The Union County Hydrogeology Project

NE Soil and Water Conservation District
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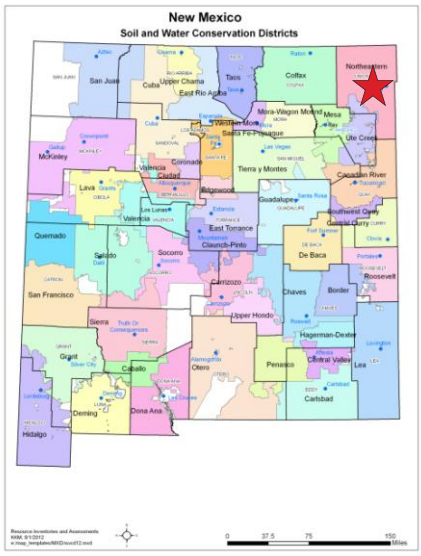
Union County and the NE Soil & Water Conservation District



The growth of the UC Hydrogeology project:

- The Union County area was not declared a groundwater basin until about 8 years ago:
  - Community concerns over water resources and usage
- NE Soil & Water District: hydrogeology project critical for laying out guidelines for drilling, pumping etc.
  - Sacramento Mountains hydrogeology project wrapping up in southeastern NM
- NM Bureau of Geology and ZGC partnered with NESWCD to develop project in phases

NESWCD Phases (10 year duration)

- Phase I (10 years, now into 8th year):
  - Measure static water level at 50 wells across the county
    - January: minimum use
    - August: maximum use
- Phase II (5 years, into 5th year):
  - Revise geologic maps, describe rocks and begin to develop context for water
    - Aquifer units identified
- Phase III (3 years, into 4th year):
  - Target selected wells for carbon dating, water chemistry, stable isotopes and data recorder monitoring.

Data Sets

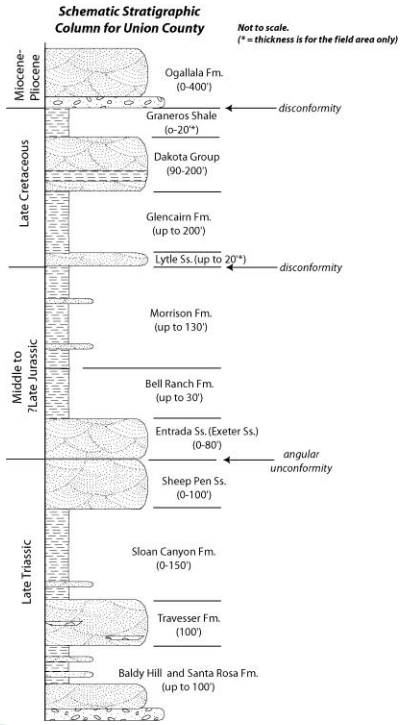
- Revised geologic maps
- Petroleum well logs
  - Subsurface information
- Water chemistry
- Radiocarbon and tritium dating
- Data recorders and static water level measurements

- Community assumptions: everyone is using the Ogallala aquifer throughout the county
  - There's an ocean of water down there!

Rocks You Can Shake Hands With

- In Union County, the following age rocks are exposed:
  - Late Triassic (230 to 200 million years ago)
  - Middle to Late Jurassic (175 to 150 million years ago)
  - Late Cretaceous (125 to 95? million years ago)
  - Miocene–Pliocene (23 to 2.6 million years ago)
  - Quaternary and Recent (2.6 to 0 million years ago)

The Rocks of Union County



A *disconformity* is where sedimentary rocks are overlain by sedimentary rocks, but there is time missing between the two sets of rocks.

Chinle Group, Dry Cimarron V.

Exeter Sandstone, Morrison Fm.

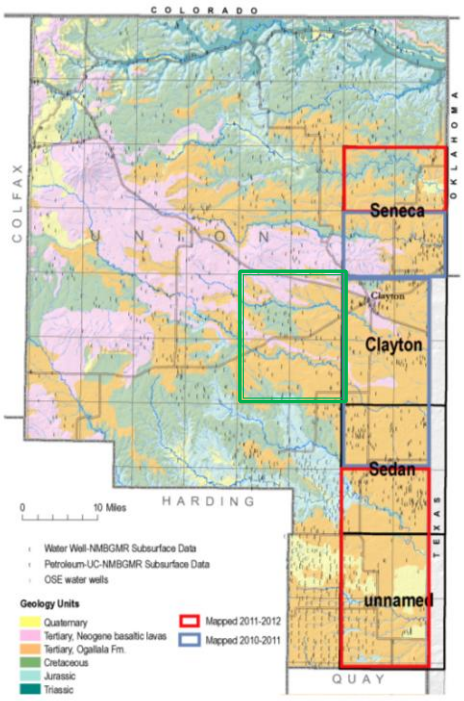
Dakota Group, Graneros Shale

Ogallala Formation

Geologic Mapping

- Five 1:50,000' quadrangles finished by Spring 2013:
  - Originally mapped in 1950s by air photo and walking of surface exposures
  - Northern Seneca quadrangle to Quay County line and west of Clayton
  - Using 1950s air photo maps and spot checking creek bottom exposures.
- A way to examine potential aquifer units and understand the relationships between rock types in the area.

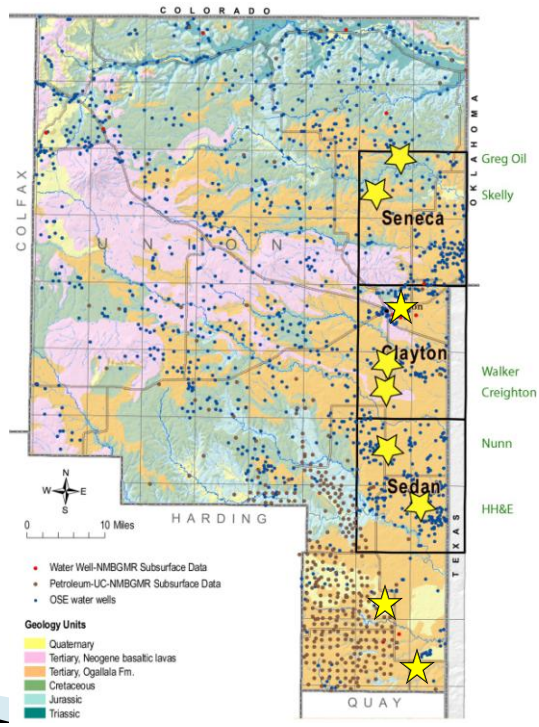
Location of Quadrangles



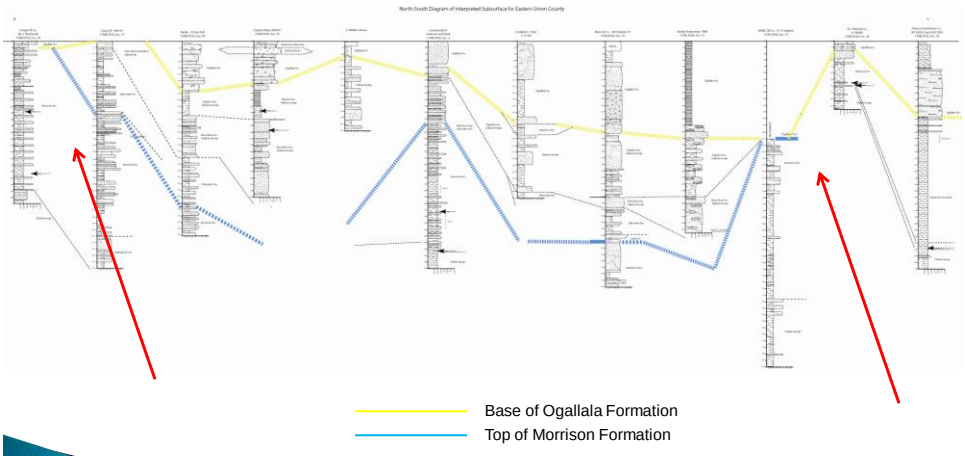
Updated Geologic Maps: Links to Aquifer Characteristics

- Appearance of Jurassic Morrison Formation at Tramperos Creek:
  - Influences water chemistry
  - Thick sandstones are not laterally continuous and thickness varies.
    - Worth drilling for?
  - Why is Jurassic Morrison Formation occurring at the surface?
    - Regional tilt to rocks?
    - Fault relationship?
    - Folding?

Petroleum Wells

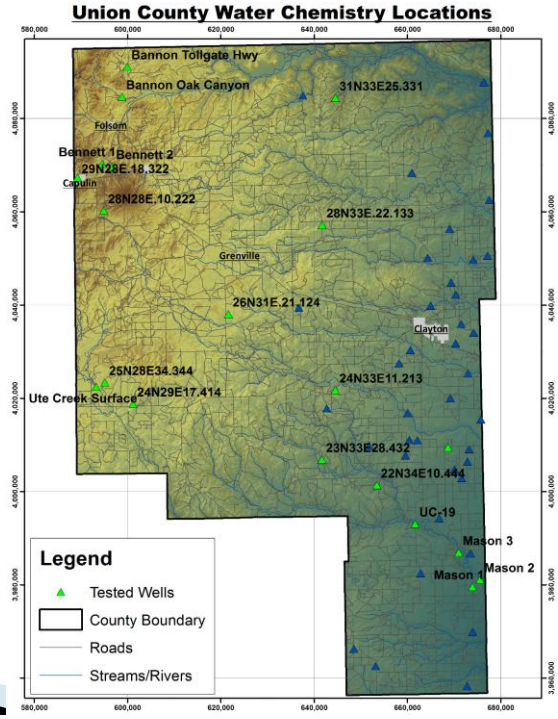


North-South Subsurface Diagram

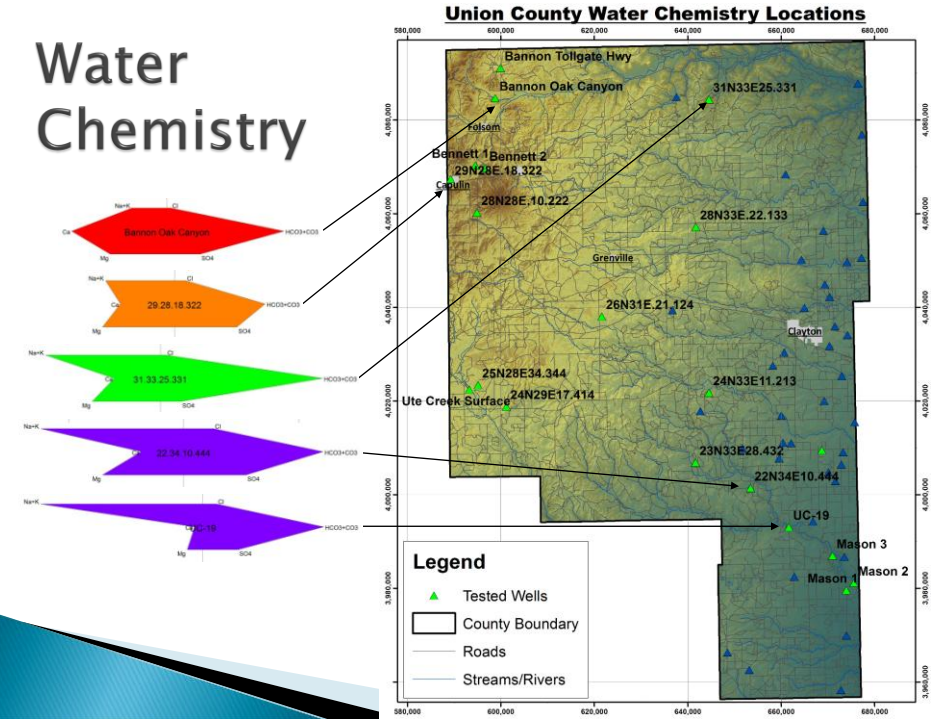


Water Chemistry

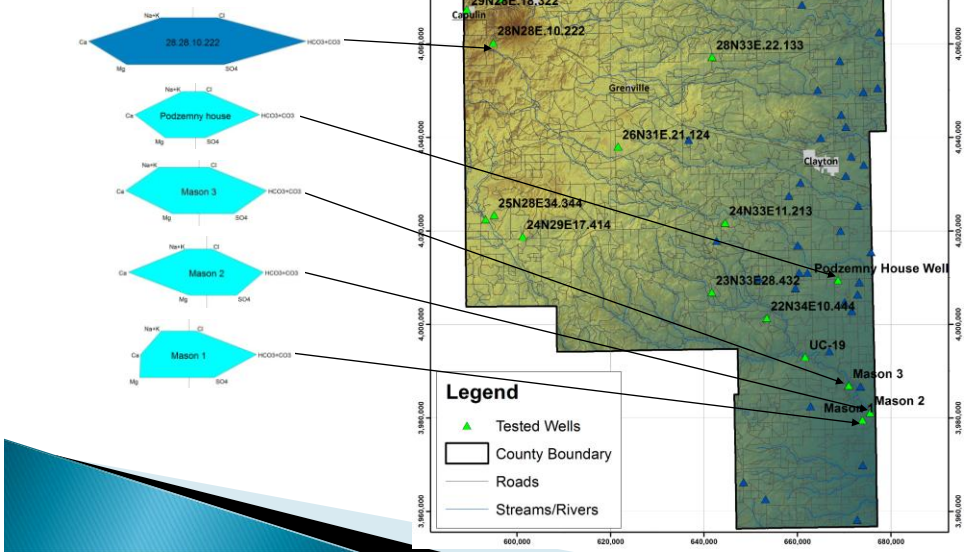
Example Stiff Diagram



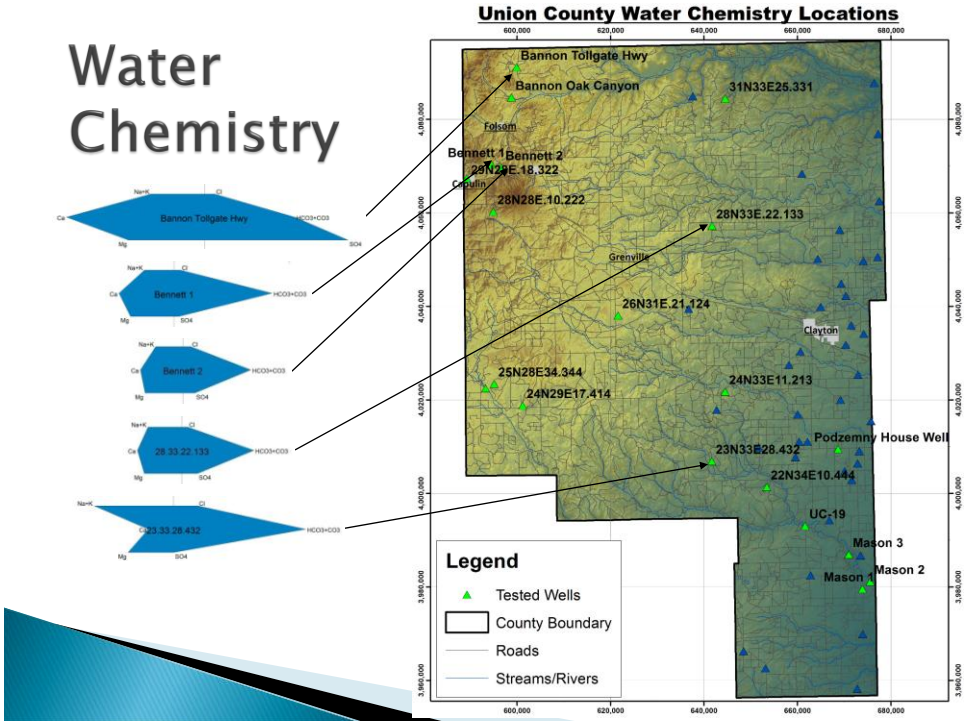
Water Chemistry



Water Chemistry



Water Chemistry

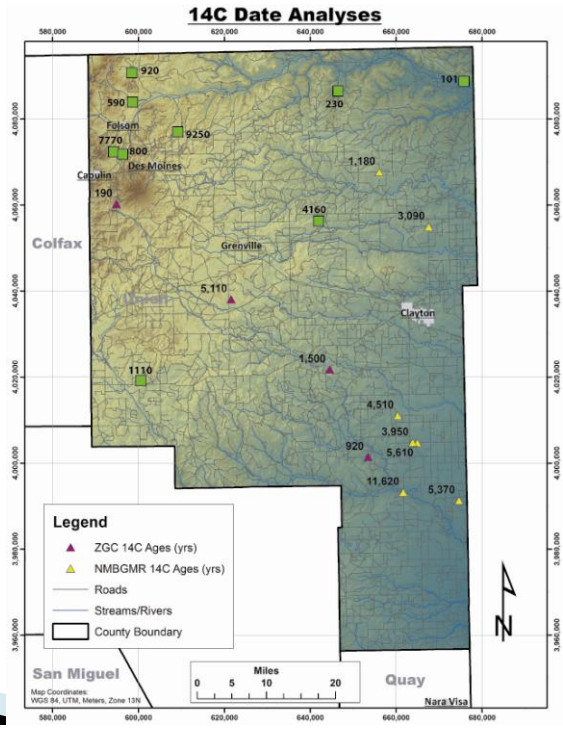


Water Chemistry

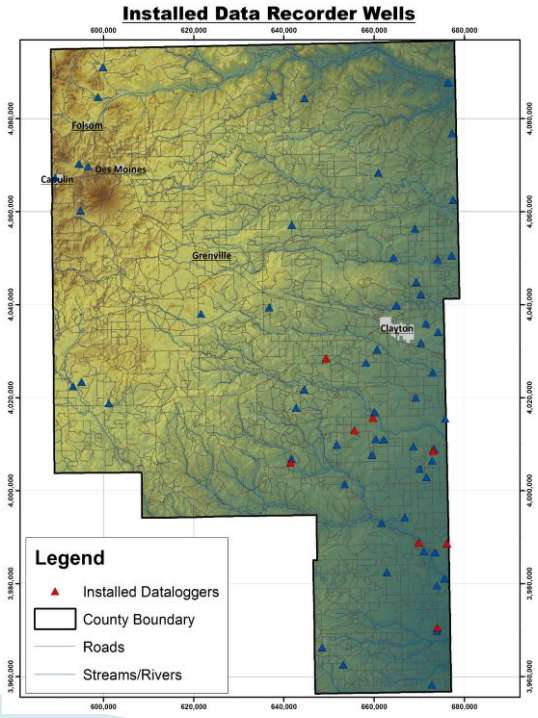
- Results:
  - High sodium seems to be associated with Jurassic Morrison Formation outcrops
  - High sulfate is associated with Cretaceous marine shales
  - Calcium, magnesium, carbonate and bicarbonate associated with Dakota Formation ± Ogallala Formation

^{14}C Dates

- Seemingly random distribution of ages across Union County suggests partitioned aquifer(s).
  - Further investigation will include both additional ^{14}C dates and tritium dates
    - Can we identify mixing of younger, recharging waters with older waters?



Data Recorders



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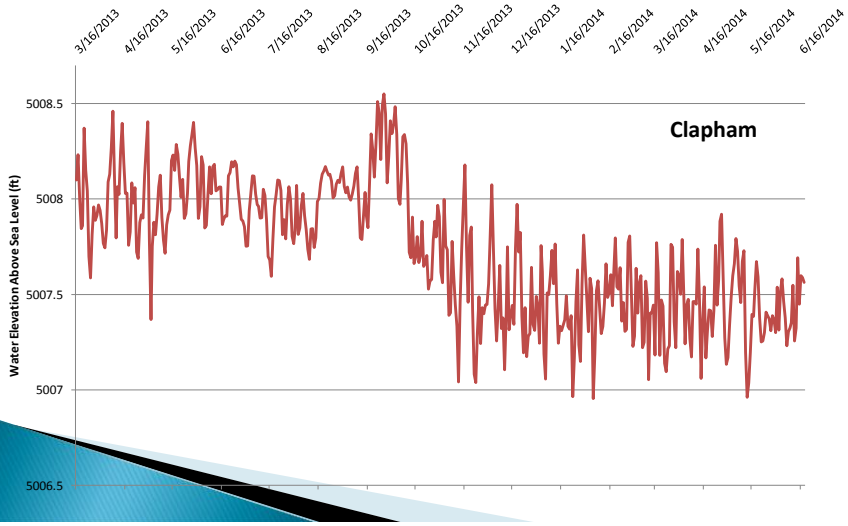
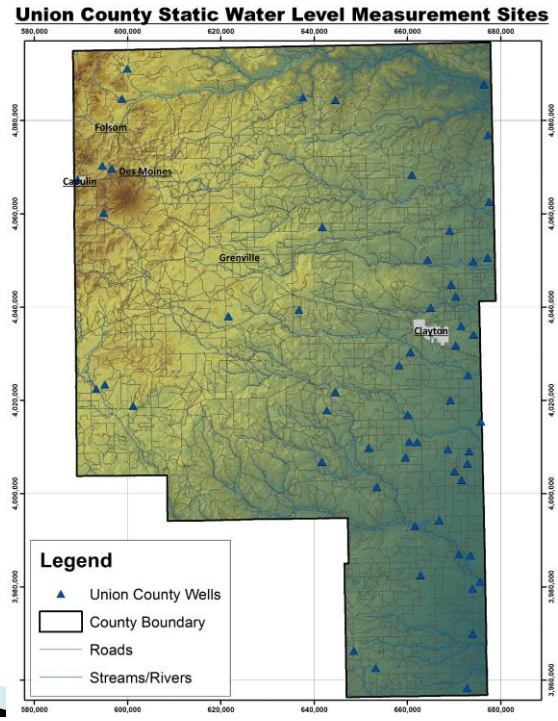
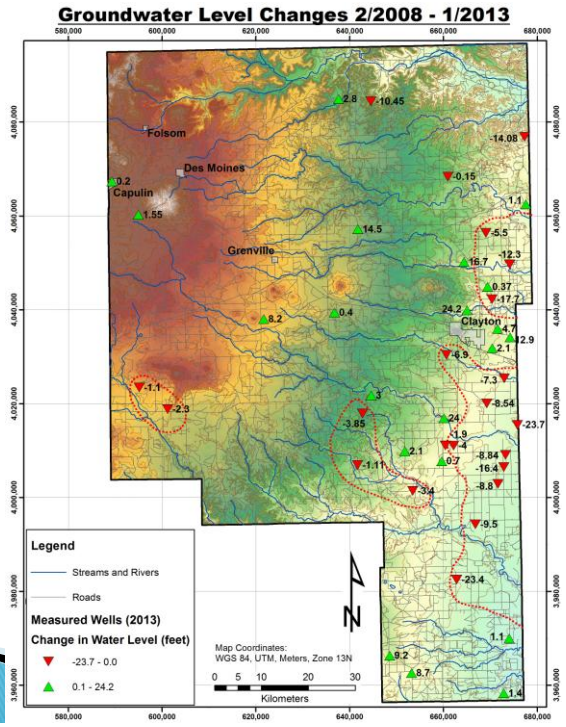


Biannual Static Water Level Measurements





Greatest change in wells in Ogallala paleovalleys.

Conclusions

- Results:
  - Water chemistry and petroleum well data aid in refining picture of the subsurface
    - Partitioned aquifer system versus regional aquifer
  - ^{14}C data suggest highly partitioned aquifer system, even within one unit (e.g. Dakota Group)
  - Data recorders are capturing more precise behavior of different parts of the aquifer system
  - Static water level measurements have provided a base line for understanding of recharge and discharge areas

Community Integration & Further Efforts

- ZGC "deliverables":
  - Presentations at annual Producers Meeting, County Fair
  - Articles for county newspaper
  - Annual report available to all community members
- Response to data at the community level
- Continuation of data collection through 2015
- Joining with other organizations
  - Mora-Wagon Mound SWCD, Colfax County

Colfax County Groundwater Initiative

- Begun April 2014 at an open townhall meeting in Maxwell.
  - Working group formed that includes county commissioners, SWCD board members and land owners
  - Developing a project on the same scale as the Union County project
    - Continuity from east to west
    - County is leading financing efforts

M-WM SWCD Hydrogeology Project

- Received funding this year from SWCC
  - First round of biannual static water level measurements
  - Preliminary geologic mapping
  - Small number of water samples for analyses
- Beginning work in September
- Working with NRCS to identify the best sampling scheme to give us the most bang for our buck

Home-grown hydrogeology!

- What steps can producers and land-owners take to begin a project like this?
  - Measure static water level in wells across county for 10 years (maximum and minimum use seasons)
  - Target wells for chemistry, carbon dating, isotopes, data recorders
    - Work with hydrologists and geologists to assess the best wells to sample.
    - Determine east-west or north-south transects to examine lateral changes in chemistry and/or age from well to well.
  - Identify outcrops of rocks in the area
    - Work with geologists to identify and characterize the units exposed on the surface.

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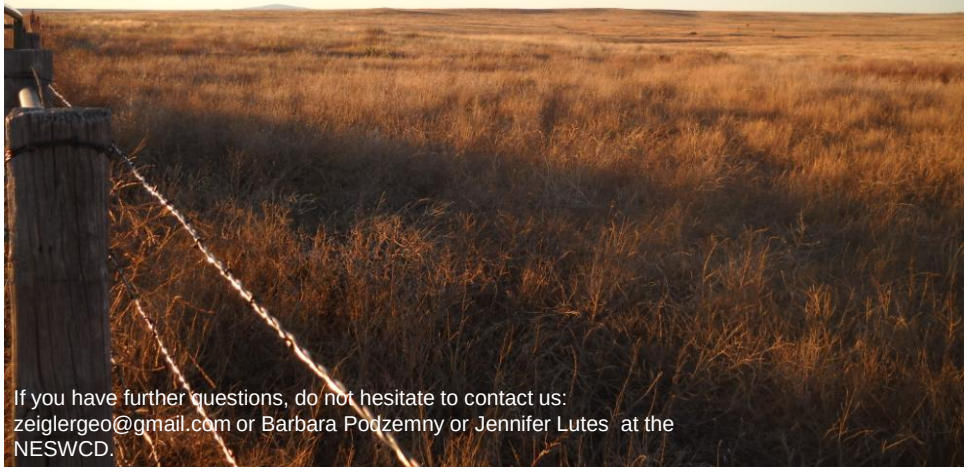

If you have further questions, do not hesitate to contact us: zeiglergeo@gmail.com or Barbara Podzemny or Jennifer Lutes at the NESWCD.