

# Aquifer Monitoring for Water Management in Nebraska

Western States Water Council  
Groundwater Modeling Workshop 2025

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Interim Director of NeDNR and  
NDEE



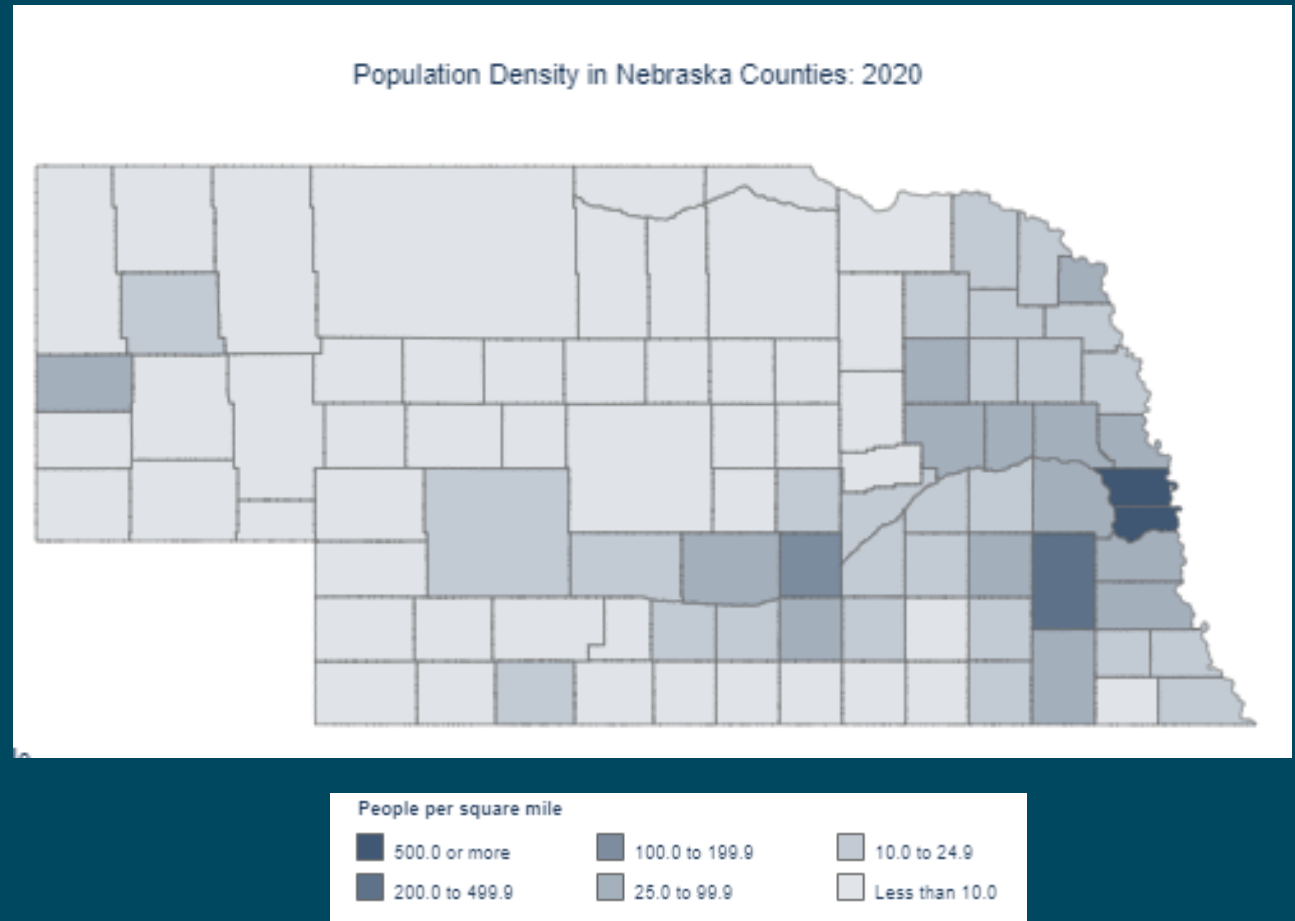
# Outline

- General Overview of Nebraska Hydrology
- Governance and Water Planning
- Science Used to Support Water Planning (Data Collection, Modeling, Etc.)

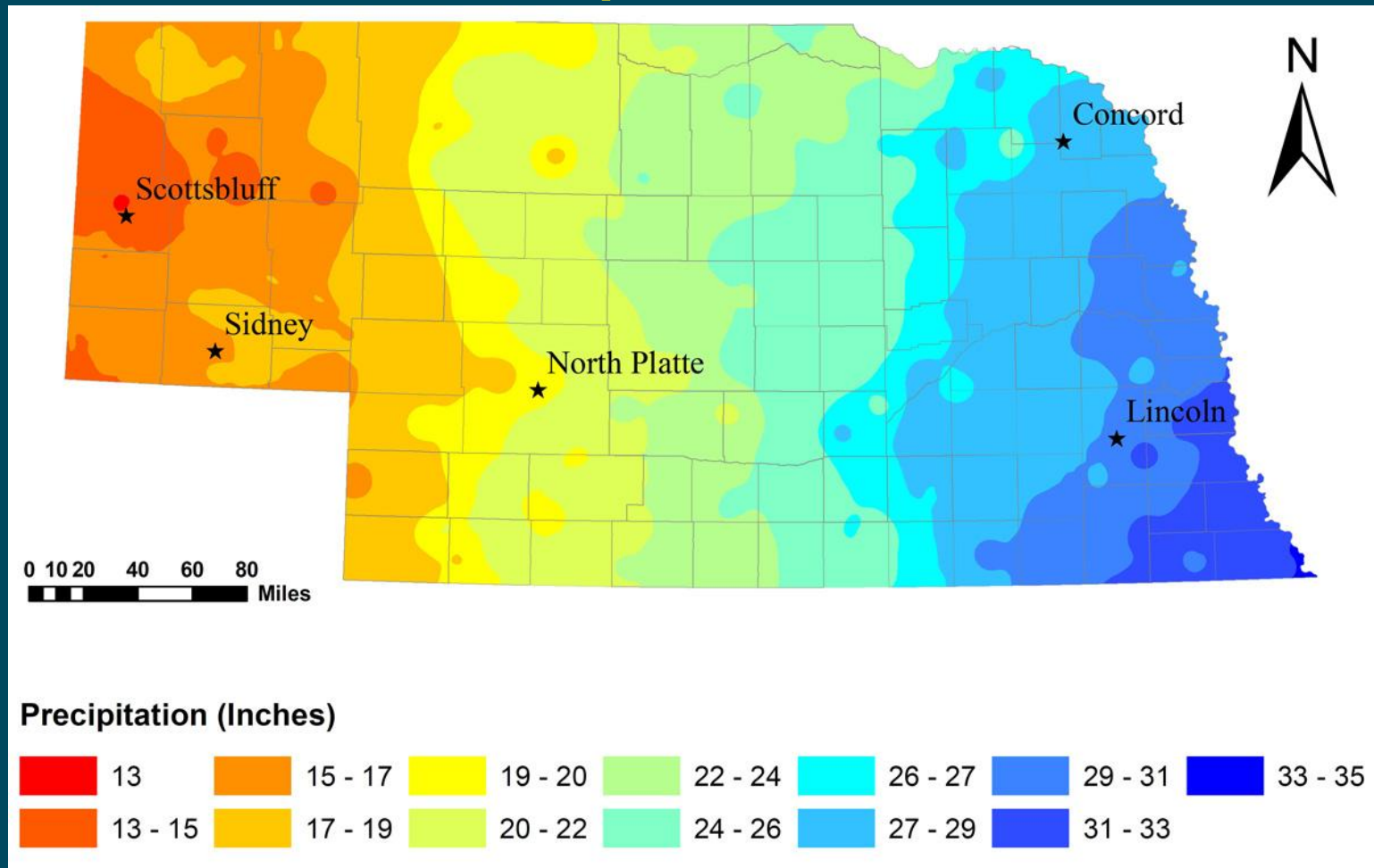
# Nebraska Hydrology Overview

# Nebraska Demographics

- ~77,000 square miles
- 93 Counties
- ~ 2 million people
- 2<sup>nd</sup> largest ethanol producing state
- 3<sup>rd</sup> largest corn producing state
- Beef production is the largest agriculture sector (cattle outnumber people by more than 3 to 1)

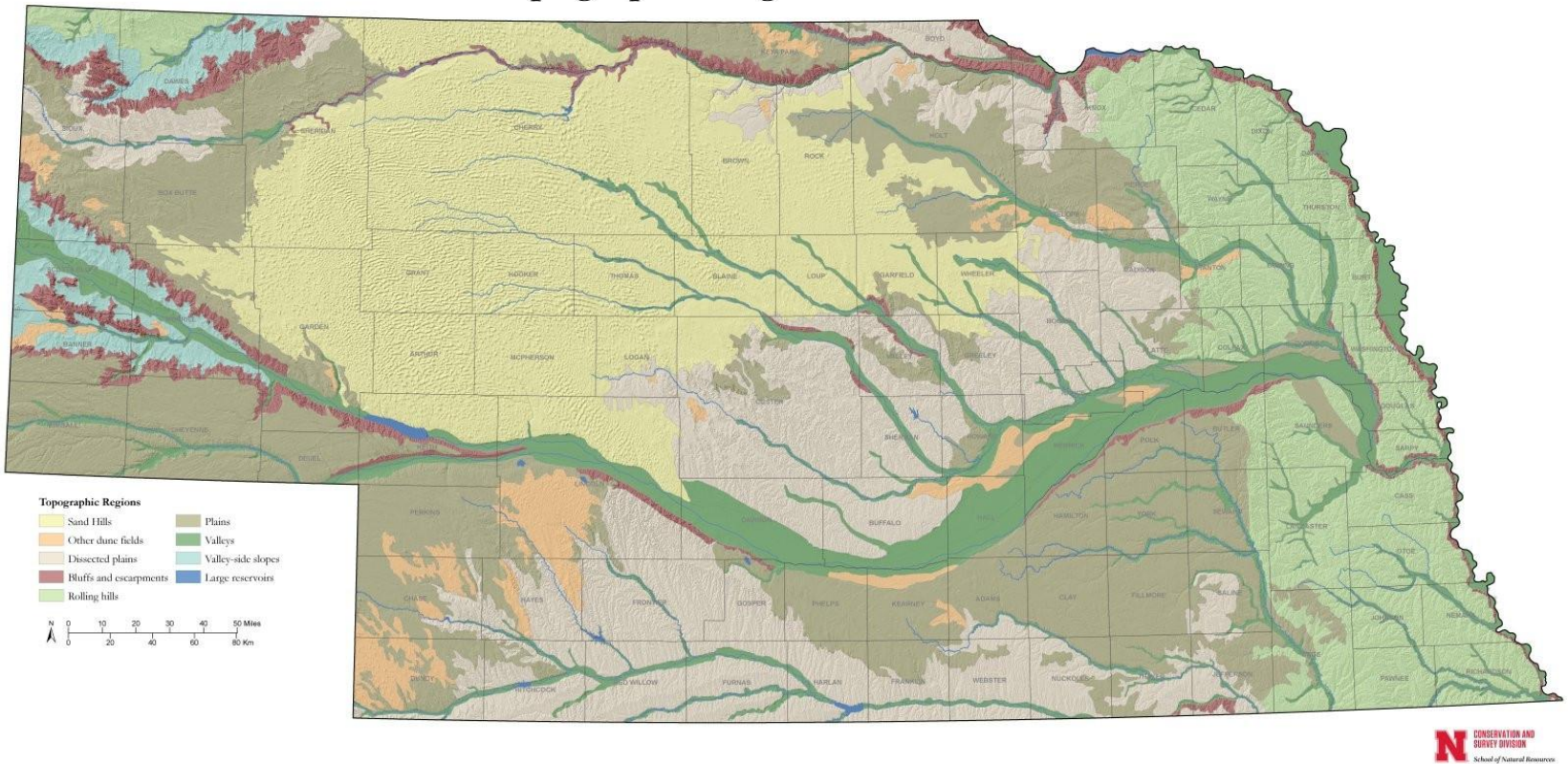


# Nebraska Precipitation Distribution

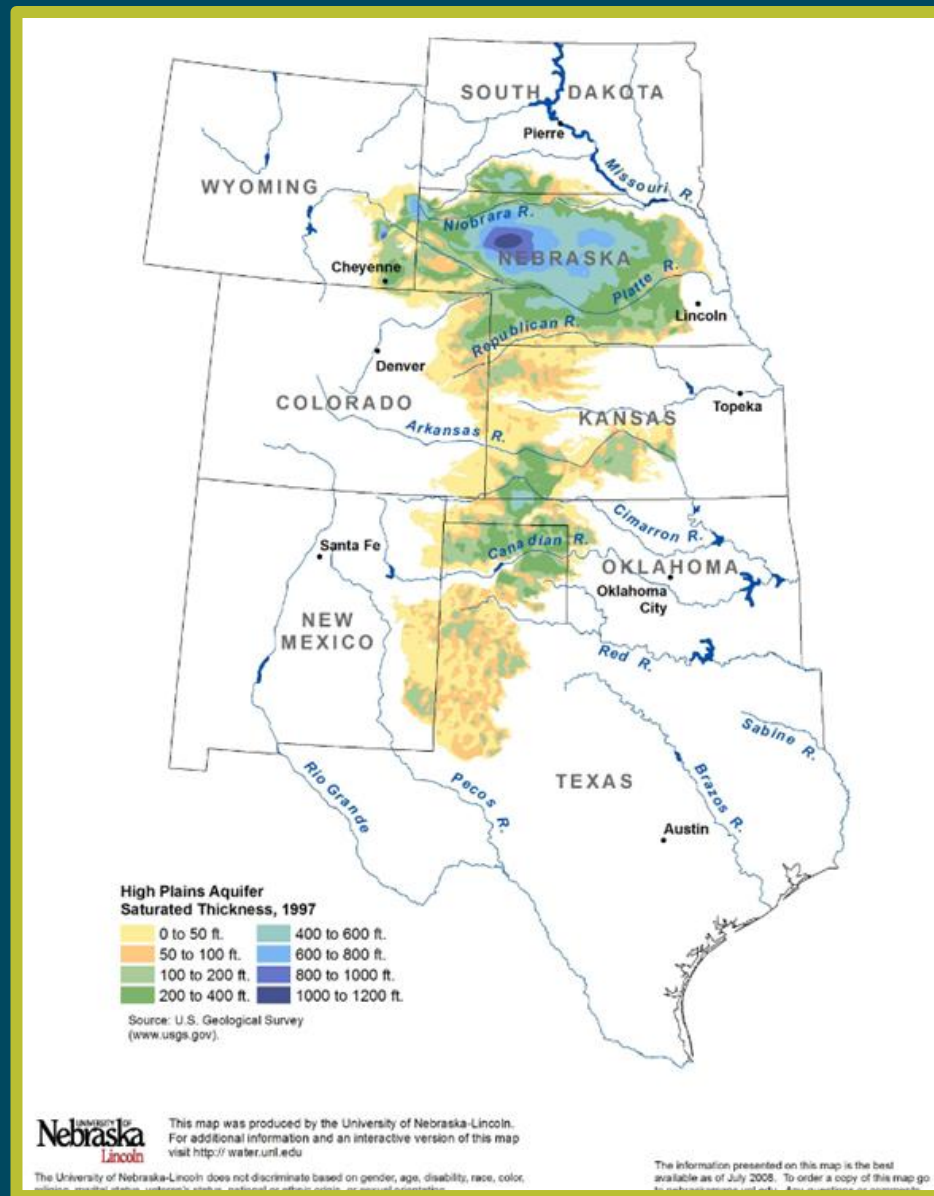


# Nebraska Topography Distribution

# Topographic Regions of Nebraska

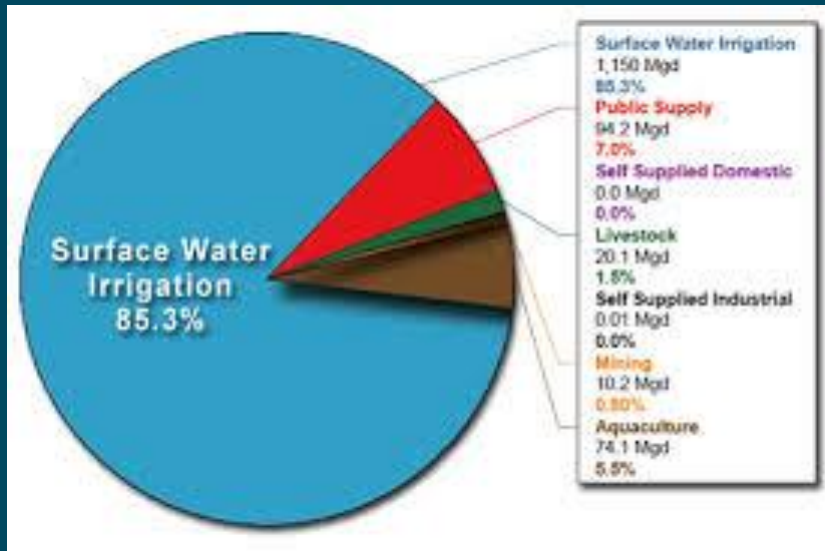


# Regional High Plains Aquifer

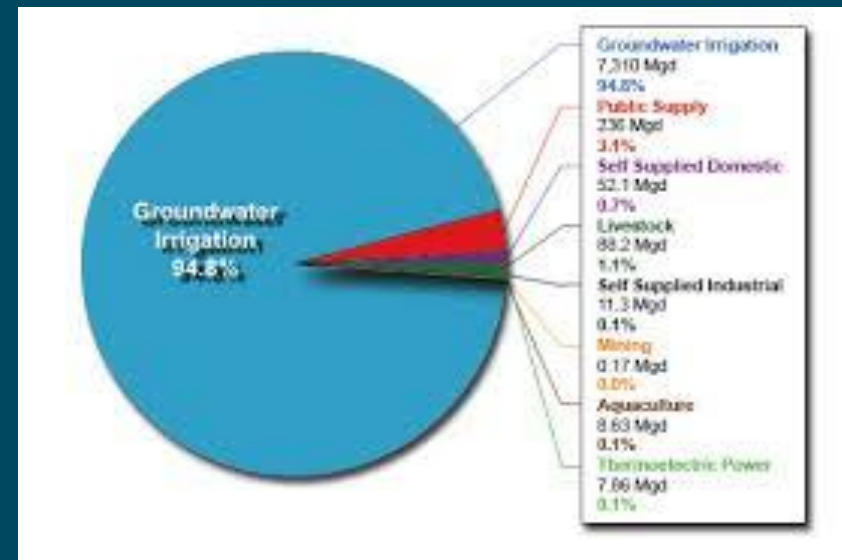


# Surface and Groundwater Management Boundaries

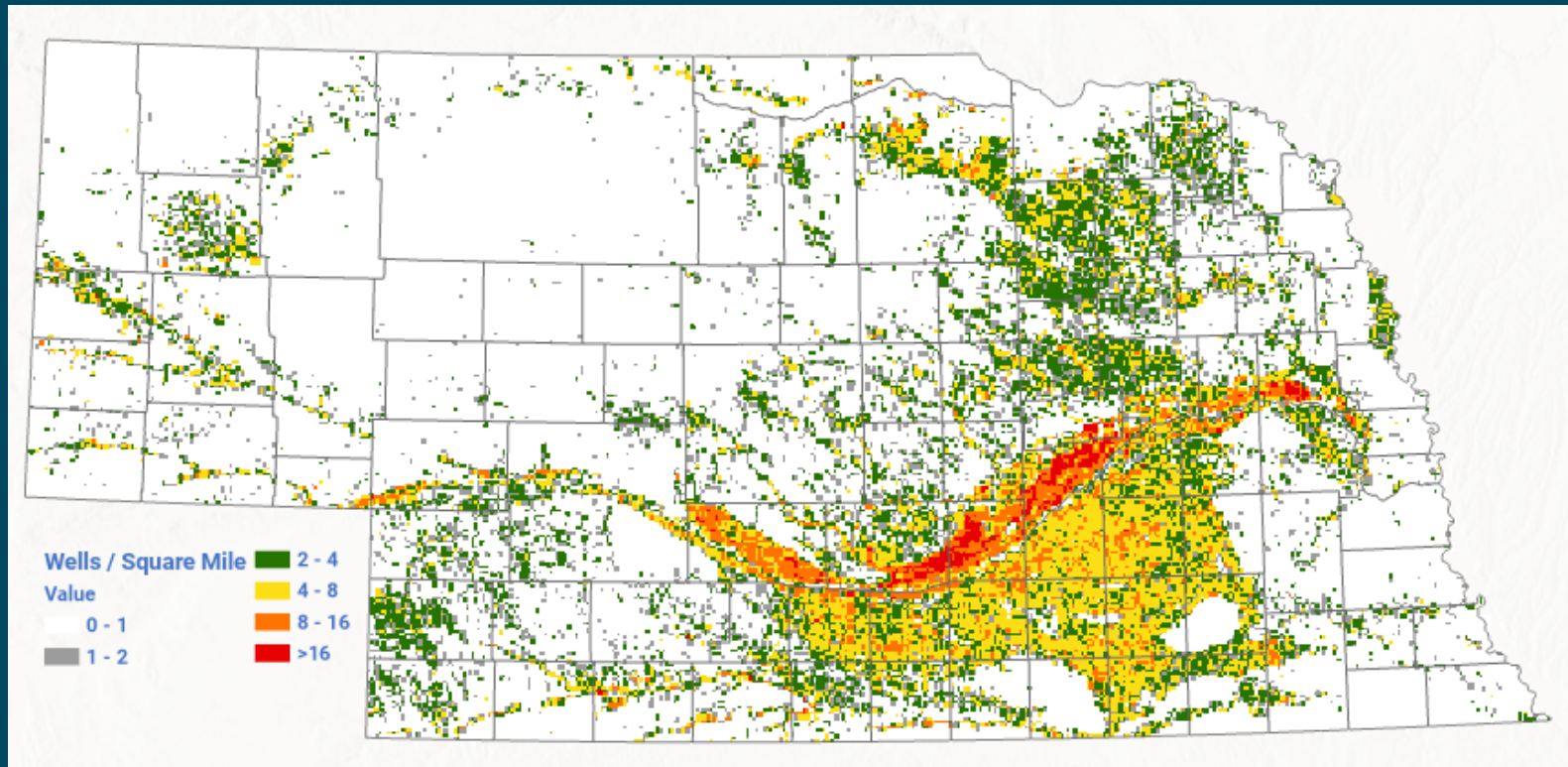
## Surface Water Demands by Category



## Groundwater Demands by Category



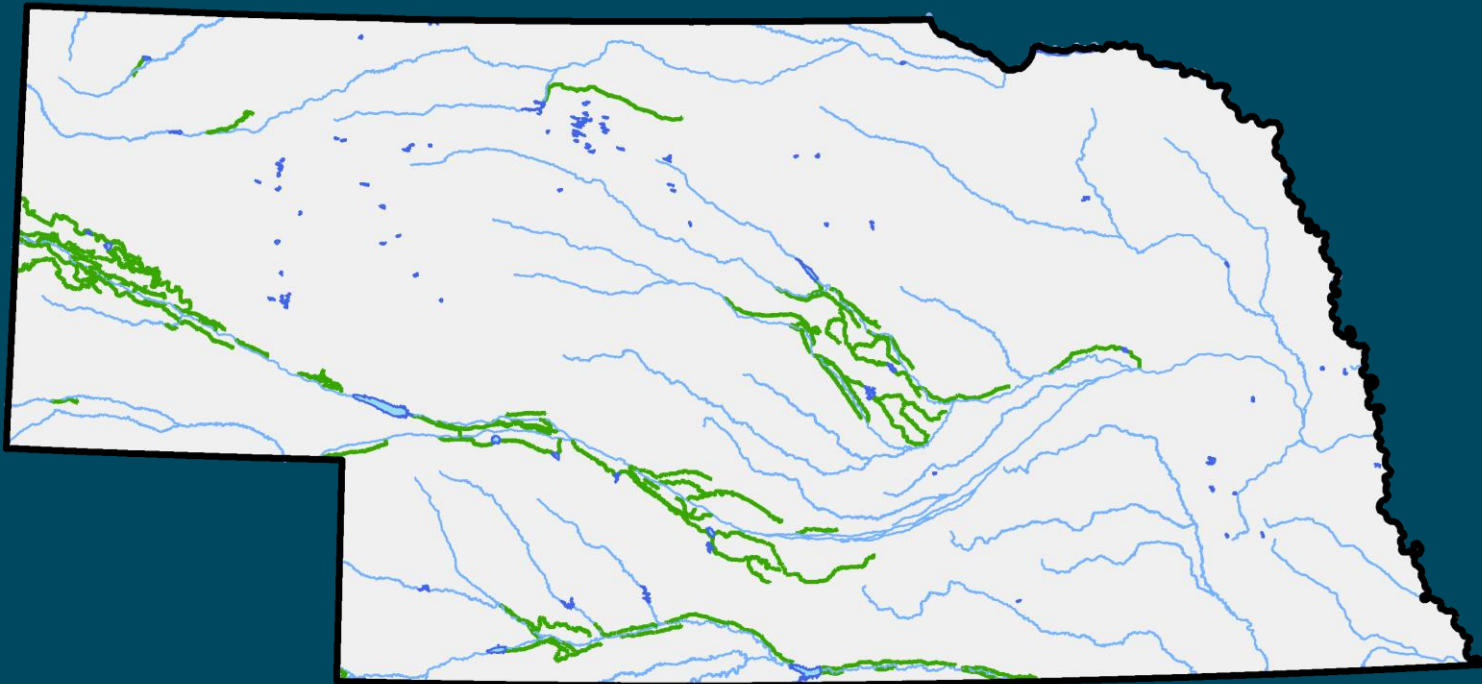
# Nebraska Groundwater Development



Over 110,000 irrigation wells

~8.0 million groundwater irrigated acres

# Nebraska Surface Water Development



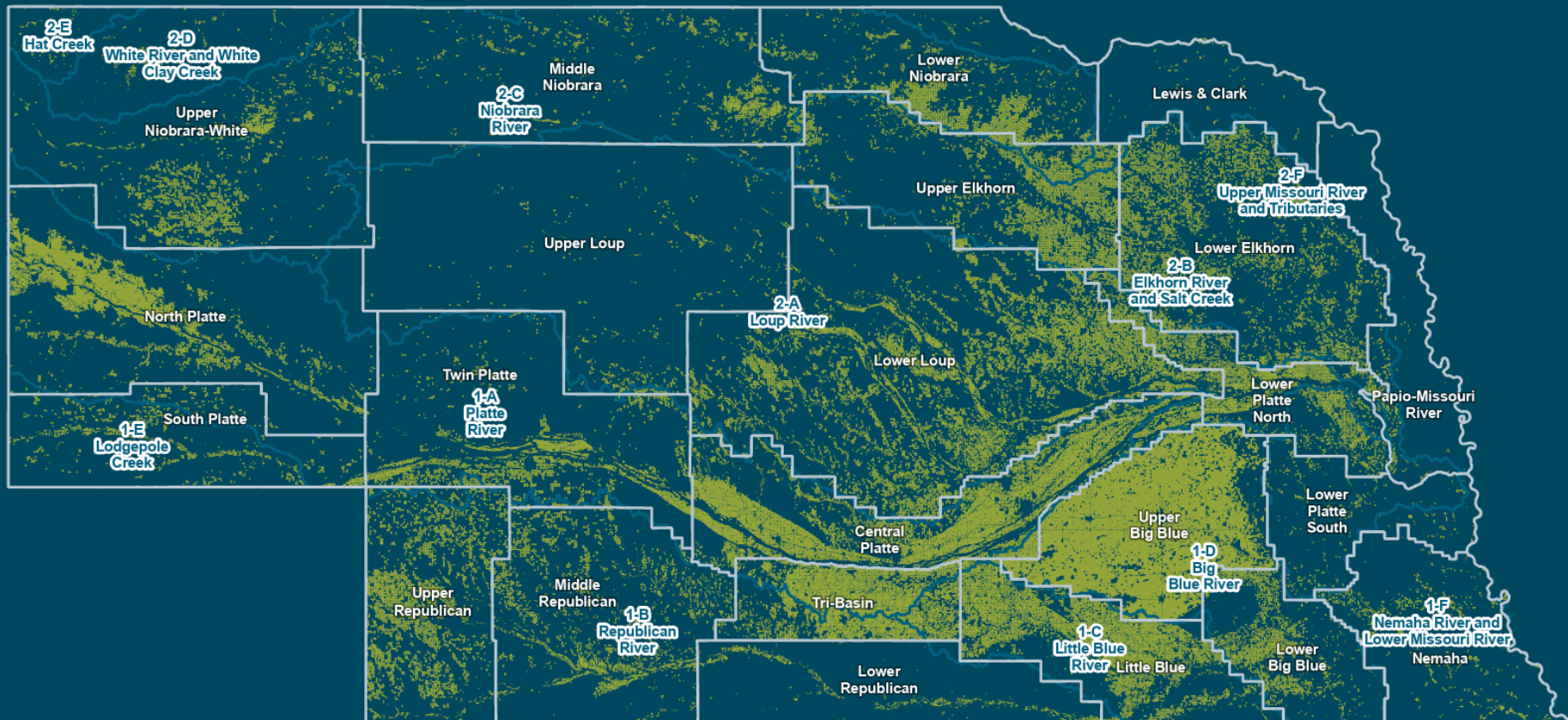
 Lake  Canal  Stream

- ~ 6,200 active surface water permits for irrigation
- ~ 1,400,000 acres permitted to be irrigated

\* Department of Natural Resources Surface Water Database

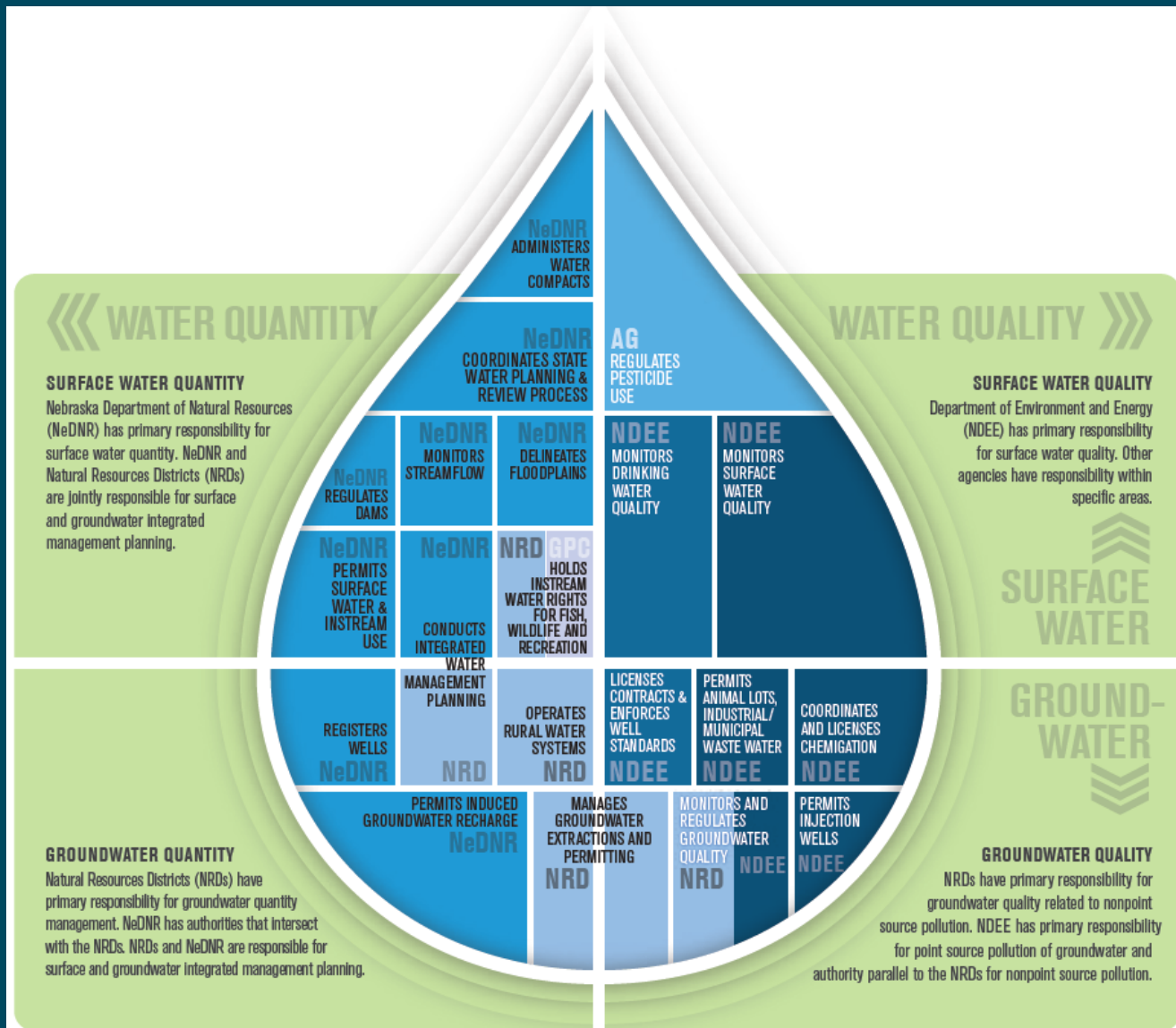
June 28<sup>th</sup>, 2023

# Legally Irrigable Groundwater and Surface Water Parcels



# Governance and Water Planning

# Water Management Agencies

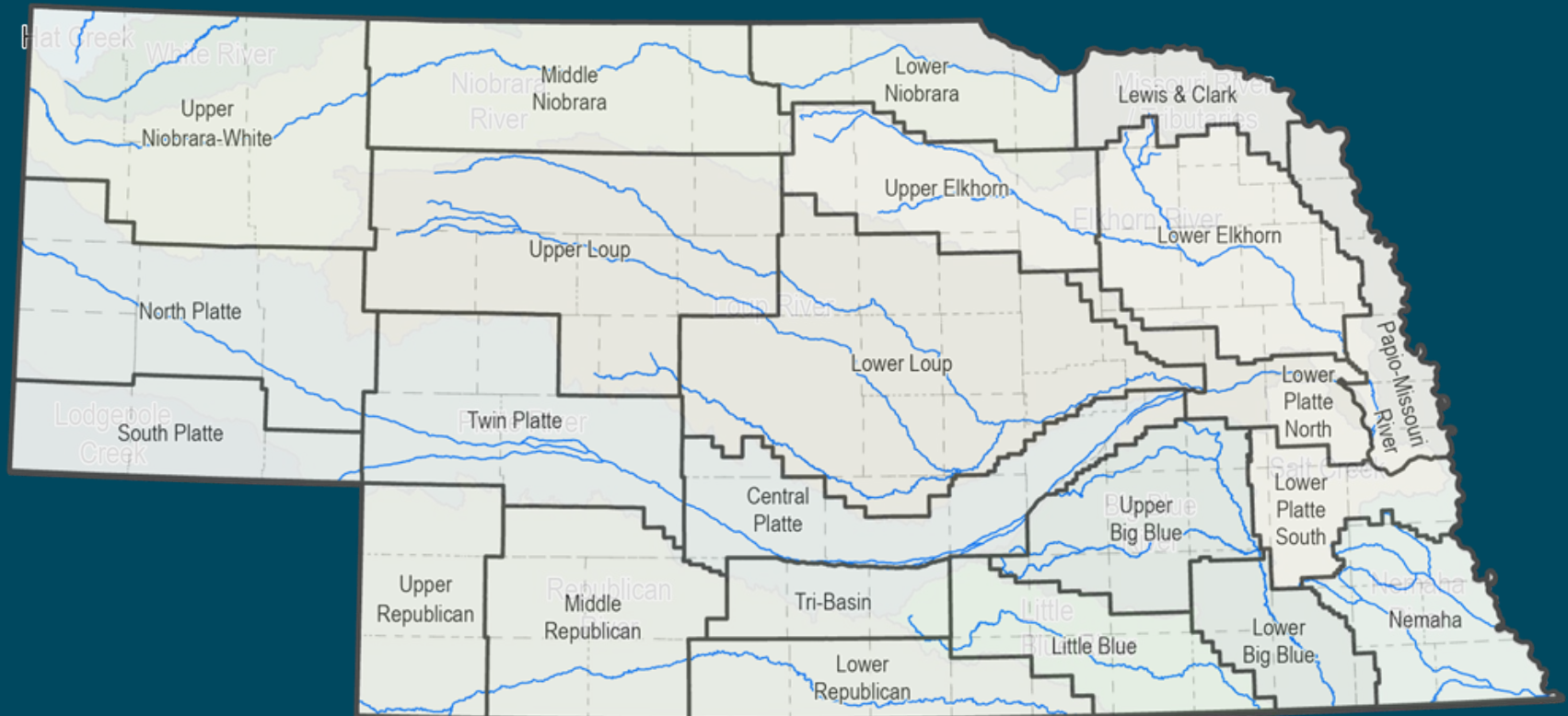


## ***Creation of the NRD System***



- In 1969, four state senators introduced LB1357 in order to consolidate 154 special-purpose districts into a series of multipurpose districts based on river basin boundaries.
- NRDs unique to Nebraska.
- Law became effective in 1972.
- Nebraska Legislature has enacted laws that have expanded NRD authorities over-time.

# Surface and Groundwater Management Boundaries



# NRD's Financial Role in Nebraska's Water Management

- NRD Property Tax Levy
    - Up to 5.5 cents per \$100 as determined by the local board.
  - NRD Occupation tax on irrigated land
    - Up to \$10/acre as determined by the local board.
  - State and Federal Grants:
    - NRDs can also receive funding from state and federal grants for various programs and projects.
      - NDEE, FEMA, NRCS, WSF, etc.
- 
- General Levy Total is \$76 million
  - Groundwater Management Activities Levy Total is \$11 million
  - Disbursement & Transfers Total is \$357 million (leverage federal and state funds included)

# NRD's Responsibilities

## NRDs Have 12 Statutory Responsibilities:

1) Erosion prevention and control

2) Prevention of damages from flood water and sediment

3) Flood prevention and control

4) Soil conservation

5) Water supply for any beneficial uses

6) Development, management, utilization, and conservation of ground water and surface water

7) Pollution control

8) Solid waste disposal and sanitary drainage

9) Drainage improvement and channel rectification

10) Development and management of fish and wildlife habitat

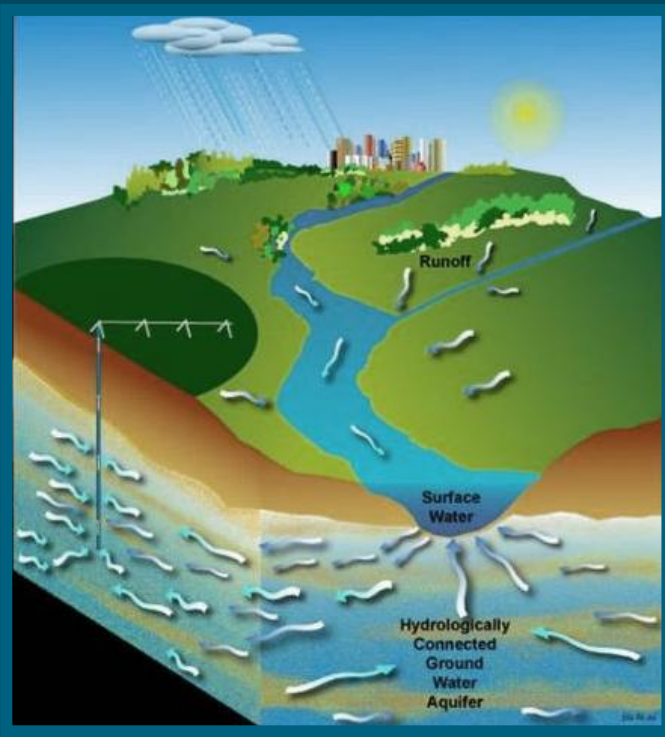
11) Development and management of recreational and park facilities

12) Forestry and range management.

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# Nebraska Integrated Water Management and Protection Act

## Surface Water and Ground Water Authorities



### Surface Water

- Regulated by NeDNR
- Prior appropriations
- First in time is first in right



### Groundwater

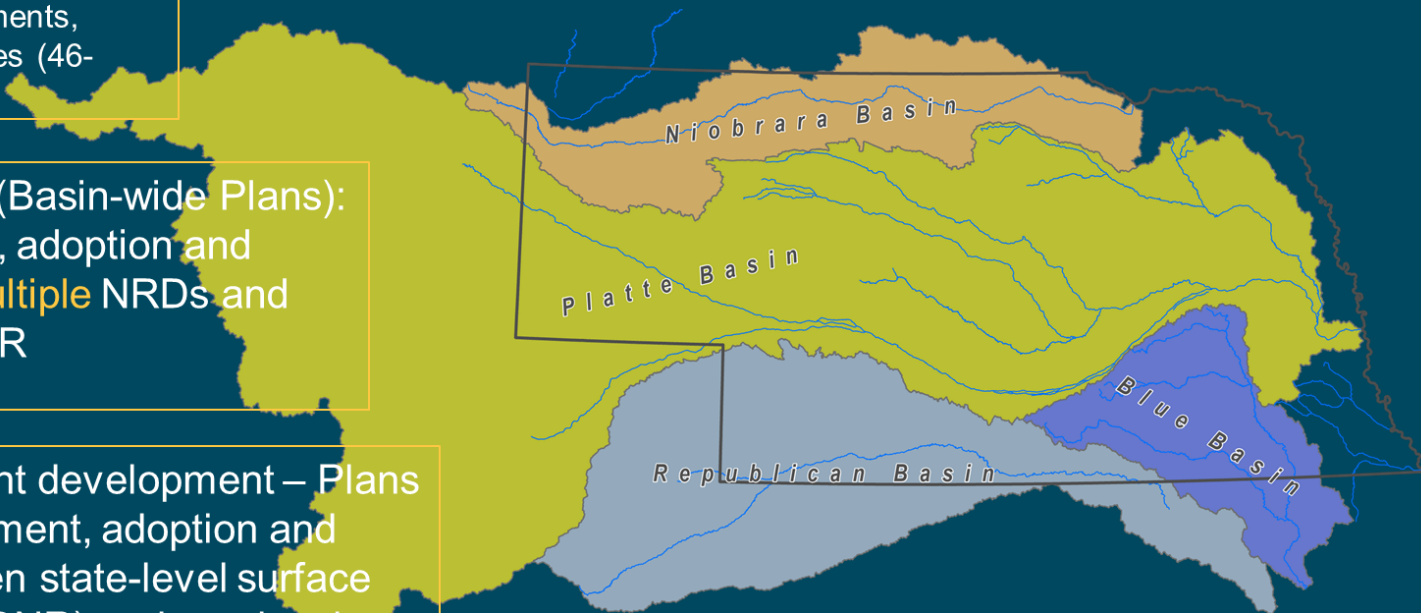
- Regulated by NRDs
- Correlative rights
- Share and share alike

# Interstate Compacts and Agreements

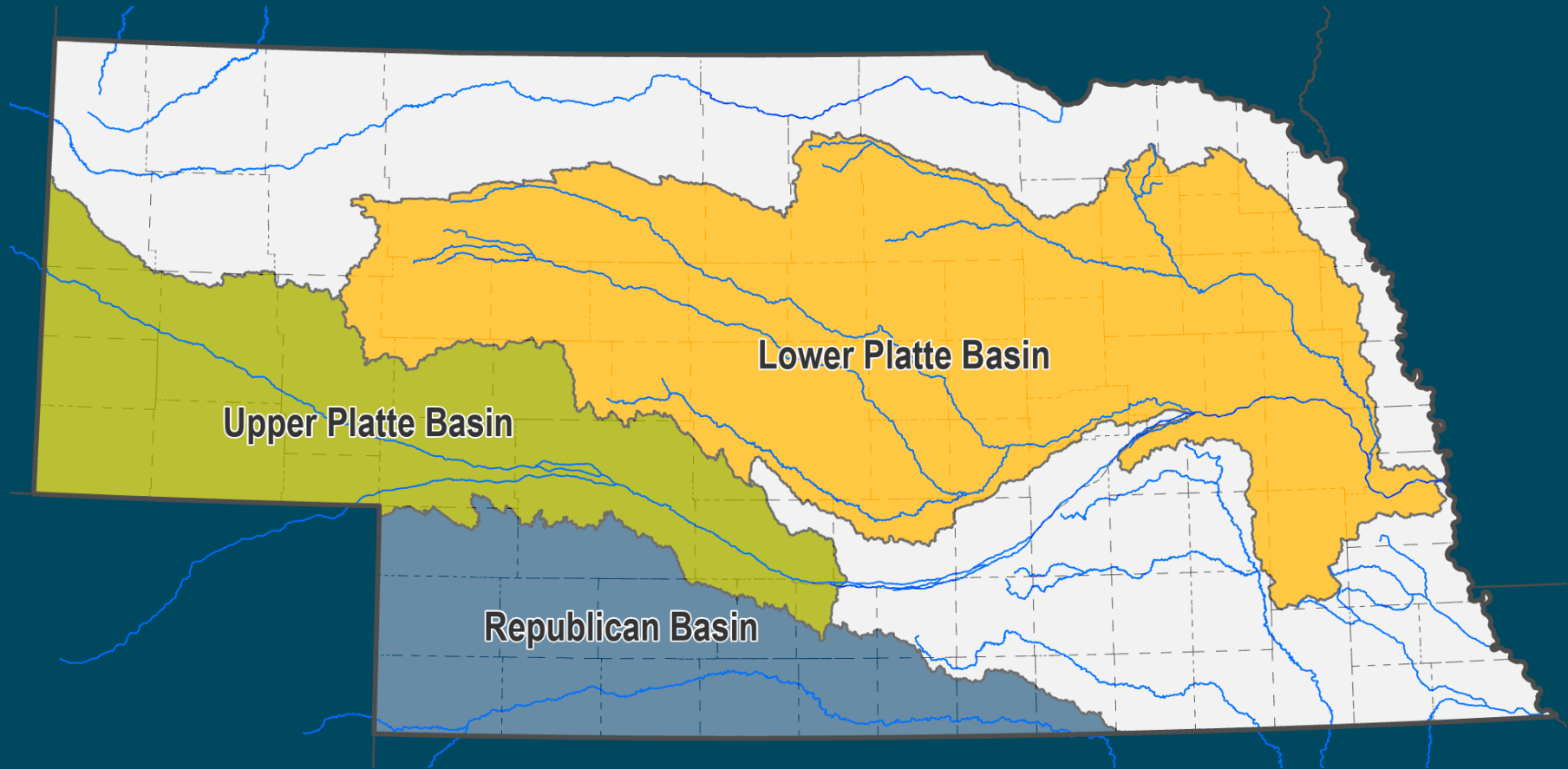
Interstate Basins: IMPs must keep the State in compliance with Interstate Agreements, Compacts, Decrees (46-715(4)(b))

River Basin Approach: (Basin-wide Plans): Joint development, adoption and implementation – **multiple** NRDs and NeDNR

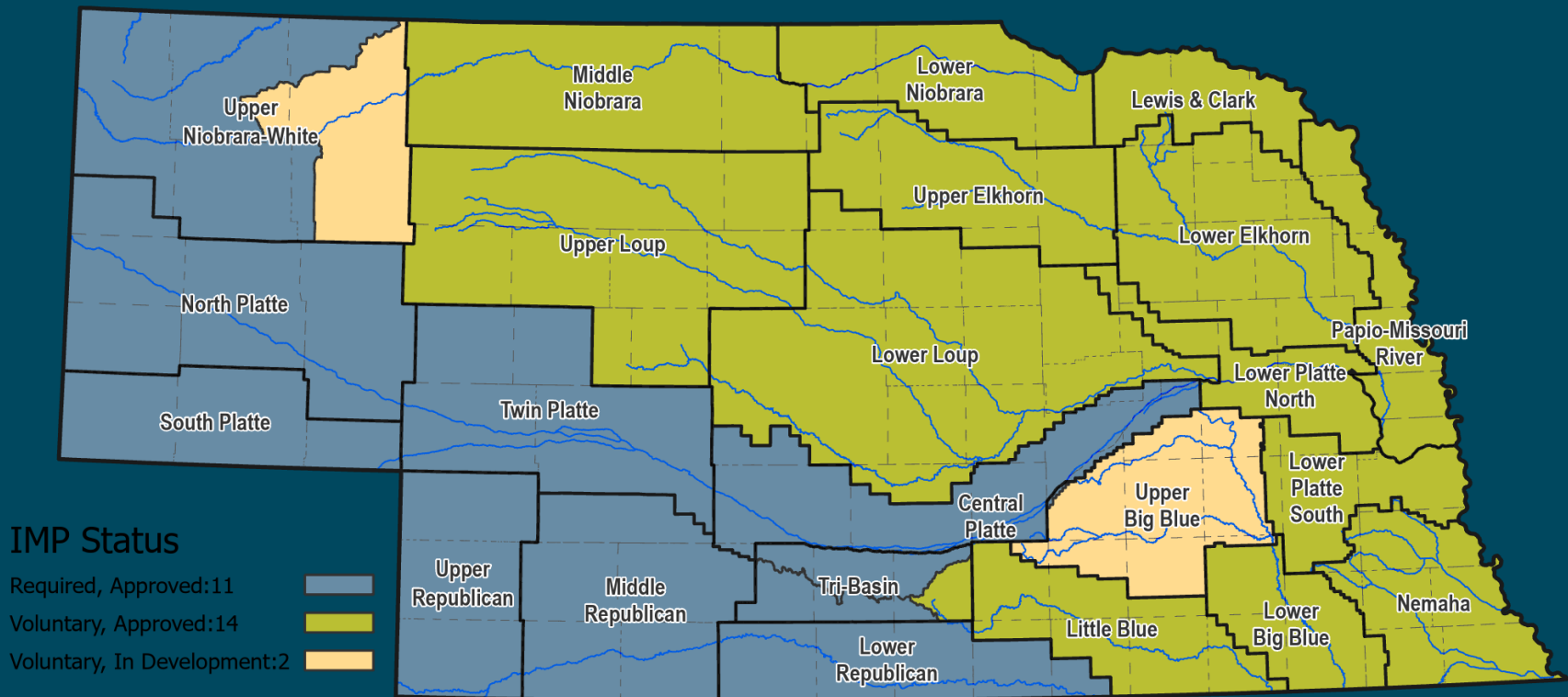
Local Control (IMPs): Joint development – Plans require joint development, adoption and implementation between state-level surface water managers (NeDNR) and **one** local groundwater manager (NRD)



# Basin-wide Plan Areas



# Integrated Management Plan Areas



# Integrated Management Plan Development and Monitoring

## Monitoring, Process, Sanctions

a plan to gather and evaluate data, information, and methodologies to increase understanding and test the validity of the conclusions and information of the plan

### IMPLEMENTATION

Water Management Projects

Strategic Planning Actions

### PLANNING AND PUBLIC PARTICIPATION

Goals and Objectives for Water Planning

Stakeholder Involvement

Water Availability and Water Shortages

Water Supplies and Water Uses

### SCIENCE

Hydrologic Models, Data, and Analyses



PLAN  
DEVELOPMENT

SCIENTIFIC  
ASSESSMENT

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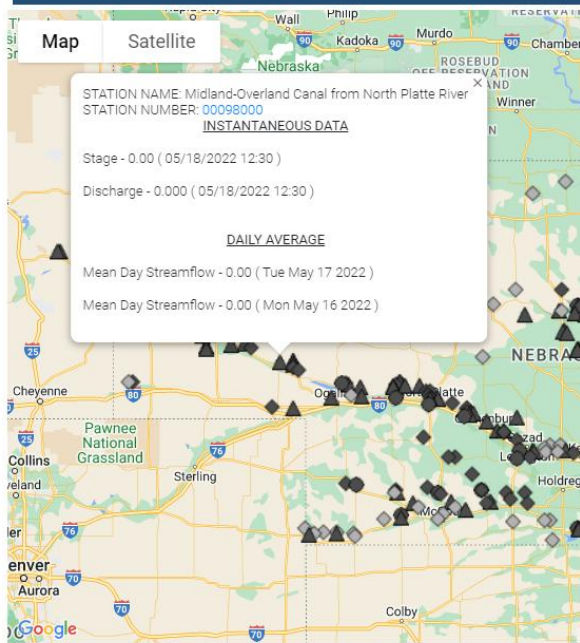
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# Science and Modeling

# Stream Flow and Surface Water Use Monitoring

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## Nebraska Interactive Streamgauge Map



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## 06459025 - Niobrara River near Nenzel

Latitude: 42.80469° N  
Longitude: -101.12290° W  
Station Type: Stream  
River Basin: Niobrara River  
Source: NeDNR

Current Streamflow

Daily Data

Measurement/Shift Data

Hydrographic Reports

Rating Curve

Station Description

05/11/2022

to

05/18/2022

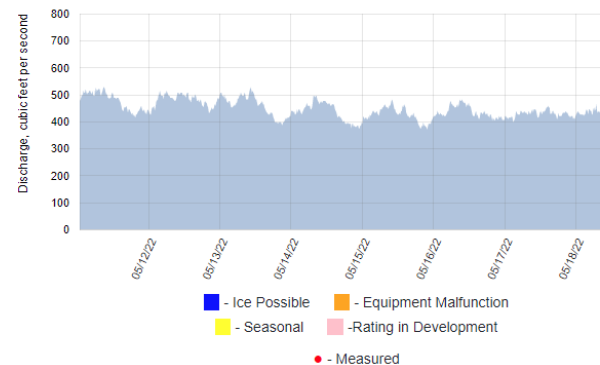
Get Graph Data

Currently data is available for the past two years, in one year intervals

Provisional Data Subject to Revision

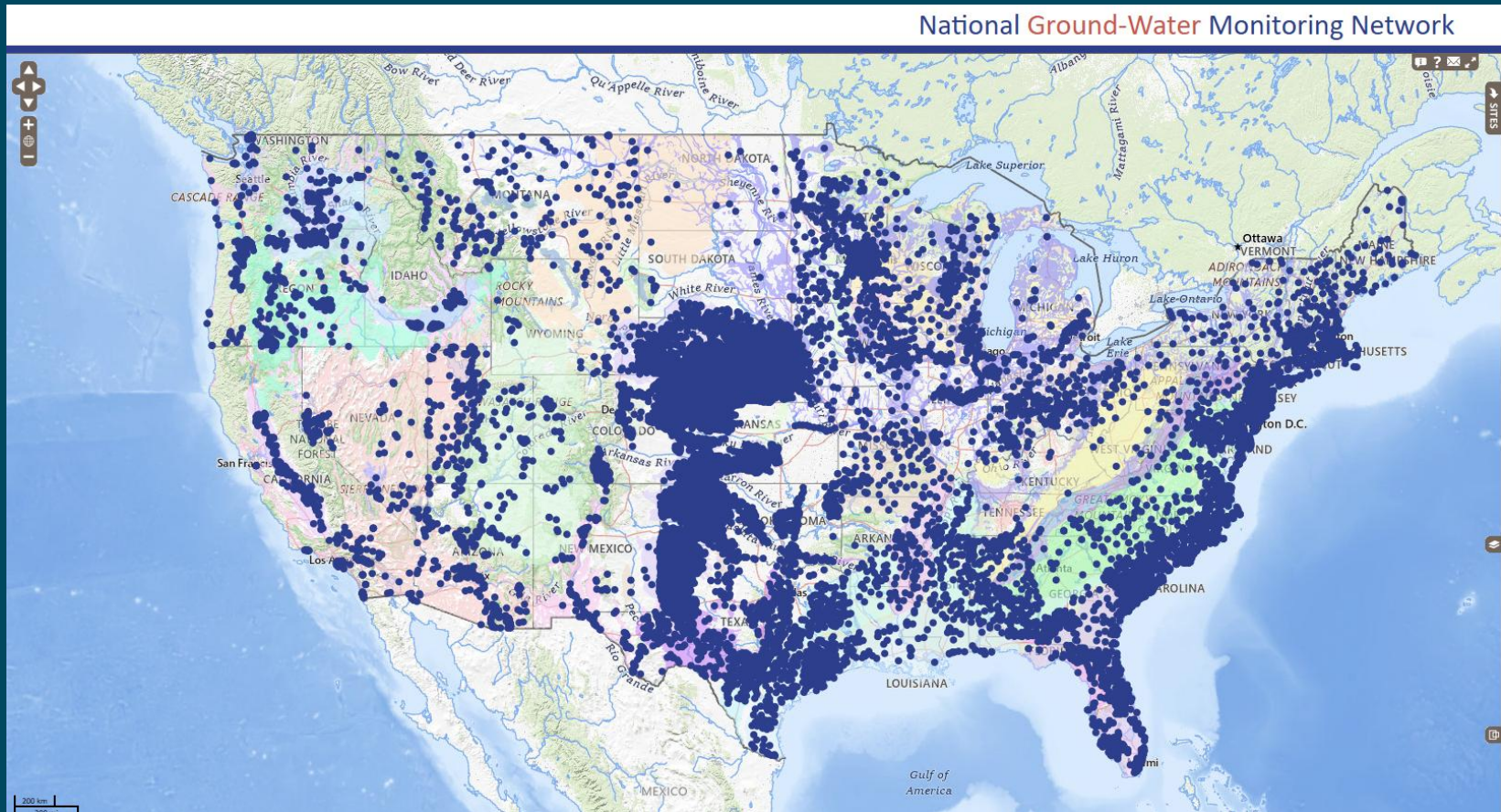
### Instantaneous Discharge

06459025 - Niobrara River near Nenzel



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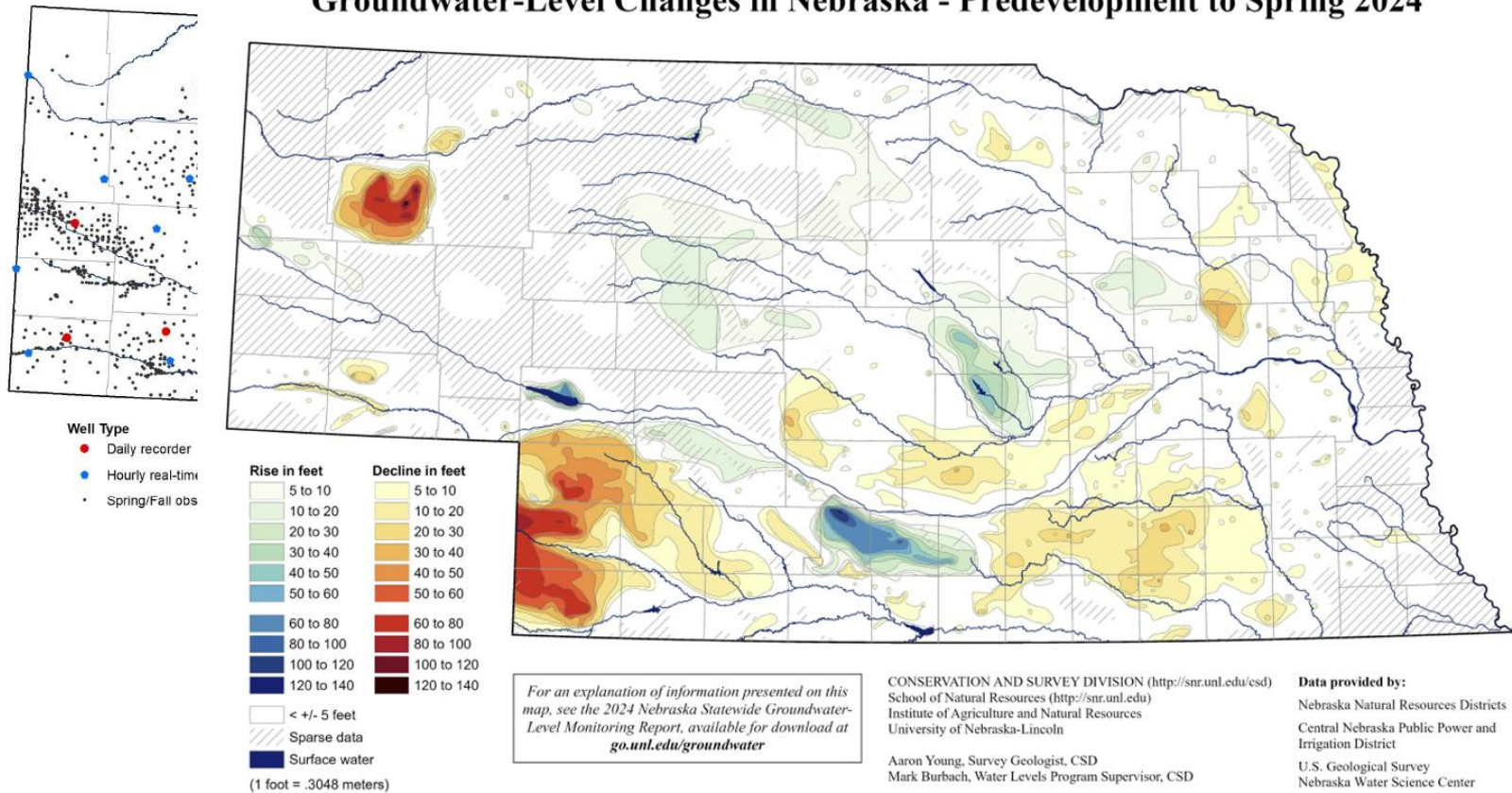
# Aquifer Monitoring



Over 22,000 sites for field measurements in Nebraska

# Groundwater Monitoring (NRDs)

## Groundwater-Level Changes in Nebraska - Predevelopment to Spring 2024



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

### Data provided by:

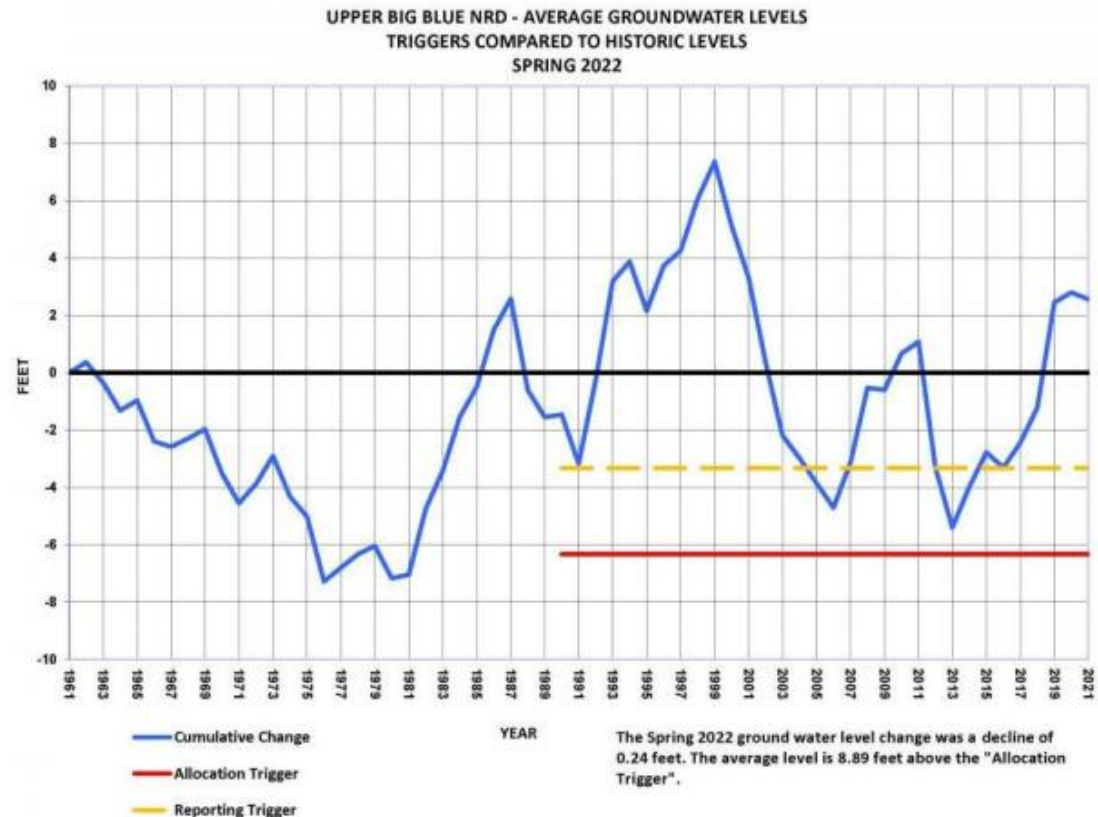
Nebraska Natural Resources Districts  
 Central Nebraska Public Power and Irrigation District  
 U.S. Geological Survey  
 Nebraska Water Science Center  
 U.S. Bureau of Reclamation  
 Kansas-Nebraska Area Office  
 Conservation and Survey Division,  
 University of Nebraska - Lincoln

February 2025

Disclaimer: groundwater-level changes on this map are depicted at a small scale. They are intended to provide only a general overview of regional variation.

# Groundwater Quantity Management Plans & Regulations

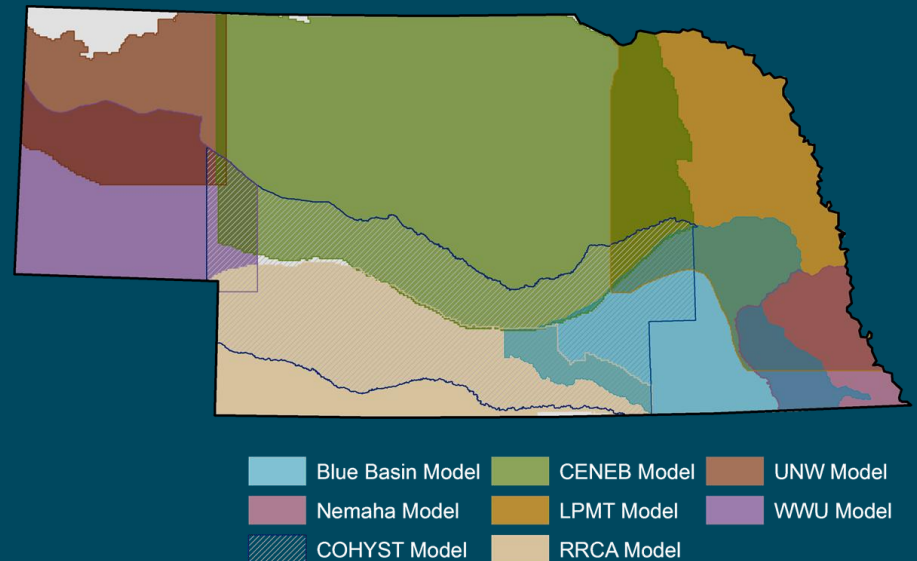
- All plans have trigger levels based on groundwater levels for additional regulation.
- If levels decline NRDs Implement Management Actions
  - Moratoriums
  - Allocations
  - Can require a reduction in irrigated acres
  - Transfers and variances are up to the local NRD



# GW Model Areas

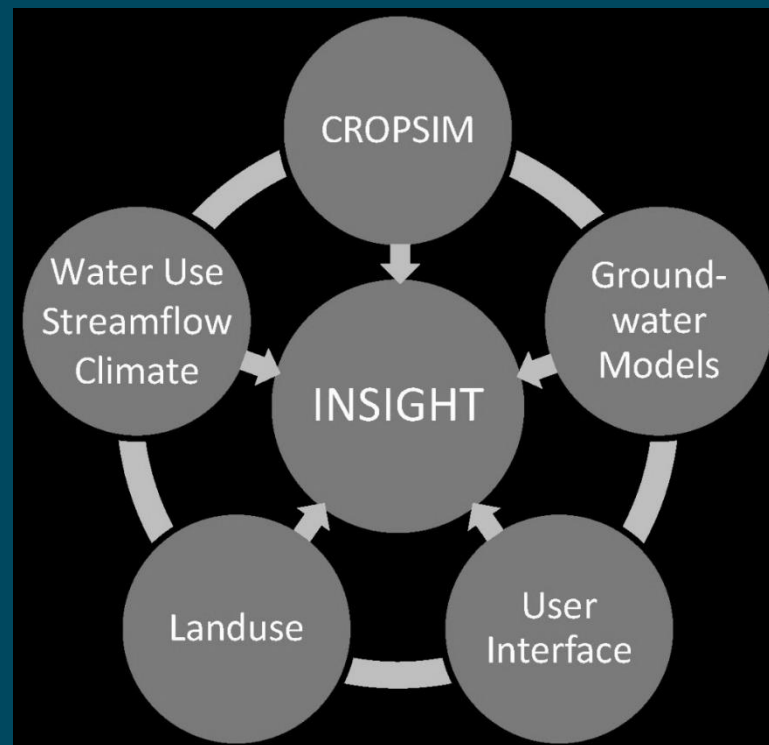
## ➤ Groundwater Models for Integrated Management

- Central Nebraska (CENEB)
- Upper Lower Platte Missouri Tributaries (LPMT)
- Nemaha
- Blue Basin
- Upper Niobrara-White (UNW)
- Western Water Use (WWU)
- Cooperative Hydrological Study (COHYST)
- Republican River Compact Administration (RRCA)



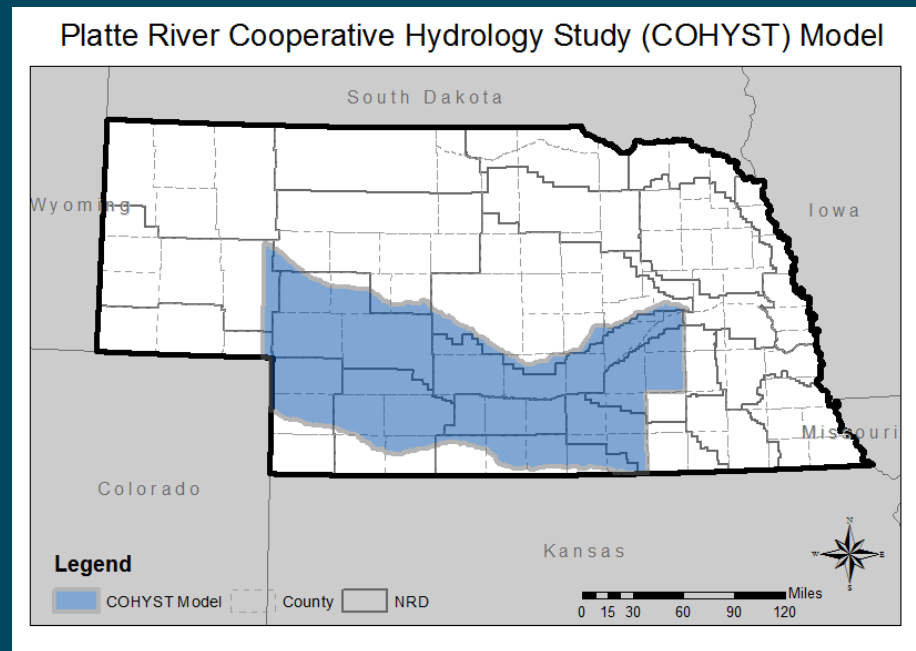
# Models and Data

- Water Supplies
  - ✓ Basin water supplies
  - ✓ Groundwater depletions
  - ✓ Surface water depletions
  - ✓ Streamflow
- Water Uses/Demands
  - ✓ Meter data
  - ✓ Diversion records
  - ✓ Climate data
  - ✓ CROPSIM outputs
  - ✓ Water administration data
  - ✓ Land use data
  - ✓ And more...



# Groundwater Model Purposes

- Assist DNR and NRDs with meeting objectives of integrated water management plans
- Monitor compliance with ESA (Platte river recovery implementation program)
- Evaluate depletions to determine allowable levels
- Understand impact of water use and management practices on long-term supplies



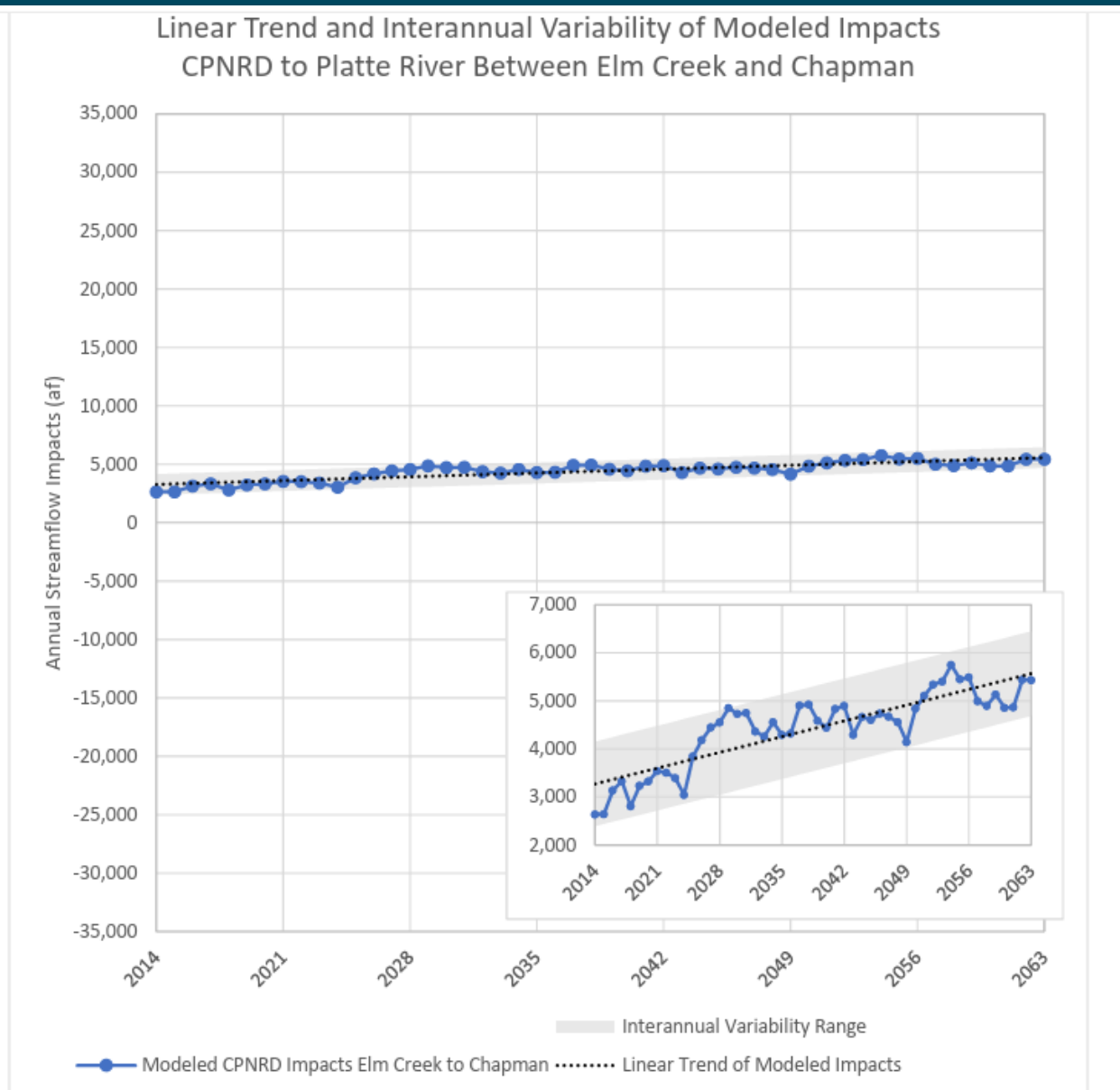


Figure 19: Modeled CPNRD post-1997 impacts to the Platte River between Elm Creek and Chapman, the linear trend line of the modeled impacts from 2014-2063, and the inter-annual variability range of modeled impacts across the trend.

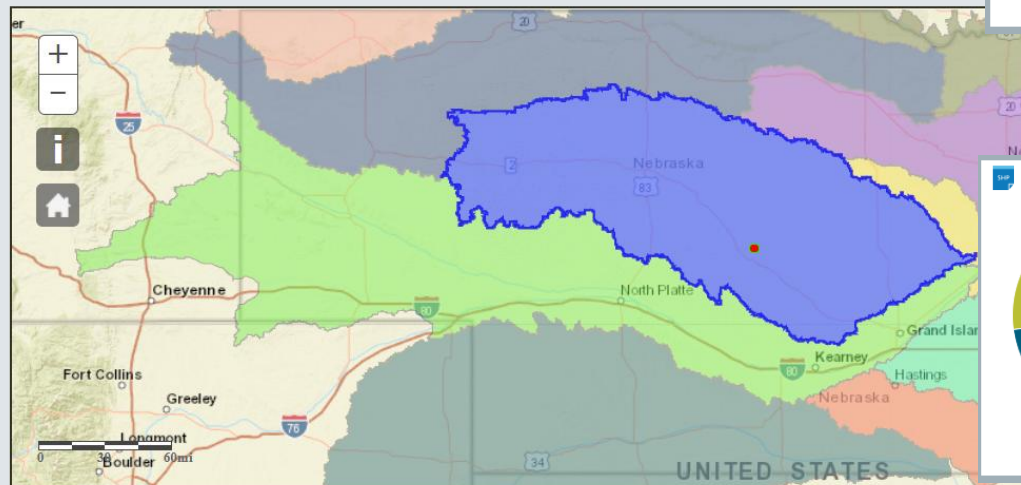
- Groundwater models used to account for change in depletions from baseline conditions
- Models used in interstate accounting to measure compliance
- Also used to assess various management strategies

# INSIGHT

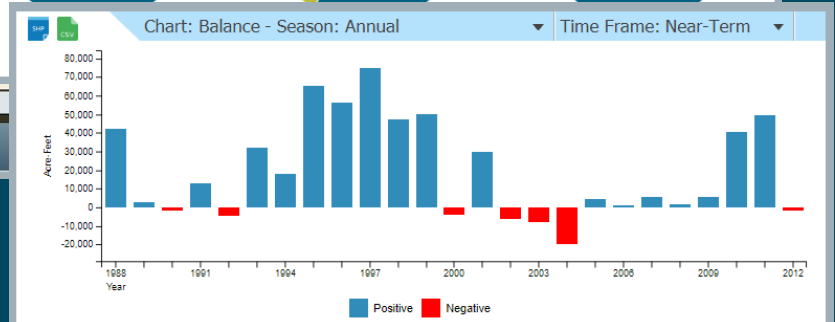
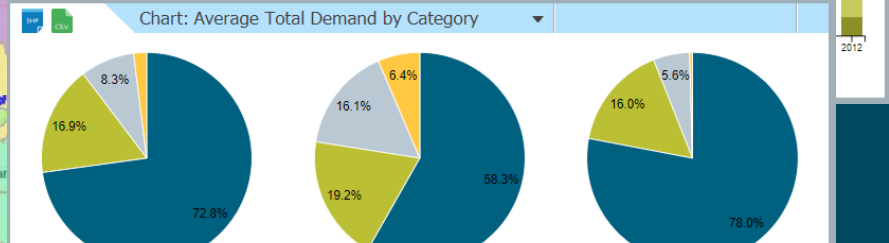
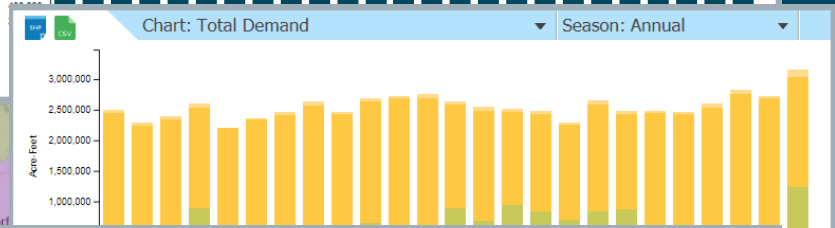
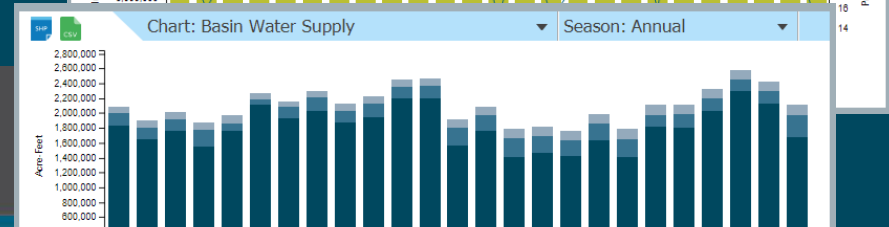
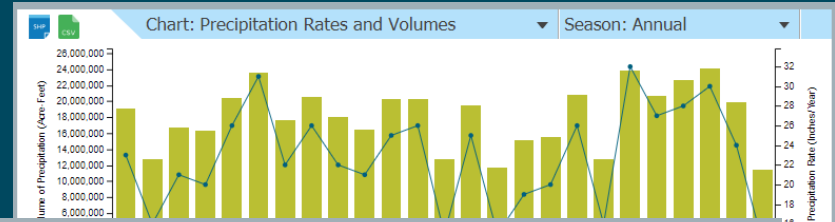


An Integrated Network of Scientific Information & GeoHydrologic Tools

HOME ABOUT MODELING DATA STREAM GAGING



Basin Overview Big Picture Supply Demand Nature & Extent of Use Balance



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# Decision Support Tool

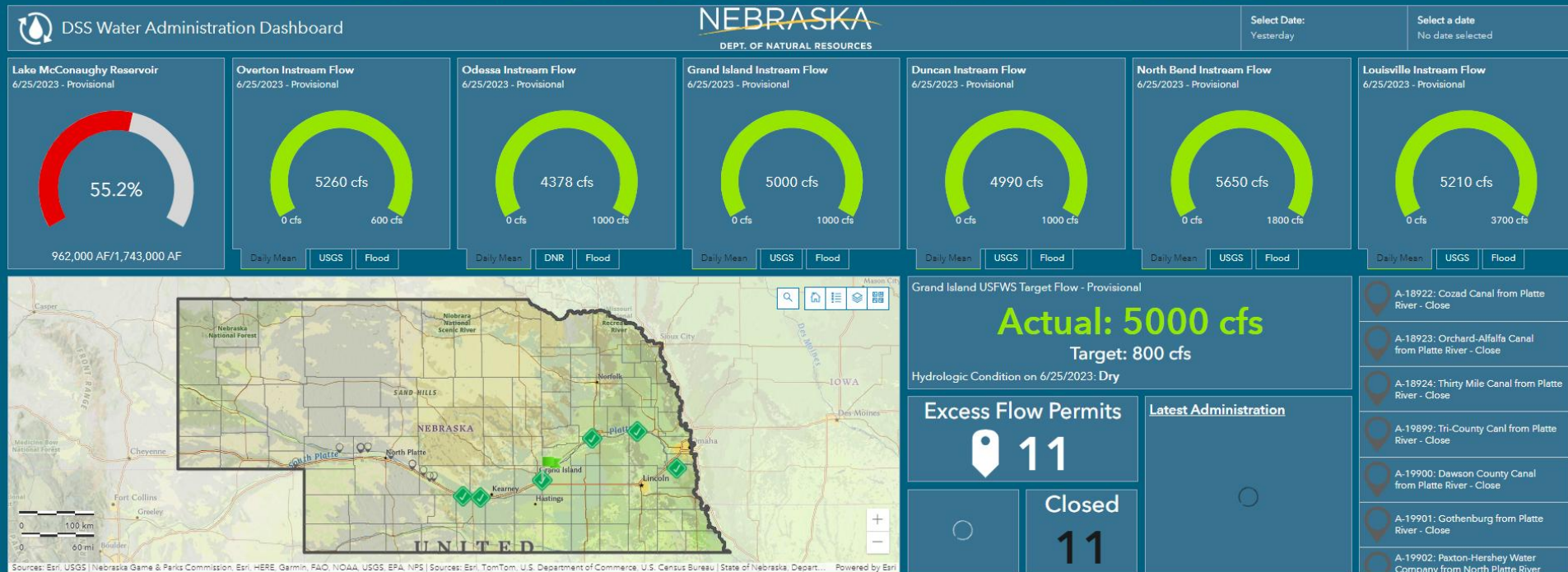
## What is DSS?

Scroll down to learn about the Platte River Decision Support System

Nebraska Department of Natural Resources

### DSS Public Dashboard

*\*All data on this page are provisional and subject to revision. Data displayed below is the best available but please be aware that it can be affected by ice conditions, equipment malfunctions, and/or telemetry complications.\**



# Summary

- Nebraska' aquifer management is tightly coupled to streamflow management (IWM)
- NRD/DNR partnership is key to successful outcomes (IMPs)
- Science and monitor play a significant role in plan monitoring and adjustment



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# THANK YOU

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[dnr.nebraska.gov](http://dnr.nebraska.gov)

