

**MINUTES**  
**ENWRA Annual Meeting – Technical Focus**  
**Tuesday, January 26, 2016 3:00-5:00 pm**  
**Meeting Room: Chancellors 2/3 Embassy**  
Suites- 1040 P Street - Lincoln

**Attendees (24<sup>+</sup>):**

Chuck Wingert (NNRD), Paul Woodward (PMNRD), Duane Woodward (CPNRD), Larry Angle (LPNNRD), Ginny McGuire (USGS), Jesse Korus (CSD), Dana Divine (CSD), Dan Schulz (LPSNRD), Paul Zillig (LPSNRD), Shaula Ross (LPSNRD), Marlin Petermann (P-MRNRD), Sue Lackey (CSD), Stephanie Butler (Bazile GWMA), Annette Sudbeck (LCNRD), Miles Lammers (LCNRD), Tom Moser (LCNRD), Brian Bruckner (LENRD), Amy Zoller (NDNR), Eric Slegh (NDNR), Jim Cannia (AGF), Amanda Flynn (USGS), Dick Ehrman (LPSNRD), Tom Mountford (LPNNRD), Katie Cameron (Coordinator), + additional managers later on

**Review of 2015, WSF Applications, and FY16-17 Budget**

ENWRA Recon flights are done and reports are final and data is posted on the ENWRA website (group agreed to increase website service contract \$10/month to add storage capacity). ENWRA gave many presentations on AEM results and the ENWRA/NDNR interlocal agreement for flights is closed out. Annual water samples collected at ENWRA pilot study sites in September with pesticide sampling event (results not in yet), routine equip maintenance, transducer downloads/water level graphing, graphing and statistics on water quality samples continues.

AEM WSF Applications: 6 NRDs (LPNNRD, LPSNRD, LENRD, LCNRD, LLNRD, P-MRNRD) and Bazile Man. Area group each went in separately for WSF in Dec. 2015 (Estimated total asking < or = \$250,000 per NRD) for additional AEM flights. April 2016 would be when we may find out if applications are approved and it is looking for our chances since more money is set aside than has been requested this round.

USGS/ENWRA WSF Application: The ENWRA group also submitted a WSF application Dec 2015 with the USGS for quality and age-dating reconnaissance of secondary aquifers. ENWRA is proposing to enter into a two-year joint funding agreement (JFA) with the USGS Nebraska Water Science Center, to accomplish this goal if the WSF application is accepted. The total cost to ENWRA for the agreement for the current scope of 20 wells would be \$64,200 over a 2-year period (providing WSF provides all match in the first year). ENWRA has \$70,000 in FY 17 for potential WSF match. Also, July 2016 will be the next acceptance period for WSF applications and the 20 well sampling scope could be expanded in another application.

Budget: ~\$316,500 in ENWRA budget to work with at start of FY17 after commitments and income. Plan to get Pilot Study site HEM converted into Google Earth format by end of FY16 and possibly a couple more ENWRA test holes along recon lines. Will have: \$70,000 routine expenses, \$25,000 in data management, \$64,200 budgeted for Water Sustainability Fund (WSF) application match, and \$130 extra for website upgrades in ENWRA's FY17 budget. Estimated \$277k banked starting FY18.

**Long Range Plan (LRP) Review & Data Management and Science Topics (LRP Obj. #7 & other Obj. #s)**

GERDA: Outreach to Denmark-Greenland Geological Survey (GEUS) about GERDA (Denmark AEM database paper handout) discussions. Sounds like group is glad GEUS is interested to help guide us, need to think about whether we are ready to go with the next step of building a GERDA platform based out of Nebraska, details of how it would work, what kind of hands on time required VS subcontractor, costs, what expected uses/products NRDs would be interested in, and would CSD be providing a guide and standards like GEUS is for GERDA.

LRP#7 Initial Step Option - USGS Data Preservation Funding Application (Dr. Jesse Korus): CSD plans to submit an application to the USGS National Geological and Geophysical Data Preservation Program for combining the CSD TH database with a digital inventory of geophysical data and paper-based geologic records for the state. Since ENWRA has collected the majority of geophysical data for the state and we are currently wanting to make progress toward our data management goals in LRP, CSD would like

ENWRA as a partner on the application (due Feb. 8<sup>th</sup>). This database would provide a structure to house the data all in one place and have it inventoried and ready for future customized web applications and GIS functionality. The funding (\$750k annually) is geared to state surveys and a 50% match is required (in-kind salary and 3<sup>rd</sup> party – need to figure costs - thinking \$40k grant asking and \$20k of direct match using ENWRA funds). CSD won \$20k grant from this program in 2014. Katie will coord. with ENWRA and CSD to get app. cost/scope drafts out and letters of support from ENWRA. [Feb 2016 update – app. higher cost than anticipated but further talks with GEUS indicate it will be worth it, submitted a grant asking for ~\$85k from USGS with \$25k in ENWRA funds for match plus ~60k CSD match]

Science related LRP objectives and AEM (Dr. Jesse Korus): Jesse went over a recent paper he submitted with Jared Abraham on the Sprague-Firth HEM data to demonstrate some additional paleovalley stratigraphy understandings gleaned from looking deeper at the 2007 and 2009 HEM datasets. Jesse also presented discussion points for the group on the AEM data: what scientific questions could be worked on using the data: aquifer boundary values and water inputs/outputs, estimating hydrogeologic parameters using the HEM/AEM data for water budget analysis and what steps do we need to go from the data collection phase to management impacts.

### **USGS National Brackish Groundwater Assessment Overview – Ginny McGuire USGS**

The National Brackish Groundwater Assessment compiles existing data to describe the distribution and character of brackish groundwater, the current use of brackish groundwater, and the data gaps for fully characterizing the resource. Ginny has been involved in the assessment project all along and went over a general overview of the sources of the data, the reports available, how the assessment was compiled and presented and specifics regarding the data specific for Nebraska data and what information is available. Question and Answer:

- Dick and Marlin: Feth report (Feth, 1965) and our maps (see attached reference list from Ginny)
- There was much discussion and follow-up after the meeting regarding this topic and other potential USGS services/initiatives/publications could help ENWRA goals and objectives - **see attached** USGS follow-up reference compilation list from Ginny McGuire after the meeting

### **Upcoming 2016 Actions and Questions**

#### Group Updates:

- P-MRNRD: ENWRA test holes: 2 complete along flight lines one more (Hubbard) to go in spring will get \$9,150 ENWRA credit on FY16 dues – asked about caps for artesian wells
- LPSNRD: using the DVB flight block AEM data to site new test holes and monitoring wells (one planned in a potential recharge area, another to explore Dakota resistor) and maybe look at lifting irrigated acre ban for east block area based on AEM aquifer mapping results (unconfined/less confined and separated from north and south blocks)

Next Tech Comm. Meeting (If we get WSF - will likely be in April), Brackish Assessment can be WebEx or scheduled if Jennifer Stanton has plans to come to Lincoln. [**Update** - add Jennifer's other SIR report: High Plains Water Budget 1940-1949 and 2000-2009 on that meeting Agenda].

LRP Finalization – Katie will send updated version out and finalize if no changes from group

Data Use/Management – put \$25k in FY17 ENWRA budget - Katie will coordinate with GEUS and CSD –ENWRA members invited to workshop at USGS on March 14<sup>th</sup> to learn how GeoScene software works in viewing AEM

Test Holes: 2-4 more NRD test holes with ENWRA funds in FY16? Schedule all before June 2017.

Mead Drilling: March 2016 - opportunity to collect Dakota samples while they packer off 10-foot intervals – Larry provided details - Group on board – Katie will coordinate sampling & info.

Pilot Sites: ENWRA routine annual sampling for pilot sites back to Spring (March-June 2016)

#### **Additional USGS Brackish-Saline References:**

- Feth, 1965 available at <https://pubs.er.usgs.gov/publication/ha199> Jen Stanton will answer Dick's question about discussing some of the differences of Feth and our maps, but there won't be a formal analysis. Answer to Marlin's question at meeting: As to the areas of high dissolved solids in western Nebraska in the Feth map, the mapped areas of dissolved solids are based on geophysical logs and reflect salinity in the Dakota aquifer (aka Great Plains aquifer). The Denver sedimentary basin of Mesozoic age underlies part of this area in western Nebraska (Coleman and Cahan, 2012, Figure 2); basins are indicators of salinity because often very deep, which results in compacted sediment, sluggish flow, and long flow paths. Sluggish flow and long flow paths give more time for dissolution of aquifer material. Also, units are of marine origin, which can result in the presence of evaporites (Johnson, 2008) and residual connate seawater. Helgesen and others (1993--plate 6) mapped dissolved solids in the Dakota aquifer generally in CO, KS, NE, NM, and southeastern WY; in western Nebraska, the data-point values are from borehole geophysical logs.
- Helgesen and others, 1993, available at <https://pubs.er.usgs.gov/publication/pp1414E>
- Plate 6: <http://pubs.usgs.gov/pp/1414e/plate-06.pdf>
- Coleman and Cahan, 2012, available at <http://pubs.usgs.gov/of/2012/1111/>
- Johnson, Kenneth S., 2008, Evaporite-karst problems and studies in the USA, in Environmental Geology, vol. 53, no. 5, p. 937-943
- Three USGS pilot studies on saline systems -- <http://water.usgs.gov/ogw/gwrp/brackishgw/pilot.html>
- Each pilot took a different approach. But the one, which includes Nebraska (Osborn and others, 2013, <http://pubs.usgs.gov/sir/2013/5017/>), calculated volume of saline water in selected aquifers.
- To map salinity, the one for SE Coastal Plain (not published) used borehole geophysics and the one for Mississippi Embayment used borehole geophysics and water-quality sample results.
- Osborn, N.I., Smith, S.J., and Seger, C.H., 2013, [Hydrogeology, distribution, and volume of saline groundwater in the southern midcontinent and adjacent areas of the United States](#): U.S. Geological Survey Scientific Investigations Report 2013-5017, 58 p.
- Gillip, J.A., 2014, [Characterization of the structure, clean-sand percentage, dissolved-solids concentrations, and estimated quantity of groundwater in the Upper Cretaceous Nacatoch Sand and Tokio Formation, Arkansas](#): U.S. Geological Survey Scientific Investigations Report 2014-5068, 23 p.

#### **Additional USGS References Useful to ENWRA Goals and Objectives:**

- Water-budget report for the High Plains Aquifer – will add to Jen's meeting scope with ENWRA <http://pubs.usgs.gov/sir/2011/5183/>
- New Base Flow est. method – <http://sd.water.usgs.gov/projects/RRAWFLOW/RRAWFLOW.html>
- USGS National Geologic Database and Mapping Interface (includes catalog of Geophysical and pdf geologic papers and reports) - [http://ngmdb.usgs.gov/ngmdb/ngmdb\\_home.html](http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)
- Lower Cretaceous Aq.- [http://water.usgs.gov/GIS/metadata/usgswrd/XML/ds25lcrctcs\\_a10.xml](http://water.usgs.gov/GIS/metadata/usgswrd/XML/ds25lcrctcs_a10.xml)
- High Plains Aquifer - [http://water.usgs.gov/GIS/metadata/usgswrd/XML/ds11hgpln\\_a10.xml](http://water.usgs.gov/GIS/metadata/usgswrd/XML/ds11hgpln_a10.xml)
- RASA (incl. USGS Helgesen Papers: 1414B and E) - <https://pubs.er.usgs.gov/publication/cir1099>

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**MINUTES**  
**ENWRA Spring Meeting – Technical Focus**  
**Friday, May 6, 2016 10:00 am -12:00 pm**  
**Lower Platte South NRD, Lincoln, NE**

**Attendees (17):**

Amanda Flynn (USGS), Chris Hobza (USGS), Paul Woodward (PMRNRD), Dan Schulz (LPSNRD), Hua Guo (NDNR), Larry Angle (LPNNRD), Robert Swanson (USGS), Dana Divine (CSD), Dick Ehrman (LPSNRD), Jim Cannia (AGF), Annette Sudbeck (LCNRD), Curt Becker (LENRD), Myles Lammers (LCNRD), Ginny McGuire (USGS), Jesse Korus (CSD), Jennifer Stanton (USGS via Webex), Katie Cameron (Coordinator)

**ENWRA recent activities/status review**

Long Range Plan (LRP) Finalized: Final changes/updates to the Long Range Plan were made and presented with no additional edits at meeting – considered final and will go out to all partners via email.

Airborne Electromagnetic Survey (AEM) WSF Applications: Reviewed map of planned AEM flights for July 2016 based on April 2016 AEM meeting in Norfolk for 6 NRDs (LPNNRD, LPSNRD, LENRD, LCNRD, LLNRD, P-MRNRD) and Bazile Creek Area. Follow-up meetings for each NRD/group to go over detailed routes and getting NRD boards to approve flight contracts and payments are planned for May to June 2016.

ENWRA AEM ground truth test holes: ENWRA test holes have been advanced along flight lines where there might be questions (PMRNRD and LPNNRD holes targeted in the Dakota shown on map with recent ENWRA split sampling locations at Mead USACE site also depicted). The PMRNRD received a \$9,150 dues credit on their FY16 ENWRA dues invoice for test holes completed. The Nemaha (planned in summer 2016) and Lower Platte North (completed) NRDs are also planned for dues credits in FY17 (\$9,150 each). LENRD and LCNRD may combine test hole/ well installation efforts and LENRD, LCNRD and LPSNRD are planned for ENWRA dues credits in FY18 at this time.

Pilot Study Sites: Annual sampling is back to June annual sampling, will send fall 2015 pesticide sampling results to clearinghouse. Google Earth kmzs are complete for each ENWRA pilot study site and the Sprague block for LPSNRD, reviewed example screenshot of profiles that AGF created.

AEM Data Management (Jesse Korus): CSD in cooperation with the USGS have plans for creating a statewide AEM database like the current CSD test hole database but specifically designed for AEM and supporting geological datasets. The anticipated Nebraska cloud-based data management system will permit data integration and sharing of results between the CSD, USGS, and Nebraska's NRDs aimed at mapping the bedrock surface and other hydrostratigraphic units to improve estimation of groundwater in storage. A pilot version of the statewide cloud work and GeoScene software is in progress with CSD and several non-enwra NRDs who have conducted AEM surveys are also being approached for support.

USGS/ENWRA Secondary Bedrock Aquifer Recon Project: The ENWRA group was awarded WSF funding with the USGS in April 2016. ENWRA will enter into a contract with the NDNR to receive the grant funds and enter into a two-year joint funding agreement (JFA) with the USGS Nebraska Water Science Center to accomplish this goal (planned as a June LPSNRD board meeting agenda items on behalf of ENWRA). The general scope was reviewed and discussed [**Update:** sampling is planned for August 2016, 2 areas in each NRD have been identified (starting in LCNRD and LENRD first and working south) and NRDs are to secure access for the identified well owner choices outlined by Amanda Flynn using the USGS letter].

**ENWRA FY17-18 Budget and Upcoming Plans**

Budget: ~\$320,000 in ENWRA budget to work with at start of FY17 after FY16 commitments and income. General routine items and previously agreed to/planned on items were reviewed. ENWRA has \$25,000 in data management, \$15,000 in software purchase (no longer needed due to potential free viewers available and CSD/USGS ownership of software) and \$30,000 in potential match for the upcoming 2016 WSF Applications in our draft budget going to LPSNRD for approval on behalf of ENWRA in June. Coordinator will check back with each NRD for confirmation on ENWRA draft budget amounts [**Update:** NRDs confirmed up to ~\$78,000 in ENWRA funds split over FY17, 18, 19, and 20 which will go toward AEM data management efforts including support of the WSF application for a statewide AEM database cloud platform. Additionally, NRDs

who have flown AEM flights (ENWRA and non-ENWRA) pledged contributions totaling \$87,000 spread over FY18, 19 and 20.]

### **USGS National Brackish Groundwater Assessment – Jennifer Stanton USGS via Web Interface**

Jennifer presented to the group information on the National Brackish Groundwater Assessment which compiles existing data to describe the distribution and character of brackish groundwater, the current use of brackish groundwater, and the data gaps for fully characterizing the resource. Jennifer gave a general background on the brackish water sampling results compiled with the study and Nebraska's coverage was discussed (2009 Secure Waters Act which authorized the study, 1980s Uranium sampling effort where they collected TDS and salinity in sections of Nebraska, journal article out July 2015 on more of the geochemistry aspects) as well as plans for the next step to fill in data gaps and identified limitations of the national approach (need more local scale data to understand potential widespread pumping/inconstancies in well yields, see past the shallow bias of the map, address sustainability questions etc.). Discussions included potential economic costs associated with desalination near towns and potential Nebraska-related brackish water sources.

### **High Plains Water Budget 1940-1949 and 2000-2009 - Jennifer Stanton USGS via Web Interface**

Selected Approaches to Estimate Water-Budget Components of the High Plains, 1940 through 1949 and 2000 through 2009 <http://pubs.usgs.gov/sir/2011/5183/>. Quantification of water-budget components is a prerequisite for effective water-resources management. Components analyzed as part of this study were precipitation, evapotranspiration, recharge, surface runoff, groundwater discharge to streams, groundwater fluxes to and from adjacent geologic units, irrigation, and groundwater in storage. Jennifer discussed the Soil WATER Balance (SOWAT) Model for the High Plains Aquifer and how SOWAT gets at short time events and is more sensitive to inputs for recharge and taking into account irrigated cropland. SOWAT is same basic equation as soil water balance (SWB) and can be a way to check existing groundwater flow models (improved portions of Elkhorn Loup Model [ELM]). She reviewed the limitations: deep percolation assumes recharge output immediately can only adjust one land use category per cell, does not account for shallow groundwater, not sensitive to irrigation efficiency and crop demands, not calibrated to hydrogeological measurements. Satellite imagery is the driver to get more accurate soil moisture target at what point irrigation turned on. Learned takeaways: great outside source to get lots of data, need QA effort to verify mixed results/red flags, less accurate when temperature changes are smaller, beware of the sensitivities in the model.

### **Recap and Questions**

- NRDs will be going for more AEM flights in July with the WSF but not with ENWRA funds - will need to coordinate efforts. Detailed planning continues for existing flights planned for July 2016 **[Update:** eastern Nebraska AEM Flights were completed in early August 2016, pdf flight map and "as flown" Google Earth files are posted on the ENWRA website (2016 AEM tab) along with the other 2017-2015 eastern Nebraska AEM survey lines - AGF has provided preliminary flight line images to each NRD]
- ENWRA will need to go through LPSNRD board in June to get our awarded WSF contracts through and ENWRA match plans for new WSF application for the GeoCloud. Coordinator will follow-up with NRD sponsors on FY17 budget and WSF grant plans
- USGS has several experts with recharge (John Nemo and others) interested in the ENWRA pilot and recharge study data and providing expertise/project work. They have recommendations and ideas and Coordinator will get the USGS access to the recharge/pilot data and follow-up with the Sponsors.
- Dana Divine mentioned CSD was planning an Education Circular geared to well drillers.
- Annual sampling for ENWRA pilot sites is back to Spring (March-June 2016).
- USGS will be sampling secondary aquifers for WSF, will contact each NRD for two areas and access to wells for sampling in August and sign a JFA.