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New Mexico Bureau of Geology and Mineral Resources: Update on San Agustin Plains

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A non-regulatory governmental agency (the state's geological survey) that conducts scientific investigations leading to responsible economic development of the state's mineral, water, and energy resources.

A Division of New Mexico Tech

New Mexico Tech

Aquifer Mapping Program 2018

Aquifer Mapping Program aims to provide unbiased, publicly accessible water science and interpretations on the state's aquifers by combining geology, hydrology, geophysics and geochemistry. Funding comes from NMBGMR base budget plus gifts, grants, and contracts.

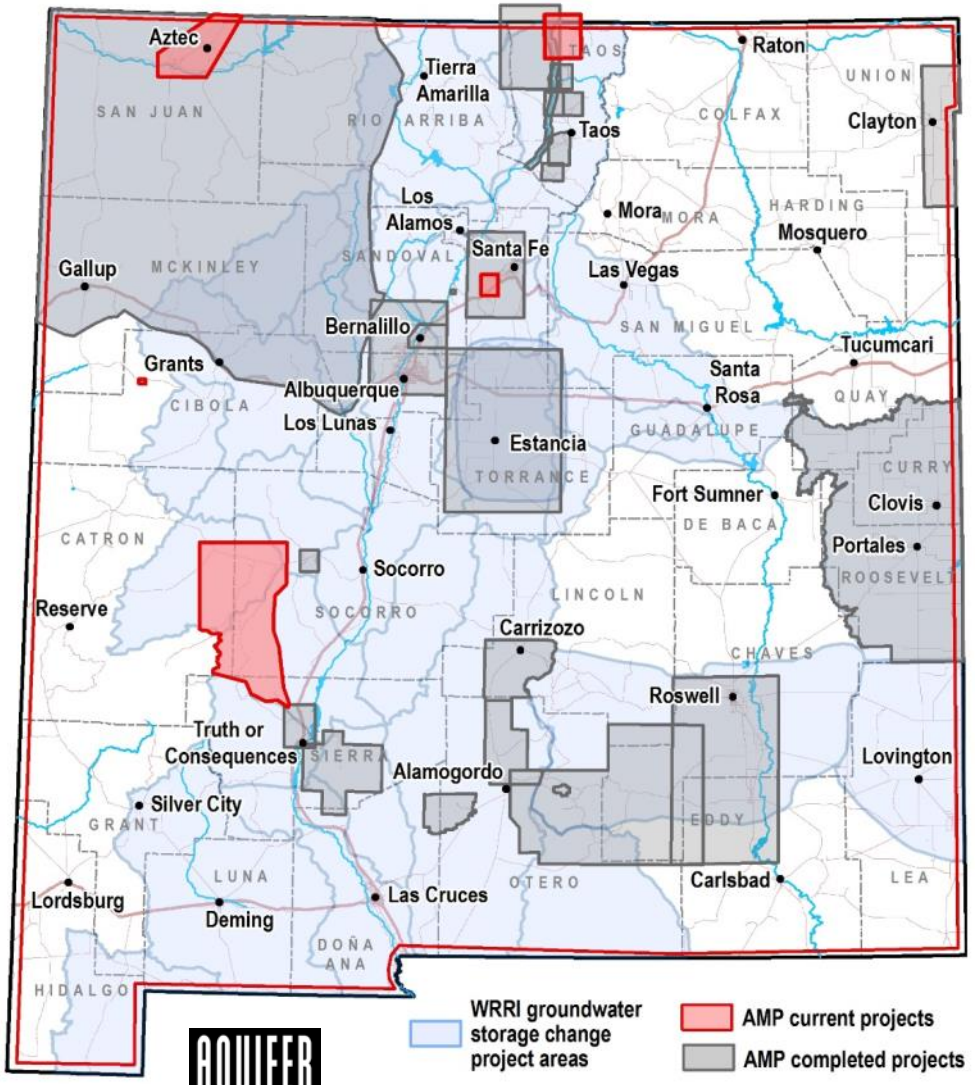
Current projects

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

Upcoming projects

- Groundwater level and storage changes (WRRI)
- Data compilation for hydrogeology in Rio Rancho (City of Rio Rancho)

(Primary funding sources in parentheses)



San Agustin Plains Hydrogeology Study

Aquifer Mapping: Long-term project began in 2009

Funding from NMBGMR, Aquifer Mapping Program, Healy Foundation, USGS National Cooperative Geologic Mapping Program (Statemap), and NMOSE

Started because of questions about

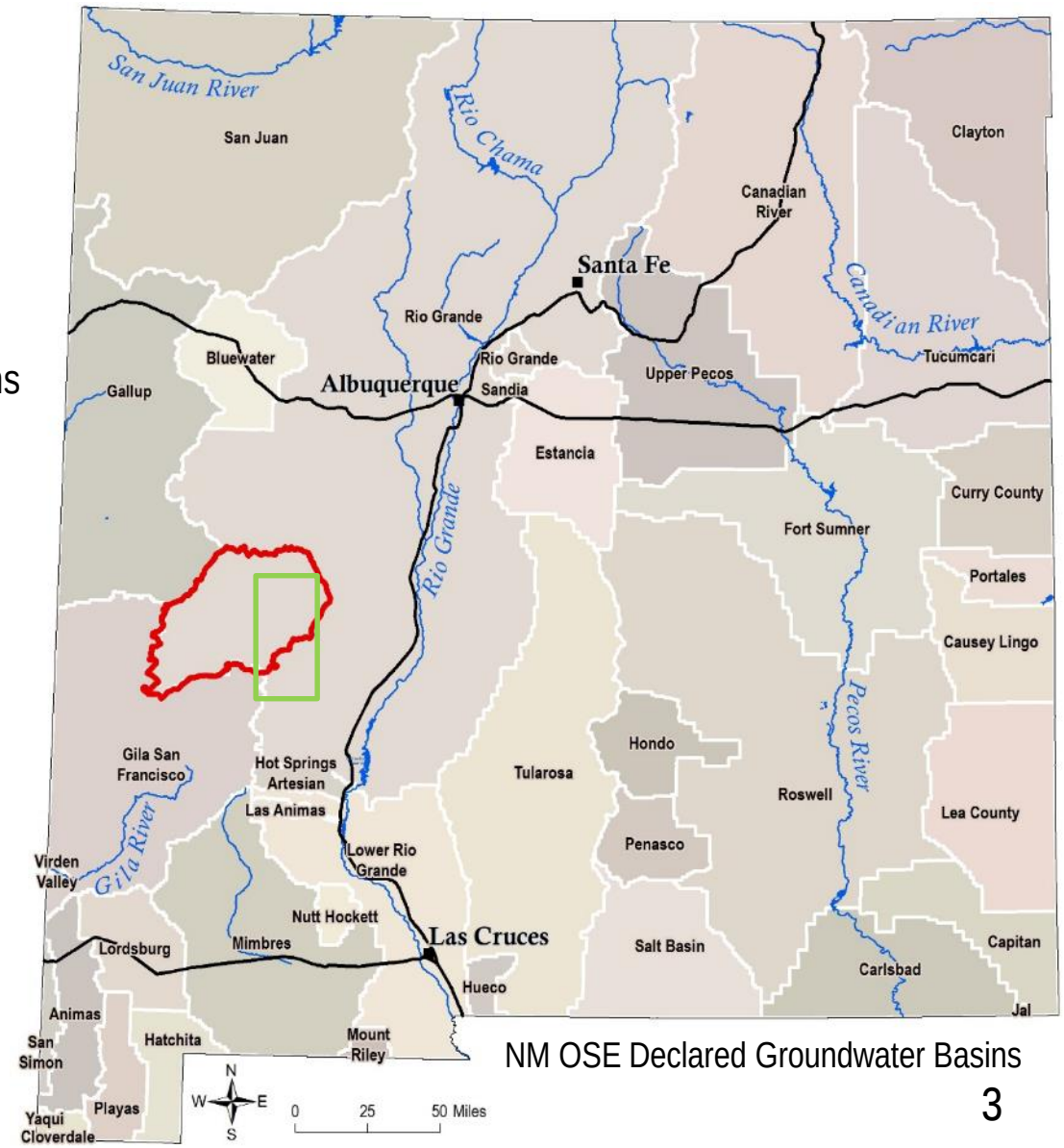
- Groundwater availability in San Agustin Plains (related to water transfer application)

- Water quality concerns (related to a mining application)

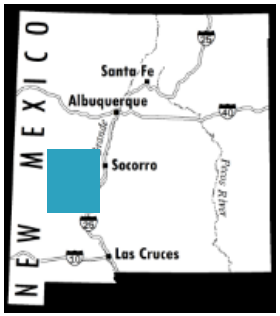
Project lead by Alex Rinehart and Dan Koning

San Agustin Plains outlined in red, within NM OSE's Rio Grande groundwater basin

NMBGMR study area in green box

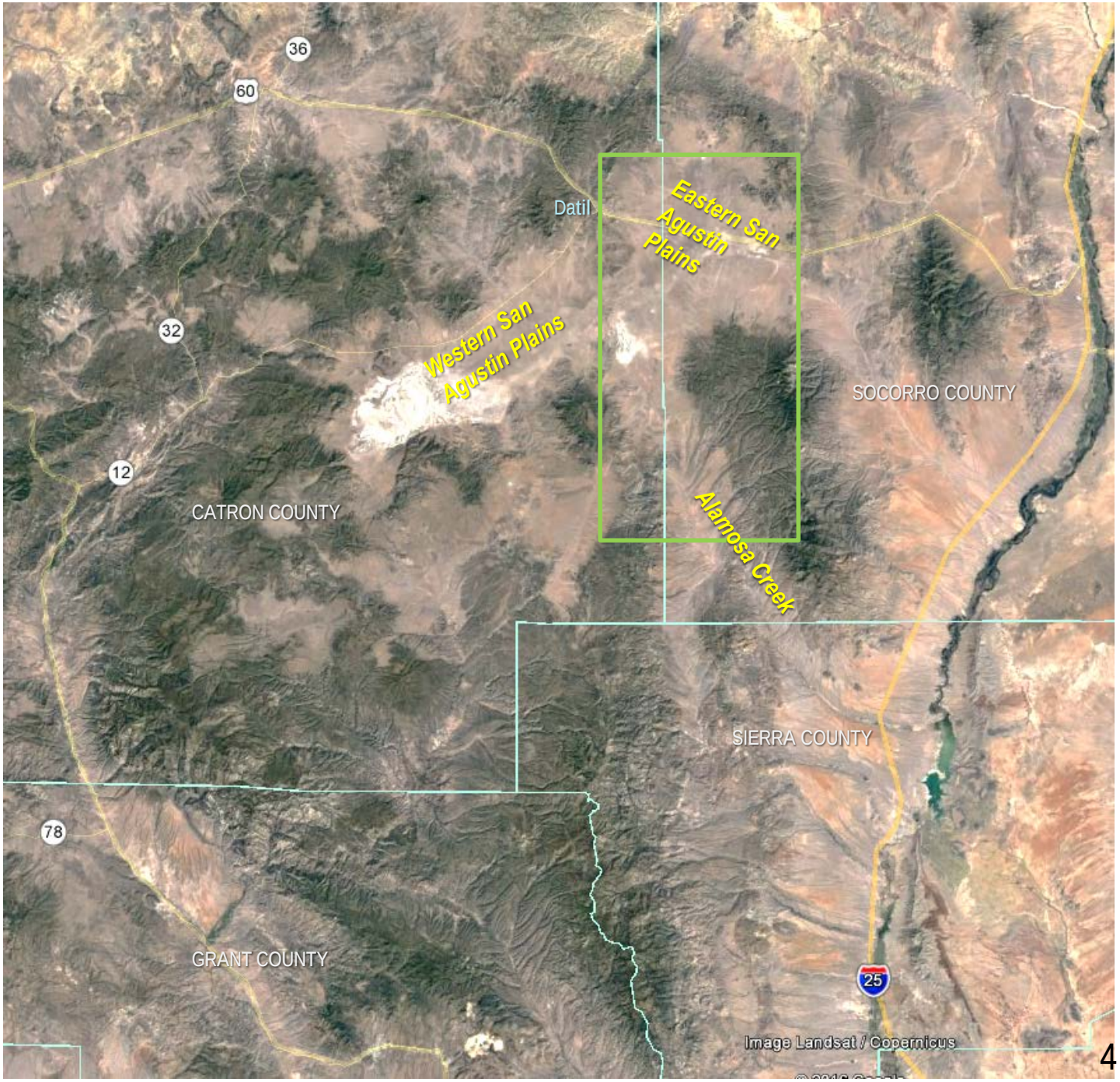


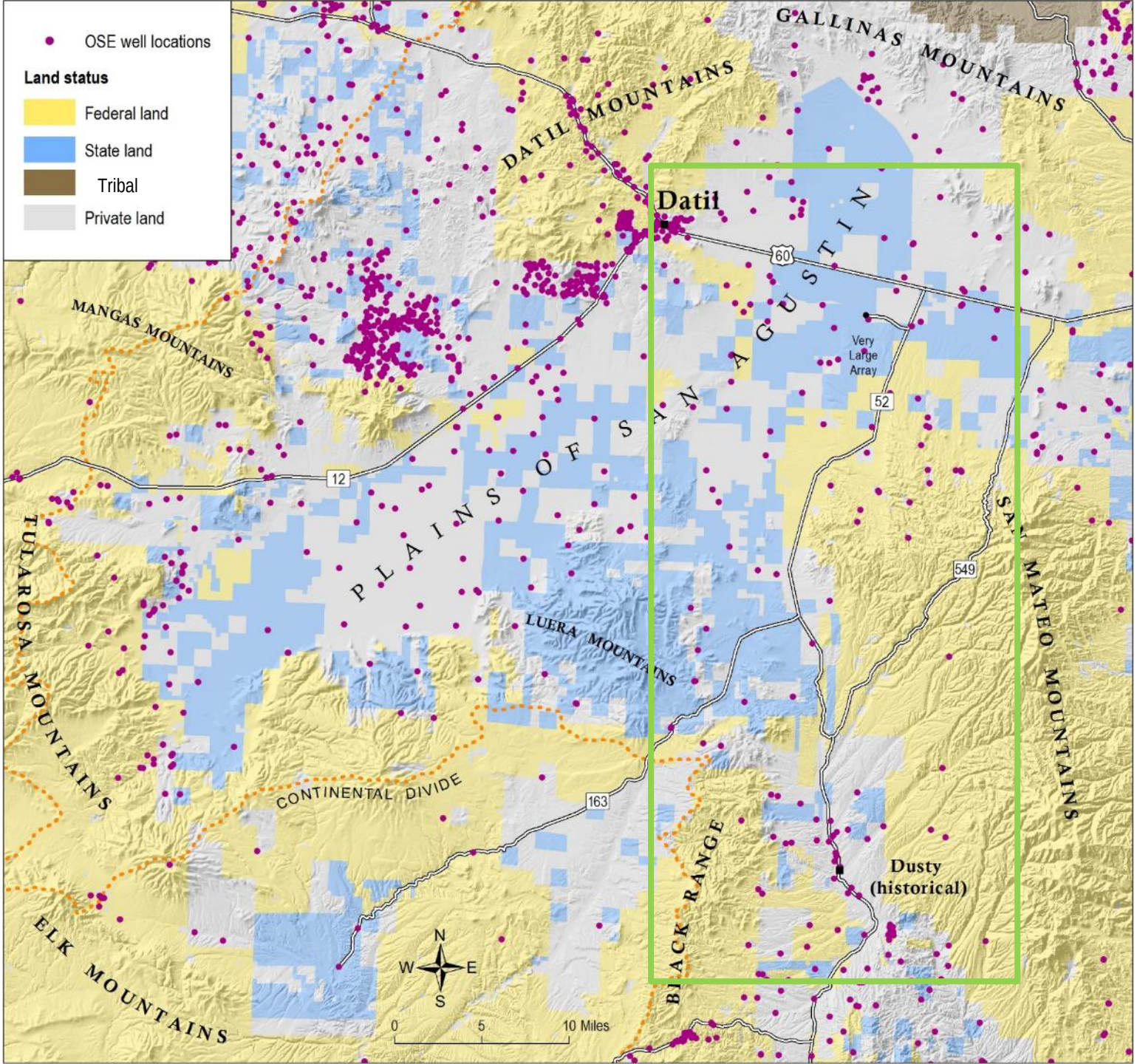
NM OSE Declared Groundwater Basins



Area of study by NMBGMR

Focus on eastern San Agustin Plains

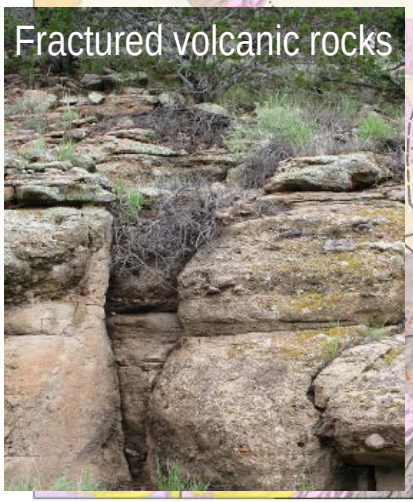



OSE well locations
Land status
Federal land
State land
Tribal
Private land
GALLINAS MOUNTAINS
DATIL MOUNTAINS
Datil
60
SAN AGUSTIN
MANGAS MOUNTAINS
Very Large Array
52
12
PLAINS OF SAN AGUSTIN
549
SAN MATEO MOUNTAINS
TULAROSA MOUNTAINS
LUERA MOUNTAINS
CONTINENTAL DIVIDE
163
BLACK RANGE
Dusty (historical)
ELK MOUNTAINS
N
W
E
S
0
5
10 Miles

Geology

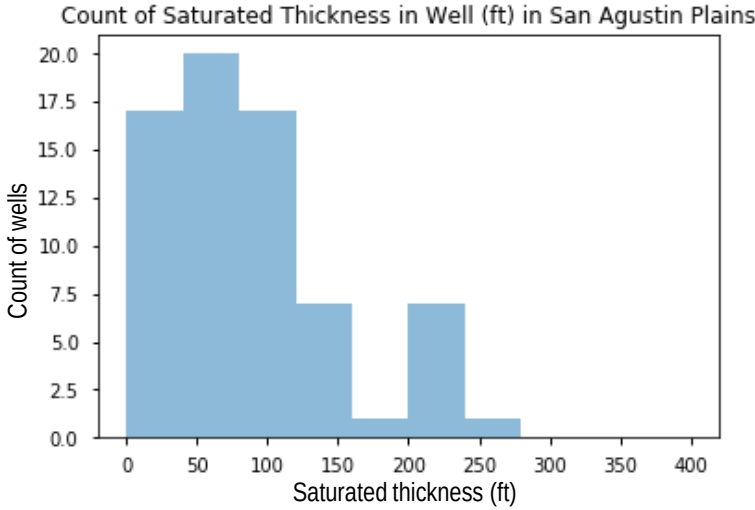
- Faults solid lines and dashed lines break up the basins into smaller sub-basins (“grabens”)
- Basins are filled with **sediments** from a period of intermittent playas/lakes ~8,000-11,000 years ago
  - *Yellow and beige units on map*

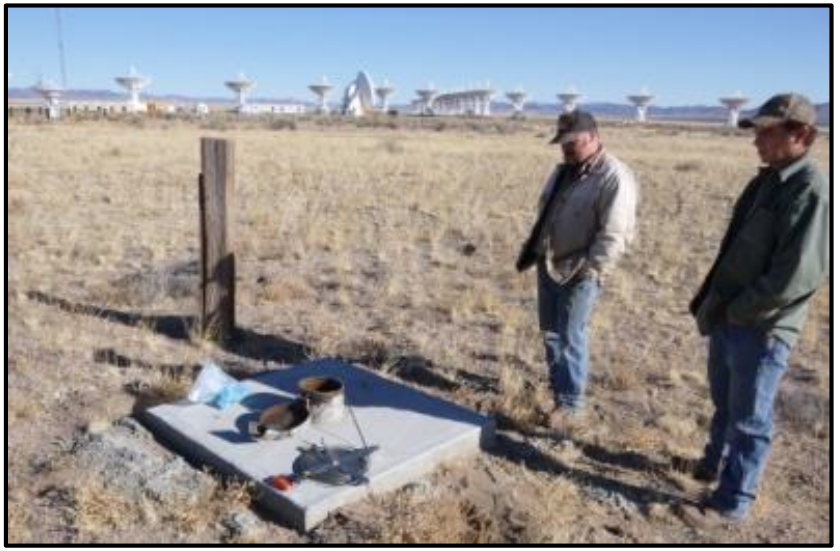
- Surrounding mountains and beneath basin-fill sediments are **volcanic rocks** (some good aquifers, some not) erupted ~34-28 million years ago
  - *Pink, orange, brown units on map*
- Groundwater is found in **fractures in volcanic** rock and in **tiny pore spaces** between sand/clay/gravel grains



San Agustin Plains

- Precipitation ~8-15 inches per year, depending on location
- Most wells are up to ~500 ft total depth
- Most wells have about **100 ft or less saturated thickness** (column of water)
- Depth to water ranges from ~150-300 ft below ground





Summary of Previous Work

Blodgett and Titus (1973, NMBG OFR 51)
Myers et al. (1994, USGS Water Resources Report 91-4125)

Major findings

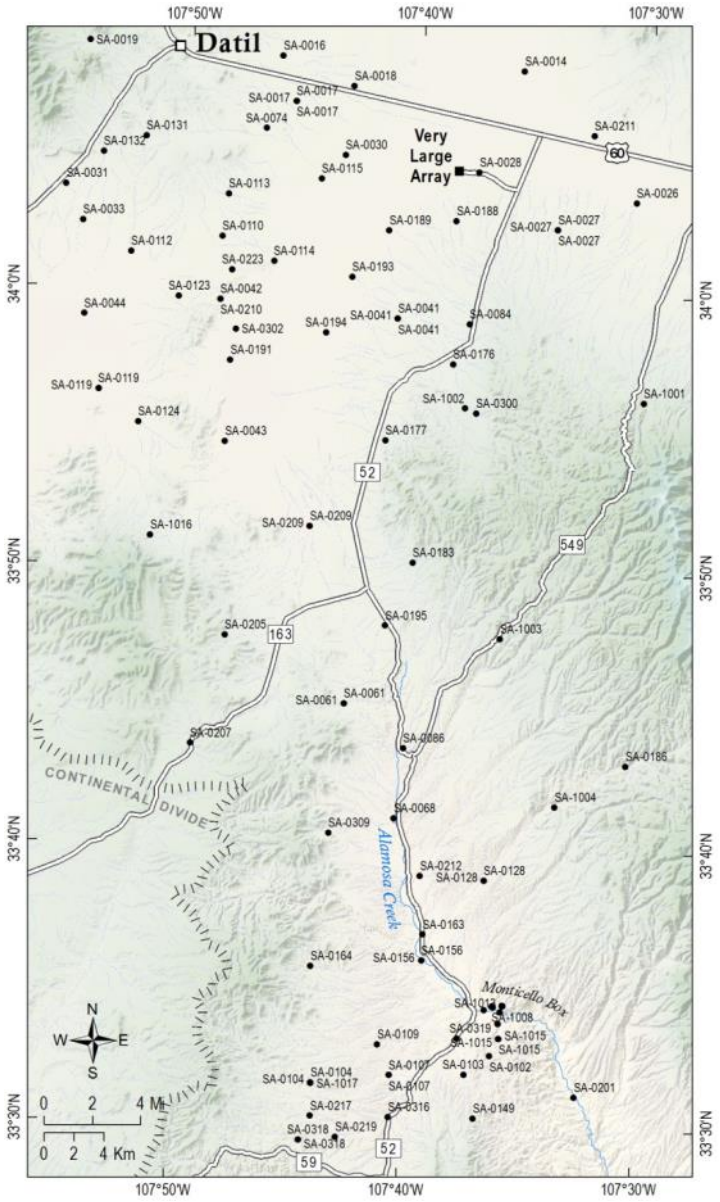
- Good water quality in eastern San Agustin Plains, possible brackish water in western San Agustin Plains ~1000 ft below ground surface.
- Very low gradient of groundwater flow.
- San Agustin Plains drains into Gila basin, subsurface through volcanic rocks between Tularosa Mts. and Pelona Mts.
- Volcanic aquifers and basin fill aquifers are connected, but they could not assess how well or where because of lack of data.
- Estimated basin-fill thickness and depth-to-brackish-water using geophysics.
- Used 5 aquifer tests and resistivity data to *estimate* basin-fill water storage. Myers states:

"Lack of sufficient aquifer-test data and well-logs makes accurate estimation of water in storage difficult."

- Eastern San Agustin Plains estimate groundwater in storage: 34 Million Acre Feet*
- Western San Agustin Plains estimate groundwater in storage: 19 Million Acre Feet*

**No corrections were done for compaction of sediments at depth*

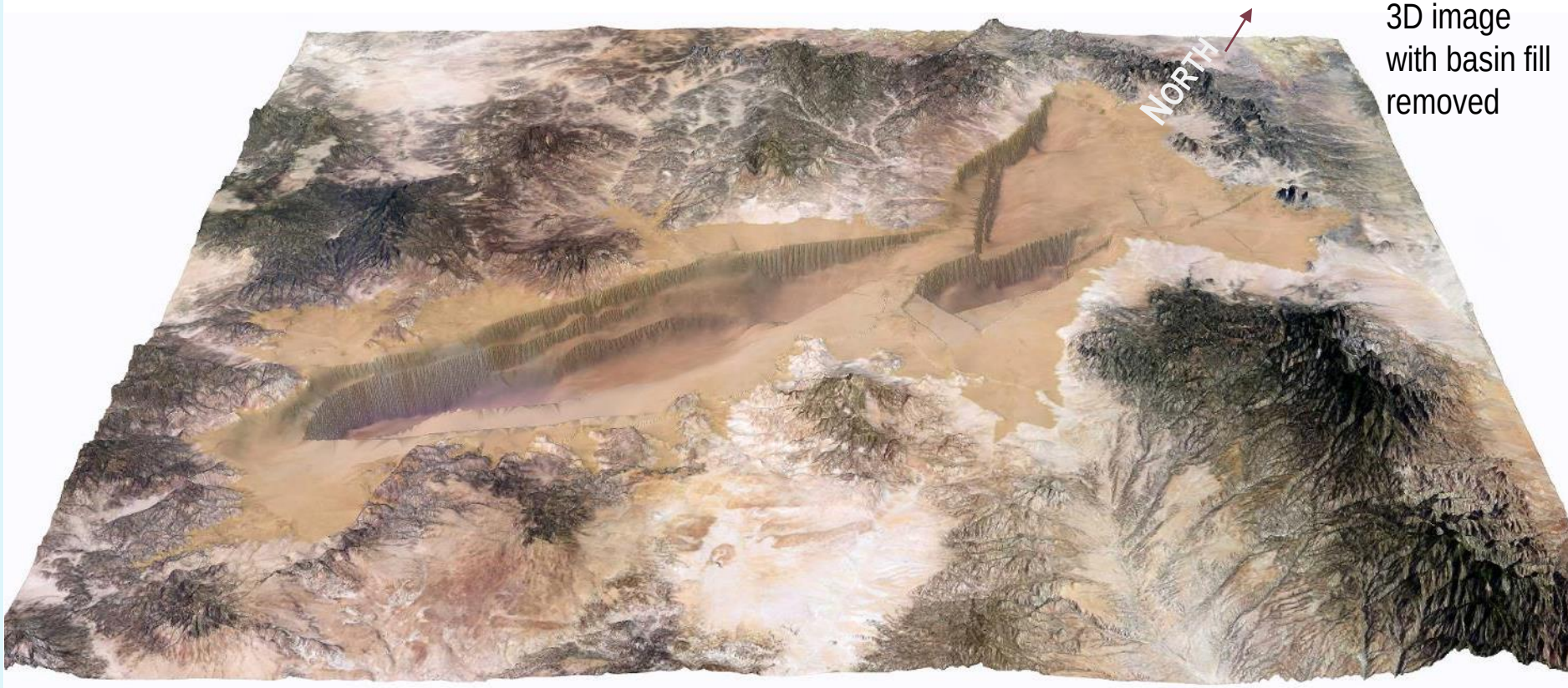
New data in San Agustin Plains - NMBGMR



- Geologic mapping and detailed review of well logs / geophysics available
- Groundwater level measurements over multiple years
- Sampled 37 wells and 16 surface water sites (geochemistry)
- Analyzed subset for environmental tracers / groundwater age

New Results

1. Greatly improved geologic understanding
   - Better constraints on sub-basins (<3000-3500 ft deep) and faults
   - More detailed mapping of volcanic rocks surrounding basin



3D image with basin fill removed

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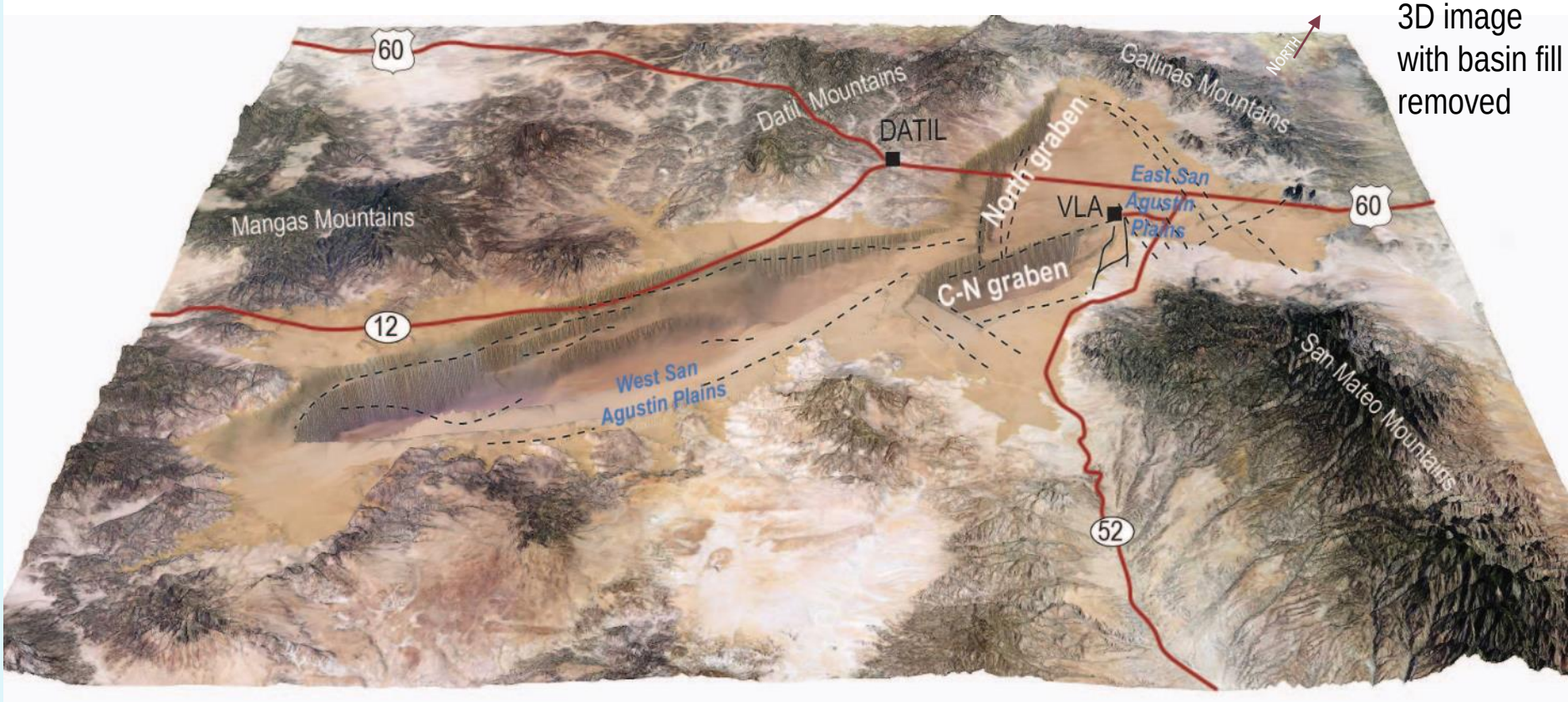
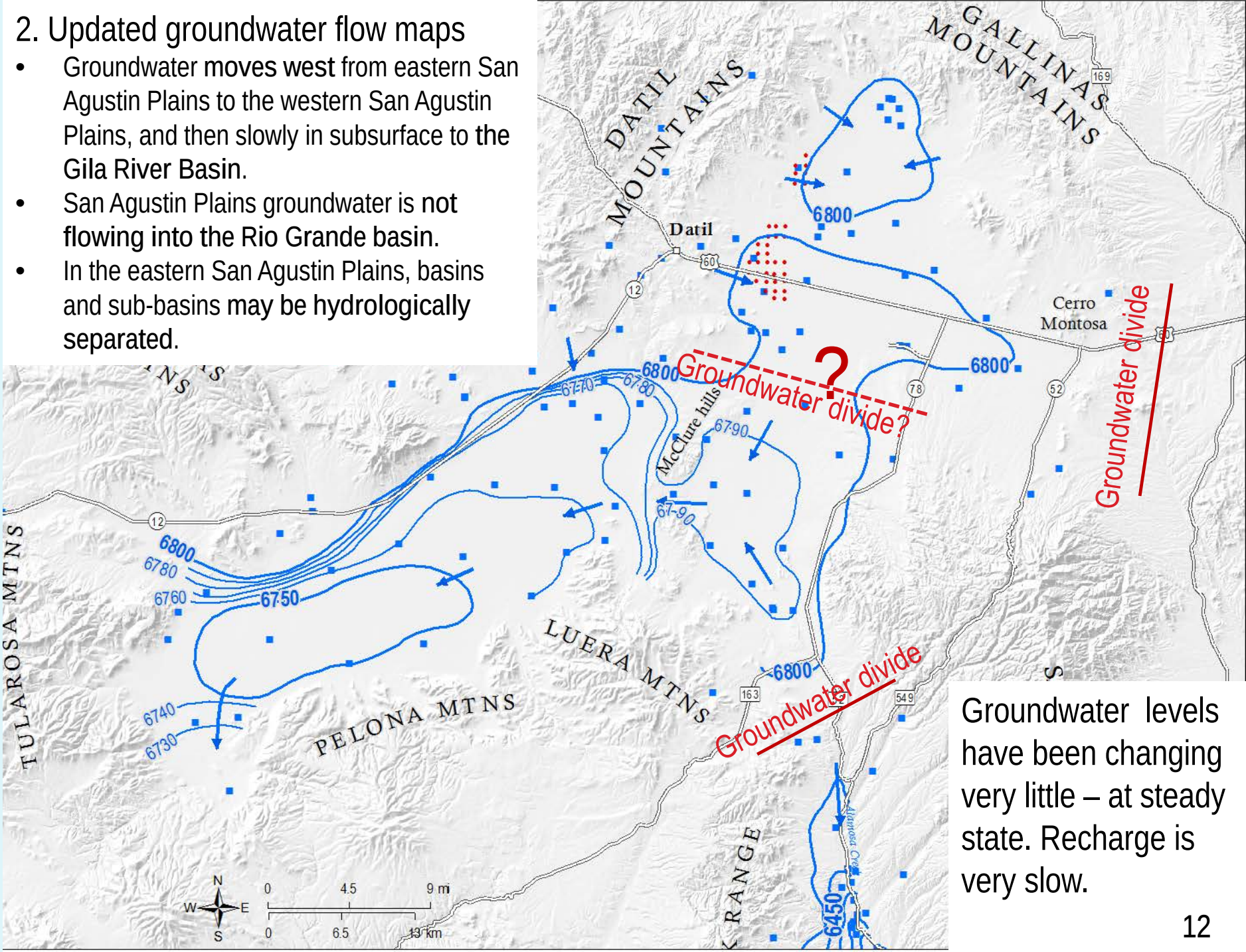


3D image with basin fill removed

2. Updated groundwater flow maps

- Groundwater **moves west** from eastern San Agustin Plains to the western San Agustin Plains, and then slowly in subsurface to **the Gila River Basin**.
- San Agustin Plains groundwater is **not flowing into the Rio Grande basin.**
- In the eastern San Agustin Plains, basins and sub-basins **may be hydrologically separated.**



Groundwater levels have been changing very little – at steady state. Recharge is very slow.

Summary of New Results

1. Greatly improved geologic understanding
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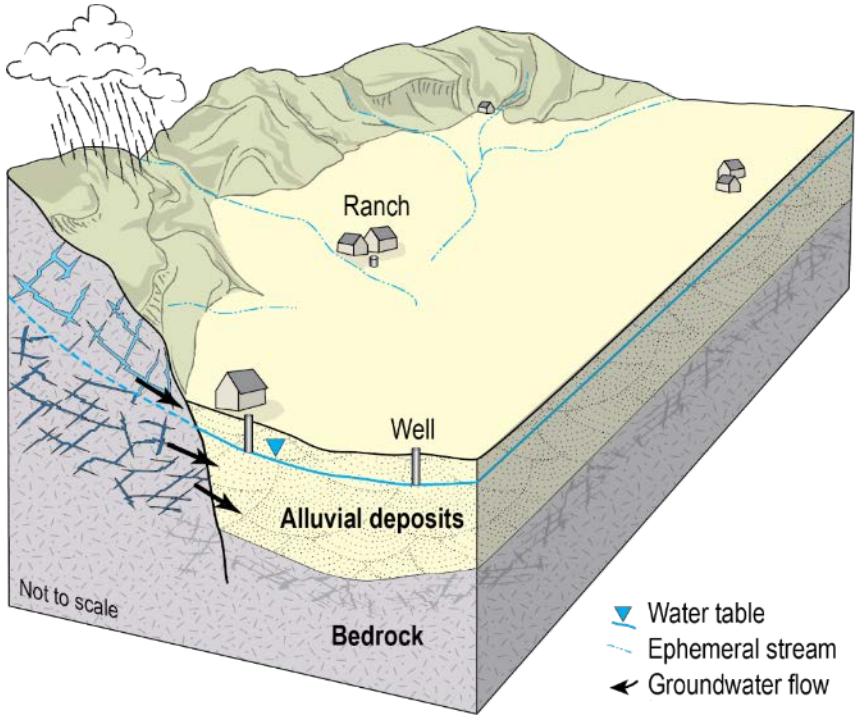
2. Updated groundwater flow maps
   - Groundwater **moves west** from eastern San Agustin Plains to the western San Agustin Plains, and then slowly in subsurface to **the Gila River Basin.**
   - San Agustin Plains groundwater is **not flowing into the Rio Grande basin.**
   - In the eastern San Agustin Plains, basins and sub-basins **may be hydrologically separated**.
3. Eastern San Agustin Plains **groundwater is old** (**average ~11,000 years old**), with limited recharge slowly coming in from surrounding mountains through subsurface.
4. Updated estimate of **groundwater in storage**, including sediment compaction
   - Eastern San Agustin Plains estimate: 21-25 Million Acre Feet (previous estimate was 34 Maf)
   - North Graben (sub-basin) estimate: 12-15 Million Acre Feet

Unanswered questions

- How connected are basin fill aquifers to surrounding bedrock? And to each other?
- What are aquifer characteristics at depth (water quality, aquifer properties)?

Data used to generate groundwater storage estimates, aquifer properties, subsurface geology are STILL sparse, making it **difficult to accurately assess** impact of the proposed project.



In order to answer these questions:

- Sample wells for geochemistry and other tracers to inform understanding of connection
- Drill deep wells – so we know what's down there
- Test water quality and hydraulics at different zones in deep wells

New research as of 2018:

NMBGMR: With state and gift funding, 12-15 new geochemistry sample sites in North graben, eastern San Agustin Plains

U.S. Geologic Survey: With BLM funding, looking at wells in San Agustin Plains on BLM land, to collect geochemistry and groundwater level measurements

Thank you!

geoinfo.nmt.edu

geoinfo.nmt.edu/resources/water/amp

To see and rotate the 3D basin image, go to:
http://bit.ly/2NHEsdf