

ANNUAL REPORT 2018

Conservation and Survey Division

School of Natural Resources

University of Nebraska–Lincoln



**CONSERVATION AND
SURVEY DIVISION**

School of Natural Resources



Photo: Smokestack Rock in Banner County, NE

OUR MISSION

The Conservation and Survey Division (Nebraska Geological Survey), the natural resource survey component of the School of Natural Resources, is a unique, multi-disciplinary research, service and data-collection organization established by state statute in 1921. The Division's mission is to investigate and record information about Nebraska's geologic history, its rock and mineral resources, the quantity and quality of its water resources, land cover and other aspects of its geography, as well as the nature, distribution and uses of its soils.

WHO ARE WE?

We are a dedicated group of geologists and other Earth scientists who constantly build upon an in-state, national, and international reputation for scientific and service excellence extending back more than 120 years.

WHAT DO WE DO?

We engage in data collection and research dealing with the geology, soils, and physical environment of Nebraska and the enclosing region. Our work includes research, extension, outreach, and teaching.

WHY ARE WE NECESSARY?

We are Nebraska's designated geological survey and we provide essential, unbiased scientific expertise, not readily supplied from other organizations, which supports the many needs of diverse stakeholders and the citizens of Nebraska. The Conservation and Survey Division is mandated by law in Nebraska Revised Statutes 85-163 and 85-164.

Conservation and Survey Division
Annual Report 2018

Total extension contacts by CSD personnel in 2018: **4,519**

Total requests for data and analysis served by CSD personnel in 2018: **565**

Total continuing education units for professionals (CEUs) generated by CSD personnel in 2018: **3,396**

Total footage of test holes drilled and/or logged by CSD personnel in 2018: **10,487 ft**

Total automated groundwater-data entries overseen by CSD personnel in 2018: **382,122**

Total groundwater quality results processed by CSD personnel in 2018: **19,214**

Total individual measurements of groundwater levels made by CSD personnel in 2018: **7,901**

Total number of groundwater-monitoring wells replaced by CSD personnel in 2018: **5**

Total number of monitoring wells serviced by CSD personnel in 2018: **33**

Total media interviews by CSD personnel in 2018: **23**

Total teaching load of CSD personnel in 2018: CSD faculty taught **10 courses** with a combined enrollment of **103 students**

Publications authored or coauthored by CSD personnel in 2018:

- Aslan, A., Karlstrom, K.E., Heizler, M., Kirby, E., Granger, D., **Hanson, P.R.**, Feathers, J.K., Mahan, S., 2018. Controls on patterns of upper Colorado River bedrock incision. *Geological Society of America Abstracts with Programs* 50 (5), doi: 10.1130/abs/2018RM-313816
- Berry, M.E., Taylor, E.M., Slate, J.L., Paces, J.B., **Hanson, P.R.**, Brandt, T.R., 2018. Geologic map of the Fort Morgan 7.5' quadrangle, Morgan County, Colorado. U.S. Geological Survey Scientific Investigations Map 3408, 2 sheets, scale 1:24,000. <https://doi.org/10.3133/sim3408>
- Berry, M.E., Taylor, E.M., Slate, J.L., Paces, J.B., **Hanson, P.R.**, Brandt, T.R., 2018. Geologic map of the Weldona 7.5' quadrangle, Morgan County, Colorado. U.S. Geological Survey Scientific Investigations Map 3396, 1 sheet, scale 1:24,000. <https://doi.org/10.3133/sim3396>
- Bishop, I. W., Tucker, S. T., **Joeckel, R.M.**, Spaulding, S. A., 2018. Benthic fossil diatoms from the upper Ogallala Group (late Miocene) near Scotia, NE (USA). *Nova Hedwigia, Beihefte*, 147, 261-294.
- Czap, H.J., Czap, N.V., **Burbach, M.E.**, and Lynne, G.D., 2018. Does might make right? – An experimental investigation on the impact of who owns the property rights. *Ecological Economics*, 150, 229-240.
- Czap, N.V., Czap, H.J., Khachatryan, M., and **Burbach, M.E.**, 2018. Conforming to or defying gender stereotypes? Empathy nudging vs. financial incentives in environmental context. *Review of Behavioral Economics*, 5(1), 61-84.
- Czap, H.J., Czap, N.V., **Burbach, M.E.**, and Lynne, G.D., 2018. Experiments on Empathy Conservation: Implications for Environmental Policy. *Journal of Behavioral Economics for Policy*, 2(2), 71-77.
- Divine, D.P., Joeckel, R.M., and Lackey, S.O.**, 2018. Characterizing the aquifer properties of the Cretaceous Niobrara Formation in eastern Nebraska. *Geological Society of America Abstracts with Programs*, 50 (4), doi: 10.1130/abs/2018NC-311608
- Divine, D.P. and Eversoll, D.A.**, 2018. *The Groundwater Atlas of Red Willow County, Nebraska*. Conservation and Survey Division, University of Nebraska, Resource Atlas 11, 35 p.
- Fernandez, G., Tyree, M., **Joeckel, M.**, and Spaulding, S.A., 2018. Investigation of a paleolake environment in the Late Miocene, Nebraska. American Geophysical Union Fall Meeting, <https://agu.confex.com/agu/fm18/meetingapp.cgi/Paper/382076>.
- Fielding, C.R., and **Joeckel, R.M.**, 2018. *New Insights into Carboniferous Cyclothems*. *American Association of Petroleum Geologists Midcontinent Section Fourth Biennial Field Conference Abstracts and Guidebook*. In Conservation and Survey Division Guidebook Series No. 28. (pp. 68). Conservation and Survey Division, School of Natural Resources, University of Nebraska-Lincoln.

- Floress, K., Reimer, A., Thompson, A., **Burbach, M.**, Knutson, C., Prokopy, L., Ribaud, M., Ulrich-Schad, J., 2018. Measuring farmer conservation behaviors: Challenges and best practices. *Land Use Policy* 70, 414-418.
- Gilmore, T.E.**, M. J. Wells, N. Nelson, A.R. Mittelstet, J.K. Bohlke and D.D. Snow, 2018. Decadal changes in groundwater recharge and nitrate concentrations in a shallow aquifer under changing agricultural practices: application of repeat sampling and machine learning approaches. American Geophysical Union Fall Meeting, <https://agu.confex.com/agu/fm18/meetingapp.cgi/Paper/371221>
- Gilmore, T.E.**, Zlotnik, V., & Johnson, M. 2018. Recognition of Regional Water Table Patterns for Estimating Recharge Rates in Shallow Aquifers. *Groundwater* (online view). <https://doi.org/10.1111/gwat.12808>
- Hanson, P.R.**, Larsen, A.K., **Howard, L.M.**, 2018. Surficial geology of the Axtell East 7.5' Quadrangle, Nebraska. <http://snr.unl.edu/data/geologysoils/STATEMAP/index.aspx>
- Joeckel, R.M.**, Diffendal, R.F., Jr., Hanson, P.R., Korus, J.T., 2018. Geologic mapping in Nebraska: Old rocks, new maps, fresh insights. *Great Plains Research*, 28, 119-147.
- Joeckel, R.M.**, 2018. Alberta's Lower Athabasca Basin: Archaeology and Paleoenvironments, Edited by Brian M. Ronaghan, etc. [Book review]. *Great Plains Research* 28 (1), 98-99.
- Joeckel, R.M.**, and **Howard, L.M.**, 2018. The ups and downs of Nebraska: Recognizing gilgai in the state. *Great Plains Research* 28 (1), 51-64.
- Joeckel, R.M.**, Sorsen, N.R., **Howard, L.M.**, **Waszgis, M.M.**, and Tucker, S.T., 2018. Surficial Geology of the Cooper Canyon 7.5 Minute Quadrangle, Nebraska. <http://snr.unl.edu/data/geologysoils/STATEMAP/index.aspx>
- Korus, J.T.**, 2018, Combining hydraulic head analysis with airborne electromagnetics to detect and map impermeable aquifer boundaries, *Water*, v. 10, no. 8, p. 975. doi: 10.3390/w10080975
- Korus, J.T.**, 2018, Nebraska GeoCloud brings high-tech hydrogeologic data down to earth. *Water Well Journal* 72 (1): 10-11.
- Korus, J.T.**, **Cameron, K.**, Hobza, C.M., Jensen, N-P., Rico, D., Munoz-Arriola, F., 2018, Integrating AEM and borehole data for regional hydrogeologic synthesis: Tools and examples from Nebraska, USA. 7th International Workshop on Airborne Electromagnetics, Kolding, Denmark. <https://www.conferencemanager.dk/AEM2018>
- Korus, J.T.**, **Gilmore, T.E.**, **Waszgis, M.M.**, & Mittelstet, A.R., 2018. Unit-bar migration and bar-trough deposition: impacts on hydraulic conductivity and grain size heterogeneity in a sandy streambed. *Hydrogeology Journal*, 1–12. <https://doi.org/10.1007/s10040-017-1661-6>
- Korus, J.T.**, and **Joeckel, R.M.**, 2018, Airborne geophysical resolves stratigraphic and hydrogeologic complexity at the eastern boundary of the Great Plains in Nebraska;

Geological Society of America Abstracts with Programs, 50 (4), doi: 10.1130/abs/2018NC-313061

Larsen, A.K., and **Hanson, P.R.**, 2018. Dune formation south of the Niobrara River Valley, north-central Nebraska Sand Hills. *Geological Society of America Abstracts with Programs* 50 (4), doi: 10.1130/abs/2018NC-313227

Ludvigson, G.A., Moller, A., **Joeckel, R.M.**, Upchurch, G.R., and Smith, J.J., 2018, Scientific investigations on Cretaceous (Albian-Turonian) strata from the Rose Creek Escarpment (RCE) along the Nebraska-Kansas border, cratonic margin of the Western Interior Basin. *Geological Society of America Abstracts with Programs*, 50 (4), doi: 10.1130/abs/2018NC-312703

Martin, S.J., Funch, R.R., **Hanson, P.R.**, Enki Yoo, E.-H., 2018. Massive 4000-year-old termite populations continue to survive in NE Brazil. *Current Biology* 28, R1283-R1295.

McDonald, E.V., Sweeney, M.R., **Hanson, P.R.**, 2018. When did vesicular A (Av) horizons form in the desert SW U.S.: Elucidating between soil processes and luminescence ages. *Geological Society of America Abstracts with Programs* 50 (6), doi: 10.1130/abs/2018AM-324029

Miao, X., **Hanson, P.R.**, Stohr, C.J., Wang, H. 2018. Holocene loess in Illinois revealed by OSL dating: implications for stratigraphy and geoarchaeology of the Midwest United States, *Quaternary Science Reviews* 200, 253-261.

Rawling, J.E., III, **Hanson, P.R.**, Larsen, A.K., Carson, E.C., 2018. Using high resolution LiDAR-derived DEM's to interpret early Holocene dunes and their reactivation around 4000 yrs ago in northwest Wisconsin. *Geological Society of America Abstracts with Programs* 50 (4), DOI: 10.1130/abs/2018NC-312983

Richey, J.D., Upchurch, G.R., Montañez, I.P., Lomax, B.H., Suarez, M.B., Crout, N.M.J., **Joeckel, R.M.**, Ludvigson, G.A., and Smith, J.J., 2018. Changes in CO₂ during the Ocean Anoxic Event 1d indicate similarities to other carbon cycle perturbations. *Earth and Planetary Science Letters* 491 (1): 172-182.

Scofield, N.I., **Joeckel, R.M.**, and **Divine, D.P.**, 2018. Surficial geologic mapping in the Missouri National Recreational River in Nebraska and landscape evolution at the eastern margin of the Great Plains. *Geological Society of America Abstracts with Programs*, 50 (4), doi: 10.1130/abs/2018NC-313040
[<https://gsa.confex.com/gsa/2018NC/meetingapp.cgi/Paper/313040>].

Sliwinski, M., **Burbach, M.E.**, Powell, L., and Schacht, W., 2018. Ranchers' perceptions of vegetation heterogeneity in the Northern Great Plains. *Great Plains Research* 28, 185-197.

Smith, J.J., Turner, E., Moller, A., **Joeckel, R.M.**, Otto, R.E., 2018. First U-Pb zircon ages for late Miocene Ashfall Konservat-Lagerstätte and Grove Lake ashes from eastern Great Plains, USA. *PLoS One* [<https://doi.org/10.1371/journal.pone.0207103>].

- Szilagyi, J.**, 2018. *County-wide assessment of irrigation expansion on air temperature, humidity and evapotranspiration rates in Nebraska, 1979-2015*. Conservation Bulletin 10, Conservation & Survey Division, University of Nebraska-Lincoln, ISBN 1-56161-076-3.
- Szilagyi, J.**, Jozsa, J., 2018. Evapotranspiration Trends (1979–2015) in the Central Valley of California, USA: Contrasting tendencies during 1981–2007. *Water Resources Research*, doi: 10.1029/2018WR022704.
- Szilagyi, J.**, 2018. Anthropogenic hydrological cycle disturbance at a regional scale: state-wide evapotranspiration trends (1979-2015) across Nebraska, USA. *Journal of Hydrology*, 557, 600-612, doi:10.1016/j.jhydrol. 2017.12.062.
- Szilagyi, J.**, 2018. A calibration-free, robust estimation of monthly land surface evapotranspiration rates for continental-scale hydrology. *Hydrology Research*, 49, doi:10.2166/nh.2017.078.
- Smith, J.J., Turner, E., Möller, A., **Joeckel, R.M.**, Tucker, S.T., and Otto, R.E., 2018. Discovery of zircons in the Ashfall Fossil Beds and Grove Lake volcanic deposits of northeastern Nebraska: U-Pb ages and successful sampling strategies. *Geological Society of America Abstracts with Programs* 50 (4), doi: 10.1130/abs/2018NC-312753
- Wells, M., **Gilmore, T.**, Mittelstet, A., Snow, D., **Sibray, S.**, Wells, M. J., et al., 2018. Assessing decadal trends of a nitrate-contaminated shallow aquifer in western Nebraska using groundwater isotopes, age-dating, and monitoring. *Water*, 10(8), 1047. <https://doi.org/10.3390/w10081047>
- Young, A.R., Hanson, P.R.**, Larsen, A.K., **Howard, L.M.**, 2018. Surficial geology of the Edgar NW 7.5' Quadrangle, Nebraska. <http://snr.unl.edu/data/geologysoils/STATEMAP/index.aspx>
- Young, A.R., Burbach, M.E., & Howard, L.M., Waszgis, M.M., Lackey, S.O., and Joeckel, R.M.**, 2018. *Nebraska Statewide Groundwater-Level Monitoring Report – 2017*. School of Natural Resources, University of Nebraska-Lincoln, Water Survey Paper 85.

Presentations by CSD personnel and their students in 2018:

- 2018 ENWRA Spring Technical Meeting Presentation. Six Nebraska NRDs and USGS, CSD, and DNR partner agencies, May 3, 2018 (**Cameron**).
- 3D Architecture of Miocene Boulder Conglomerates Using Unmanned Aircraft, Photogrammetry, and GPR. 20th International Sedimentological Congress, Quebec, Canada (**Korus and Joeckel**).
- 3D Site Characterization Using Unmanned-Aircraft Photogrammetry and Ground Penetrating Radar (GPR): Examples from the Arikaree Group in Western Nebraska. Association for Materials and Methods in Paleontology, 11th Annual Meeting, Lincoln, Nebraska (**Korus**)

A Visual Guide for Estimating Sand Percentage in the Field. Nebraska Society of Professional Soil Scientists Research Symposium. University of Nebraska, Lincoln. 2 Feb. 2018 (Student Poster by Nicole Musgrave, Environmental Studies, supervised by **Turk**).

AEM Presentations to Lower Platte North NRD and Producers. January 30, March 13, March 22 (**Cameron**).

Aeolian Systems of the Central Great Plains Under Glacial and Interglacial Climates: Progress and New Questions. CANQUA/AMQUA Joint Meeting, Ottawa Canada Aug 2018 (**Hanson**).

Airborne Geophysics Resolves Stratigraphic and Hydrogeologic Complexity at the Eastern Boundary of the Great Plains in Nebraska. North-Central Section, Geological Society of America, Ames, Iowa, April 17, 2018 (**Korus and Joeckel**).

Analysis of Particles and Voids in Soil. Environmental and Water Resources Engineering Graduate Seminar. University of Nebraska, Lincoln. February 16, 2018 (**Turk**).

Basic Soil Evaluation: The Art of Soil Texturing. Nebraska Water Industries Convention. Kearney, Nebraska. February 13, 2018 (**Young**).

Catalysts of Change: An evaluation of the Nebraska Water Leaders Academy. ISSRM, June 20, 2018 (**Burbach**).

Catalysts for Water Resources Protection and Restoration: Applied Social Science Research. First Annual ARD Hatch Multistate PD Meeting, June 12, 2018 (**Burbach**).

Characterizing the Aquifer Properties of the Cretaceous Niobrara Formation in Eastern Nebraska. North Central Section, Geological Society of America, Ames, IA, April 17, 2018 (**Divine**).

Controls on patterns of upper Colorado River bedrock incision. Joint 70th Annual Rocky Mountain Geological Society of America Section/114th Annual Cordilleran Geological Society of America Section Meeting, Flagstaff, Arizona, May 16, 2018 (**Hanson**, with others).

Decadal changes in groundwater recharge and nitrate concentrations in a shallow aquifer under changing agricultural practices: application of repeat sampling and machine learning approaches. American Geophysical Union Fall Meeting, December 13, 2018 (**Gilmore**, with others).

Demonstration of Nebraska GeoCloud and Related Software Tools for Groundwater Practitioners. NRD Water Programs Conference, Kearney, NE. March 6, 2018 (**Korus**).

Discovery of Zircons in the Ashfall Fossil Beds and Grove Lake Volcanic Deposits of Northeastern Nebraska: U-Pb Ages and Successful Sampling Strategies. North-Central Section, Geological Society of America, Ames, Iowa, April 17, 2018 (**Joeckel**, with others).

Dune Formation South of the Niobrara River Valley, North-Central Nebraska Sand Hills. North-Central Section, Geological Society of America, Ames, Iowa, April 17, 2018 (**Hanson**, with others).

ENWRA Annual Presentation at NRD Legislative Conference, and ENWRA Long Range Plan Update. January 23, 2018 (**Cameron**).

ENWRA Update to Lower Elkhorn NRD. February 22, 2018 (**Cameron**).

ENWRA Update to Lower Platte North NRD. January 8, 2018 (**Cameron**).

ENWRA Update to Nemaha NRD. February 8, 2018 (**Cameron**).

ENWRA Update and AEM Presentation. Lower Platte South NRD Board & Water Subcommittee, April 4 and 12, 2018 **Cameron**).

Full Range Leadership for Leaders in the Water Arena. Nebraska State Irrigation Association, Water Leaders Academy, January 25, 2018 (**Burbach**).

Haskell Agricultural Laboratory CSD Drilling and Logging Presentation. Aug 14, 2018 (**Cameron, Lackey, Marxsen, Seaman**).

Impressive Interpretations from the USA Soil Survey Maps. European Geosciences Union General Assembly 2018. Vienna, Austria, April 8-13, 2018 (**Turk**)

Improving of Student Accuracy at Determining Soil Texture by Feel. Earth Educators Rendezvous. University of Kansas, Lawrence, Kansas, 16-20 Jul. 2018 (**Turk**).

Integrating AEM and Borehole Data for Regional Hydrogeologic Synthesis: Tools and Examples from Nebraska, USA. 7th International Workshop on Airborne Electromagnetics, Kolding, Denmark (**Korus, Cameron**, and others).

Investigation of a Paleolake Environment in the Late Miocene, Nebraska. American Geophysical Union Fall Meeting, December 10, 2018 (**Joeckel**, with others).

Maximizing Your Civic Capacity by Engaging in Water Issues. Nebraska Association of County Officials (NACO), Institute of Excellence, February 13, 2018 (**Burbach**).

Maximizing Your Civic Capacity by Engaging in Water Issues. Nebraska Association of County Officials (NACO), Institute of Excellence, September 7, 2018. Invited Presentation - State Spotlight - Nebraska. Water4Ag Annual Meeting, September 25, 2018 (**Burbach**).

Nebraska GeoCloud and AEM data integration. Nebraska Water Industries Convention, Kearney, NW. February 13, 2018 (**Korus**).

Online Data Available from the CSD. Nebraska Association of County Officials (NACO), Institute of Excellence, February 13, 2018 (**Burbach**).

Online Data Available from the NRCS and CSD for Locating and Evaluating Potential Project Sites. Nebraska Water Industries Convention. Kearney, Nebraska. February 13, 2018 (**Young**).

Parcel-Scale Observations of Groundwater and Surface Water. WCREC Water and Crops Field Day 2018 (**Hallum**).

Pedology Research at UNL. Nebraska Society of Professional Soil Scientists Research Symposium. University of Nebraska, Lincoln. February 2, 2018 (**Turk**).

Perc Test Discussion. Nebraska Water Industries Convention. Kearney, Nebraska. February 14, 2018 (**Young**).

Porosity Formation in Disturbed V Horizons: A comparison across three desert ecoregions. Nebraska Society of Professional Soil Scientists Research Symposium. University of Nebraska, Lincoln. February 2, 2018 (Student Poster by Alexa Davis, Environmental Restoration Science, supervised by **Turk**).

Rainfall and Formation of Vesicular Pores. Weatherfest. University of Nebraska, Lincoln, April 7, 2018 (Yvette Rosas, Environmentors student of **Turk**).

Range Soils. Nebraska Range Short Course. Chadron State College, Chadron, NE, June 18, 2018 (**Turk**).

Recognition of Bedrock Geology and Structure in Nebraska and Relevance in Hydrogeology. Nebraska Water Industries Convention. Kearney, Nebraska. February 14, 2018 (**Joeckel**).

Rosebud Formation in Niobrara Valley, Nebraska, USA: Silt-Dominated Alluvial to Eolian Deposition on the Oligocene Great Plains. 20th International Sedimentological Congress, Quebec, Canada (**Joeckel**).

Scientific Investigations on Cretaceous (Albian-Turonian) Strata from the Rose Creek Escarpment (RCE) along the Nebraska-Kansas Border, Cratonic Margin of the Western Interior Basin. North-Central Section, Geological Society of America, Ames, Iowa, April 17, 2018 (**Joeckel**, with others).

Secondary Aquifers in Nebraska and Surrounding States. Shallow Exploration Drillers Clinic, LaVista, NE, April 18, 2018 (**Divine**).

Securing Water for and from Agriculture through Effective Community & Stakeholder Engagement. Nebraska Association of Resources Districts, Legislative Conference, January 24, 2018 (**Burbach**).

Securing Water for and from Agriculture Through Effective Community & Stakeholder Engagement. Nebraska Water Center, Spring Retreat, April 5, 2018 (**Burbach**).

Soils Training and Field Workshops for Nebraska Onsite Waste Water Association. North Platte, October 30, 2018 (28 participants), and Lincoln, November 1, 2018 (**Turk**).

Surficial Geologic Mapping in the Missouri National Recreational River in Nebraska and Landscape Evolution at the Eastern Margin of the Great Plains. North-Central Section, Geological Society of America, Ames, Iowa, April 17, 2018 (**Joeckel**, **Divine**, with others).

Sustainability of Groundwater Resources: Myths and Realities of Water Balance. Nebraska Water Leaders Academy. Lincoln, NE. January 26 (**Korus**).

The Geology and Characteristics of Nebraska's Aquifers. Water Topics for Teachers Conference, American Groundwater Trust, Nebraska City, NE (**Young**).

The Geology of Nebraska in Context. Shallow Drillers Exploration Clinic, La Vista, NE, April 18, 2018 (**Joeckel**).

The Unified Soil Classification System, Comparisons, and Related Aspects. Shallow Drillers Exploration Clinic, La Vista, NE, April 18, 2018 (**Joeckel**).

The Pedagogy of Pedology. Geography and Atmospheric Science/Geology Joint Colloquium. University of Kansas, Lawrence, KS. January 19, 2018 (**Turk**).

Tutorial on Groundwater in Nebraska: February 2018. Nebraska Water Industries Convention. Kearney, Nebraska. February 12, 2018 (**Joeckel**).

Using High Resolution LiDAR-Derived DEM's to Interpret Early Holocene Dunes and Their Reactivation Around 4000 yrs ago in Northwest Wisconsin. North-Central Section, Geological Society of America, Ames, Iowa, April 17, 2018 (**Hanson**, with others).

Watershed Science Training: Perspectives and Needs of Locally-elected Water Resources Directors. University Council on Water Resources/National Institutes of Water Research Conference, June 26-28, 2018, Pittsburgh, PA (**Gilmore**).

What is Beneath the Sand? Sandhills Discovery Conference, Ainsworth, Nebraska (**Lackey**).

When Did Vesicular A (Av) Horizons Form in the Desert SW U.S.: Elucidating between Soil Processes and Luminescence Ages. Geological Society of America Annual Meeting, Indianapolis, Indiana, November 4, 2018 (**Hanson**, with others).

World Water and Geological Background for Understanding Groundwater in Nebraska. Nebraska Water Leaders Academy. Lincoln, Nebraska. January 26, 2018 (**Joeckel**).

Awards attained by CSD personnel and students in 2018:

ASABE Blue Ribbon Award in Educational Aids Competition for Pilot Watershed Science Curriculum for Natural Resources Districts (2018 ASABE Annual International Meeting in Detroit, MI - July 2018) to T. Gilmore and others.

Editors' Choice on EOS website (eos.org); "Evapotranspiration trends (1979–2015) in the Central Valley of California, USA" *Water Resources Research*, 54 (doi.org/10.1029/2018WR022704) to J. Szilagyi

Editors' Pick in journal *Sedimentology* showcasing "good practice, innovative approaches, and noteworthy advances in our science" for article "3-D architecture and hydrostratigraphy of cross-cutting buried valleys using airborne electromagnetics, glaciated Central Lowlands, Nebraska, U.S.A." to J. Korus, R.M. Joeckel, and D. Divine

UNL Soil Judging Team 1st place overall, 3rd place group, 1st, 3rd, and 5th place individuals. Region 5 Soil Judging Contest, Manhattan, KS. 17-21 Sept. 2018 to J. Turk.

Margaret Hawn Mirabile Memorial Best Student Paper Award at the 2019 Eastern Section AAPG meeting was awarded to a paper on which R. M. Joeckel and D. Divine were coauthors.

Organizations for which CSD personnel fulfilled requests for information, consultation, or services in 2018:

Adaptive Resources, Inc.

Alfs Well Drilling

American Association of Petroleum Geologists

APEC Climate Center, South Korea

Bazile GWMA group

Benesch

Black and Veatch Consulting

Bucknell University

Budapest University of Technology

CH2M Hill Consulting

Central Platte NRD

Chinese Academy of Sciences

Citizens opposed to proposed Lancaster County chicken farms

City of Hastings, Nebraska

City of Omaha, Nebraska

City of Waverly, Nebraska

Daugherty Water for Food Institute

Delta Plastics

Desert Research Institute

Downey Drilling
Dr. Mary Anne Holmes
Duck Creek Ranch
EA Engineering
HDR Consulting
Husker Ag LLC
Jefferson County, Nebraska
JEO Consulting
Journal of Hydrology
K2 Geothermal
Kerford Limestone Company
KLKN TV
KODY Radio
KOLN TV
KRVN Radio
Lewis and Clark NRD
Little Blue NRD
Lower Big Blue NRD
Lower Elkhorn NRD
Lower Loup NRD
Lower Platte North NRD
Lower Platte South NRD
Middle Republican NRD
Missouri State University
National Groundwater Monitoring Network
National Park Service
Natural Resources Conservation Service
Nebraska Association of Natural Resource Districts
Nebraska Department of Education
Nebraska Department of Environmental Quality
Nebraska Department of Health and Human Services
Nebraska Department of Natural Resources
Nebraska Environmental Trust
Nebraska Game and Parks Commission
Nebraska Oil and Gas Conservation Commission
Nebraska Public Power
Nebraska State Irrigation Association
Nebraska Water Leaders Academy
Nebraska Well Drillers Association
Nemaha NRD
NET Radio
North Platte area homeschoolers
NTV News

Papio-Missouri River NRD
Pennsylvania State University
Roy Lyles (rancher and NRD candidate)
RTA Petroleum
Santee Sioux Nation
Skylar Loeffler (rancher and NRD candidate)
South Platte NRD
Spear “T” Ranch
Twin Platte NRD
United States Department of Agriculture
United States Forest Service
United States Geological Survey, Nebraska Water Science Center
University of Nebraska-Lincoln faculty and students
University of Nebraska State Museum
University of Nevada-Reno
University of Wisconsin
Upper Elkhorn NRD
Upper Loup NRD
Upper Republican NRD
U.S. Geological Survey
Utah State University
Utah Water Research Laboratory
Village of Springfield, Nebraska
Village of Stuart, Nebraska
Webster Well Drilling

Selected Objectives for CSD in 2019:

- ✓ Develop the “Nebraska GeoModeling Workshop,” educating groundwater professionals on the use of geological models in water management.
- ✓ Complete multiple geologic maps (STATEMAP, Missouri National Recreational River).
- ✓ Completion of two maps for U.S. Geological Survey STATEMAP Cooperative Geologic Mapping Program.
- ✓ Completion of Nebraska CarbonSafe Phase II
- ✓ Completion of 2018 groundwater-levels report
- ✓ Omaha Combined Sewer Outflow tunnel subsurface geology assessment.
- ✓ Continue research on geology of Nebraska Panhandle, Niobrara River Valley, Sand Hills, and statewide hydrogeology.
- ✓ Continue extensive test-hole drilling and data analysis for Eastern Nebraska Water Resources Assessment (ENWRA).
- ✓ Improve and maintain CSD core- and sample-storage facilities at Mead.



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