

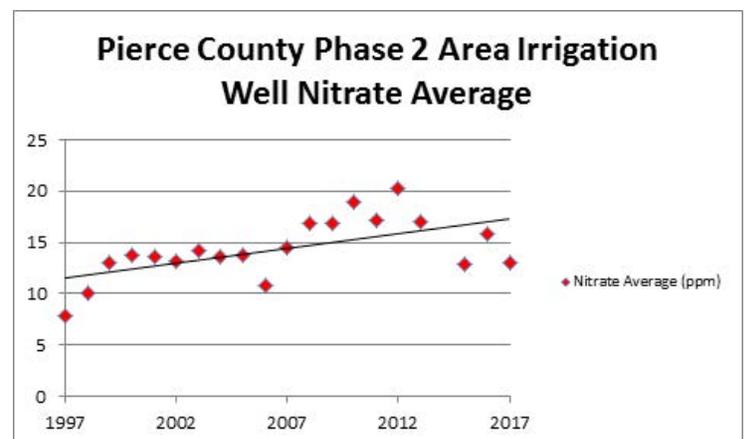
Excessive Nitrate Levels & Groundwater Quality

The time is now, to significantly reduce the nitrate levels in our soil and groundwater

The Lower Elkhorn Natural Resources District's (LENRD) concern for groundwater quality and the growing health concerns for the public, as well as the desire to further implement best management practices to prevent groundwater contamination, are the primary reasons the district expanded the geographic area of the Phase 2 & 3 Groundwater Management Area in Pierce and Madison Counties. Concerns about high nitrates in the district have risen as long-term monitoring has shown increasing levels of nitrate concentration in much of the groundwater in Pierce County, and most recently in small portions of northern Madison County. Results indicate that of the approximately 40% of the registered wells sampled in Pierce County, the average nitrate-nitrogen level is 11.7 parts per million (ppm). Several health concerns are related to the consumption of high nitrate water. Nitrates can be particularly harmful to infants under six months of age. Excessively high nitrates can lead to methemoglobinemia, a condition that is commonly known as "blue baby syndrome" in which there is a reduction in the oxygen-carrying capacity of blood, potentially leading to death. Pregnant women and other adults with certain health conditions may also be at increased risk. Preliminary results from another study also indicate a potential positive link between groundwater nitrates and the incidence of birth defects and non-Hodgkins lymphoma. Because of these potential health risks, the MCL has been set by EPA to 10 ppm.

The LENRD has been monitoring the groundwater across their 15 counties for over 40 years. Nitrate levels in some areas are not declining, and additional portions of the district are experiencing elevated groundwater nitrates, including northern Madison County, even with Best Management Practices (BMPs) in place. High nitrates in our drinking water can have negative health impacts, and some communities within the area have been required to invest significant financial resources to upgrade their infrastructure in order to deliver a safe, reliable source of drinking water.

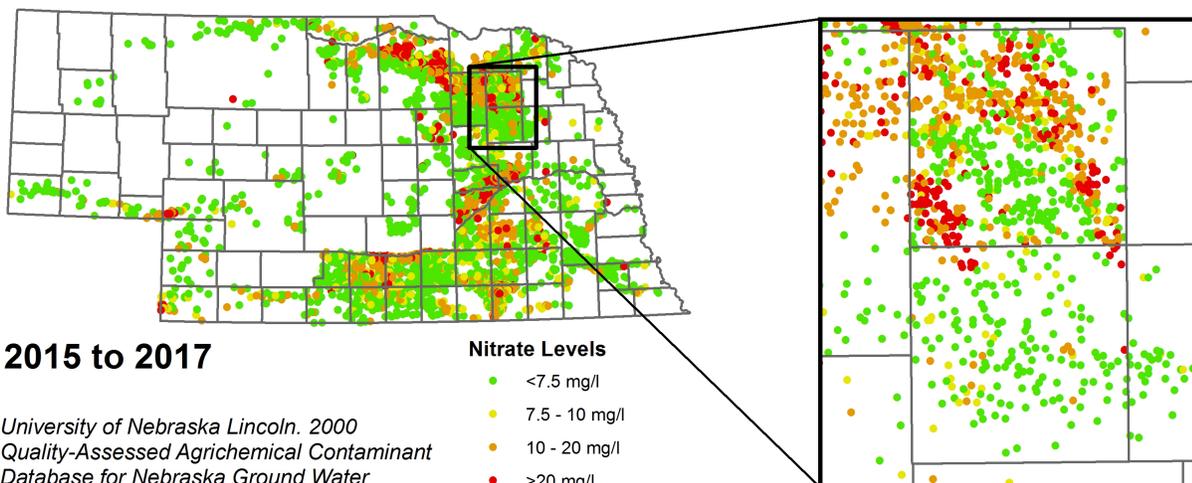
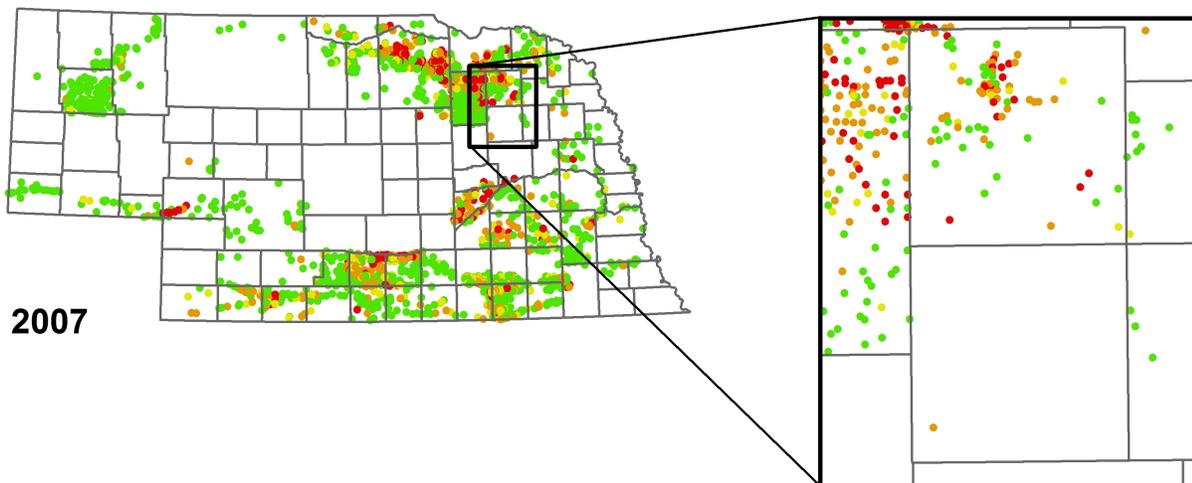
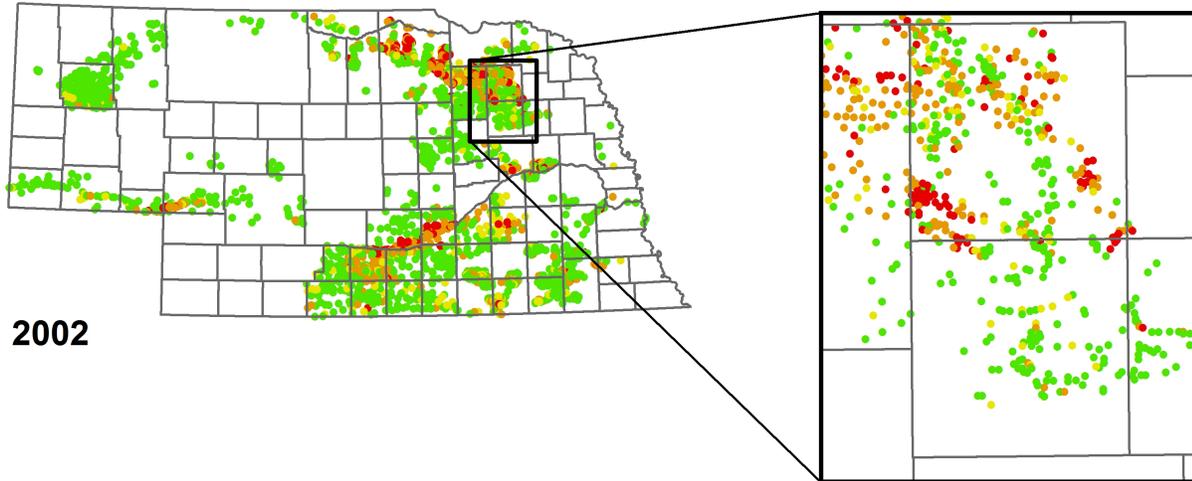
- Since 2002, the percentages of groundwater samples in Nebraska that exceed the 10mg/L maximum contaminant level (MCL) for drinking water have increased from 27% to 33% (NDEQ, 2012).
- According to a UNL study, isotopes of nitrates can be used as a "fingerprint" of sources, providing the ability to identify the source of nitrate contamination (Snow, 2014).
- The Nebraska Department of Health and Human Services (DHHS) is responsible for implementing federal requirements and can take action toward public water supplies that are not safe.
- Nitrogen in the soil and irrigation water should be accounted for when making fertilizer rate decisions to maximize yield and profit. This will help prevent excess nitrogen fertilizer leaching into groundwater.
- Some areas within the Groundwater Management Area have nitrate levels that exceed 30 mg/L, three times the level for safe drinking water.
- Excessive and long-term exposure to nitrate in drinking water have the potential to lead to negative health consequences (Dr. Martha Rhoades, UNL).



In 1997, irrigation well sampling was initiated in Pierce County. The graph above displays the data collected from 1997-2017. The points on the graph represent an average of all the samples taken for each respective year in the current Phase 2 area of Pierce County.

Evidence reveals that the leaching of nutrients applied in the form of organic and inorganic fertilizers, is a major contributing factor to the presence of nitrate in many portions of Nebraska.

Water quality data obtained from the sampling of wells in the district illustrate a consistent upward trend of elevated nitrates in portions of Pierce and Madison Counties.



University of Nebraska Lincoln. 2000
Quality-Assessed Agrichemical Contaminant
Database for Nebraska Ground Water

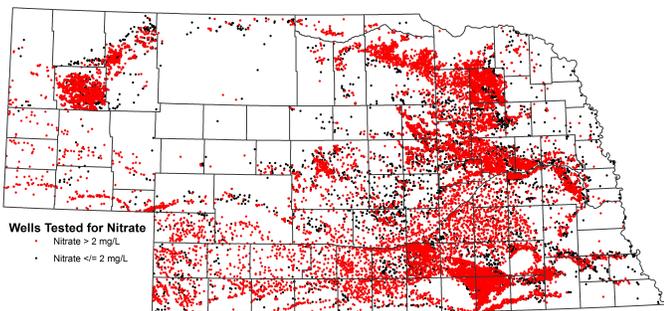
Excessive Nitrate Levels & Public Health Concerns

Nitrate (fertilizer) and atrazine (herbicide) are two of the most prevalent drinking water contaminants in Nebraska

- On average, Nebraska and Delaware had the greatest proportion of public water systems in violation of the nitrate maximum contaminant level (2.7% and 2.4%, respectively), while Ohio and California had the greatest number of people served by systems in violation (278,374 and 139,149 people, respectively). (Pennino, M., et al. Trends in Drinking Water Nitrate Violations Across the United States. 2017.)

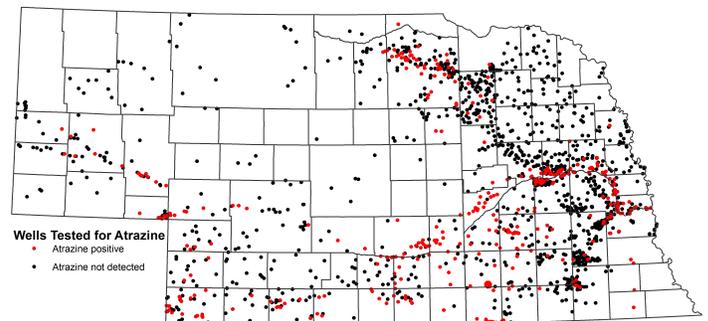
Wells sampled for nitrate 1974-2017

13,589 of 17,543 irrigation wells sampled were positive at 2 mg/L or more; 1,257 of 1,646 wells sampled in the LENRD were positive.



Wells sampled for atrazine 1974-2017

493 of 1,820 wells sampled were positive; 8 out of 128 wells sampled in LENRD were positive.



University of Nebraska Lincoln, 2000. Quality-Assessed Agrichemical Contaminant Database for Nebraska Groundwater (Queried July 2018)
Lower Elkhorn Natural Resources District

Rural residents on private wells and town residents are forced to deal with unacceptable levels of nitrates in their drinking water supplies. The cost of nitrate contamination is not only a health concern but also a financial burden for communities.



A LOOK AT...

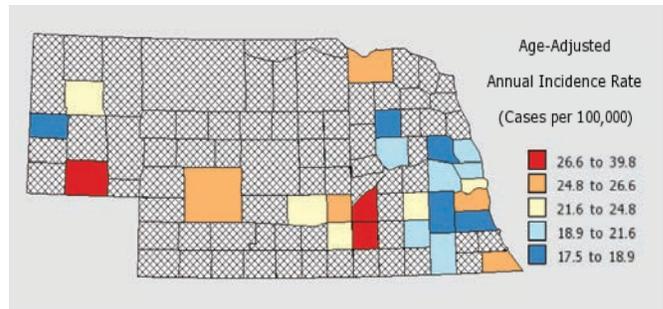
OSMOND, PLAINVIEW, AND CREIGHTON, NE

- All rural residents and community water systems in the Groundwater Management Area (GMA) use groundwater for their domestic supply.
- Nitrate concentrations in the Groundwater Management Area range from non-detection to 47.9 mg/L
- The communities of Osmond and Plainview, NE have both had to comply with the terms of administrative orders issued by the Nebraska Department of Health and Human Services due to elevated levels of nitrate in their public water supplies.
- In 1993, Creighton, NE became the first community in Nebraska to build a costly reverse osmosis facility, which then removed them from the administrative order list after taking these steps to provide safe drinking water. The cost of the original plant, excluding engineering and equipment, was \$605,507. An additional \$1.2 million has since been invested to rehabilitate the plant.

There is indisputable evidence that people living in northeast NE are experiencing higher incidents of adverse health conditions related to elevated exposure to nitrate.

- The potential health consequences of continued exposure to nitrates are potentially life-threatening.
- There are risks associated with pesticide exposure and exposure to nitrate in drinking water.
- Knox County has the second highest incident rate for non-Hodgkin’s lymphoma in Nebraska.

**Incidence Rates for Nebraska, 2008 – 2012
Non-Hodgkin’s Lymphoma-All Races, Both Sexes, All Ages**

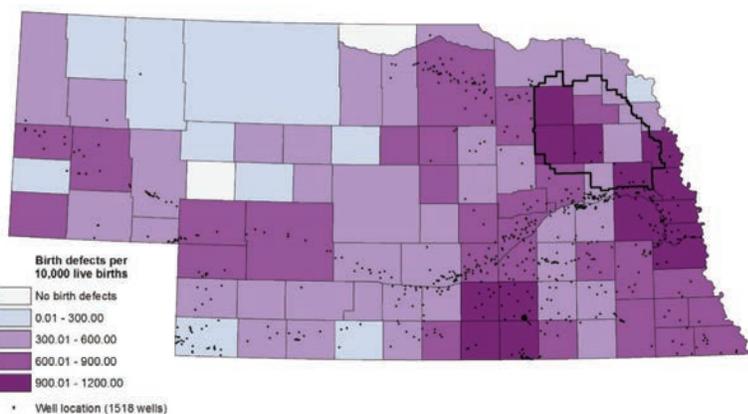


Map created from statecancerprofiles.cancer.gov 01/2016

Continued exposure to nitrogen may be responsible for a range of adverse health effects on humans.

- The risk of developing B-cell lymphoma is 3.5 times higher for individuals exposed to nitrate and atrazine in drinking water.
- The non-Hodgkin’s lymphoma risk is 2.5 times higher for individuals exposed to nitrate and atrazine in drinking water.
- Blue-baby syndrome, non-Hodgkin’s lymphoma, as well as a multitude of severe birth defects, such as neural tube defects, heart defects, abnormal development of the lower spine, intestines and other organs developing outside the fetal abdomen may be associated with continued nitrate exposure.

Between 2005 and 2014, the national rate for birth defects was 3.3% of all live births. During that same time in Nebraska, the rate for birth defects was 5.8%.



NC (n=19;7 parent and 12 degradation products)

We have to ask ourselves...

Is the incidence of birth defects in Nebraska associated with wells testing positive for nitrate and nitrosatable compounds?

Nebraska county rates for birth defects (2005-2014). Birth defect data obtained from Nebraska Birth Defects Registry, Nebraska Department of Health and Human Services. Well data for nitrate (>0 mg/L) and NC (>0 µg/L) obtained from Quality-Assessed Agrichemical Contaminant Database for Nebraska Ground Water (1977-2014).

Reducing Excessive Nitrate Levels: The Time to Act is NOW

Actions taken in the Phase 2 & 3 Areas by agricultural producers and the LENRD will help to protect and improve groundwater quality for the future.

Phase 2 Area Controls

(Recent changes in bold italics):

- Fall and winter application of commercial nitrogen fertilizer prohibited between October 15 and March 15
- Operators who apply commercial nitrogen must be certified by the LENRD
- Submittal of annual field reports to the LENRD by March 15th of each calendar year
- Require deep soil sampling (24 inches) in fields planted to continuous corn
- Require irrigation water sampling once every four years
- ***Any single application of commercial nitrogen fertilizer in excess of 80 pounds per acre is prohibited***
- ***Require use of LENRD approved nitrogen inhibitor or stabilizer if applying more than 50 pounds of commercial nitrogen in any single application (after March 15) and provide documentation to verify use along with proper application rate***

Phase 3 Area Controls

(Recent changes in bold italics):

- Continue all Phase 2 Area controls
- Require use of district approved nitrogen inhibitor if applying more than **50** pounds of commercial nitrogen in any single application (after March 15)
- ***Any single application of commercial nitrogen fertilizer in excess of 80 pounds per acre is prohibited***
- ***Require deep soil sampling (24 inches) in all fields planted to corn (regardless of crop rotation)***
- ***Require the development and adherence to a district approved Nutrient Management Plan***
- ***Require annual irrigation water sampling***



Best Management Practices for Reducing Excessive Nitrate

Everyone has a role to play in reducing nitrate levels. As a community, we can improve our environmental stewardship to restore and protect our natural resources for the next generation.

There are safer and better ways to save money and increase yields

- Prevention is always more effective than waiting for the cure.
- The Groundwater Management Area Plan provides guidance and recommendations for more effective nitrate use.
- Your local NRD has secured additional cost share incentives for conservation practices through the Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP). EQIP is a voluntary conservation program that helps producers implement best management practices that conserve natural resources and improve agricultural operations.



Best Management Practices (BMPs) eligible for cost share include:

- Nutrient Management
- Cover crop implementation
- Irrigation water management
- Conservation crop rotation
- No till practices
- Field border
- Filter strip
- Integrated pest management

Best Management Practices for Reducing Excessive Nitrate Levels

- Cover crops
- Strip cropping
- Soil testing
- Fertilizer management
- Rain sensors for lawn irrigation
- Domestic and stock well analysis
- Seasonal application restrictions
- Manure application restrictions
- Alternative cropping methods
- No-till cultivation
- Nutrient management program
- Crop tissue analysis
- Fertigation
- Variable rate application and precision farming (UNL recommendations)
- Incorporate realistic yields goals
- Flow meters
- Soil moisture sensors

For more information and cost-share opportunities to implement many of these practices, contact your local NRD or NRCS office.



Cover crops (left) are an excellent way to keep nitrate from leaching into groundwater. Follow fertilizer and pesticide application directions on packaging, and consider soil sampling to help you refine how much and when to apply (right).