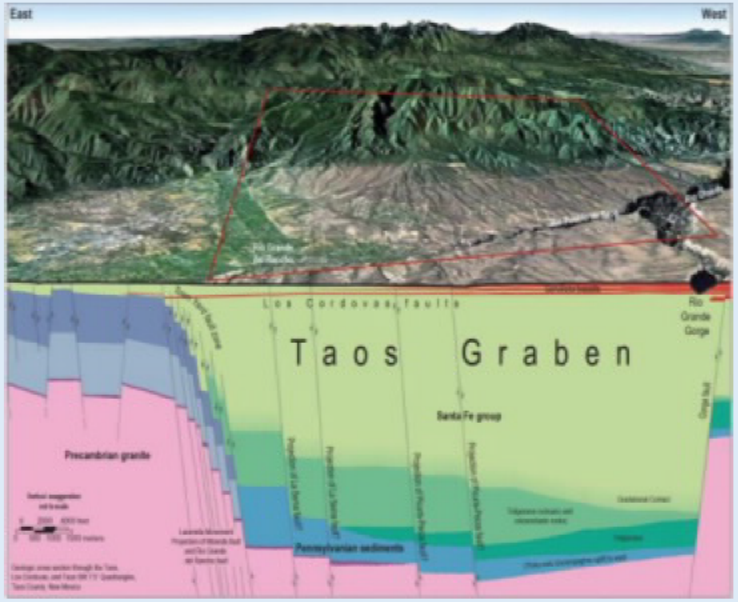


Groundwater quantity and quality: it begins with the geology

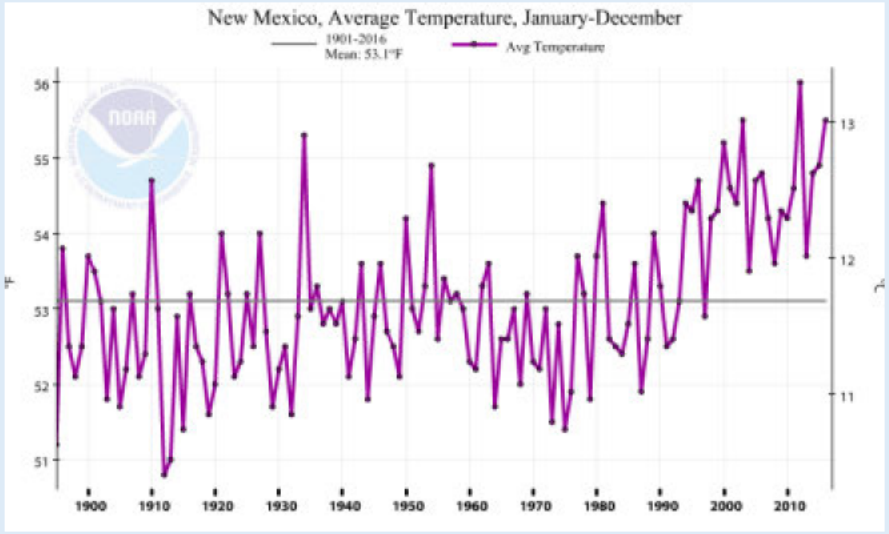
- Aquifer thickness (relates to available storage)
- Depth to groundwater
- Rocks effects on water quality
- How rock will transmit water
  - Hydraulic conductivity
  - Transmissivity
- Estimates of specific storage
- Connections with surface water
- Where recharge occurs







Future of Water in New Mexico





A more ARID New Mexico

- Warmer temperatures
- Long term drought conditions
- Increased evapotranspiration rates
- Reduction in surface water flow and recharge to groundwater
- Increase demand on groundwater
- Increased vulnerability!

AQUIFER MAPPING PROGRAM

What is Aquifer Mapping?

Aquifer mapping is a scientific process applying a combination of geologic, geophysical, hydrologic, and chemical field and laboratory analyses to characterize the quantity, quality, and sustainability of groundwater in aquifers.

- NON-REGULATORY APPROACH
- IMPARTIAL DATA; UNBIASED INTERPRETATIONS
- RESULTS THAT INFORM DECISION MAKING AND SUPPORTS OTHER FEDERAL, STATE, TRIBAL AND LOCAL AGENCIES/INDIVIDUALS

FUNDING 2017-2018 FY

- HYDROGEOLOGY PORTION OF NMBGMR BUDGET **($280K)**
- LEVERAGED WITH GIFTS AND GRANTS **($480K)**

USED TOWARD BETTER UNDERSTANDING OF OUR WATER RESOURCES

AQUIFER MAPPING PROGRAM

Aquifer Mapping Program 2018

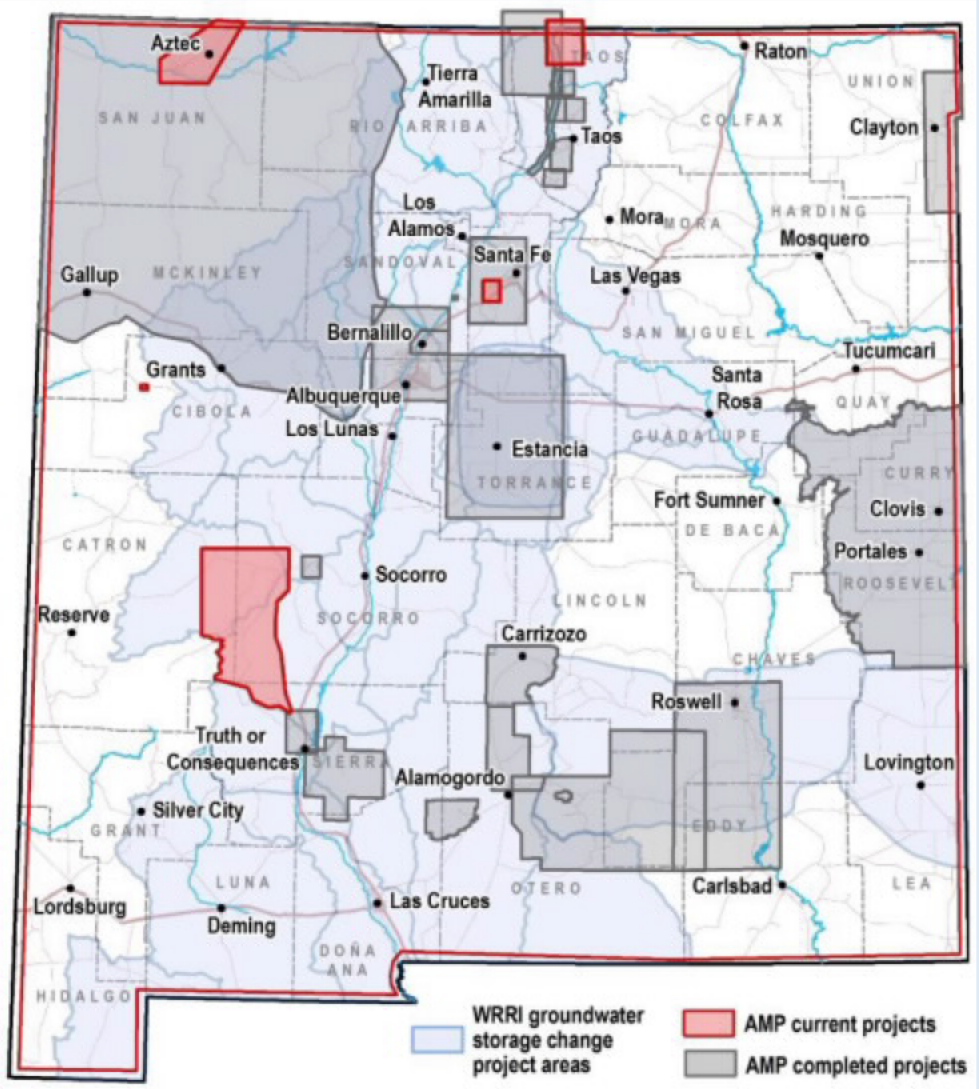
Current projects

- Animas River aquifer long term monitoring (NMED-EPA funding)
- San Agustin Plains (NMBG)
- Groundwater level monitoring in La Cienega (Las Golondrinas – community)
- Aquifer map 3D visualizations (Healy Foundation)
- Collaborative groundwater level monitoring (Healy Foundation)

Recent projects

- Groundwater level and storage changes (WRRI)
- Statewide groundwater recharge model (WRRI)
- Clovis Region Aquifer Lifetime Mapping (Clovis, Curry Cty, ENMWUA)

(Primary funding sources in parentheses)



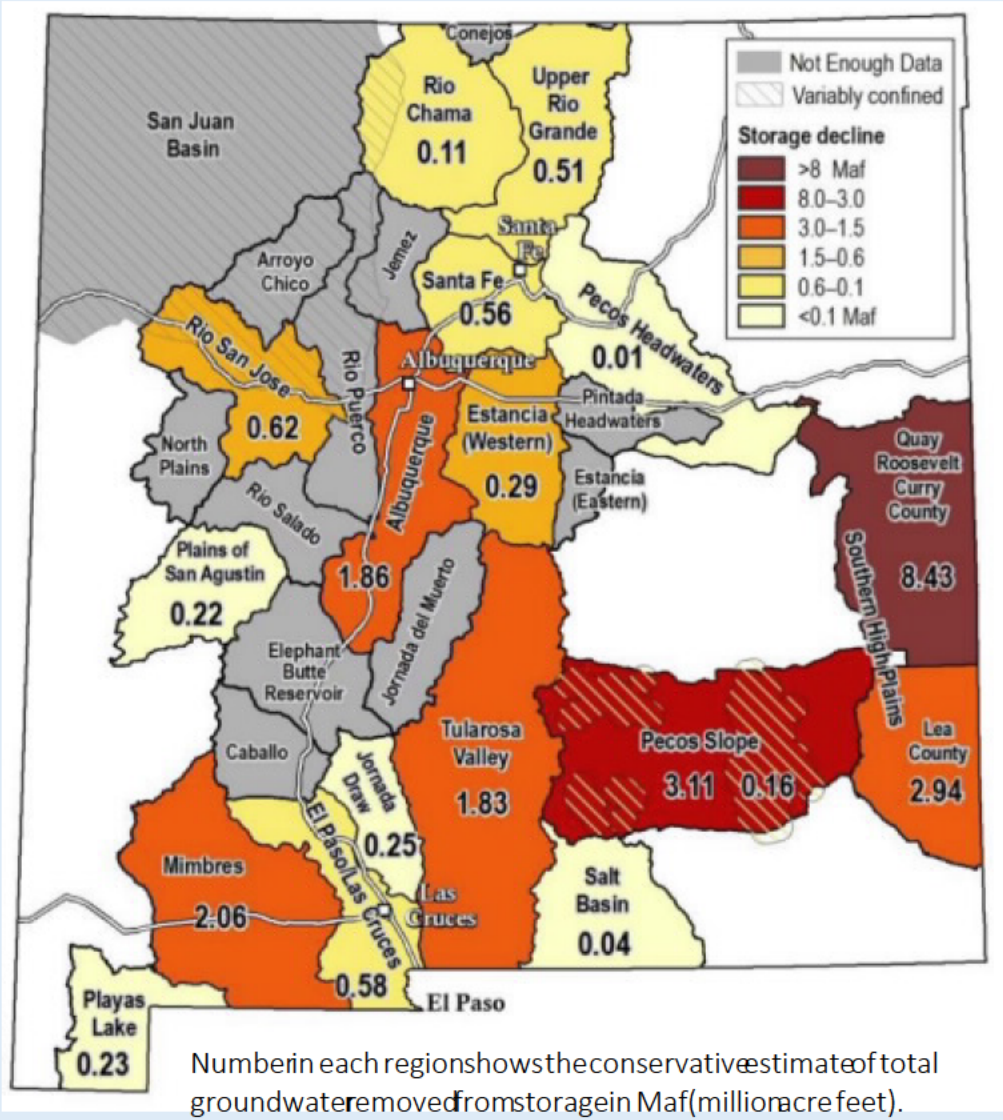
Groundwater Level and Storage Changes

Funding from WRRI Statewide Water Assessment 2014-2017

Project lead: Dr. Alex Rinehart
NMBGMR – AMP

Results

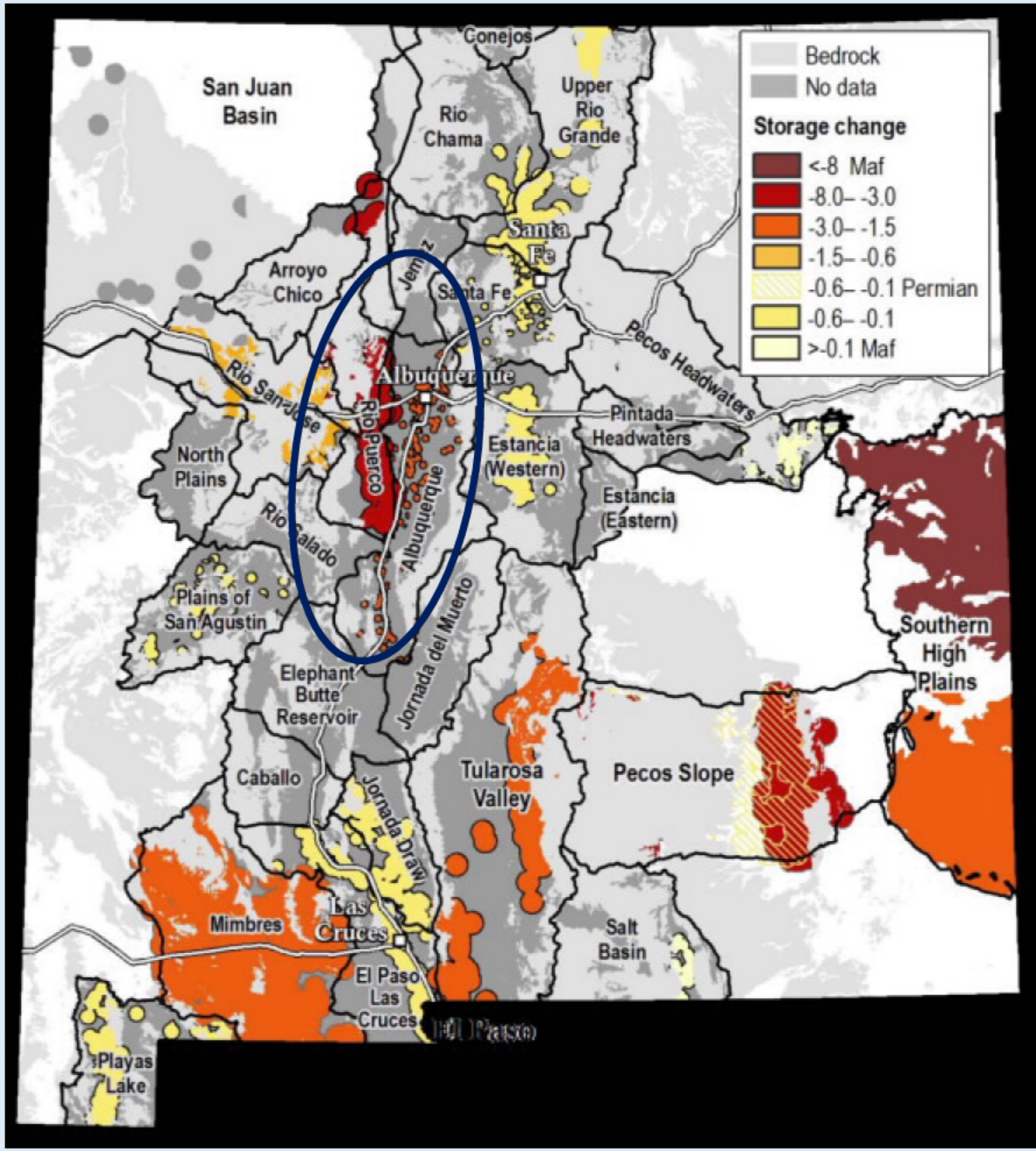
- A geostatistical analysis entirely based upon ***groundwater level monitoring network*** from USGS/OSE/NMBG since 1900s
- Large groundwater storage declines in Eastern NM, Pecos Slope, Mimbres, Tularosa, Albuquerque, and Mesilla Basins.
- Results are ***likely low estimates*** due to well network and sparse data coverage



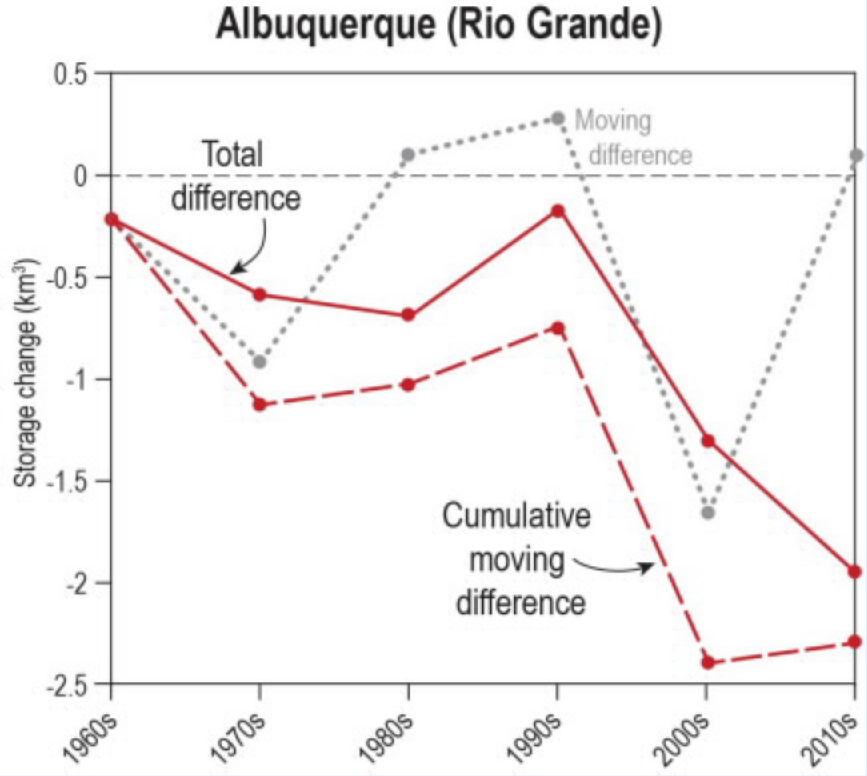
Number in each region shows the conservative estimate of total groundwater removed from storage in Maf (million acre feet).
Grey = lack sufficient data

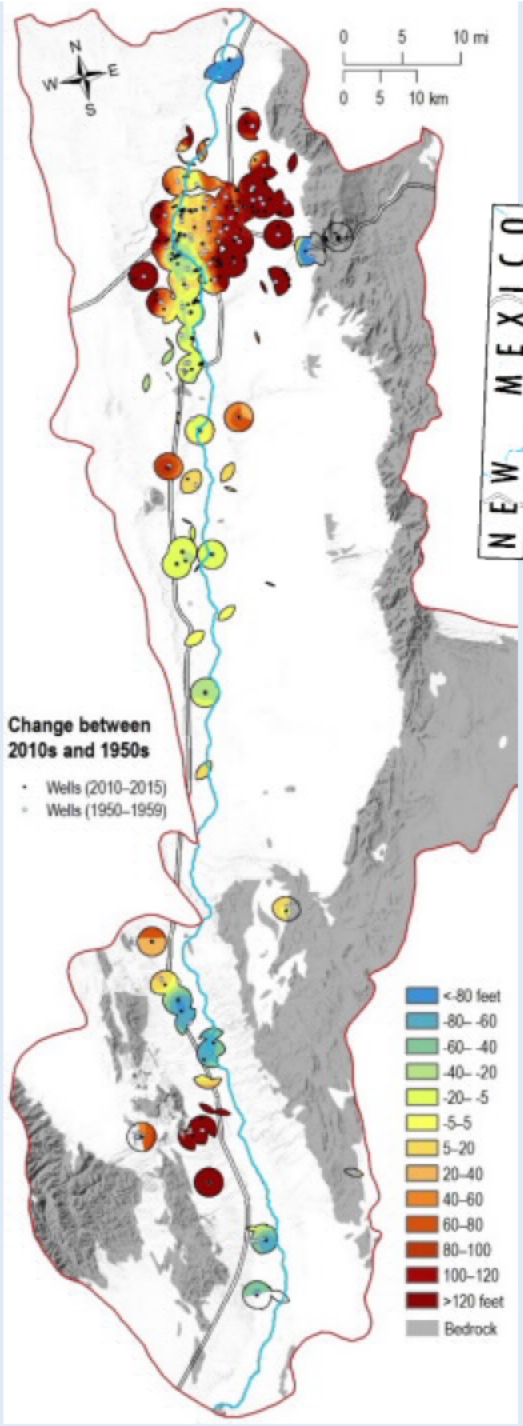
Albuquerque Basin

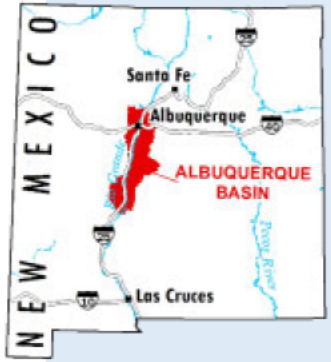
- Reliant on combination of surface water and groundwater
- Primary aquifer is in **basin-fill (100s to 2000 ft),** with deeper wells on basin flanks and shallower wells in valley bottom
- Major population center, but still has significant agriculture.



Albuquerque Basin



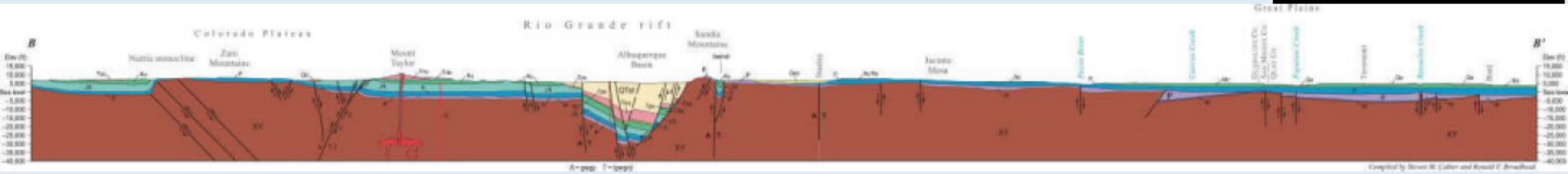


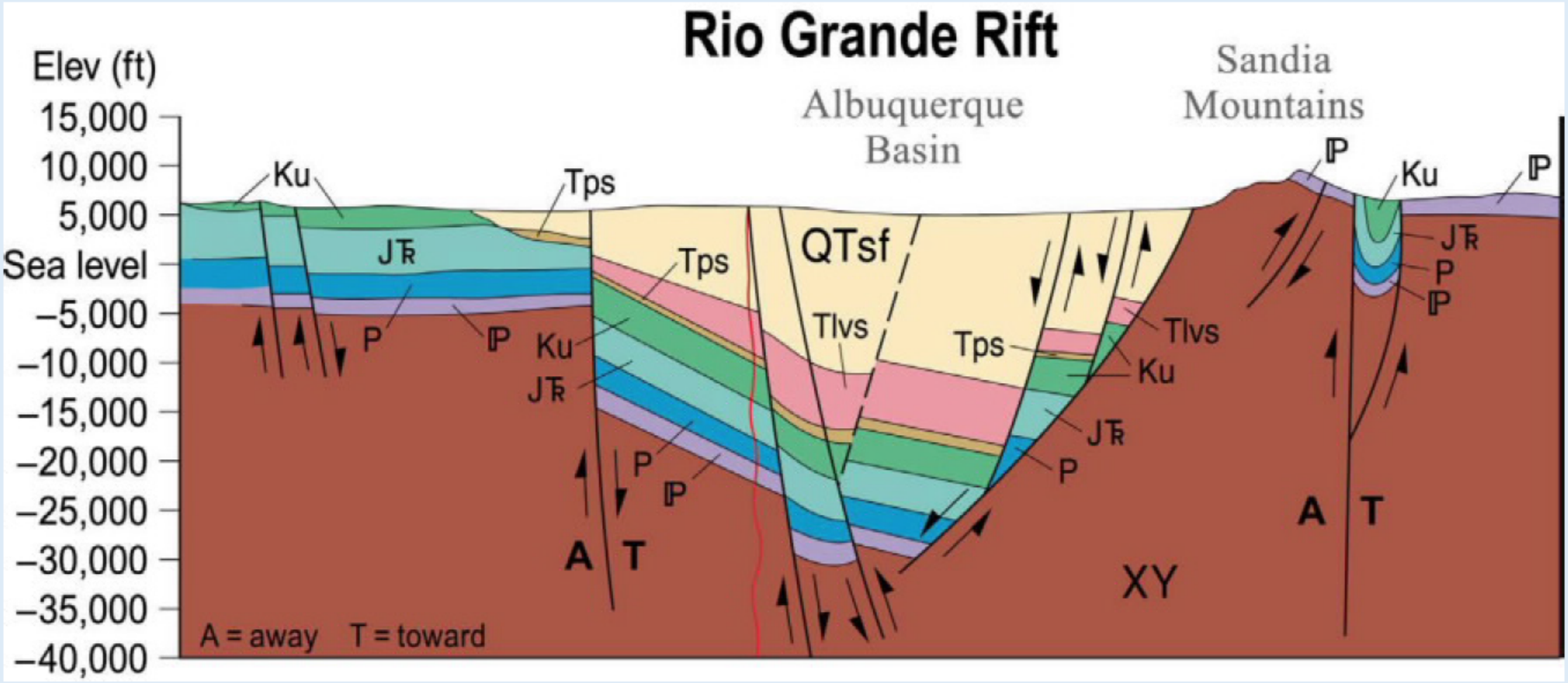


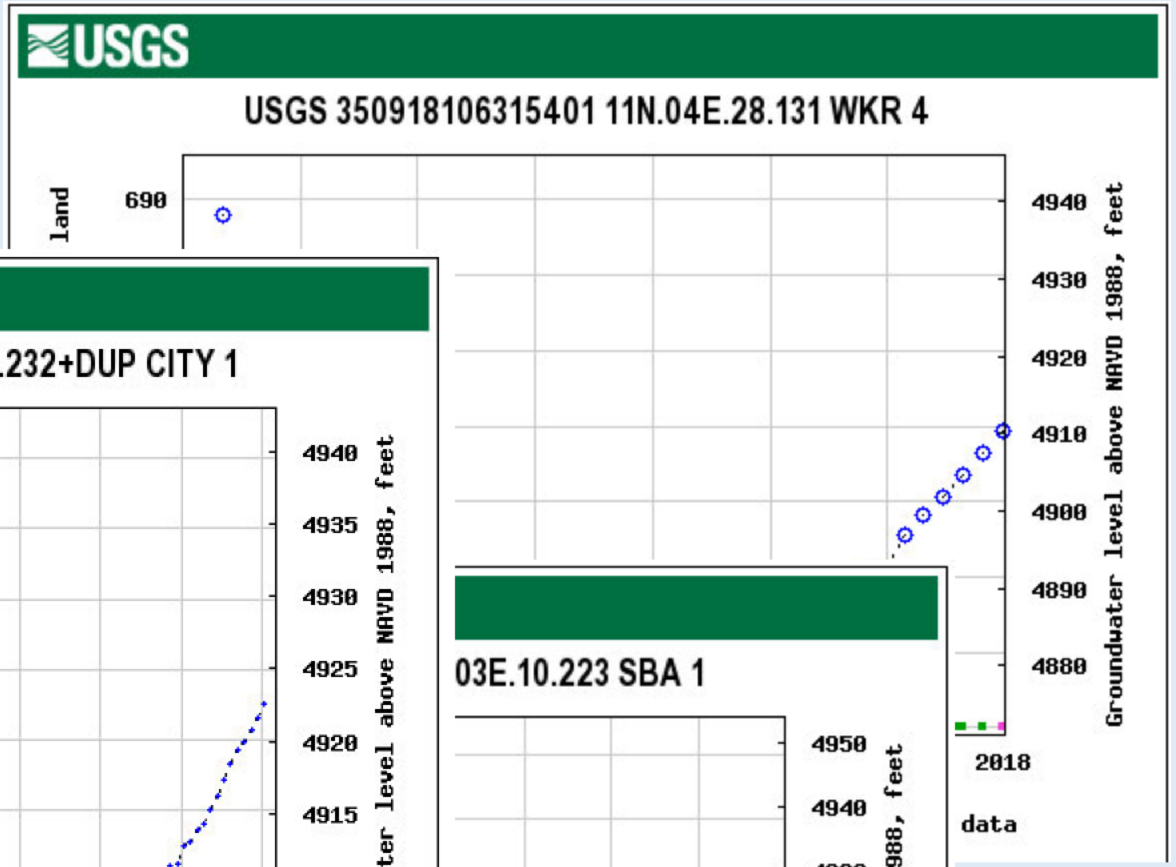
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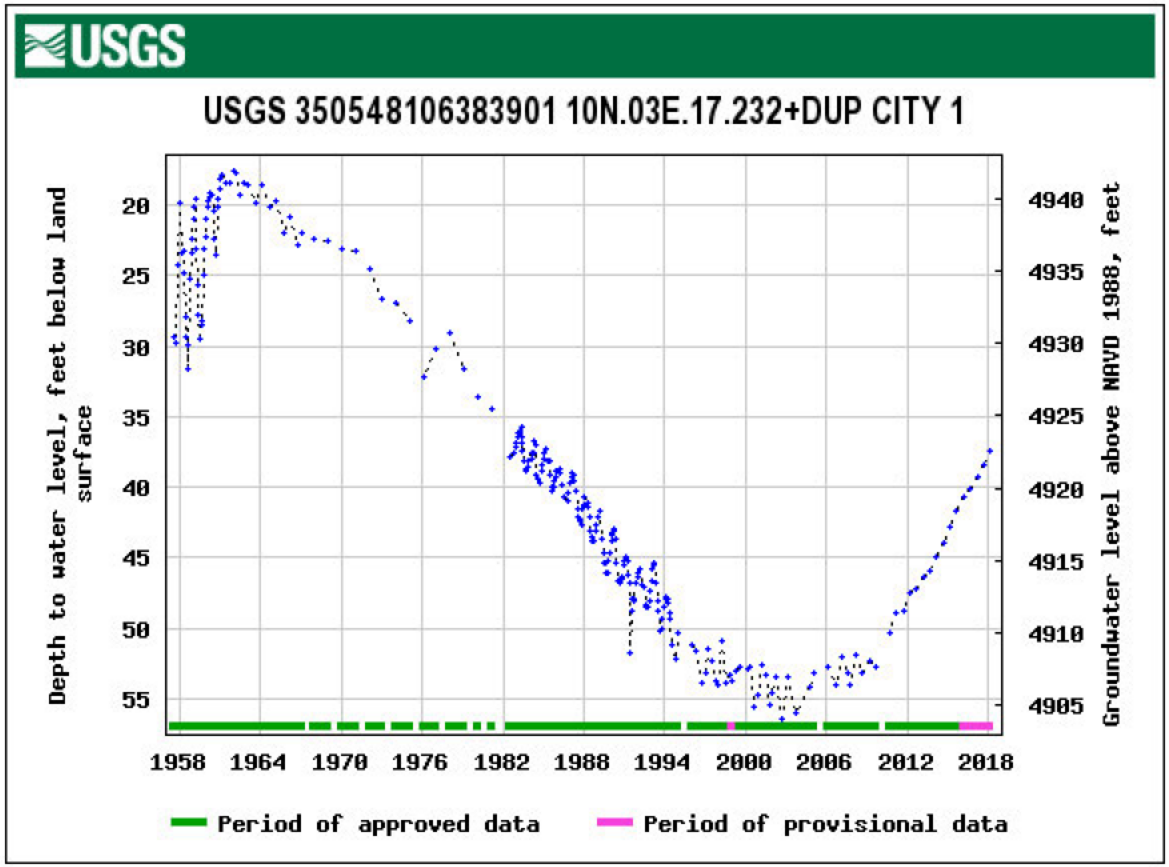
Albuquerque Basin

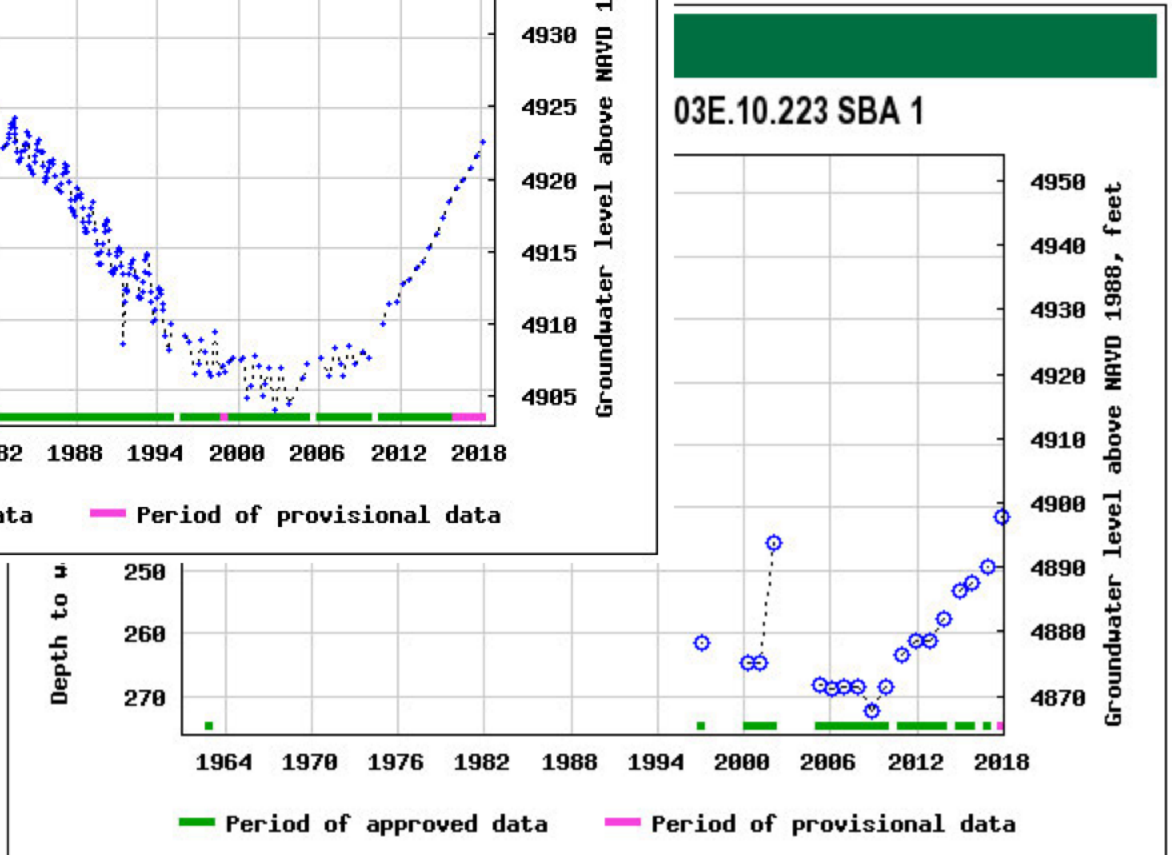







USGS
USGS 350918106315401 11N.04E.28.131 WKR 4
land
690
4940
4930
4920
4910
4900
4890
4880
Groundwater level above NAVD 1988, feet
2018
data

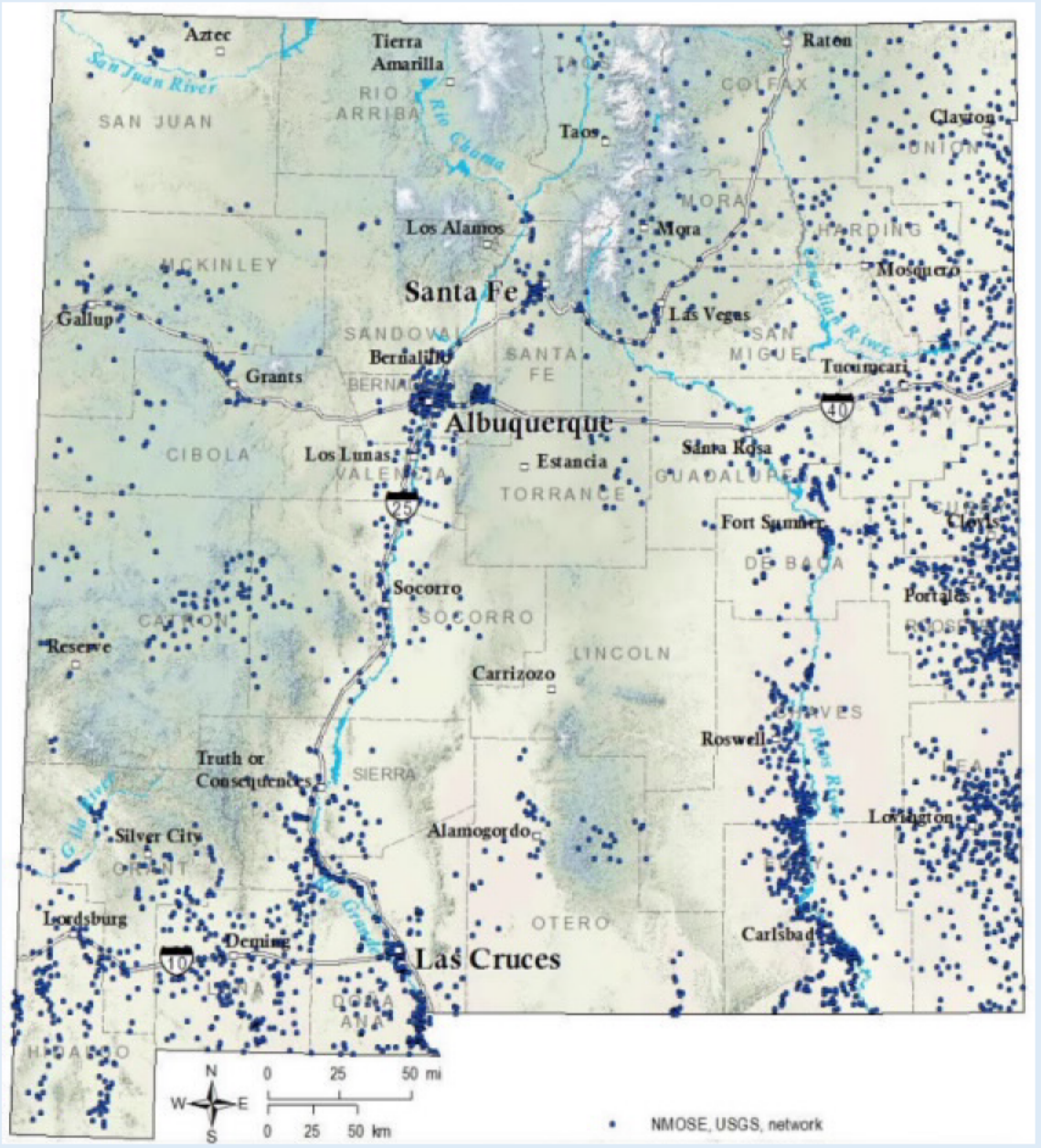

USGS
USGS 350548106383901 10N.03E.17.232+DUP CITY 1
Depth to water level, feet below land surface
20
25
30
35
40
45
50
55
4940
4935
4930
4925
4920
4915
4910
4905
Groundwater level above NAVD 1988, feet
1958
1964
1970
1976
1982
1988
1994
2000
2006
2012
2018
Period of approved data
Period of provisional data


03E.10.223 SBA 1
Depth to w
250
260
270
4950
4940
4930
4920
4910
4900
4890
4880
4870
Groundwater level above NAVD 1988, feet
1964
1970
1976
1982
1988
1994
2000
2006
2012
2018
Period of approved data
Period of provisional data

OSE/USGS Groundwater Monitoring Network in NM

Blue points are part of the once per year or per 5 year monitoring network currently operated by OSE/USGS

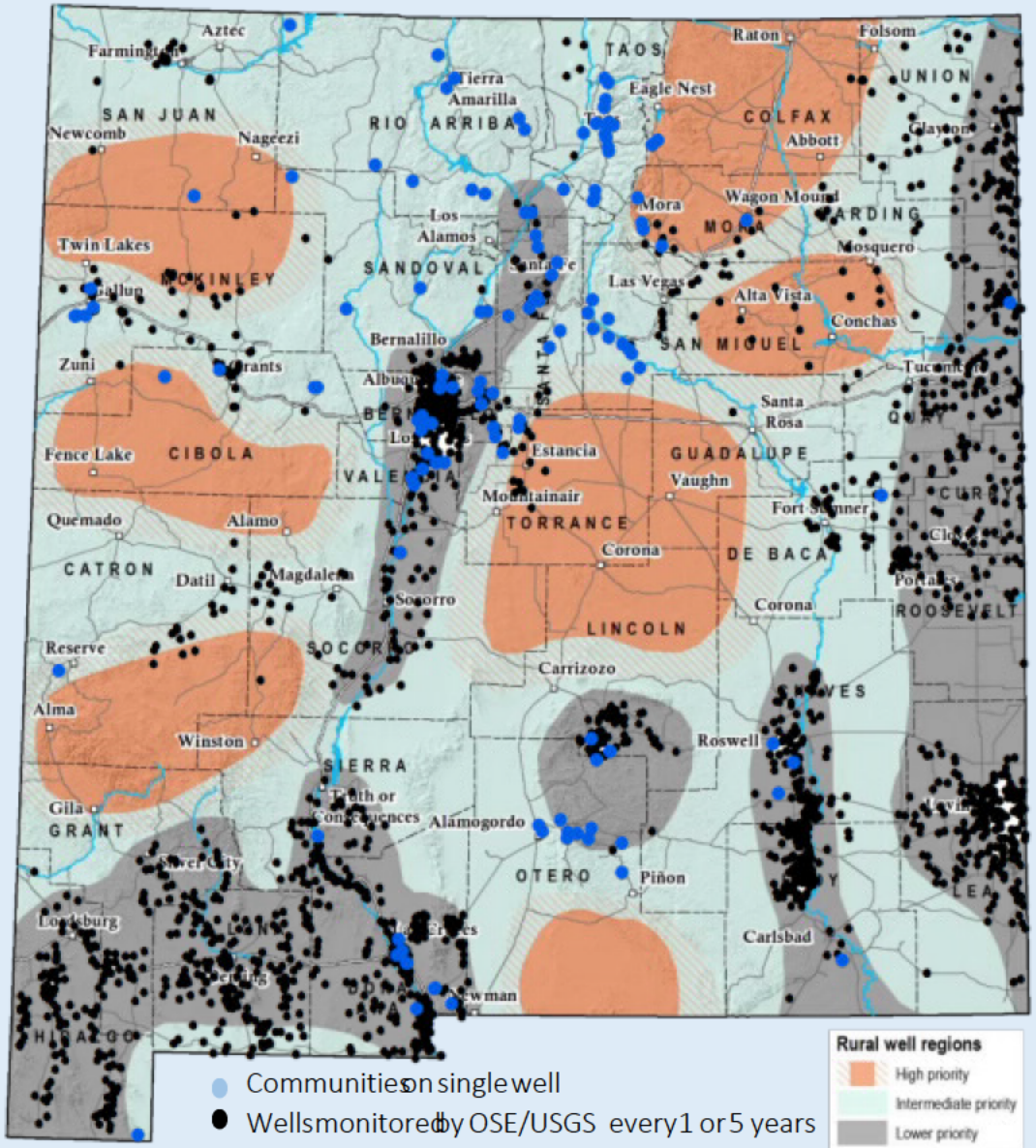
Long term data – these are *essential* in tracking the trends in groundwater level and storage changes



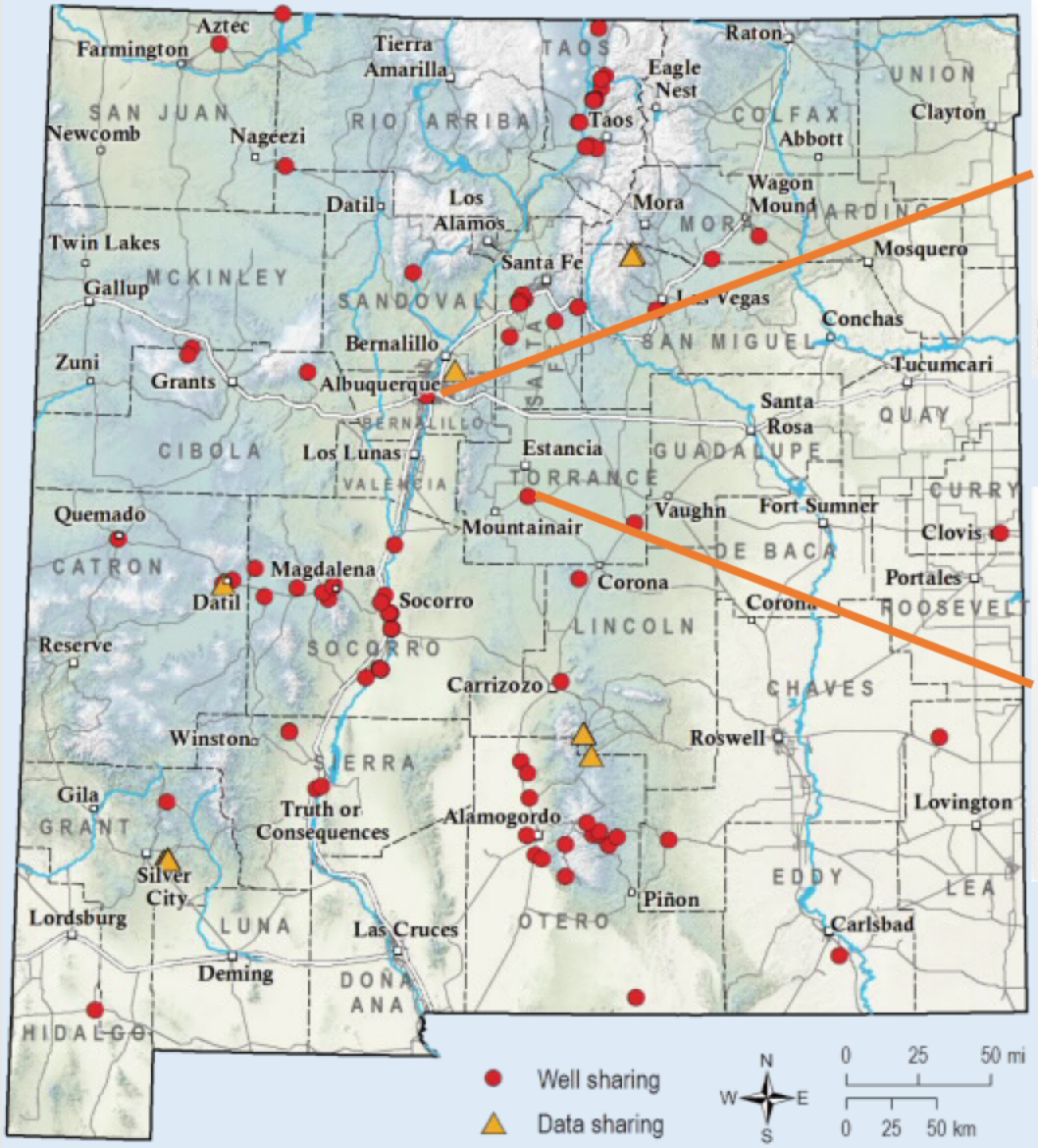
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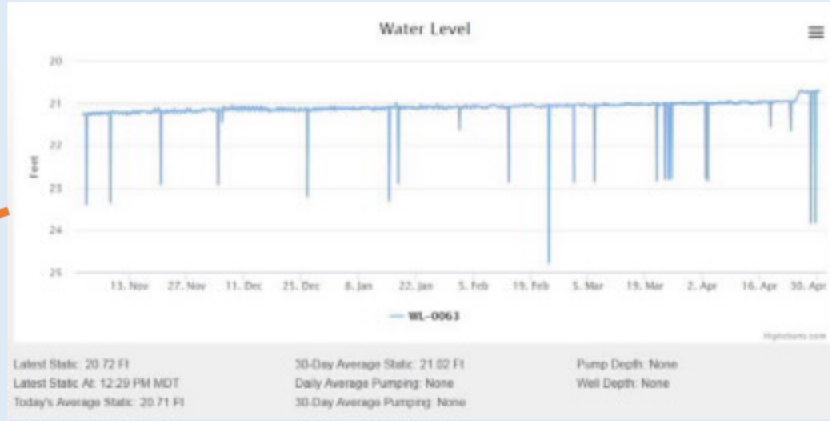
Collaborative Groundwater Monitoring Network

- DATA COLLECTION
  - Focus on groundwater data to rural communities, especially those on a single well
  - Filling in data gaps in state monitoring network (OSE/USGS, 1-5 year rotating network)
  - Cooperating with communities, private well owners, NM Rural Water Association, NMED, OSE, and USGS
- TRAINING and EDUCATION
  - On-site
  - NM Rural Water Association annual meetings
- PUBLIC ACCESS/ARCHIVE
  - Interactive webmap (geoinfo.nmt.edu)
  - Upon request



Funding from Healy Foundation


Aztec
Farmington
Tierra Amarilla
TAOS
Raton
Eagle Nest
UNION
Clayton
SAN JUAN
Newcomb
Nageezi
RIO ARRIBA
Taos
COLFAX
Abbott
Datil
Los Alamos
Mora
Wagon Mound
HARDING
Twin Lakes
MCKINLEY
Gallup
SANDOVAL
Santa Fe
Las Vegas
Mosquero
Conchas
Bernalillo
SAN MIGUEL
Zuni
Grants
Albuquerque
Tucumcari
Santa Rosa
QUAY
BERNALILLO
CIBOLA
Los Lunas
Estancia
GUADALUPE
VALENCIA
TORRANCE
CURRY
Quemado
Mountainair
Vaughn
Fort Sumner
Clovis
DE BACA
CATRON
Magdalena
Datil
Socorro
Corona
Portales
ROOSEVELT
LINCOLN
Reserve
SOCORRO
Carrizozo
CHAVES
Winston
Roswell
SIERRA
Gila
Truth or Consequences
Alamogordo
Lovington
GRANT
Silver City
EDDY
LEA
Piñon
Lordsburg
LUNA
Las Cruces
OTERO
Carlsbad
Deming
DONA ANA
HIDALGO
Well sharing
Data sharing
N
W
E
S
0 25 50 mi
0 25 50 km


Water Level
Feet
20
21
22
23
24
25
13. Nov
27. Nov
11. Dec
25. Dec
8. Jan
22. Jan
5. Feb
19. Feb
5. Mar
19. Mar
2. Apr
16. Apr
30. Apr
WL-0063
Latest Static: 20.72 Ft
Latest Static At: 12:29 PM MDT
Today's Average Static: 20.71 Ft
30-Day Average Static: 21.02 Ft
Daily Average Pumping: None
30-Day Average Pumping: None
Pump Depth: None
Well Depth: None


Water Level
Feet
100
125
150
175
200
Jan '17
Jul '17
Aug '17
Sep '17
Oct '17
Nov '17
Dec '17
Jan '18
Feb '18
Mar '18
Apr '18
May '18
WL-0016
Latest Static: 112.32 Ft
Latest Static At: 11:09 AM MDT
Today's Average Static: 112.07 Ft
30-Day Average Static: 115.79 Ft
Daily Average Pumping: None
30-Day Average Pumping: None
Pump Depth: 210.00 Ft
Well Depth: None

Collaborative Groundwater Monitoring Network







DATA SHARING

A well owner/operator can submit accurate water level measurements to NMBGMR database to become publicly available data.

FREE PROGRAM!

- If well is in "key" location, fits rural criteria and works well with our equipment, we will install groundwater level monitoring equipment – for FREE!
- We will take manual measurements - for FREE!
- We will archive YOUR data - for FREE!

WELL SHARING

NMBGMR can visit site and, if well is appropriate, we can set up equipment for continuous water level measurement.

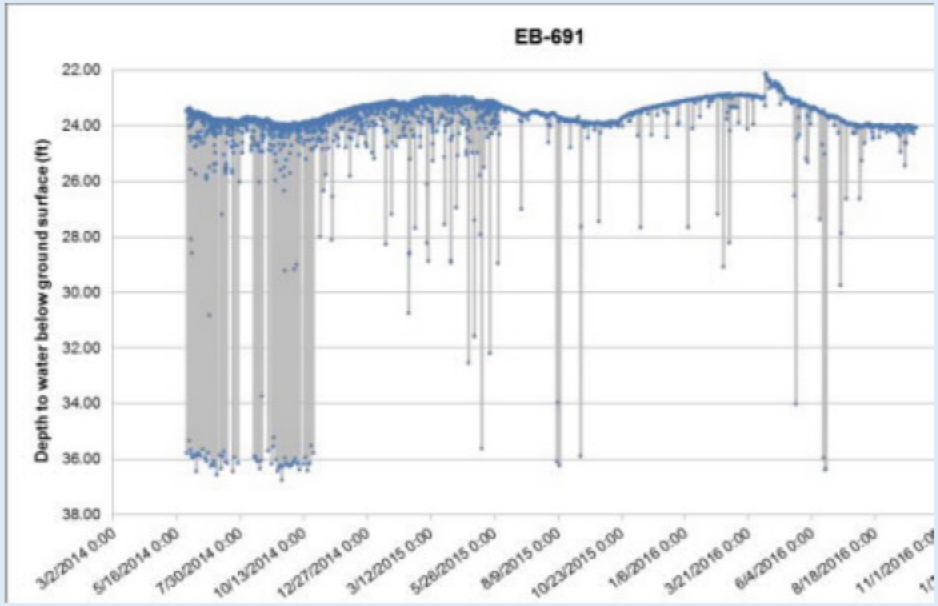


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Continuous pressure transducers

- Small data recorder sits in water
- Must be retrieved and downloaded periodically
- Requires open well, or monitoring tube



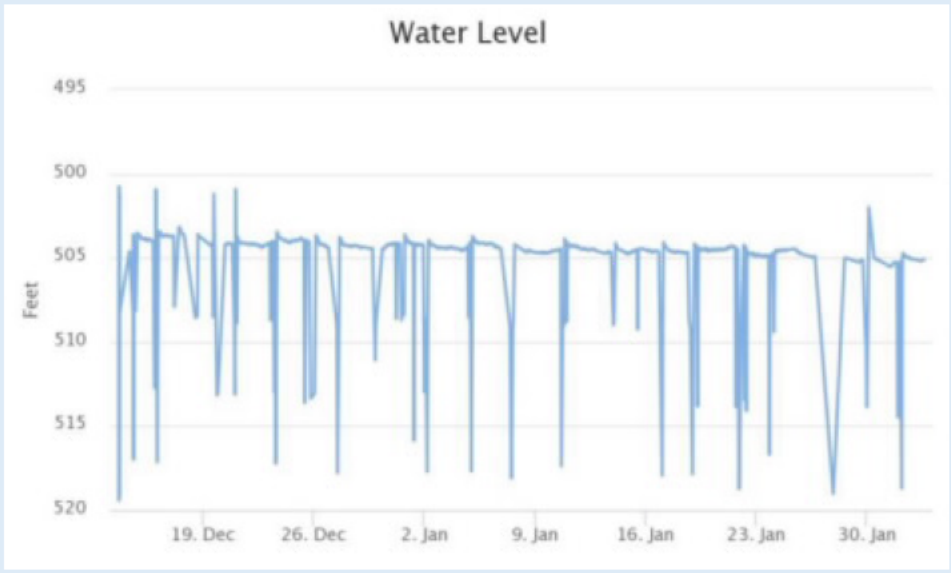


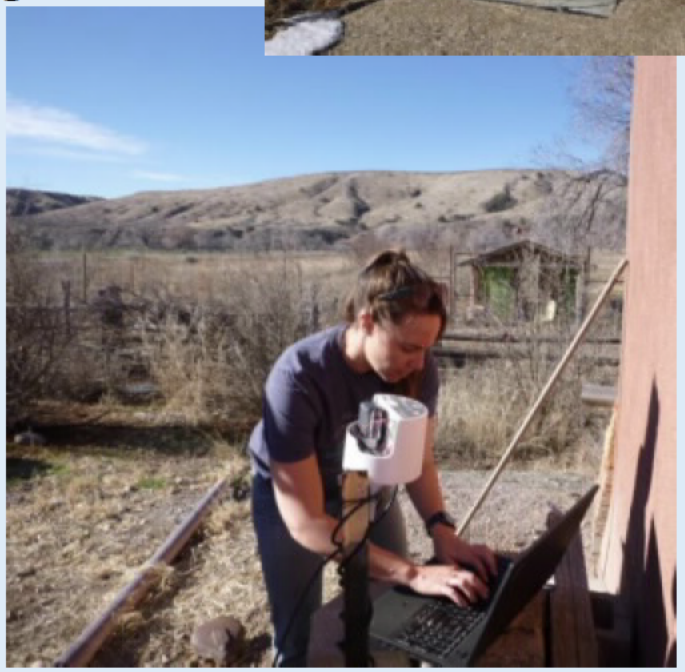


Continuous acoustic technology

- Acoustic water level measurement (WellIntel)
- Nothing touches water
- Data must be fed to internet based cloud
- Real-time or remote data recorder







Training







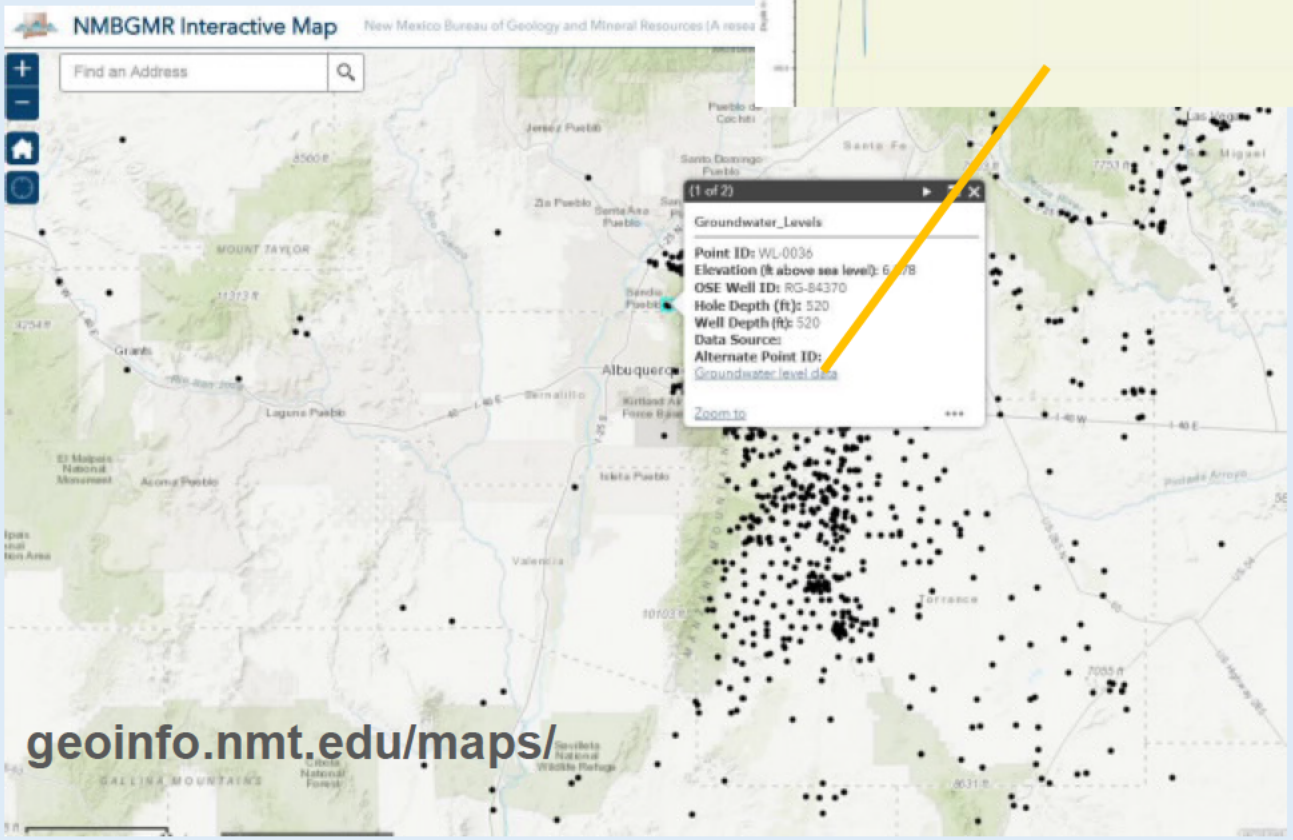
"New Mexico Rural Water Association is proud of our partnership with New Mexico Bureau of Geology and their Aquifer Mapping Program. Their work in the field, as well as their training in the classroom, brings a new level of knowledge and awareness to water systems around New Mexico about the importance of monitoring and managing their drinking water supplies for the benefit of their customers and communities."

-B. Conner, Executive Director NMRWA

Where are we going with this?

- Public data for greater visibility
- Webmap – making data accessible
- Improve groundwater awareness and public education





AQUIFER MAPPING PROGRAM

Funding from Healy Foundation

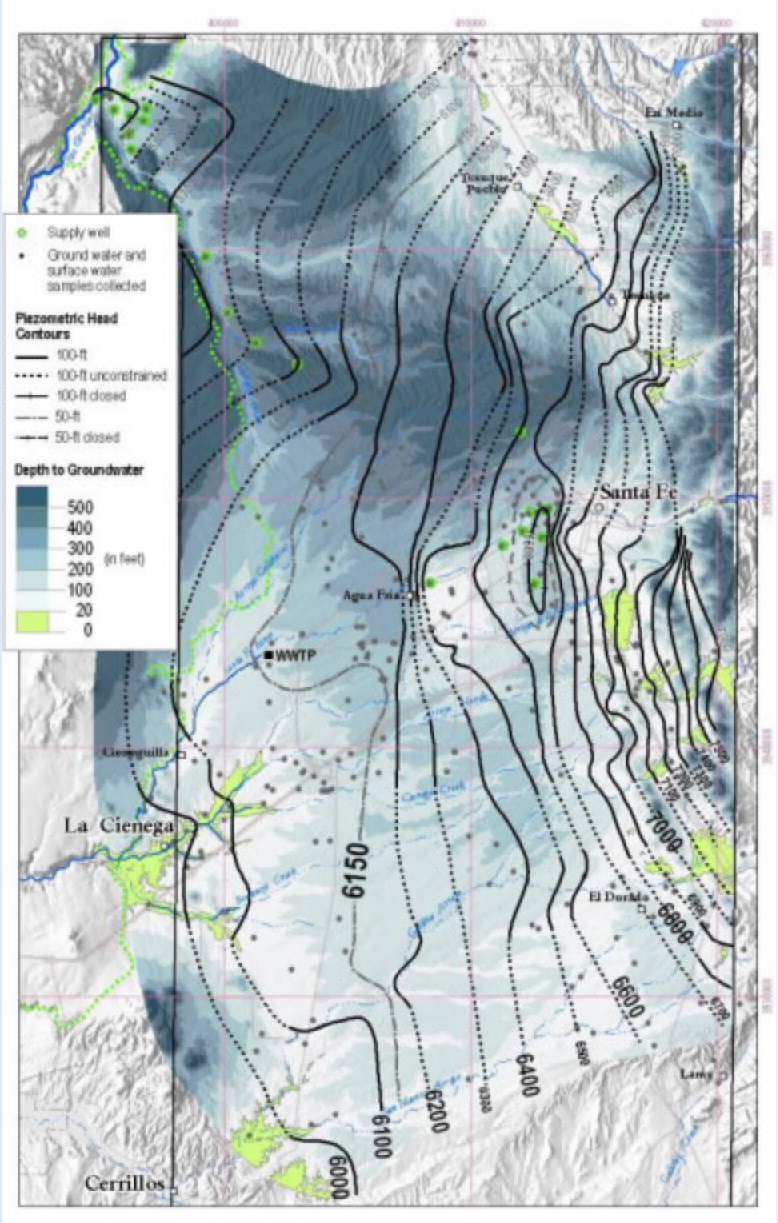
3D Aquifer Mapping

The challenge

Develop statewide coverage of aquifer maps that provide details on depth of productive aquifers and the boundaries or connections of aquifers.

Our basic method

1. Compile existing datasets to improve conceptual models of basins
2. Develop regional maps, piece together statewide eventually (5+ years)
3. Technical and non-technical easy-to-access material

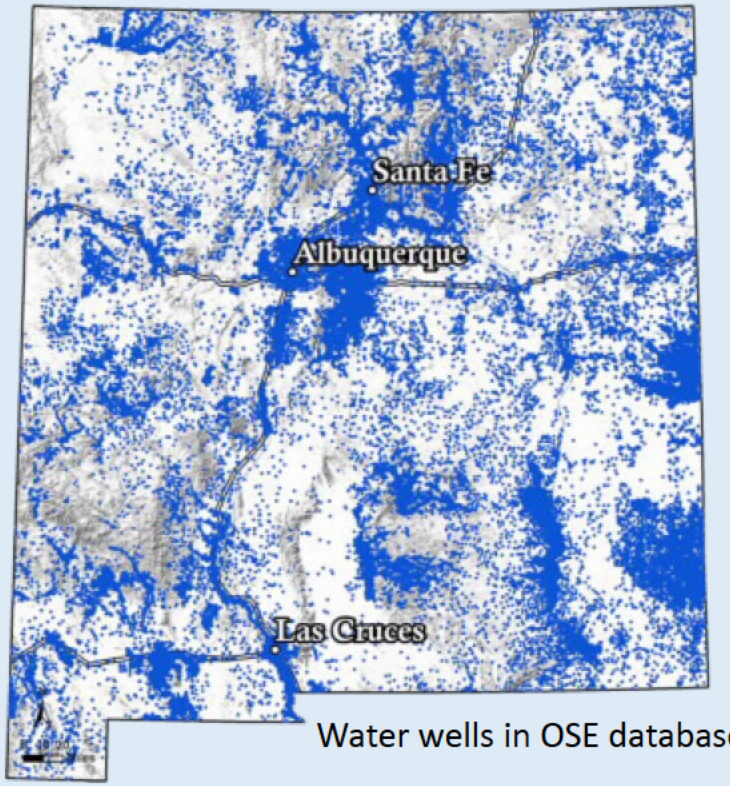


Funding from Healy Foundation

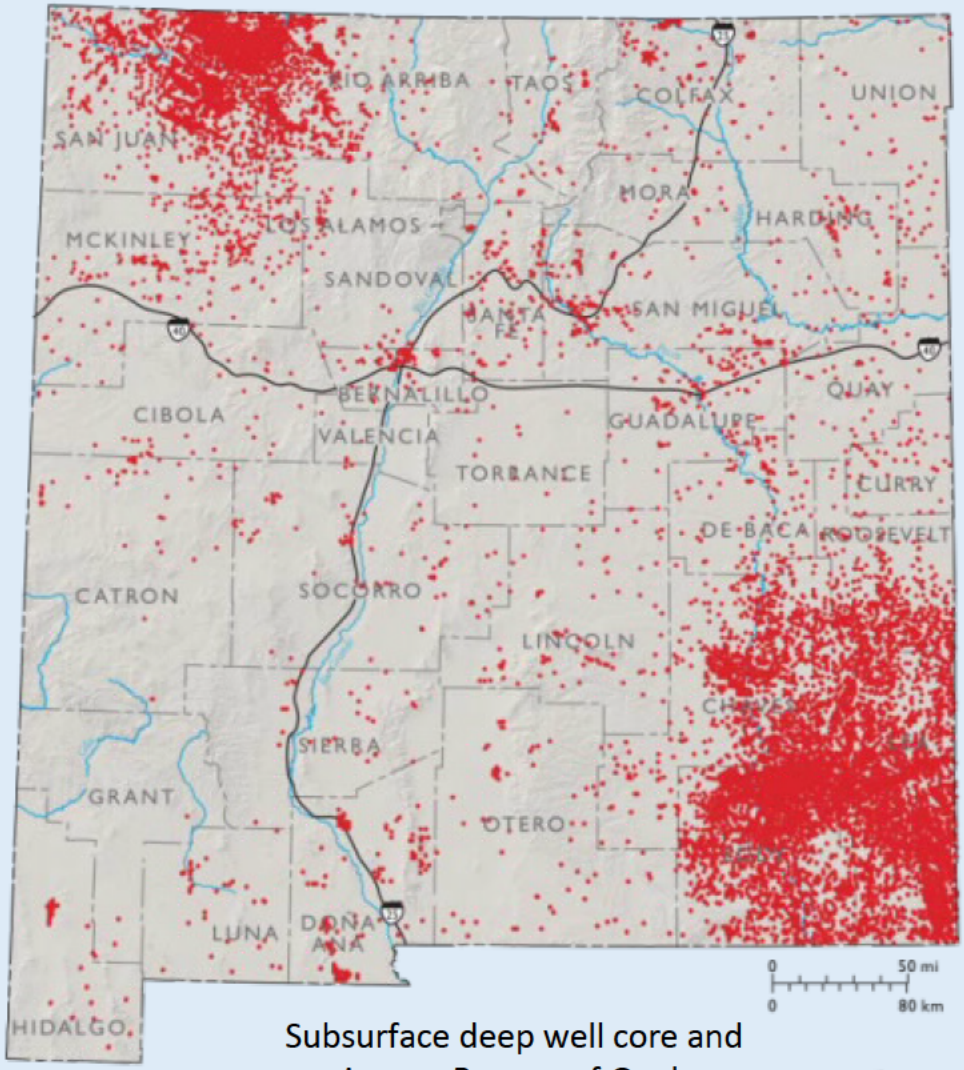
3D Aquifer Mapping

Compile existing datasets

- Geology and cross sections
- Previous work/reports
- Wells from multiple databases
- No new data collection



Water wells in OSE database



Subsurface deep well core and cuttings at Bureau of Geology

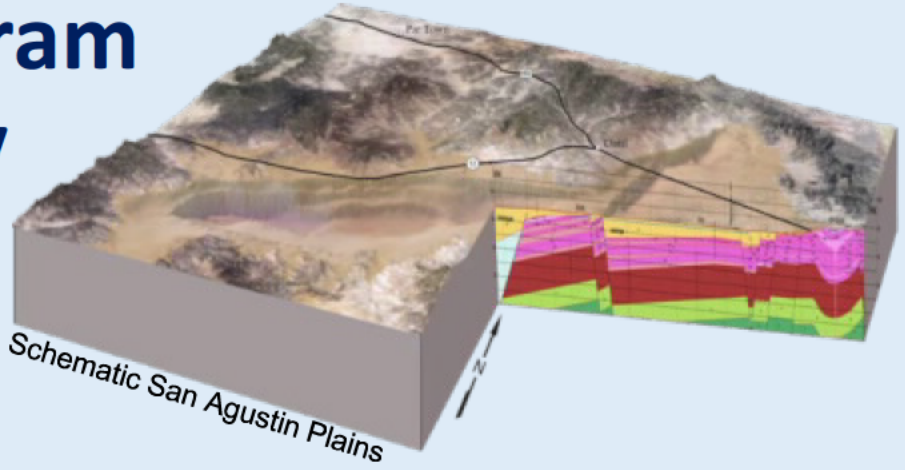
Online aquifer information



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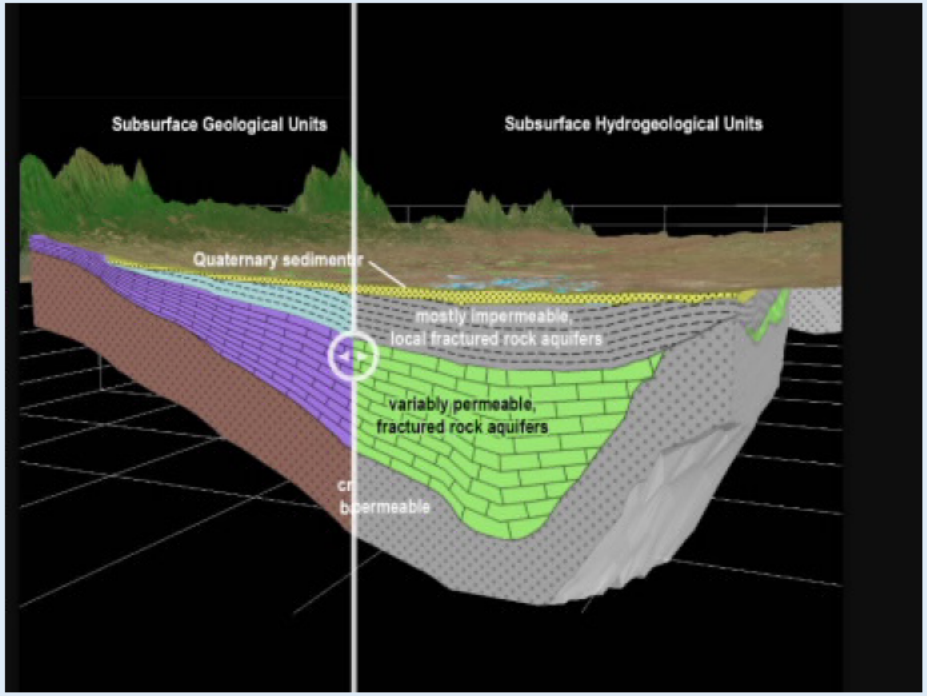
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Aquifer Mapping Program
NM Bureau of Geology



Using our geologic resources to better understand our water-limited reality

- Building better maps and information on groundwater resources, availability, and recharge
- Expanding basic groundwater monitoring – keeping an eye on the "account balance"
- Improving New Mexico's understanding of our water resources



AQUIFER MAPPING PROGRAM

For More Information

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

[redacted]

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