NEBRASKA
Good Life. Great Water.
DEPT. OF NATURAL RESOURCES

## Introduction

Nebraska has long relied on its water resources to support its citizens and the economic development of the state. The economic viability of so many of Nebraska's cities and towns is the direct result of having sustainable, resilient water supplies to provide safe and dependable drinking water, as well as to fuel the agricultural economy of the state. Nebraska's high ranking among U.S. states in the number of acres served by irrigation supplies reflects the importance of its water resources (Figure 1). The state's agriculture relies on supplemental irrigation water supplies to increase crop production. The Nebraska Farm Bureau estimated the annual economic benefits of irrigation within the state at over $11 billion in 2012.

Projections developed in 2015 by the United States Department of Homeland Security indicate that, at current usage rates, the majority of the state has in excess of 200 years of aquifer life. Projections show that some vulnerable counties in the state will face aquifer depletion at current usage rates in 50 to 100 years (Figure 2). Thus, with limited concerns related to aquifer life goals, Nebraska's primary groundwater management objectives relate to managing the widespread interconnectivity between the state's aquifers, rivers, and streams. This unique condition amongst Ogallala region states has allowed Nebraska to direct water policies toward efforts managing hydrological interconnectivity and ensuring sustainable streamflow resources in conjunction with the aquifer.

**Top States**
**Irrigated Acreage and Water Use, 2018**

| Irrigated Acres | million |
|---|---|
| California | 8.4 |
| Nebraska | 7.7 |
| Arkansas | 4.2 |
| Texas | 4.1 |
| Idaho | 3.4 |
| Colorado | 2.5 |
| Kansas | 2.4 |
| Montana | 2.1 |
| Washington | 1.9 |
| Mississippi | 1.7 |
| **U.S. Total** | **55.9** |

| Water Applied (acre-feet) | million | avg per acre |
|---|---|---|
| California | 24.5 | 2.9 |
| Idaho | 6.6 | 1.9 |
| Texas | 5.3 | 1.3 |
| Arkansas | 5.1 | 1.2 |
| Nebraska | 4.9 | 0.6 |
| Arizona | 4.4 | 4.7 |
| Washington | 4.1 | 2.2 |
| Colorado | 3.8 | 1.6 |
| Oregon | 2.7 | 1.7 |
| Montana | 2.5 | 1.2 |
| **U.S. Total** | **83.4** | **1.5** |

*Figure 1.* Top 10 states in total irrigated acres: 2018 (2017 Census of Agriculture, USDA, National Agricultural Statistics Survey).

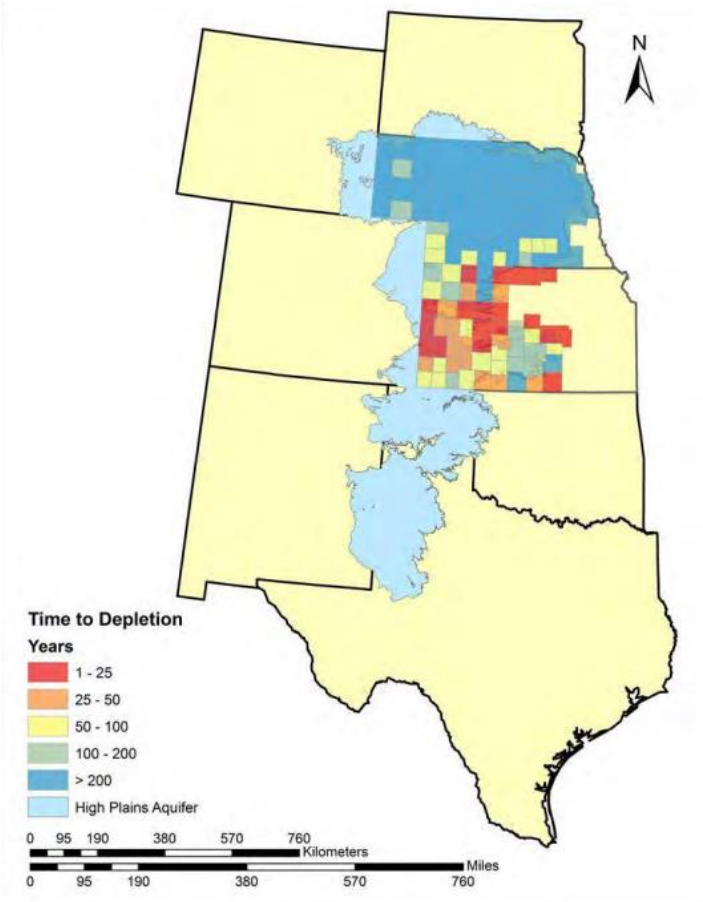


*Figure 2.* Estimated time to depletion of High Plains Aquifer due to continued pumping (U.S. Department of Homeland Security, 2015).

## Science and Data

Informed water management decisions require a comprehensive understanding of water supplies. Nebraska is fortunate to have a highly developed monitoring network that supports a robust system of groundwater modeling tools and allows for a comprehensive understanding of water supplies and water uses. Much of this data is readily available to Nebraskans through a variety of online sources, including the Nebraska Department of Natural Resources (NeDNR) INSIGHT web portal (Figure 3). The collaboration of NeDNR with local natural resources districts (NRDs) and local water users continually enhances the understanding of water supplies and water uses. This scientific foundation ensures that managers and water users can rely on a comprehensive network of information when making decisions.

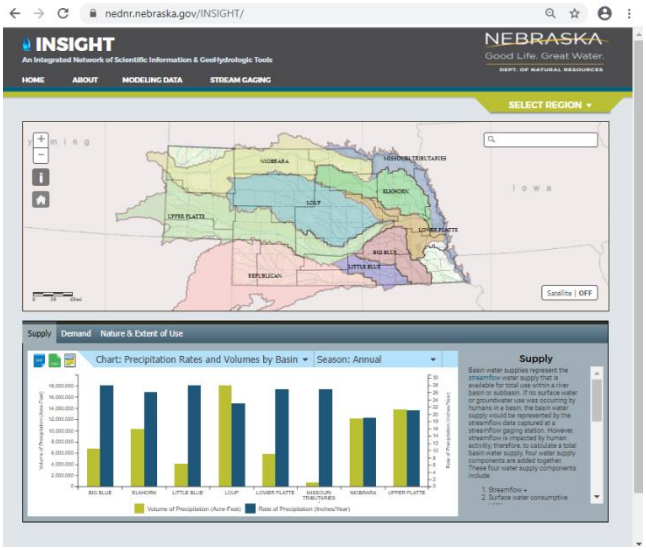


*Figure 3.* NeDNR INSIGHT homepage (2020, NeDNR)

New information continually augments Nebraska's science and data network. Data hierarchies aimed at ensuring the best available information structure this process and support local and regional water planning. This approach acknowledges the inherent variability in data sources and provides direct conduits for local NRD investments in improving data collection to incorporate throughout the water planning process. This is important for ensuring technical credibility and a common factual basis for state and local decision makers.

## Policy and Planning

The Ground Water Management and Protection Act affirms that water in the State of Nebraska is held by the state for the benefit of its citizens. A total of 23 local NRDs is charged with the primary responsibility of managing groundwater quantity and quality and guiding state policy regarding its management. Two state agencies collaborate with the local NRDs on these issues: 1) NeDNR focuses on water quantity and 2) Nebraska Department of Environment and Energy (NDEE) focuses on water quality. Groundwater quantity management occurs through a modified correlative rights system, which differs from the prior appropriation system used by NeDNR to manage and administer surface water rights. Water rights in Nebraska do not constitute ownership of water - only the right to use it for beneficial purposes.

With the Ogallala aquifer supporting a significant portion of the agricultural economic output in Nebraska, many programs, policies, and planning efforts have been directed toward conserving and sustaining this resource. Given this context, examples of management activities supporting water quality and water quantity efforts are extensive. One example is the development of Ground Water Management Plans with locally developed NRD-specific rules and regulations for both water quantity and quality. Other examples are Watershed and Basin Management Plans that target water quality through a systematic strategy to resolve nonpoint source water pollution and are collaboratively developed with NDEE, NRDs, and local stakeholders. Additionally, NeDNR, NRDs, and local stakeholders work together to develop Integrated Management Plans and Basin-Wide Plans, both of which address hydrologically connected ground and surface water resources. Other locally sourced management efforts and funding mechanisms to support conjunctive water management also provide support to water quality and water quantity planning efforts.

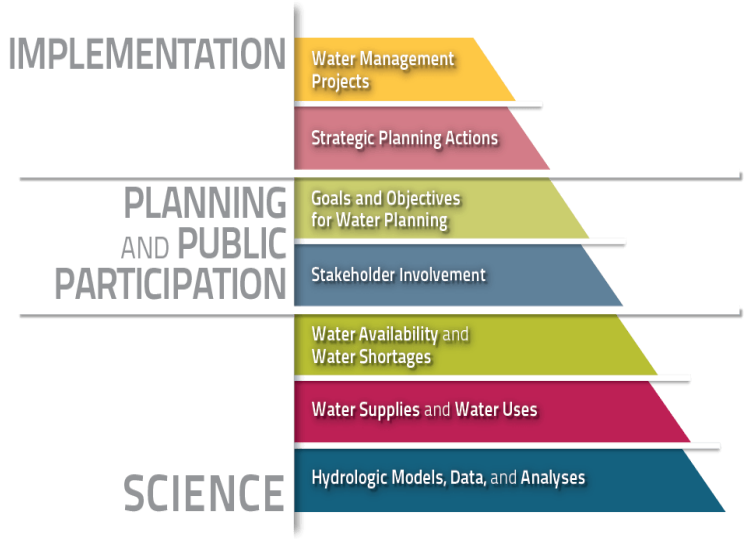


*Figure 4*. Foundations of water quantity planning in Nebraska.

Building on the policy framework described above, Nebraska places a significant emphasis on the water planning process, which relies on a strong partnership between the lead state agency and local NRDs in conjunction with stakeholders and other water management agencies.

The primary policy tenets guiding integrated management planning processes include:

- Customized and decentralized water management plans led by local NRDs and NeDNR in conjunction with strong public engagement with multiple constituents and stakeholders to ***ensure both local and state needs are addressed.***
- A commitment to the ***protection of existing water uses*** and continuing investments in water resource development and protection, such as reservoirs and groundwater recharge projects.
- Expansion of ***science-based*** conjunctive use and integrated water management strategies leveraged to optimize water supply utilization.
- Agricultural ***producer-level innovation*** in water quantity and water quality management.
- Creation of ***flexible markets and management tools*** to address both short-term and long-term water supply shortages and challenges.
- Continuous improvement amongst water agencies ***to improve the coordination*** of water quantity and water quality management.

This water planning process relies on a strong science-based foundation that allows for a thorough understanding of water supplies. NeDNR builds off this foundation to engage stakeholders and collaborating NRDs to review and develop goals and objectives specific to each local area. With that stakeholder input, NeDNR and local NRDs work to develop strategic actions aimed at achieving those goals and objectives (Figure 4).

Figure 5 illustrates the status of NRD-level integrated management planning across the state. With the high degree of variability in both water supplies and water demands in each basin across the state, the goals and objectives of plans can differ dramatically from one NRD to another. However, many common features tend to exist within a given basin, which gives rise to the desire for increased coordination among the various planning goals and objectives contained within each NRD plan. Basin-wide plans accomplish this coordination and supplement local planning.

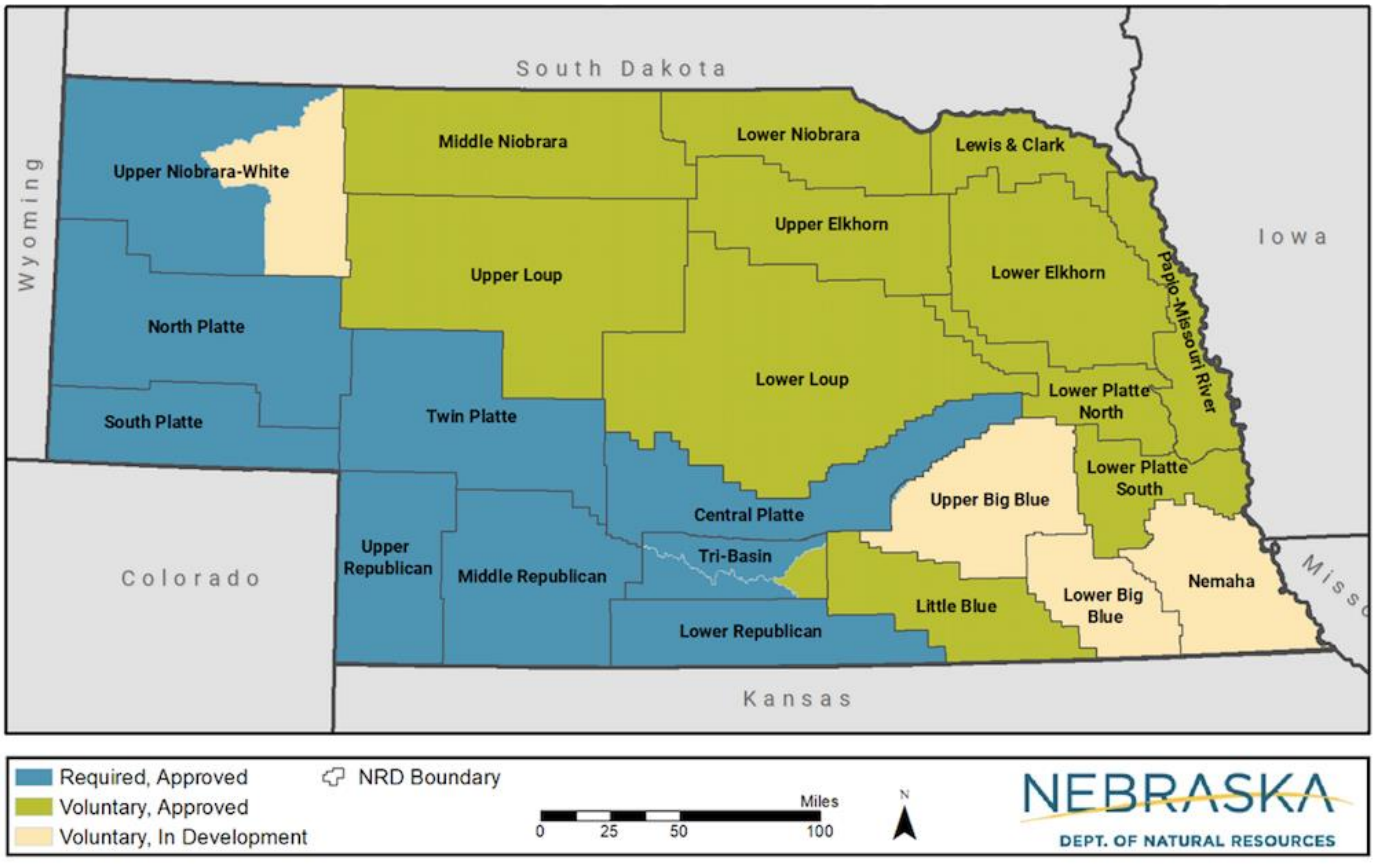


*Figure 5.* NRDs currently involved in integrated management planning (2020).

The development of basin-wide plans in three basins in the state further the aim of leveraging opportunities through collaborating with multiple NRDs and gaining efficiencies in plan implementation. The integrated management planning process does not stop with the development of a plan; it is continual and adaptive. The planning process seeks to achieve goals and objectives while identifying whether to incorporate new goals and objectives, with emphasis toward improving outcomes for water users.

There are several state and federal programs used to support groundwater quantity management in Nebraska. The state-funded Water Resources Cash Fund and Water Sustainability Fund are used to support programs targeted at reducing use and increasing water supplies through retiming and storage, as well as investments in water supply infrastructure. Local cost shares match 40% of these funds, typically with NRD participation.

Table 1. *Selected examples of producer programs offered or required by NRDs.*

| Program Target | Program | Description | Results |
|---|---|---|---|
| **Quantity** | Soil Moisture Sensor Program | NRD-level cost-share program offering technical assistance and 0-100% on purchase of soil moisture sensing equipment | Offered by 21 of 23 NRDs<br>> 436,000 acres<br>> 2,000 producers |
| **Quantity** | Groundwater Well Flow Meters | Required flow meters on existing or new groundwater wells over specified capacity | Required by 21 of 23 NRDs |
| **Quantity** | Allocations | When trigged, allocates a certain number of inches that can be pumped over a certain number of years | Required by 13 of 23 NRDs |
| **Quality** | Soil Sampling | Required soil sampling for water quality indicators | Required by 16 of 23 NRDs |

NRDs derive their funding from locally sourced taxing authorities, property tax levies, and occupation taxes on irrigated acres that support plan implementation. State and local funds are matched by federal programs and funding sources, which are also leveraged and include the Conservation Reserve Enhancement Program (CREP), Agricultural Water Enhancement Program (AWEP), Natural Resources Conservation Service (NRCS) funding sources, along with federal grants from the United States Bureau of Reclamation (USBR) and Environmental Protection Agency (EPA).

## Producer Practices

Nebraska producers have implemented cost-saving irrigation efficiency practices that have also proven to dramatically conserve and protect water resources. The NRDs have been successful in working with state and local partners including NeDNR, NDEE, universities, and UNL Extension, to research groundbreaking technology, cropping strategies, and input practices that best address local management needs. This research helps engage producers and stakeholders and demonstrate both the economic and conservation impacts of best management practices. Several NRDs have developed their own programs and networks that work to demonstrate efficiency impacts and offer producers real-time data and information to assist in making effective conservation-minded management decisions. While there are special Water Quality and Quantity Management Areas where certain practices are required, many of the most effective practices implemented by producers across the state are voluntary. Utilizing NRD funds to leverage state and federal dollars, local NRD boards are able to provide cost-share incentives to producers for innovative, research-driven advances in irrigation management. Table 1 lists a few examples of the programs offered or required by NRDs.

In addition to support from extension offices, NRDs, and NRCS district conservationists, and locally driven producer groups, such as the Water Balance Alliance, have worked to provide producer seminars and education events on technologies and practices that support producers in improving irrigation management.

A recent example of a creative program to engage producers in new technology adoption is the University of Nebraska-Lincoln (UNL) Testing Ag Performance Solutions (TAPS) program (taps.unl.edu). The TAPS program provides opportunities for producers to compete against each other, as well as UNL scientists, for (1) most profitable farm, (2) highest input (water and nitrogen) use efficiency, and (3) greatest grain yield. The goal of the competition is to promote efficiency and profitability while giving a chance to learn from those who grow corn profitably. UNL Extension, NRDs, non-profit organizations, and agricultural industries, among others, support the competition.

## Moving Into the Future

Challenges to the reliability and protection of the Ogallala aquifer do exist. Many areas of the state face nitrate concentrations in excess of 10 mg/L (Figure 6). Considering that aquifer extractions provide much of the state's drinking water, efforts to provide safe and affordable drinking water supplies for rural communities will need to be enhanced. Portions of the state are more susceptible to drought, resulting in increased in-season aquifer drawdowns and less resilient streamflows. These drought-related impacts can create well interference issues between irrigation wells and domestic wells, and reduced streamflows can create challenges in meeting the requirements for compacts and interstate agreements.

These challenges will serve to sharpen the focus of water management and planning in Nebraska. The development of science and monitoring to support planning efforts needs continued investment to ensure that the extensive data networks throughout the state can support the information needed to make well-informed management decisions. Funding will continue to be necessary to revitalize and repurpose water supply infrastructure to meet the new challenges of the future. With a continued focus on leveraging activities such as conjunctive management, retiming water supplies, producer driven innovation, and implementation of best management practices, Nebraska will work to create more resilience within each basin. It is through this extensive water planning, scientific investment, and locally sourced collaborative solutions that Nebraska intends to meet its management challenges.

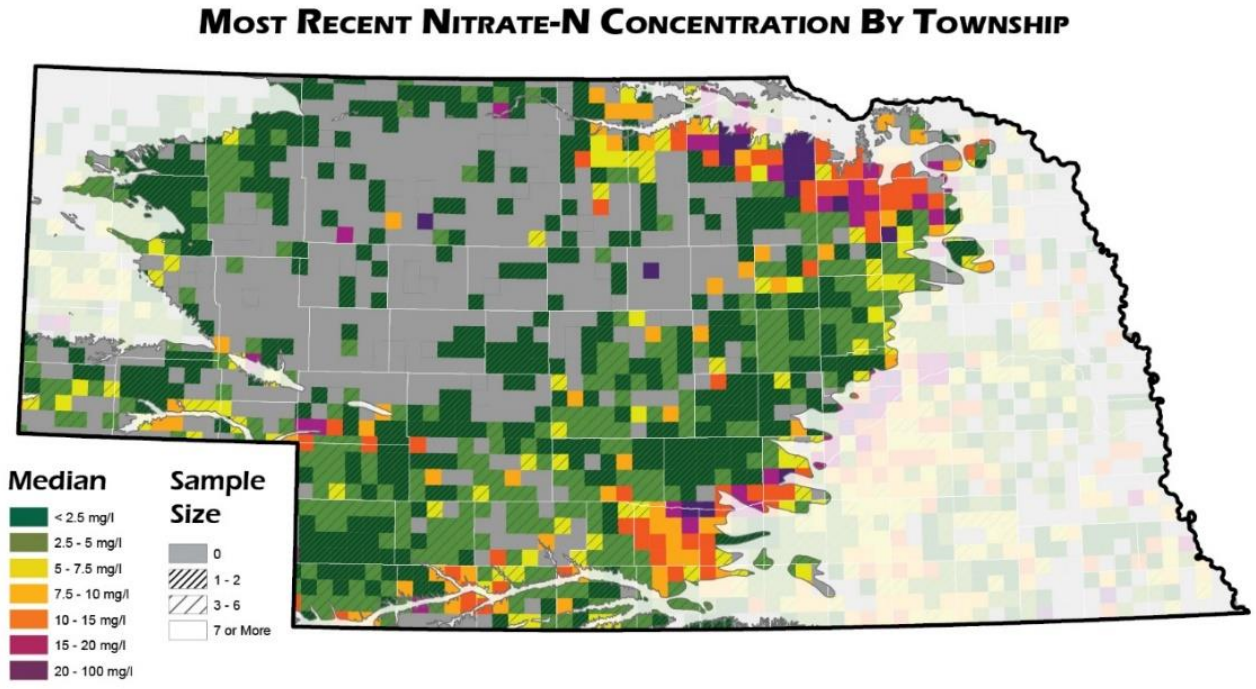


*Figure 6.* Median of the most recent nitrate-N concentrations by township of 18,299 wells from 1999-2018. (Source: Quality-Assessed Agrichemical Database for Nebraska Groundwater, 2019. Published by Nebraska Department of Environment and Energy, 2020)