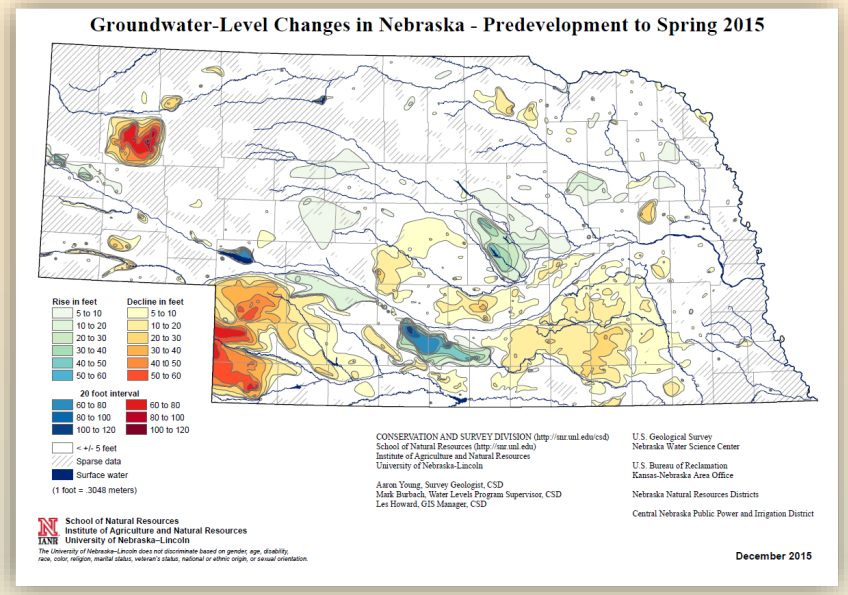
An Overview of the Nebraska Groundwater Level Monitoring Network



Aaron Young, PG

Geologist

Conservation and Survey Division

University of Nebraska-Lincoln

Dr. Mark E. Burbach

Environmental Scientist

Conservation and Survey Division

University of Nebraska-Lincoln

University of Nebraska Lincoln

Conservation and Survey Division

Why Monitor Groundwater Levels in Nebraska?

- Nebraska has 15,747 Farms
- 8.3m irrigated acres
- 8.1m acre feet applied
  - 7.4m acre feet from groundwater
  - 0.7m acre feet from surface water sources

Source:2012 Census of Agriculture

Top States in Irrigation (millions of acres)	
Nebraska	8.3
California	7.5
Arkansas	5.0
Texas	4.5
Idaho	3.5
Kansas	2.9
Colorado	2.3
Montana	1.9
Mississippi	1.7
Washington	1.6

Source: USDA NASS, 2013 Farm and Ranch Irrigation Survey (2012 Census of Agriculture).

HPA in Nebraska

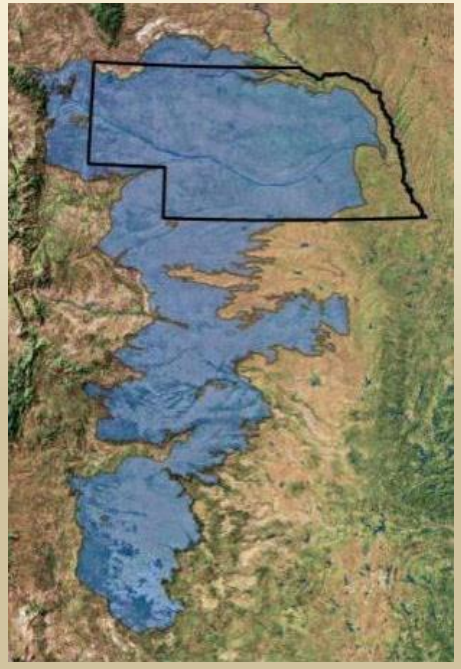
State	Area underlain by High Plains aquifer, in square miles[1]	Area with little or no saturated thickness, in square miles[2]	Volume of saturated aquifer material, in million acre-feet
Colorado	13,300	1,400	500
Kansas	30,900	5,340	1,600
Nebraska	64,600	80	13,200
New Mexico	9,300	3,590	200
Oklahoma	7,400	340	500
South Dakota	4,900	--	600
Texas	36,300	30	2,100
Wyoming	8,100	--	800
High Plains aquifer	175,000	10,800	19,500

[1]Aquifer boundary from Qi (2010), which is a modification of the Weeks and Gutentag (1981) boundary.

[2]As described by Gutentag and others (1984).

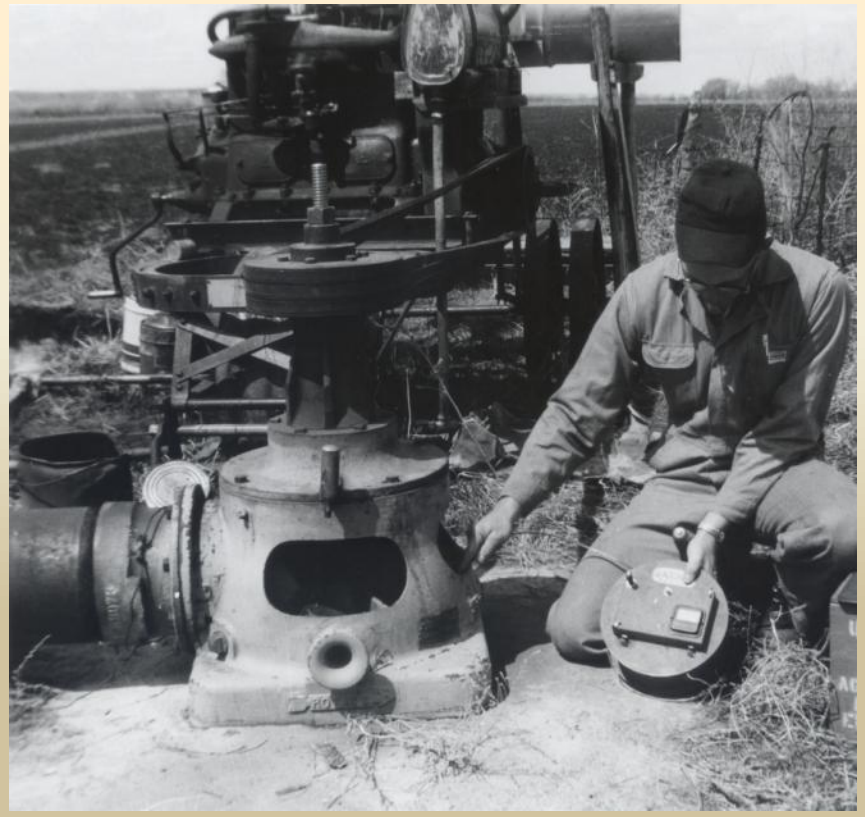
McGuire, V.L., Lund, K.D., and Densmore, B.K., 2012

- The High Plains Aquifer covers 175,000 mi^2
- Under parts of 8 states
- By area, Nebraska covers 36% of the HPA
- 69% of total water volume



Groundwater-Level Monitoring Program

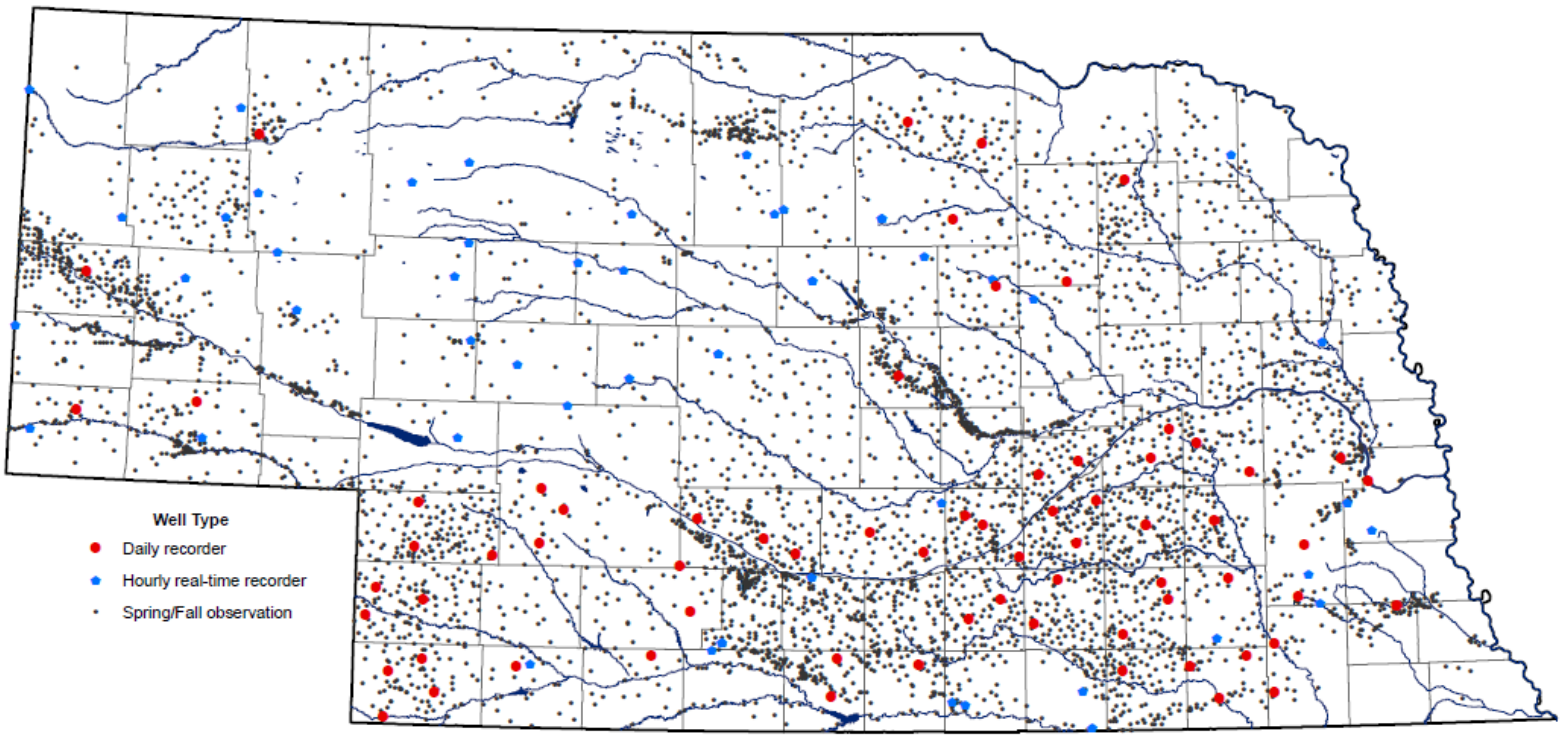
- Began in 1930
- Involves 30 agencies
- Spring and fall readings collected in ~5,000 wells
- 72 “recorder” wells measured daily or monthly
- 59 Real-Time wells measuring hourly
- Annual ground water level change maps and reports since 1954



The Nebraska Groundwater Level Monitoring Program

- Data Collected
  - A database of about 750,000 hand measurements from more than 23,000 wells statewide
  - Many wells have long, continuous histories of yearly measurements
  - Data is available online free to the public
  - CSD water level data has been used in countless research projects and studies

Figure 5. Location of Observation Wells by Type



- **Groundwater Monitoring Network**
  - 4973 wells measured in the spring of 2015
  - 72 Daily recorder wells (Red Dots)
  - 59 Real-Time wells measured hourly (Blue Dots)

Figure 7. Groundwater-Level Changes in Nebraska - Spring 2014 to Spring 2015

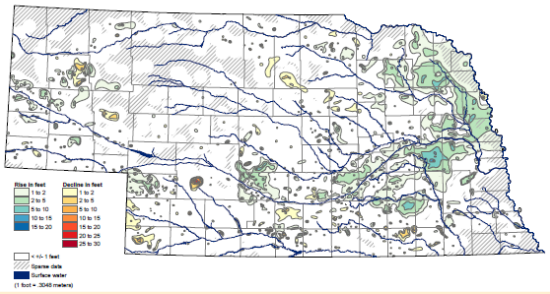


Figure 9. Groundwater-Level Changes in Nebraska - Spring 2010 to Spring 2015

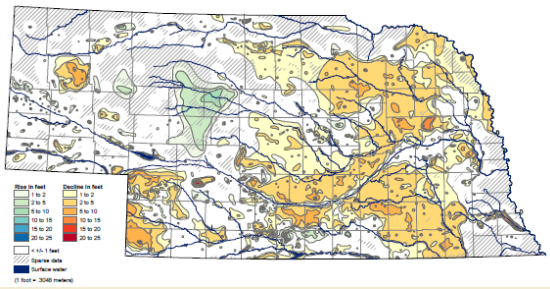


Figure 11. Groundwater-Level Changes in Nebraska - Spring 2005 to Spring 2015

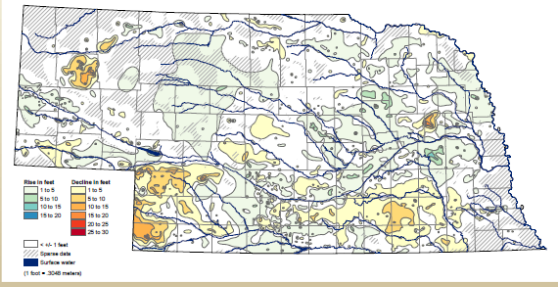
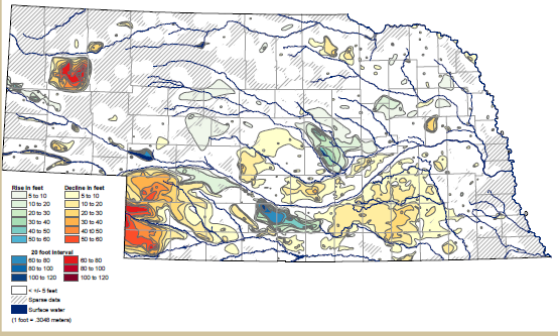


Figure 13. Groundwater-Level Changes in Nebraska - Predevelopment to Spring 2015



Nebraska Statewide Groundwater-Level Monitoring Report

2015

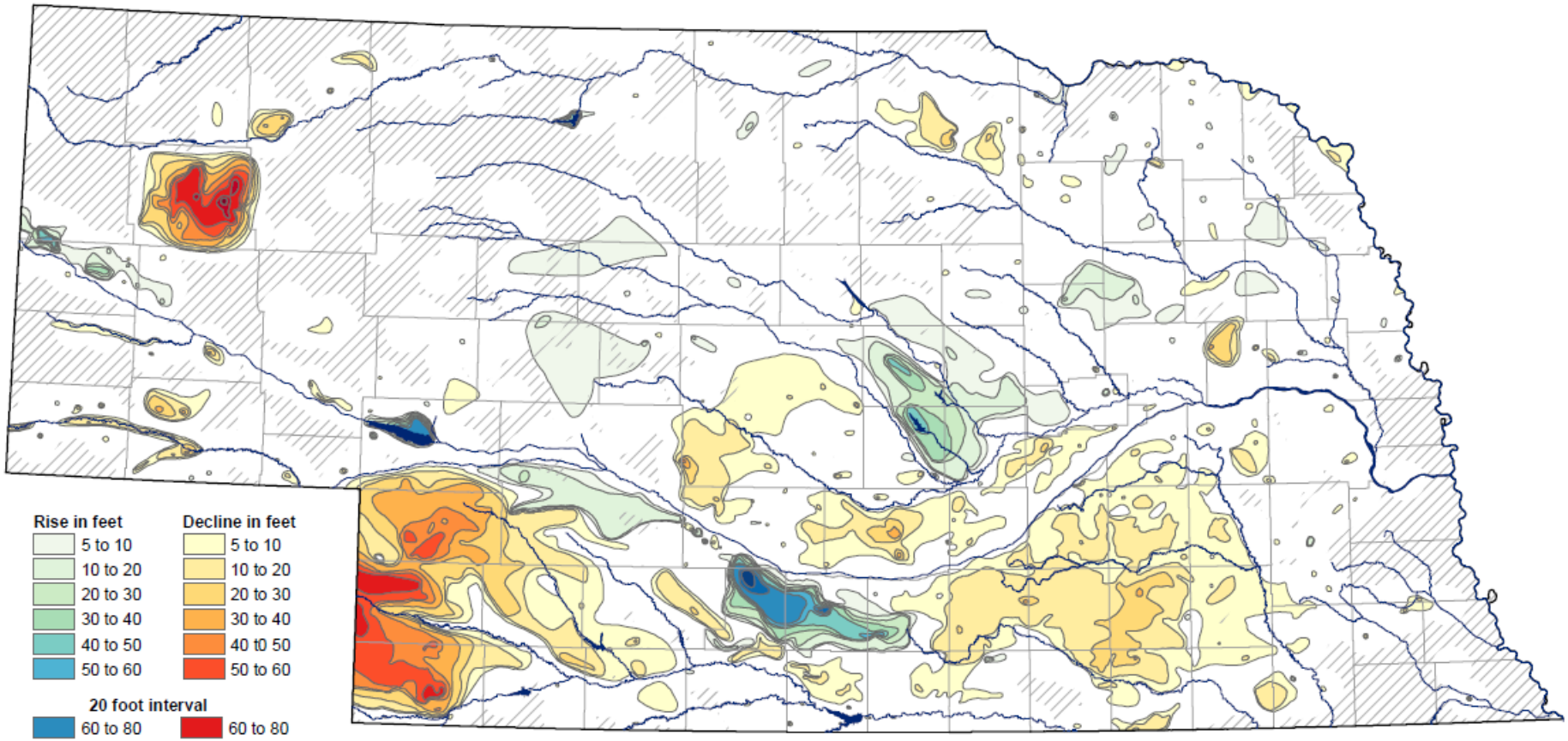
Aaron R. Young
Mark E. Burbach
Leslie M. Howard

Conservation and Survey Division
School of Natural Resources

Nebraska Water Survey Paper Number 83

Institute of Agriculture and Natural Resources
University of Nebraska–Lincoln

Groundwater-Level Changes in Nebraska - Predevelopment to Spring 2015



CONSERVATION AND SURVEY DIVISION (http://snr.unl.edu/csd)
School of Natural Resources (http://snr.unl.edu)
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln

Aaron Young, Survey Geologist, CSD
Mark Burbach, Water Levels Program Supervisor, CSD
Les Howard, GIS Manager, CSD

U.S. Geological Survey
Nebraska Water Science Center

U.S. Bureau of Reclamation
Kansas-Nebraska Area Office

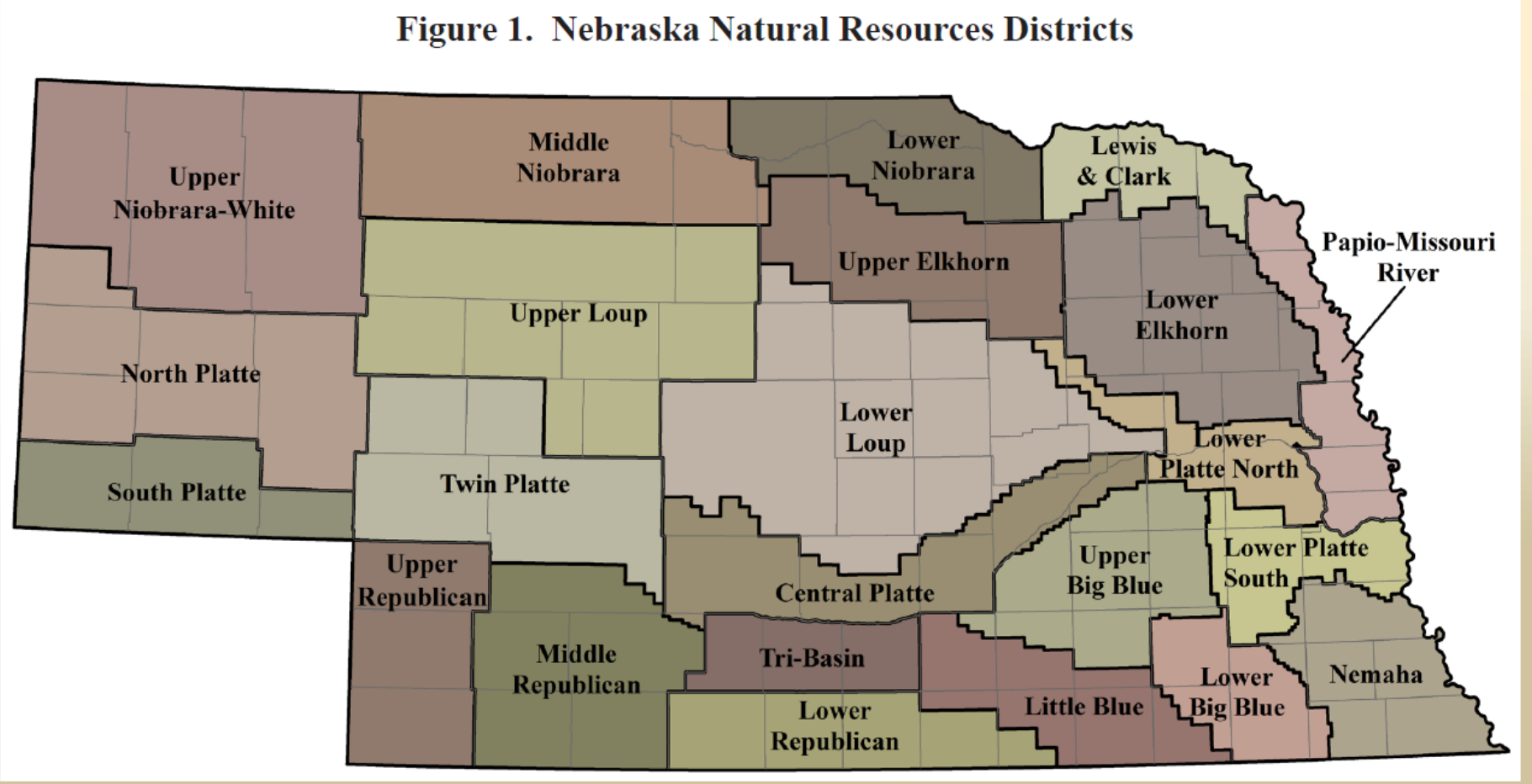
Nebraska Natural Resources Districts

Central Nebraska Public Power and Irrigation District

School of Natural Resources
Institute of Agriculture and Natural Resources
University of Nebraska–Lincoln

December 2015

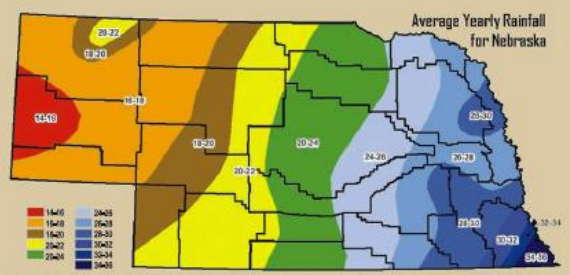
Nebraska Natural Resource Districts



NRDs Are Managing Water Statewide:

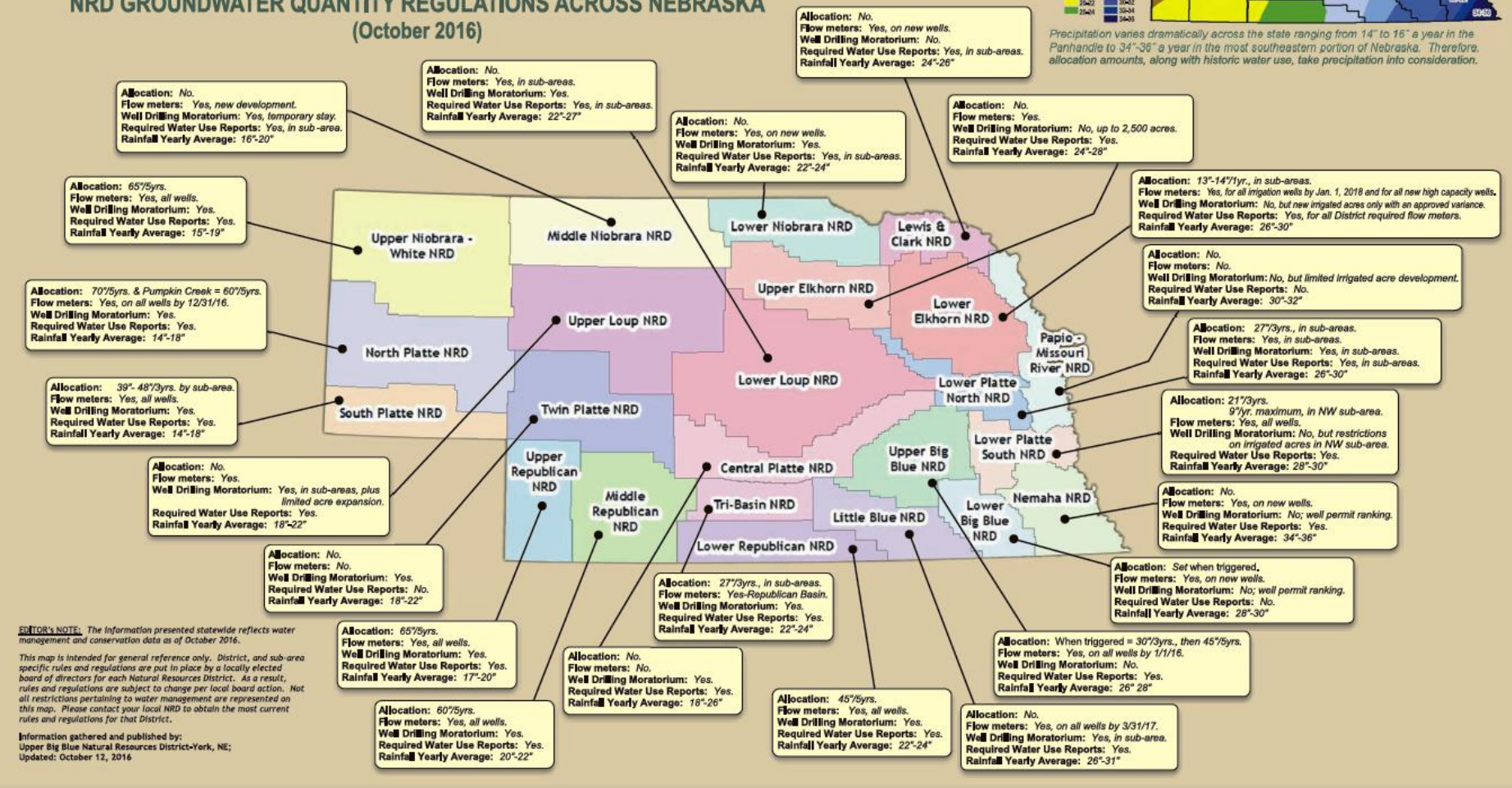
Nebraska's 23 Natural Resources Districts (NRDs) are uniquely positioned to manage the conservation of the state's natural resources through local governance. Because of Nebraska's diverse geology, climatology, and hydrology, each NRD—and it's locally elected board of directors—are able to enact rules, regulations, and programs that can assist its District's citizens and protect local natural resources for future generations to share. Water management regulations in particular include allocating groundwater, augmenting surface water, requiring flow meters, instituting well drilling moratoriums, requiring water use reports, and restricting the expansion of irrigated acres. Individual NRDs use these regulations in different combinations and to different degrees depending on their respective geographic areas of concern. Below is a map showing all 23 NRDs and their most recent status of water management techniques.

So why does this matter to you? Quite simply, Nebraska's NRDs are working to ensure that you and future generations can continue to share in the use and enjoyment of our natural resources. Nebraska's NRDs: Protecting Lives, Protecting Property, and Protecting the Future...



Precipitation varies dramatically across the state ranging from 14" to 16" a year in the Panhandle to 34"-36" a year in the most southeastern portion of Nebraska. Therefore, allocation amounts, along with historic water use, take precipitation into consideration.

NRD GROUNDWATER QUANTITY REGULATIONS ACROSS NEBRASKA
(October 2016)



Allocation: No.
Flow meters: Yes, new development.
Well Drilling Moratorium: Yes, temporary stay.
Required Water Use Reports: Yes, in sub-area.
Rainfall Yearly Average: 16"-20"

Allocation: No.
Flow meters: Yes, in sub-areas.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes, in sub-areas.
Rainfall Yearly Average: 22"-27"

Allocation: No.
Flow meters: Yes, on new wells.
Well Drilling Moratorium: No.
Required Water Use Reports: Yes, in sub-areas.
Rainfall Yearly Average: 24"-26"

Allocation: No.
Flow meters: Yes.
Well Drilling Moratorium: No, up to 2,500 acres.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 24"-28"

Allocation: No.
Flow meters: Yes, on new wells.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes, in sub-areas.
Rainfall Yearly Average: 22"-24"

Allocation: 65"/5yrs.
Flow meters: Yes, all wells.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 15"-19"

Allocation: 13"-14"/1yr., in sub-areas.
Flow meters: Yes, for all irrigation wells by Jan. 1, 2018 and for all new high capacity wells.
Well Drilling Moratorium: No, but new irrigated acres only with an approved variance.
Required Water Use Reports: Yes, for all District required flow meters.
Rainfall Yearly Average: 26"-30"

Allocation: No.
Flow meters: No.
Well Drilling Moratorium: No, but limited irrigated acre development.
Required Water Use Reports: No.
Rainfall Yearly Average: 30"-32"

Allocation: 70"/5yrs. & Pumpkin Creek = 60"/5yrs.
Flow meters: Yes, on all wells by 12/31/16.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 14"-18"

Allocation: 27"/3yrs., in sub-areas.
Flow meters: Yes, in sub-areas.
Well Drilling Moratorium: Yes, in sub-areas.
Required Water Use Reports: Yes, in sub-areas.
Rainfall Yearly Average: 26"-30"

Allocation: 39"- 48"/3yrs. by sub-area.
Flow meters: Yes, all wells.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 14"-18"

Allocation: 21"/3yrs.
9"/yr. maximum, in NW sub-area.
Flow meters: Yes, all wells.
Well Drilling Moratorium: No, but restrictions on irrigated acres in NW sub-area.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 28"-30"

Allocation: No.
Flow meters: Yes.
Well Drilling Moratorium: Yes, in sub-areas, plus limited acre expansion.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 18"-22"

Allocation: No.
Flow meters: Yes, on new wells.
Well Drilling Moratorium: No; well permit ranking.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 34"-36"

Allocation: No.
Flow meters: No.
Well Drilling Moratorium: Yes.
Required Water Use Reports: No.
Rainfall Yearly Average: 18"-22"

Allocation: Set when triggered.
Flow meters: Yes, on new wells.
Well Drilling Moratorium: No; well permit ranking.
Required Water Use Reports: No.
Rainfall Yearly Average: 28"-30"

Allocation: 27"/3yrs., in sub-areas.
Flow meters: Yes-Republican Basin.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 22"-24"

Allocation: 65"/5yrs.
Flow meters: Yes, all wells.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 17"-20"

Allocation: No.
Flow meters: No.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 18"-26"

Allocation: When triggered = 30"/3yrs., then 45"/5yrs.
Flow meters: Yes, on all wells by 1/1/16.
Well Drilling Moratorium: No.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 26" 28"

Allocation: 60"/5yrs.
Flow meters: Yes, all wells.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 20"-22"

Allocation: 45"/5yrs.
Flow meters: Yes, all wells.
Well Drilling Moratorium: Yes.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 22"-24"

Allocation: No.
Flow meters: Yes, on all wells by 3/31/17.
Well Drilling Moratorium: Yes, in sub-area.
Required Water Use Reports: Yes.
Rainfall Yearly Average: 26"-31"

EDITOR's NOTE: *The information presented statewide reflects water management and conservation data as of October 2016.*

This map is intended for general reference only. District, and sub-area specific rules and regulations are put in place by a locally elected board of directors for each Natural Resources District. As a result, rules and regulations are subject to change per local board action. Not all restrictions pertaining to water management are represented on this map. Please contact your local NRD to obtain the most current rules and regulations for that District.

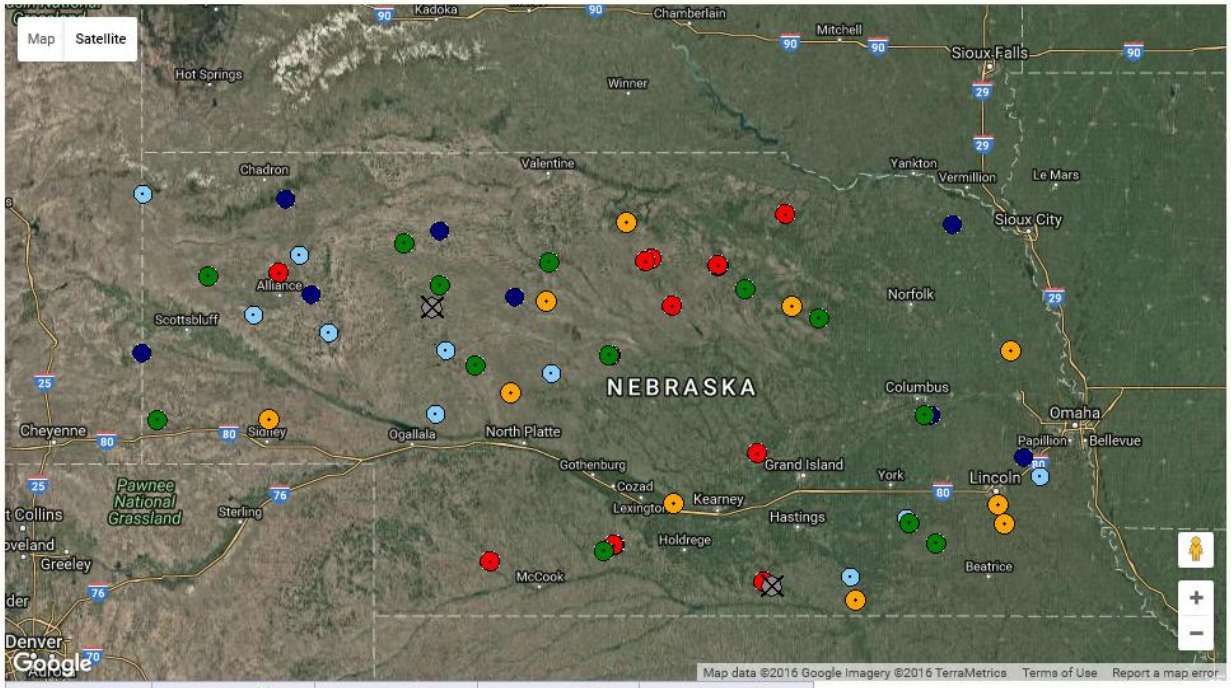
Information gathered and published by:
Upper Big Blue Natural Resources District-York, NE;
Updated: October 12, 2016

Nebraska Real-Time Groundwater Montoring Network

Find a Well

SUBMIT

The program collects groundwater-level information from a network of 58 automated observation wells, which take depth to water readings, upload information to the internet, and map water-level changes on an hourly basis. Click an icon for site specific information.



0-20%	20-40%	40-60%	60-80%	80-100%
Well Malfunctioning				

Icon colors represent the percent deviation between the reading taken during the last hour, and the long-term average of a particular site.

Real-Time Observation Wells

- 59 Wells
- Various Aquifers
  - 55 wells screened in High Plains Aquifer
  - 1 well screened in Pensylvanian Limestone
  - 2 Glacial Till Aquifers
  - 1 Unknown
- Most have 10+ years of Continuous data, with decades of seasonal measurements.
- Approximately 2/3 are “Baseline” wells, or not influenced by human use.
- Approximately 1/3 are in pumped areas.
- Variety of confined and unconfined wells

Selection Process

- Priority given to wells in the HPA
- Sites with most reliable data
- Classify sites into categories based on USGS Tip Sheets
- Approximately 52 sites to be selected as part of the NGWMN

Real-Time Observation Wells

- Database modified in 2015 similar to USGS Database format
  - Extra data tables required for NGWMN have been created and partially populated
  - Data tables should be completely populated by mid-January
  - Existing data collection methods and format very similar to USGS/NGWMN standards
- Software code sub-contracted
  - Sub-contract is nearly complete
  - Code to hopefully be implemented in late December
  - We hope to have the project complete in late January

Resources

Go.unl.edu/groundwater