DRAFT PLAN
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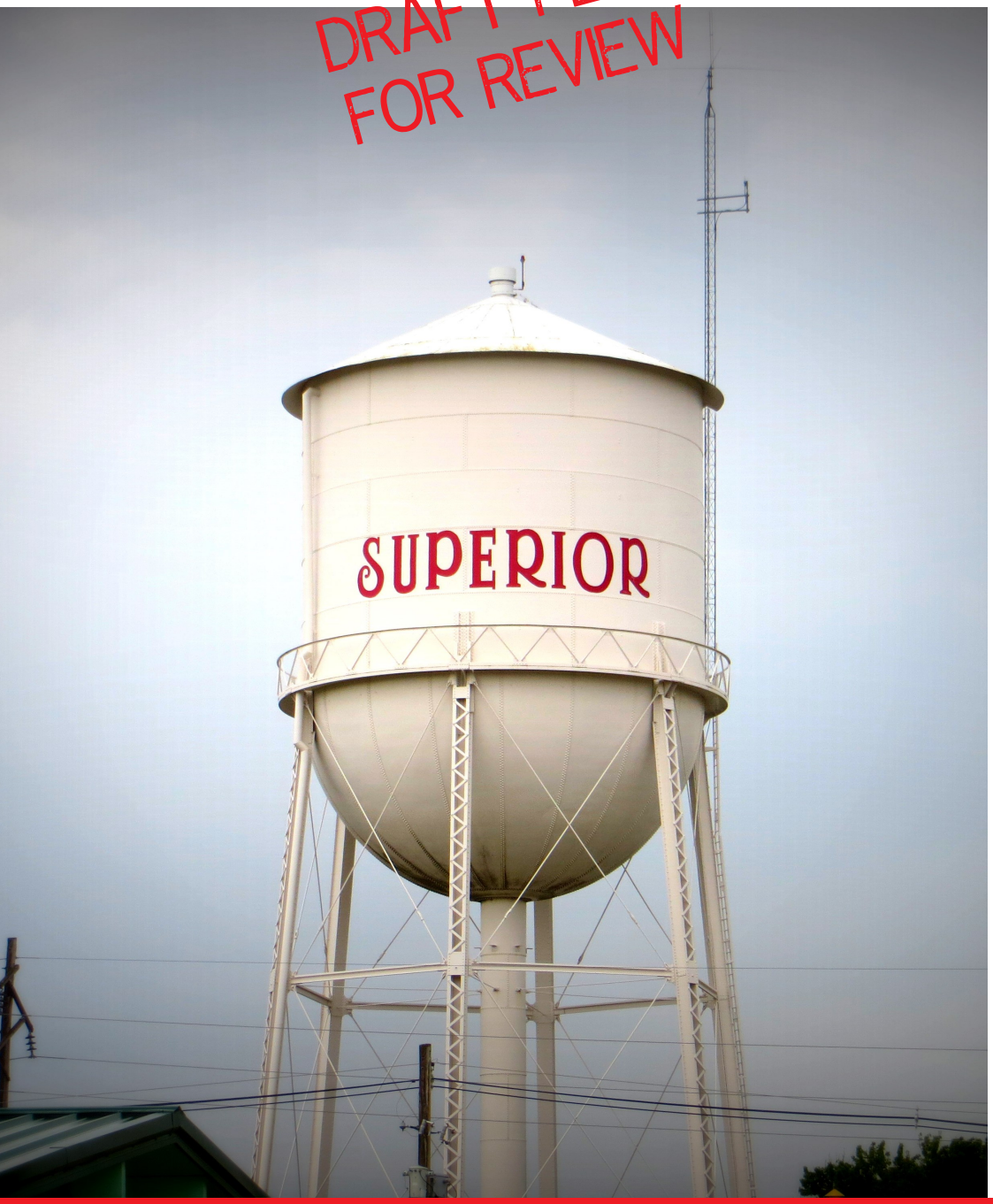

JEO CONSULTING GROUP INC

November 2014

Superior Wellhead Protection Plan

Superior, NE

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City of Superior, Nebraska

Wellhead Protection Plan

DRAFT PLAN

Prepared: November 2014
Adopted: TBD

Prepared for: *City of Superior, Nebraska*

Prepared by: *JEO Consulting Group, Inc.*

JEO Project Number: *130070.00*

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This wellhead protection plan has been prepared to assist the City of Superior to proactively protect and manage the aquifer that is the source of community drinking water. It has been written with guidance published by the Nebraska Department of Environmental Quality (NDEQ).

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LIST OF ABBREVIATIONS AND ACRONYMS

BMP	Best Management Practice
CDL	Cropland Data Layer
CWS	Community water system
DHHS	Department of Health and Human Services
DNR	Nebraska Department of Natural Resources
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
ETJ	Extraterritorial Jurisdiction
GIS	Geospatial Information Systems
GWMP	Groundwater Management Plan
IMP	Integrated Management Plan
JEO	JEO Consulting Group, Inc.
LBNRD	Little Blue Natural Resources District
LRNRD	Lower Republican Natural Resources District
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
NDEQ	Nebraska Department of Environmental Quality
NPS	Non-point Source Pollution
NRCS	Natural Resources Conservation Service
NRD	Natural Resources District
ppm	Parts Per Million
PWSS	Public Water System Supervision
PWSSs	Public Water Supply Systems
SDWA	Safe Drinking Water Act
the City	The City of Superior
USDA	United States Department of Agriculture
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Plan

NEBRASKA'S WELLHEAD PROTECTION PROGRAM SUMMARY

***A WELLHEAD PROTECTION AREA IS THE SURFACE AND SUBSURFACE AREA SURROUNDING A COMMUNITY DRINKING WATER WELL OR WELL FIELD, THROUGH WHICH CONTAMINANTS ARE REASONABLY LIKELY TO MOVE TOWARD AND REACH SUCH WATER WELL OR WELL FIELD*.**

NEBRASKA'S WELLHEAD PROTECTION PROGRAM

The Nebraska Department of Environmental Quality (NDEQ) administers the Wellhead Protection Program (WHPP), which began after the Nebraska Legislature passed LB 1161 in 1998 (Neb. Rev. Stat. §46-1501 – 46-1509), authorizing the Wellhead Protection Area Act. **The Act sets up a process for public water supply systems to use, if they choose, to implement a local WHPP**. The intent of this program was to establish guidelines for communities and other public water suppliers to develop local WHPPs. A WHPP does not provide any new powers to a community; it serves as a guide to local decision makers tasked with protecting the community drinking water supply.

All community public water supplies have a Wellhead Protection Area map as of October 1, 2004.

Nebraska Department of Environmental Quality

WELLHEAD PROTECTION PROGRAM ACTIVITIES

1. **Delineate the Wellhead Protection Area (WHPA)** - The NDEQ, and some Natural Resources Districts (NRDs), may provide a public water system with a WHPA map that shows the area which is critical to recharging a community's groundwater and drinking water supply.
2. **Perform a Contaminant Source Inventory (CSI)** - Conducting a CSI involves locating and documenting activities, structures, and locations which could affect the quality of the source of drinking water.
3. **Manage potential contaminants** - After identifying potential contaminant sources within the WHPA, the community can use management such as county and municipal zoning, local ordinances, working with landowners to implement best management practices (BMPs), or other options, such as education and information, to ensure a safe drinking water supply, which complies with The Safe Drinking Water Act.
4. **Develop emergency and contingency plans** - These plans will enable a community to react to events such as natural disasters, contamination, and drought. These and other issues, such as population growth, may be addressed through emergency/contingency plans, as well as by planning for new wells.
5. **Educate and involve the public** - Community awareness will help to provide citizens with the information they need to protect drinking water and increase their participation in the development of a wellhead protection plan.

SECTION 1. INTRODUCTION

1.01 ABOUT THIS PLAN

The planning document herein is prepared for the City of Superior (the City) as a general guide to accommodate anticipated future growth and water quality management. The intent of the document is not founded as regulatory framework nor does adoption provide additional authority to the City or other federal, state, or local authority. Adoption of the document is indicative to water system users, the community, and outside agencies that the City values its water system and desires systematic protection of its sources of water.

A strength and often over looked value of developing a WHPP is the process that communities are required to undertake. The planning process convenes community leaders, agency representatives, land owners, and technical specialists along with the general public – of which, may have competing interests, differences in viewpoints, conflicting terminologies, or general absence of knowledge pertaining to water protection. The process challenges stakeholders to re-evaluate their own ideas and continue education of the issues. The planning process is an aide in forming a relationship between all stakeholders and facilitates future community efforts.

1.02 FUTURE UPDATES TO THE PLAN

Periodic reviews and revisions should be completed to ensure the best science and inclusion of up-to-date information. Regular monitoring of the implementation progress of the plan is recommended. At a minimum, the WHPP should be updated or reviewed when new information changes the WHPA boundaries. Updates may range from when a new well is added to the system, NDEQ issues an updated map, or there has been a significant change to the land use within the WHPA.

The timeframe for updates is at the discretion of the community and may be based on the complexity of the area or pace the community is changing. It is recommended the plan be reviewed annually by the Wellhead Protection Stakeholder Committee. Groundwater and wellhead protection related actions should be documented, reported, evaluated, and revised during this time. A more comprehensive update should be addressed at a minimum of every five years. At this interval, updates should include any changes in the potential contaminant source inventory and land use within the WHPA. Long-term trends should be evaluated and extrapolated into future projections to ensure sustainability of the source water is maintained.

NDEQ and Department of Health and Human Services (DHHS) should be consulted at each update to determine if additional information has been developed or if any related regulations or plan requirements require a review of the plan.

1.03 COMMUNITY BACKGROUND

Superior is located in south central Nebraska in Nuckolls County, near the border of Kansas, and along the Republican River (Figure 1). Originally platted in 1875, Superior is known as the "Victorian Capital of Nebraska". As of the 2010 census, there were 1,957, 948 households, and 527 families residing in the City (Table 1). The City is surrounded by agricultural use, which also drives the local economy.

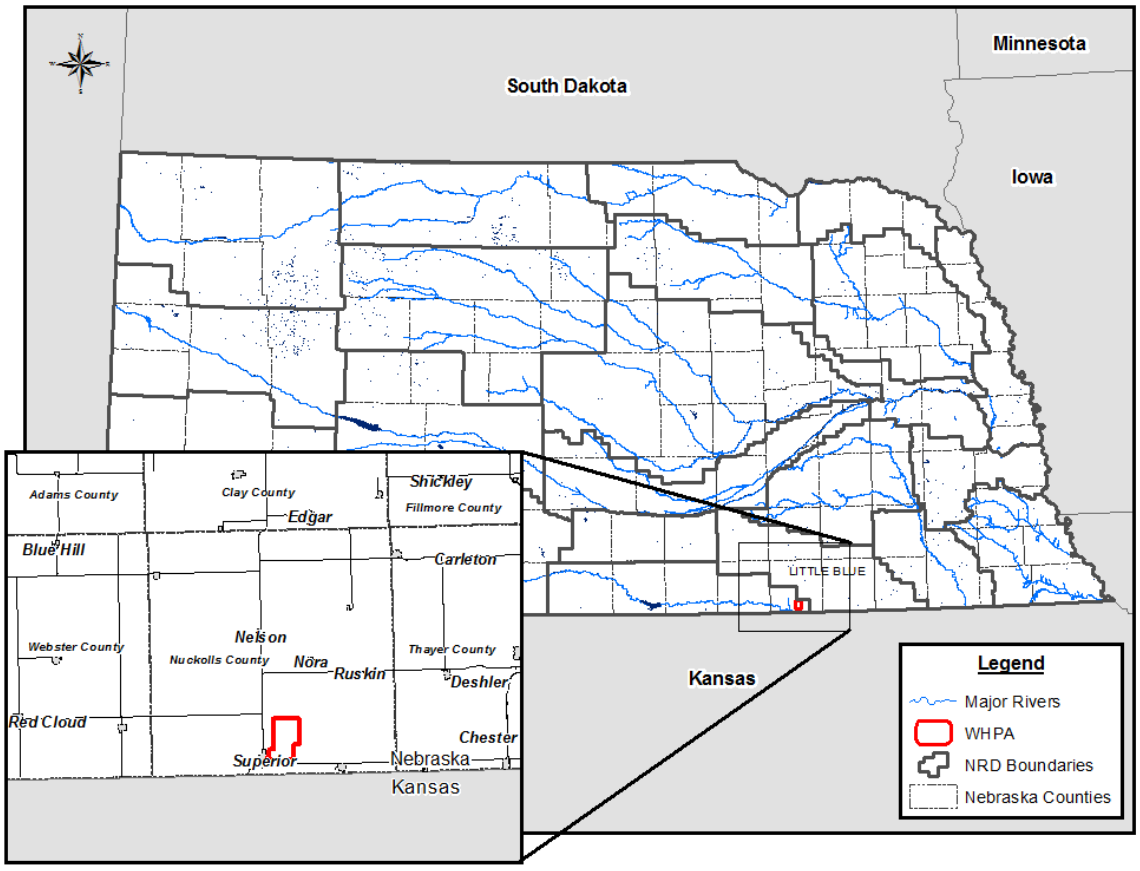
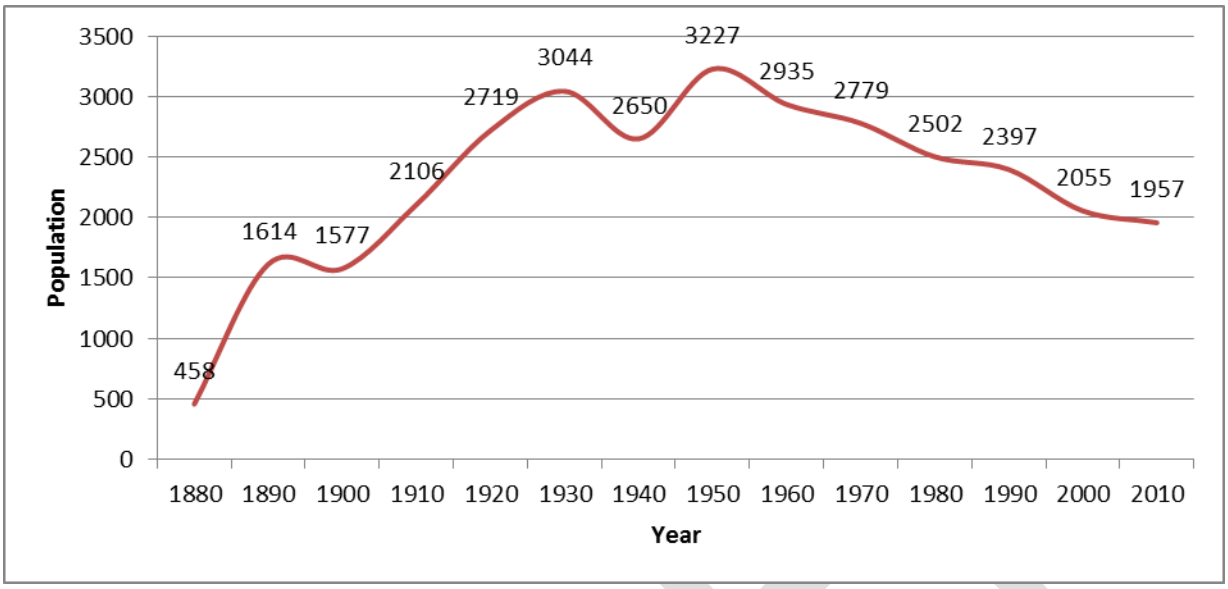


Figure 1: Superior, Nebraska Location

Table 1: Historical Population for Superior



Source: U.S. Bureau of the Census

Compiled by: Nebraska State Data Center, Center for Public Affairs Research, University of Nebraska Omaha

1.04 LOWER REPUBLICAN NATURAL RESOURCES DISTRICT

NRDs are local government entities with broad responsibilities to protect natural resources. Major Nebraska river basins form the boundaries, enabling districts to respond best to local needs. Elected boards of directors govern district and much of their funding comes from local property taxes.

NRDs were created to solve flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues. Nebraska's NRDs are involved in a variety of projects and programs to conserve and protect the state's natural resources. NRDs are charged under state law with 12 areas of responsibility including flood control, soil erosion, groundwater management and many others. Superior is located in the Lower Republican NRD (LRNRD), as shown in Figure 2.

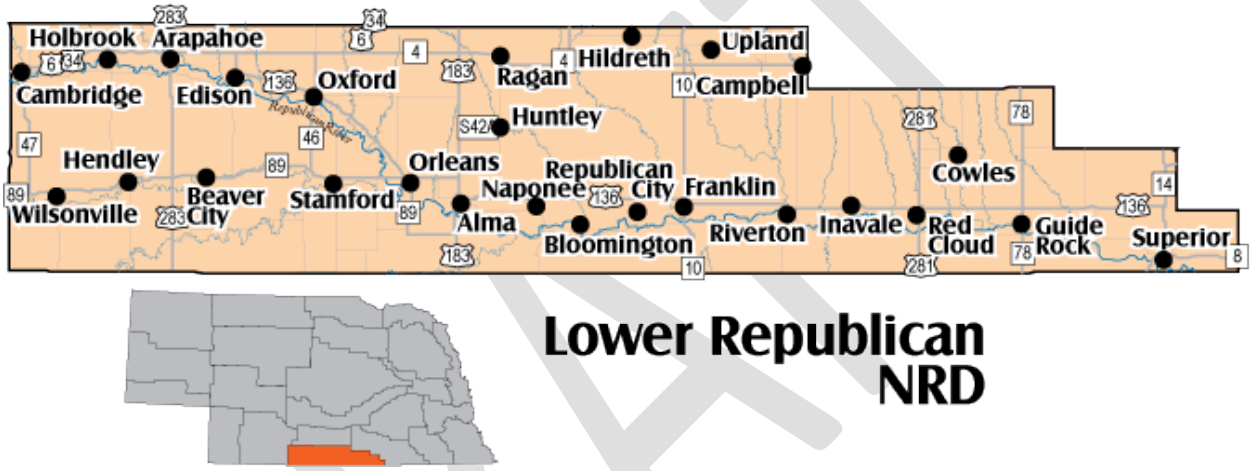


Figure 2: Lower Republican Natural Resources District

1.05 NEBRASKA GROUNDWATER

The State of Nebraska has a significant source of groundwater throughout its territorial jurisdiction, making it a vital natural resource of the state. Groundwater uses include irrigation, water supply for humans and animals, and uses for commercial and industrial activities. Nebraska receives nearly 85% percent of its public drinking water and nearly 100% of its private water supply from groundwater sources. Agriculture (the state's largest industry) is dependent on this resource as well. As of October 2010, the Nebraska Department of Natural Resources (DNR) listed over 92,000 active irrigation wells and nearly 23,900 domestic wells registered in the state. Figure 3, below, displays the density of registered irrigation wells in the vicinity of Superior.

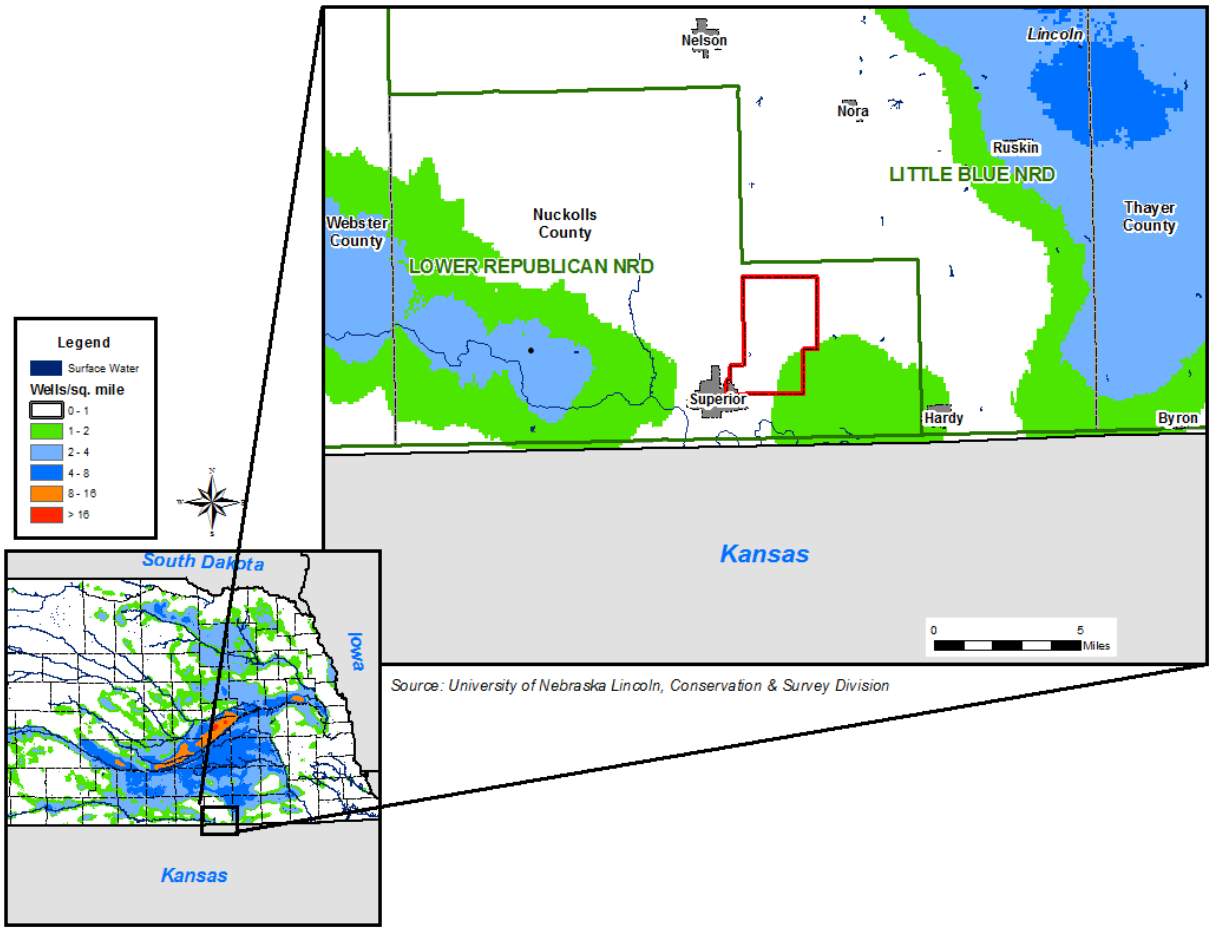


Figure 3: Density of Active Registered Irrigation Wells - January 2011

In regard to the importance of groundwater across the state, massive efforts are made in monitoring the quality of the resource. Several entities are involved:

- Natural Resource Districts (23)
- Nebraska Department of Agriculture
- Nebraska Department of Environmental Quality
- Nebraska Department of Health and Human Services
- University of Nebraska-Lincoln
- United State Geologic Survey

The results from monitoring are compiled in the Quality-Assessed Agrichemical Contaminant Database for Nebraska Groundwater (Database). The Database compiles groundwater monitoring data from different sources and provides open public access to the results. Available data from source sampling ranges from 1974 to the present. The monitoring data is collected from irrigation and domestic supply wells in addition to dedicated groundwater monitoring sites. These specific groundwater monitoring wells have begun to increase through the past several years across the state.

The network of well monitoring throughout Nebraska provides data for a range of environmental conditions and is analyzed for a variety of compounds, such as those used in agricultural production. In respect to withdrawal of groundwater, elevation of the aquifer is additionally monitored to establish trends in analysis for the status of available groundwater. Figure 4, below, characterizes the change in groundwater depth from pre-development in the area to the spring of 2010.

Even with the abundance of groundwater through the state; the southeast, northeast and northwest regions of the state have difficulties providing adequate yields. Groundwater quality is generally considered excellent for the majority of the state; however, some areas experience non-point source pollution (NPS) of contamination from pollutants such as nitrates and agricultural contaminants. The resulting effects have caused contamination of groundwater sources. In addition to NPS, point sources of contamination have had additional impacts in localized areas. These sources may include underground injection wells, leaking underground tanks, livestock lagoons, landfills, improperly constructed wells, hazardous waste, grain fumigants, munitions sites, and/or septic systems.

Contamination of groundwater has a potential to cause significant costs to communities as they may be forced to abandon wells or construct expensive treatment systems. The result of contamination leads to long-term financial impacts for communities in treatment, drilling new wells, or development of management programs.

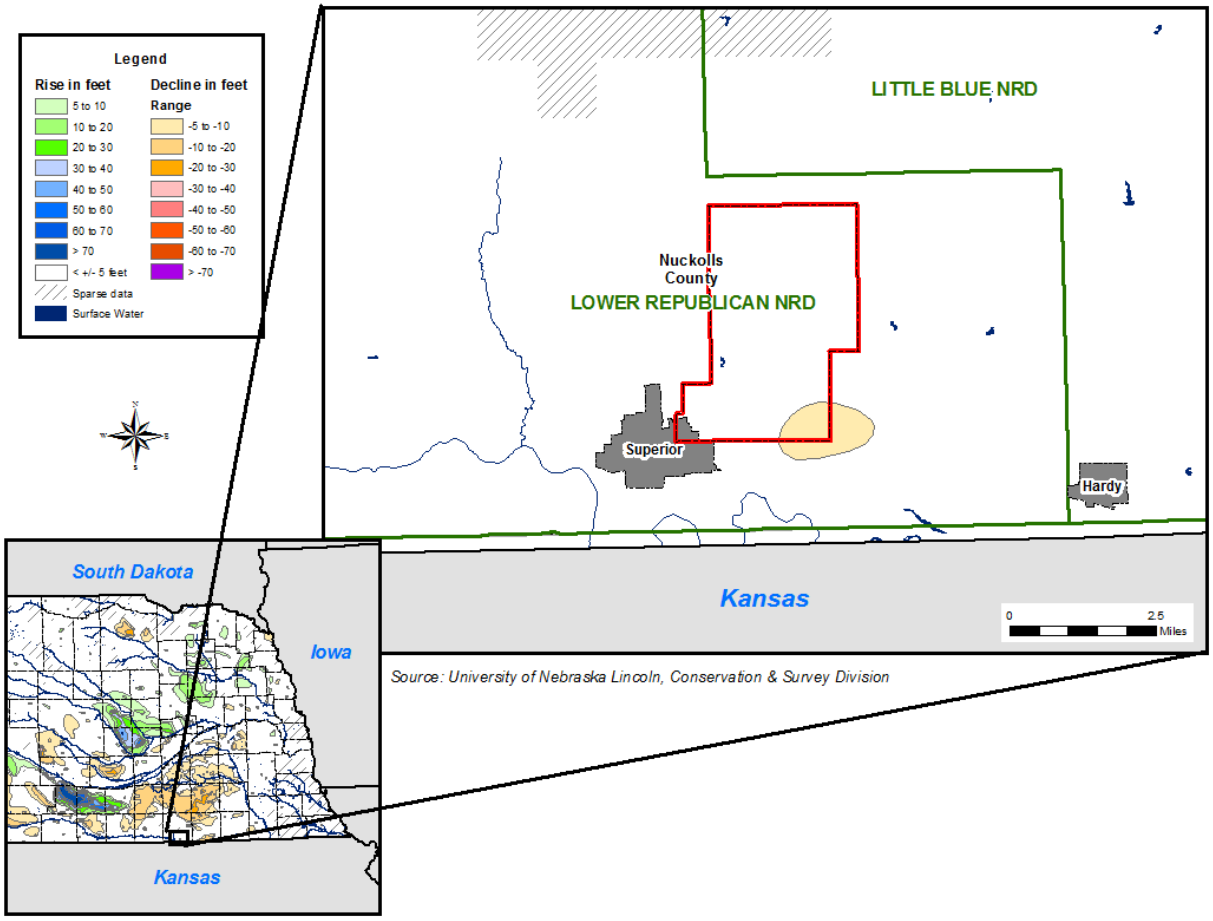


Figure 4: Groundwater-level Changes in Nebraska - Predevelopment to Spring 2010

1.06 GROUNDWATER POLLUTION IN NEBRASKA

Groundwater pollution throughout Nebraska is variable by the type of pollutant and scale of the contamination. Typically, three types of pollutants are of concern to impairments of water quality in Nebraska: nitrates, pesticides, and bacteria (coliforms, *E. coli*, etc). The presence of pesticides in water supplies is an increasing concern. Atrazine is one of the commonly detected pesticides found in drinking water wells of Nebraska which is consistent with usage, as well as its relatively high mobility and persistence. Coliform group bacteria are microscopic, generally harmless organisms living in the digestive system of warm blooded animals. Although coliform bacteria do not directly cause diseases, they are often indicators of other, more dangerous bacteria. Sources of fecal coliform are septic systems, barnyards, and animal waste lagoons (Gosselin, 1997).

Of the three pollutants, the most pervasive is nitrate-nitrogen (nitrate). Nitrates are known to cause a disease called methaemoglobinaemia (or “blue baby syndrome”) with infants. The major symptom of this disease causes inhibition of the blood’s ability to carry oxygen resulting in blue skin coloring around

the mouth, hands, and feet. Carcinogenic compounds have also been known to become more prevalent when there are high levels of nitrates in drinking water. When nitrates in the body are broken down and converted into the chemical compound nitrite, they can react with other compounds (amines) in the body and form nitrosamines; a cancer causing compound (NHDES, 2006). Due to the risk of "blue baby syndrome," the US Environmental Protection Agency (EPA) has set a maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) or parts per million (ppm) for nitrate-nitrogen in drinking water.

Available records show that beginning in the 1960s and extending through 1998, 37% of Nebraska's small city and village water systems have exceeded the MCL for nitrates. Additionally, another 28% have had readings between 5 and 10 mg/L (USDOI 1999). Figure 5 illustrates the generalized nitrate levels in sampled wells across Nebraska. As a result, groundwater concerns of Nebraska have focused heavily on nitrates, and for this reason WHPPs are typically written in that context.

Additional contaminants or concerns in water quality or quantity may be found at the local level, and may be addressed through the wellhead protection planning process, when necessary.

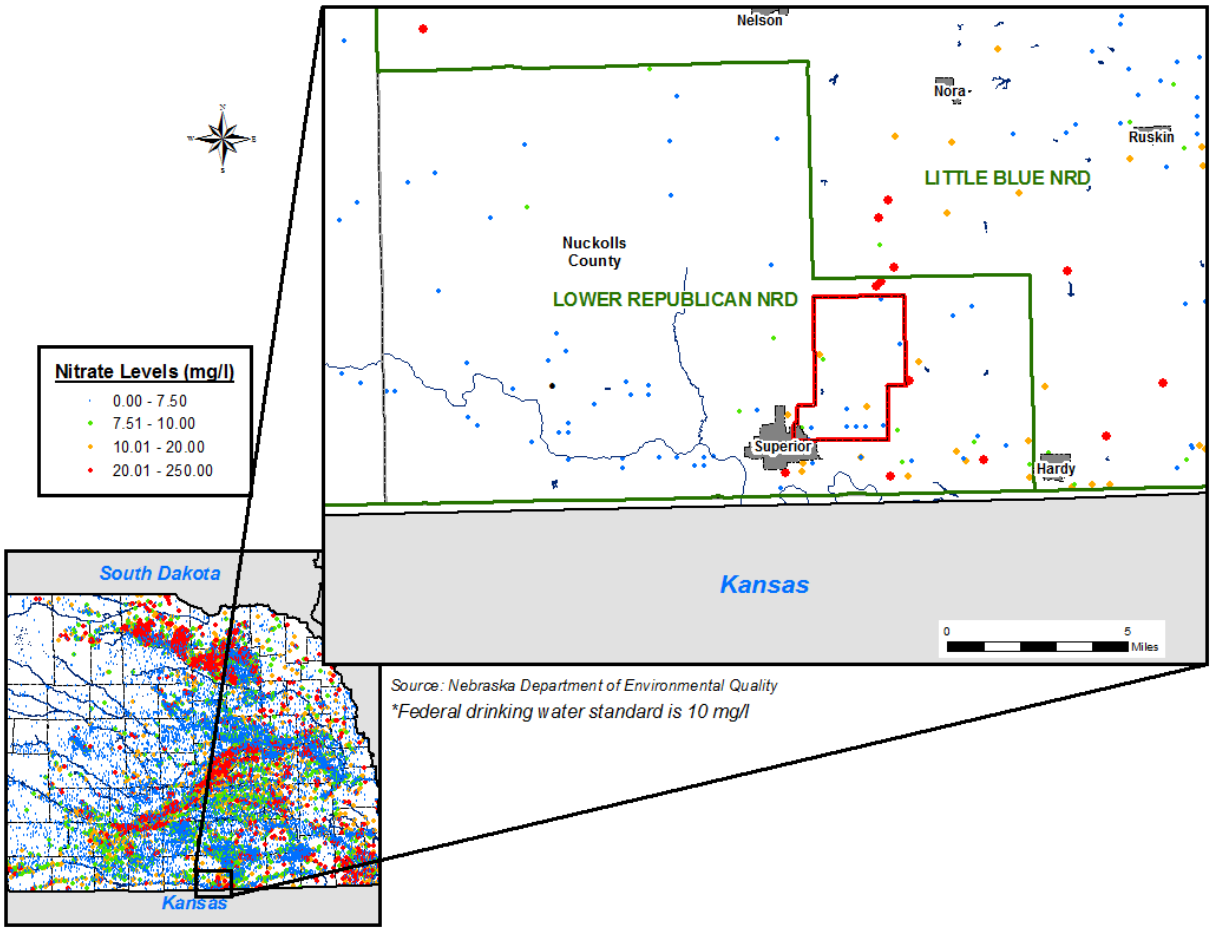


Figure 5: Generalized Nitrate Levels in Wells Sampled, 1974 - 2011

1.07 GROUNDWATER VULNERABILITY TO CONTAMINATION

Regions that are within an aquifer zone, or rely on the groundwater produced by a well have vulnerability to contamination from human activities. In order to quantify or illustrate that vulnerability, there are various computer models available that serve as a practical visualization tool for decision making. Alone, they do not fill a direct role, but cumulatively contribute to the understanding of the issues. According to the National Research Council (1993):

> ***GROUNDWATER VULNERABILITY TO CONTAMINATION IS THE TENDENCY OR LIKELIHOOD FOR CONTAMINANTS TO REACH A SPECIFIED POSITION IN THE GROUNDWATER SYSTEM AFTER INTRODUCTION AT SOME LOCATION ABOVE THE UPPERMOST AQUIFER.***

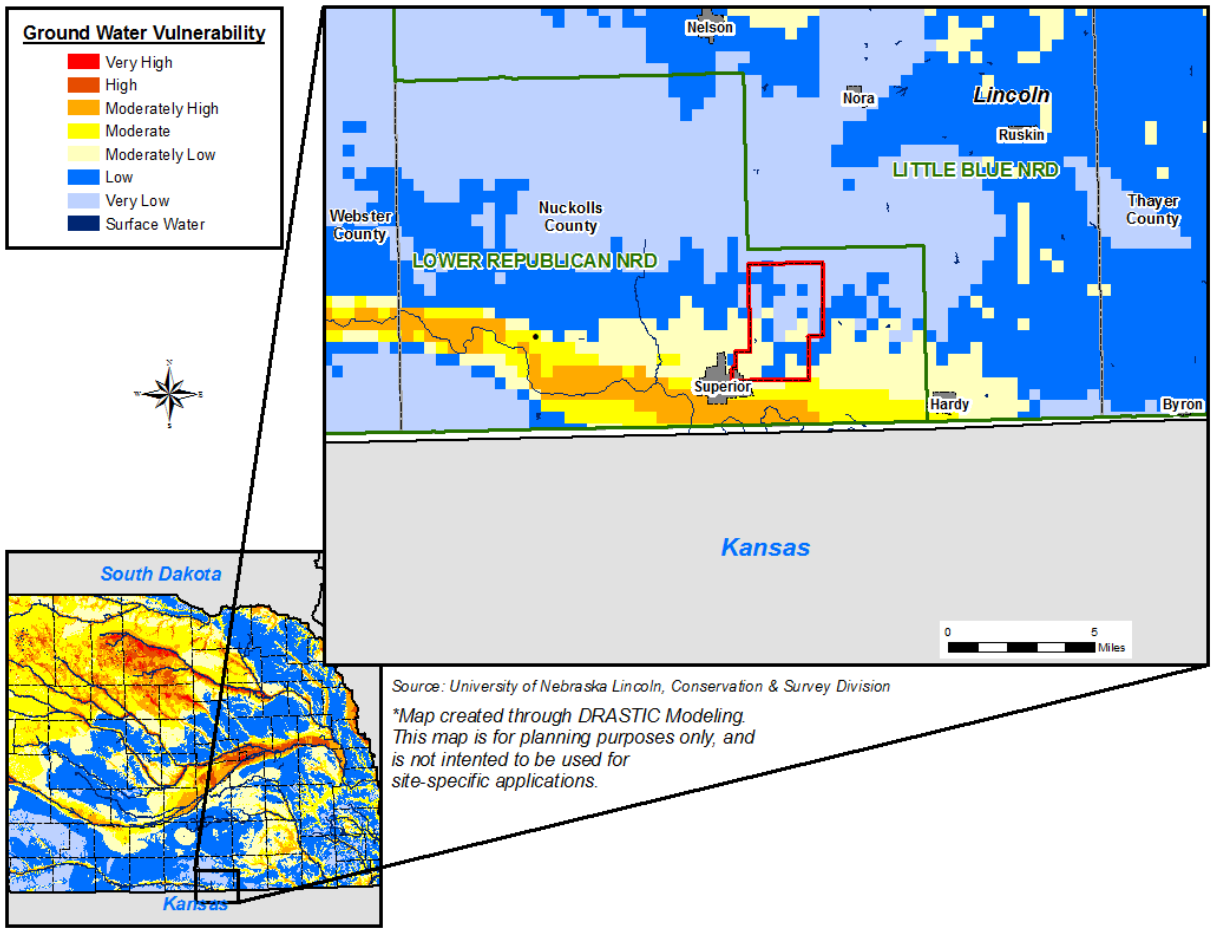


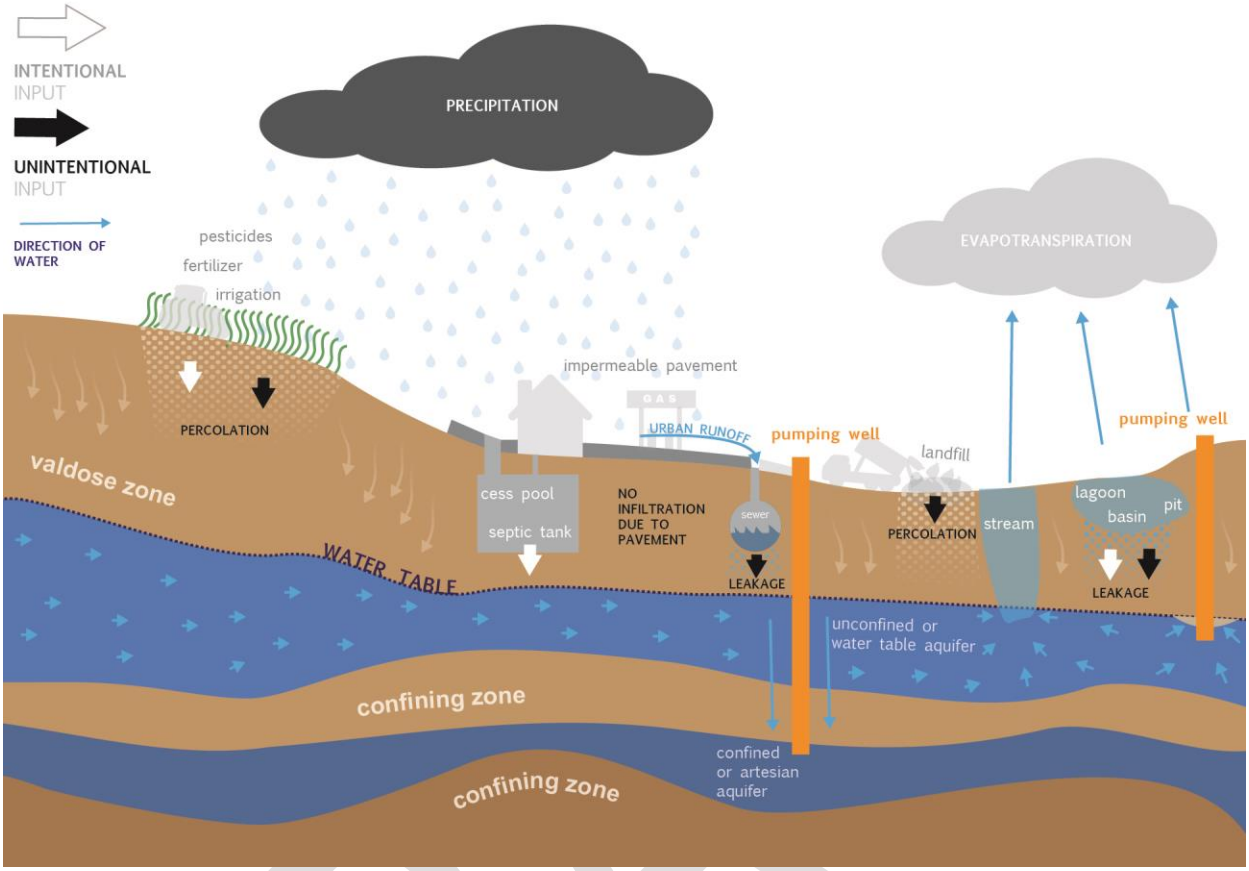
Figure 6: Groundwater Vulnerability to Contamination in Nebraska Using the DRASTIC Method

Vulnerability of groundwater contamination may be attributed to a combination of factors. Figure 6 is a generalized map of Nebraska groundwater vulnerability to contamination based on EPA's DRASTIC

model. DRASTIC is an acronym for the factors used to estimate vulnerability: **D**epth to the water table, **R**echarge (amount of water that percolates down into the aquifer), **A**quifer media, **S**oil media, **T**opography (slope), **I**mpact of the vadose zone (time required for water to percolate through the unsaturated zone between the surface and the water table), and **C**onductivity (hydraulic conductivity of the soil). The model results displayed in Figure 6 were developed on the statewide scale; in result, site (field) specific applications of the contamination potential may have limitations.

Pesticides, herbicides, fertilizer, and other chemicals have unique properties that influence how they move downward (leach) through soil column and into groundwater. The leaching rate and diffusion is dependent on the soil composition. The highest potential for groundwater contamination occurs in sandy, permeable soils low in organic matter, particularly in locations with shallow water tables. Clay soils tend to have poor drainage and typically hold moisture longer in the upper layers of the stratum.

The DRASTIC model provides a relative evaluation of vulnerability and is not designed to provide absolute vulnerability. Generally, it is fairly easy to delineate areas of high vulnerability, difficult to determine that an area has very low vulnerability, and not possible to define fine gradations in between the two. Areas identified with high risk may require a detailed hydro-geologic evaluation performed (Nebraska Natural Resources Commission). Solely utilizing the vulnerability model (or any) to address management decisions should be done conservatively and with additional information. Groundwater management requires cooperative efforts of regulatory policy makers, natural resource managers, educators, and technical experts. Actions based solely on a vulnerability assessment should be tempered by the uncertainty of the assessment and the confidence of the technical experts in the assessment they have produced (National Research Council, 1993).



Source: Adapted from University of Texas at Austin – Center for Research in Water Resources

Figure 7: Typical Routes of Groundwater Contamination

Groundwater vulnerability is a function of the properties in the natural system where groundwater is found; however, the risk of contamination may be relativity low or high regardless of the vulnerability. Contamination risk is assessed by the proximity or siting of a source where potential introduction of a pollutant into a vulnerable area may exist. Additional groundwater monitoring of vulnerable areas may aid in reducing the risk of contamination. It is important that decisions and management of resources distinguish between vulnerability and risk (Rahman 2008). Figure 7 illustrates the many ways in which contamination may be introduced to a groundwater system (risk factors). With increased potential contaminate sources present, the higher the risk of contamination (regardless of vulnerability).

BECAUSE THE WELLHEAD PROTECTION AREA IS THE MOST CRITICAL AREA FOR RECHARGE OF THE CITY OF SUPERIOR'S SOURCE OF DRINKING WATER, IT SHOULD BE CONSIDERED HIGHLY VULNERABLE AND EVERY RISK FACTOR SHOULD BE EVALUATED CAREFULLY.

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SECTION 2. SUPERIOR WATER SYSTEM

2.01 NEBRASKA'S PUBLIC WATER SYSTEM PROGRAM

The EPA established the Public Water System Supervision (PWSS) Program under the authority of the 1974 Safe Drinking Water Act (SDWA). With the SDWA and subsequent 1986 Amendments, EPA regulates nationally the limits of contaminant levels in drinking water for ensuring that public water supplies are safe for human consumption. These limits are known as MCLs. Additionally EPA sets rules for sampling, treatment, and public notification. Within the State of Nebraska, the Division of Public Health of the DHHS administers the PWSS Program, under EPA guidance. The mission of the Public Water System Program of DHHS is to protect the health and welfare of Nebraskans by assuring safe, adequate, and reliable drinking water

PEOPLE EXPECT THEIR DRINKING WATER WILL BE SAFE WHEN THEY TURN ON THE FAUCET.

As part of administering the PWSS program, DHHS's Department of Regulation and Licensure visits all Public Water Supply Systems (PWSSs) to conduct a sanitary survey. The routine sanitary survey is conducted once every three years for community water systems (CWS). A sanitary survey is an on-site review of the water source, facilities, equipment, operations, and maintenance of a public water system for the purpose of evaluating the system's adequacy and ability to reliably produce and distribute safe drinking water within the confines of the regulatory requirements.

The sanitary survey also includes a vulnerability assessment done within 1,000 feet of community wells. Ranking of vulnerability is based on the locations of potential contaminant sources within established setbacks up to a 1,000 foot radius.

Superior's most recently completed (2014) Sanitary Survey and Annual Water Quality Report (2013) is included in Appendix A. The documents are also available from the Superior Utilities Office.

2.02 SUPERIOR WATER SYSTEM INFORMATION

The City's municipal water system consists of eight (8) groundwater wells (six (6) for normal use and 2 (two) for emergency use), a well treatment system, one elevated water tower, and one underground storage facility. Well #4 was removed from the distribution system due to high nitrate levels, and is only used for watering the nearby golf course. The water system is metered at the individual well and at the individual connections to customers. Table 3, displays the general system summary for Superior's water system. In addition to serving the residents of Superior, the water system has also provided drinking water to Hardy since 2009.

The source of water supply for Superior is groundwater, which is stored in aquifers underlying the immediate area. Figure 8 and Table 3 display additional location and information about each well.

Table 2: Superior General Water System Information

General System Information	
System ID	NE3112904
Population Served	1,950
Meters Connected	100%
Maximum Daily (24-hour) Production Capability	3.988 million gallons/day
Total Production for past year	153.030 million gallons

Source: Public Water Supply Routine Sanitary Survey (2014)

Figure 8: Superior Municipal Well Locations

Table 3: Superior Municipal Water Supply Well Information

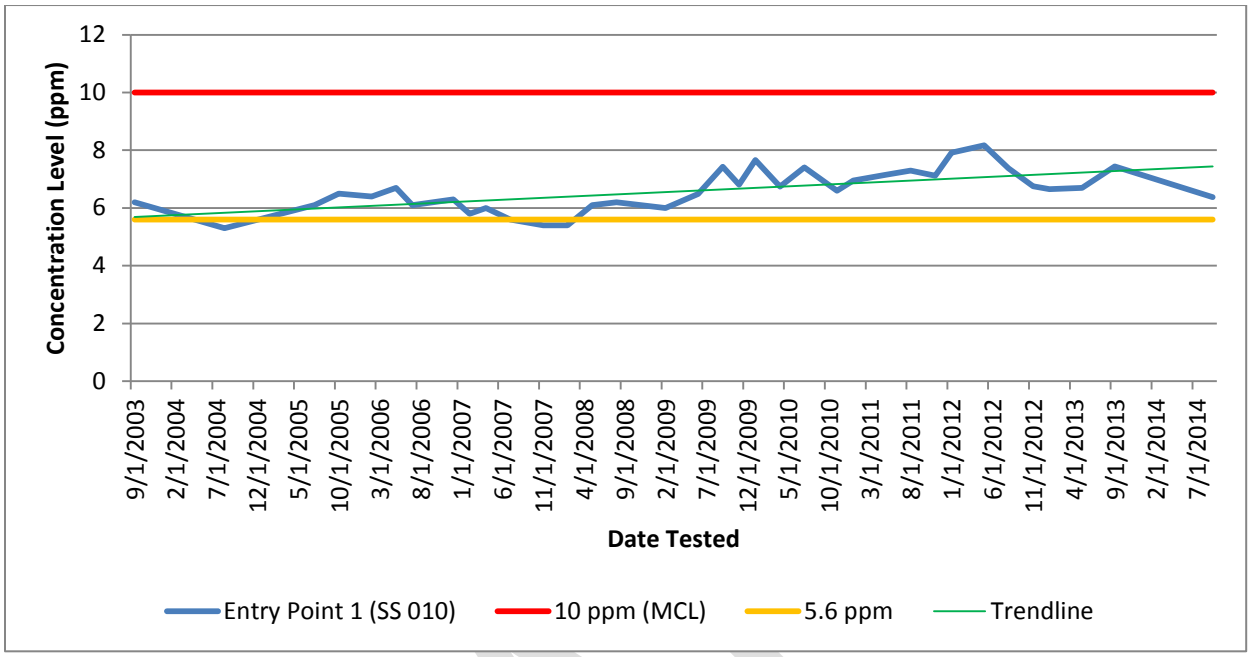
Well Common/Local Name	DHHS Well ID #	DNR Registration #	Status	Total Well Depth (feet)
Well #1	70-1	G-033470	Active	66
Well #2	70-2	G-033594	Active	98
Well #3	73-1	G-033593	Active	119
Well #4	70-4	G-033595	Disconnected	N/A
Well #5	70-5	G-033469	Emergency	71
Well #6	73-1	G-040076	Emergency	63
Well #7	73-2	G-040077	Active	72
Well #8	73-3	G-040078	Active	52
Well #9	73-4	G-040079	Active	113

2.03 HISTORICAL NITRATE SAMPLING INFORMATION

The Nebraska Department of Health and Human Services maintains historical drinking water well sampling information. This is accessible through the "Drinking Water Watch" located on their website: http://dhhs.ne.gov/publichealth/Pages/enh_pwsindex.aspx. The "Drinking Water Watch" was searched for nitrate-nitrite (code 1038) sampling results for approximately the past 10 years (2003 thru 2014). The available results are displayed below in Table 4. The chart also displays the EPA regulated MCL at 10 ppm (or mg/L) as a red line and 5.6 ppm as aN orange line, which is a level that triggers additional monitoring by the system operator.

Nitrates are known to be naturally occurring in groundwater, with a typical background concentration of 3 ppm. Measurements above 3 ppm may indicate an extent of human impact. Concentrations above 5 ppm are likely resultant of human activity (Gosselin, 1997). Currently, the system is sampled at Entry Point 1, on a three-year monitoring frequency. Previously, monitoring had been conducted both quarterly and yearly, based on historical monitoring results. The entry point for the City has consistently tested at or over the 5.6ppm trigger point, but it has not tested over the MCL of 10 ppm. The green line, displays the trend line for the system, which shows slowly rising nitrate levels.

Table 4: Historical Nitrate-Nitrite Sampling Data



2.04 SUPERIOR-HARDY SPECIAL PROTECTION AREA

The NDEQ undertook a study in March 1988 to determine the presence and extent of nonpoint source groundwater contamination in the vicinity of Superior. The Lower Republican NRD initiated the request after several domestic wells in the area, particularly to the north and east of the City had nitrate sample results greater than 10 ppm. Ultimately, the study area extended outside of the LRNRD into the neighboring NRD, the Little Blue NRD (LBNRD). These areas exhibited widespread, homogeneous levels of nitrates often exceeding 10 ppm, even after point sources were eliminated. The Superior-Hardy Special Protection Area (Figure 9) was established in order for the local NRD's to help manage the problem. According the LBNRD, the following restrictions are in place for the area:

- All operators must attend nitrogen and/or irrigation management training workshops ever four years
- Fall and winter applications of commercial nitrogen fertilizer are prohibited prior to March 1st, or row crop ground for the ensuing year
- Each operator is required to take soil samples from all planned corn or milo fields, (irrigated tracts 5 acres or larger and dryland tracts 10 acres or larger) which they farm prior to spring applying nitrogen fertilizer. Rates to be applied to these fields shall not exceed the UNL recommendations
- Irrigation scheduling will be required on all irrigated fields that are 5 acres or greater
- The annual reporting of operator's field data will be required for all fields, that meet the required acreage. Due December 31st, sent to the Little Blue NRD.

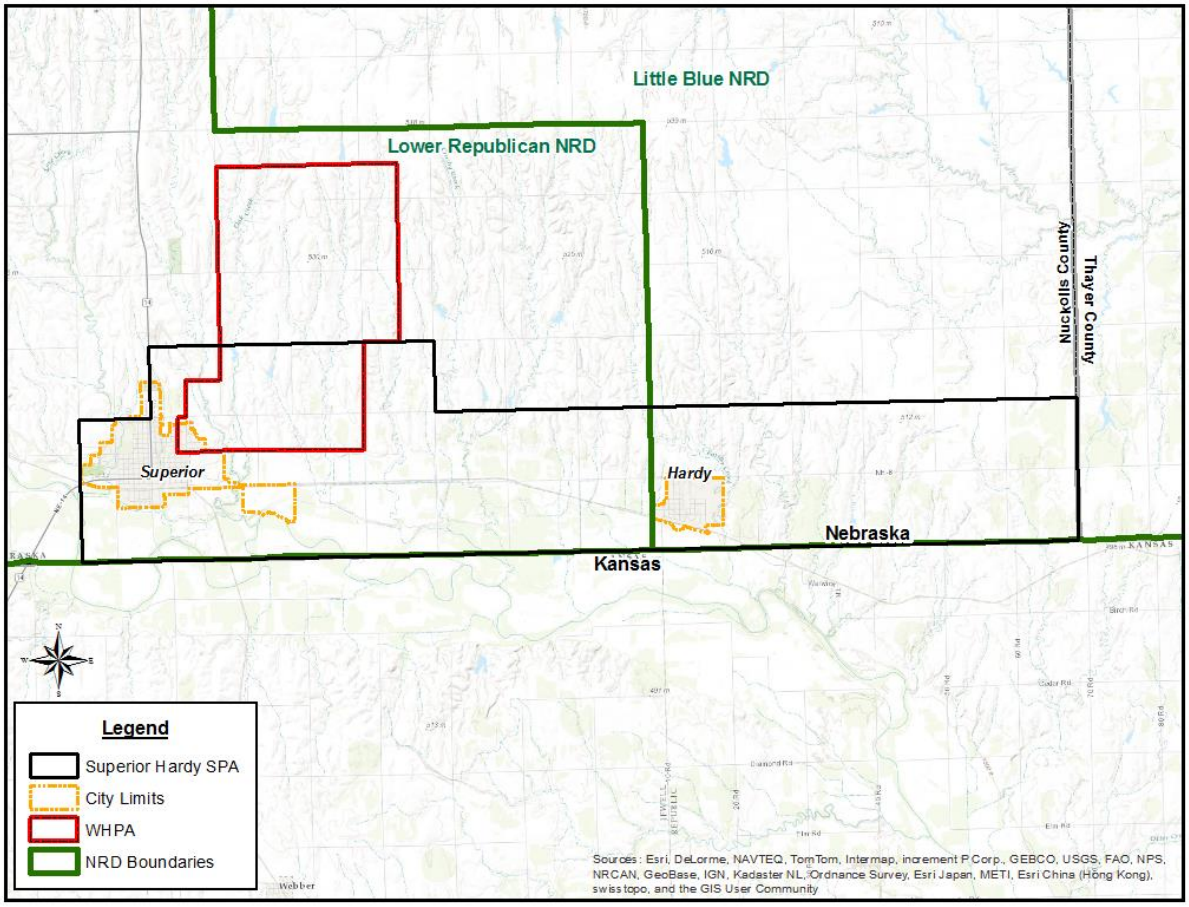


Figure 9: Superior-Hardy Special Protection Area

2.05 PREVIOUS AND EXISTING EFFORTS TO PROTECT GROUNDWATER

Superior has worked hard to take more proactive steps over the years to protect its source of drinking water. In 2001 they completed a contaminant source inventory, which will be integrated into this planning effort. Currently, in addition to this planning effort, they have also contracted with the Groundwater Foundation to provide addition community educational opportunities. These have included:

- Designating the City as a Groundwater Guardian Community
- Working towards identifying Groundwater Guarding Green Sites
    - There was interest during the public meeting of designating the parks
- Hosting a groundwater themed Family Library Day
    - Twenty (20) kids participated. Ten (10) filled out surveys about what they know about their groundwater supplies. The majority knew where their groundwater came from and cared about a clean supply of groundwater.
- Completed a groundwater restoration program with middle school students

The Groundwater Foundation and City plan to offer additional event following the adoption of this plan.

SECTION 3. SUPERIOR WELLHEAD PROTECTION AREA

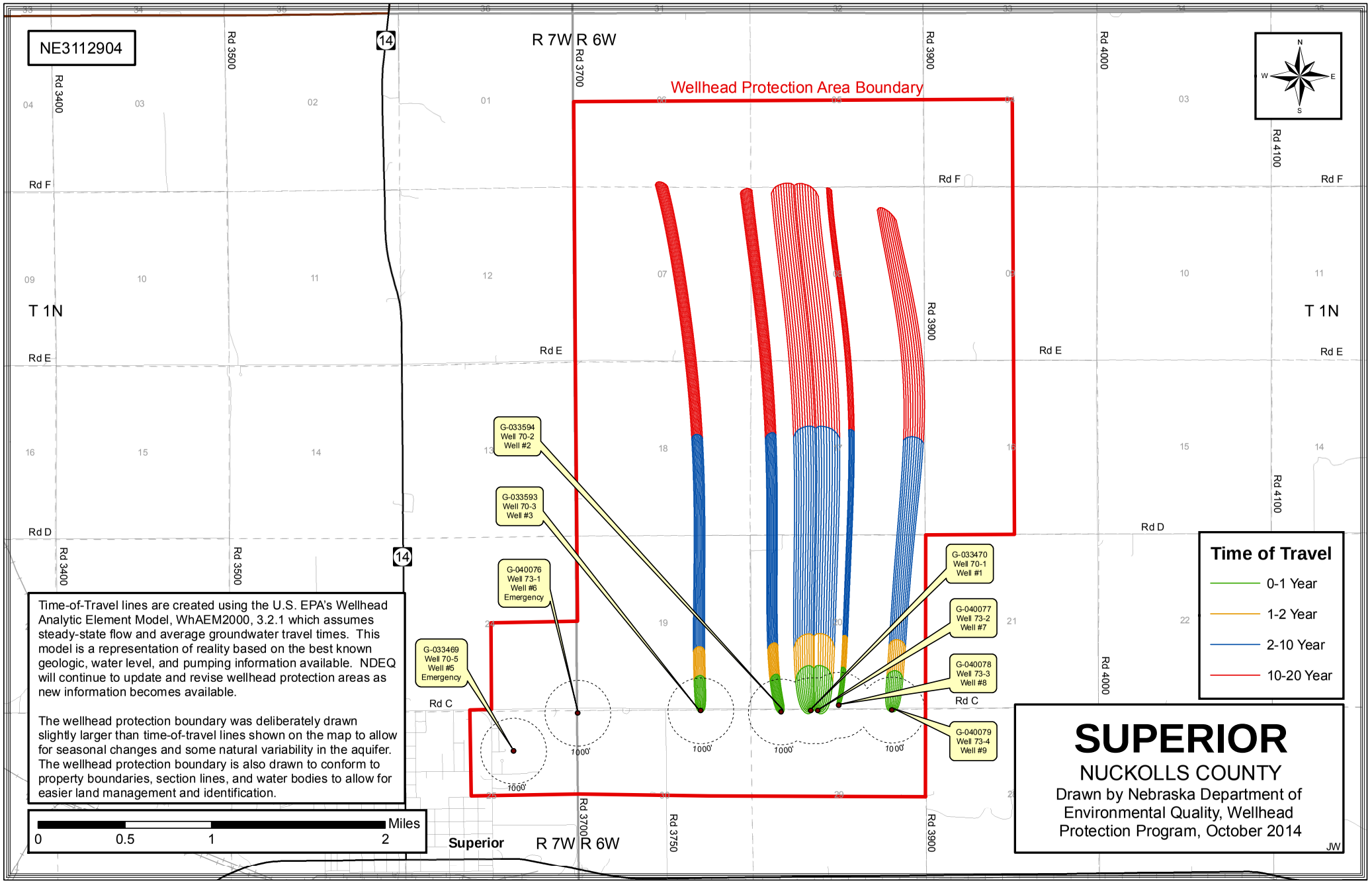
3.01 WELLHEAD PROTECTION AREA SUMMARY

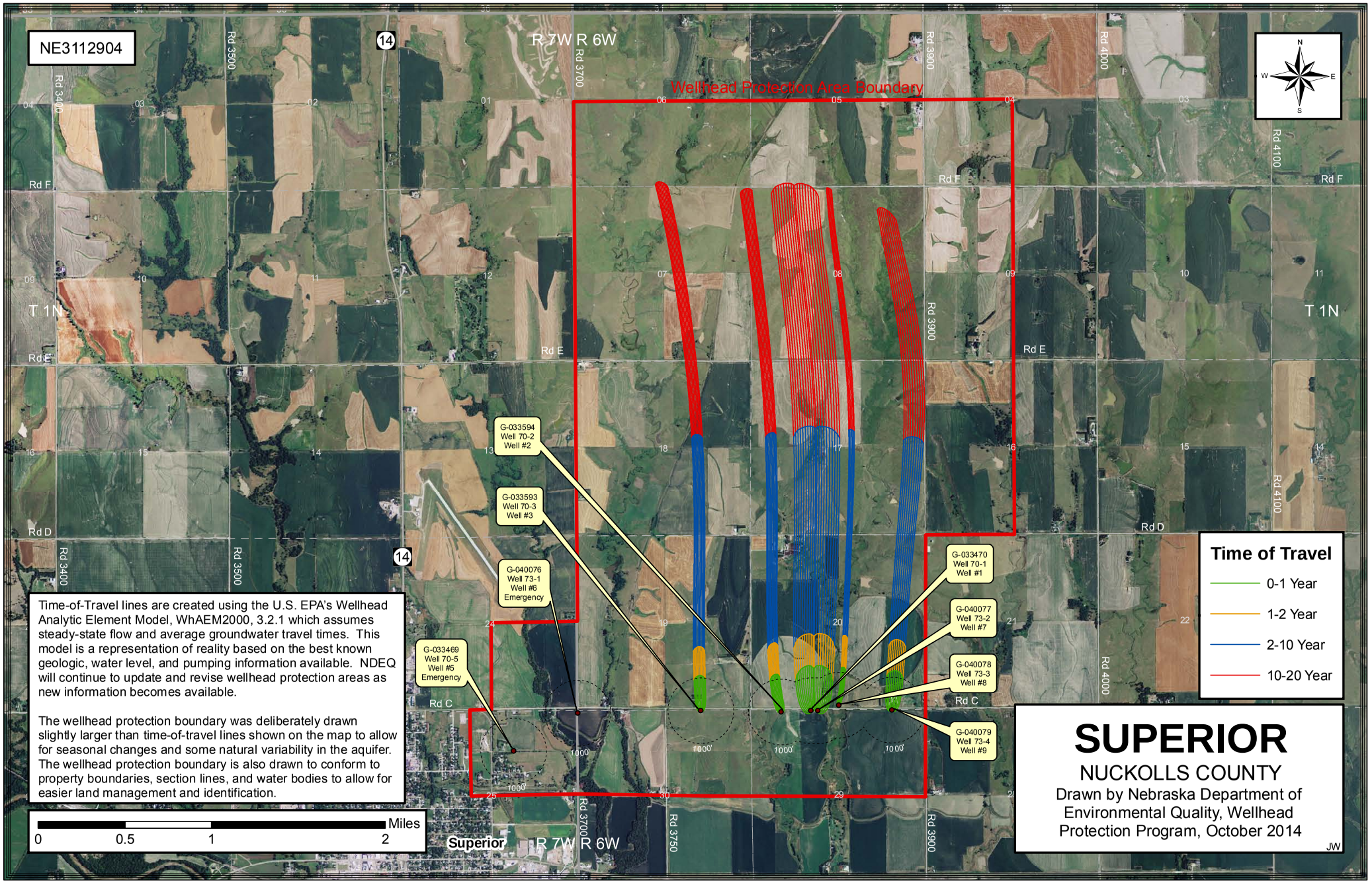
Superior's previous WHPA was provided by NDEQ in 2000. In October 2014, the NDEQ updated Superior's WHPA (Figure 10 and Figure 11). The WHPA was created by NDEQ using the modeling software "Wellhead Analytical Element Model (WhAEM) 2000", created by the US Environmental Protection Agency. WhAEM was designed to facilitate capture zone delineation and protection area mapping in support of the state's WHP programs. WhAEM uses hydrogeologic modeling for steady pumping wells, including the influence of hydrological boundaries, annual recharge estimation, and no-flow boundaries, such as rivers, recharge areas, and no-flow contacts like the local geological formations of bedrock. Figure 12 displays the HydroGeology of the region around Superior. Additionally, groundwater flow direction and velocity, pumping volumes, and well construction data is used in the model. The modeling generates flow lines, which depict the approximate path groundwater, or a contaminant in groundwater, will take to reach a well. These flow lines are associated with an estimated time-of-travel (TOT). One set of TOT path lines are delineated for each active well: one, two, 10, and 20-year.

The wellhead protection boundary is drawn slightly larger than the time-of-travel lines shown on the map to accommodate seasonal changes and natural variability of the aquifer. The WHPA is statutorily recognized as a boundary in which a community manages potential contaminant sources though the wellhead protection program. The WHPA is drawn around the 20-year time-of-travel along visible or easily identifiable boundaries such as roads, rivers, creeks, section, quarter-section, and quarter-quarter sections lines. This allows for easier land management and identification. Maps are periodically updated as modeling advances, the science behind aquifers advances, as wells are added/removed from use, or as well pumping volumes change.

Superior's WHPA covers approximately 6,334 acres, to the immediate east and northeast of town. The City officially recognized the updated WHPA on DATE November 10, 2014. The ordinance can be found in Appendix B.

THE WELLHEAD PROTECTION AREA MAP BY ITSELF DOES NOT GIVE A COMMUNITY ANY ADDITIONAL AUTHORITY OR PROTECTION OF THE PUBLIC WATER SUPPLY. IT IS JUST A PIECE OF "SCRAP PAPER" UNLESS A COMMUNITY ENACTS ORDINANCES, ZONING, OR VOLUNTARY ACTIVITIES WITHIN THE WHPA.


NE3112904
R 7W R 6W
Wellhead Protection Area Boundary
Rd 3400
Rd 3500
Rd 3700
Rd 3900
Rd 4000
Rd 4100
Rd F
Rd E
Rd D
Rd C
T 1N
14
G-033594
Well 70-2
Well #2
G-033593
Well 70-3
Well #3
G-040076
Well 73-1
Well #6
Emergency
G-033469
Well 70-5
Well #5
Emergency
G-033470
Well 70-1
Well #1
G-040077
Well 73-2
Well #7
G-040078
Well 73-3
Well #8
G-040079
Well 73-4
Well #9
1000'
Time of Travel
0-1 Year
1-2 Year
2-10 Year
10-20 Year
Time-of-Travel lines are created using the U.S. EPA's Wellhead Analytic Element Model, WhAEM2000, 3.2.1 which assumes steady-state flow and average groundwater travel times. This model is a representation of reality based on the best known geologic, water level, and pumping information available. NDEQ will continue to update and revise wellhead protection areas as new information becomes available.
The wellhead protection boundary was deliberately drawn slightly larger than time-of-travel lines shown on the map to allow for seasonal changes and some natural variability in the aquifer. The wellhead protection boundary is also drawn to conform to property boundaries, section lines, and water bodies to allow for easier land management and identification.
Miles
0
0.5
1
2
Superior
Rd 3750
SUPERIOR
NUCKOLLS COUNTY
Drawn by Nebraska Department of Environmental Quality, Wellhead Protection Program, October 2014
JW


NE3112904
R 7W R 6W
Wellhead Protection Area Boundary
T 1N
Rd E
Rd F
Rd D
Rd C
Rd 3400
Rd 3500
Rd 3700
Rd 3750
Rd 3900
Rd 4000
Rd 4100
14
G-033594
Well 70-2
Well #2
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Well 70-3
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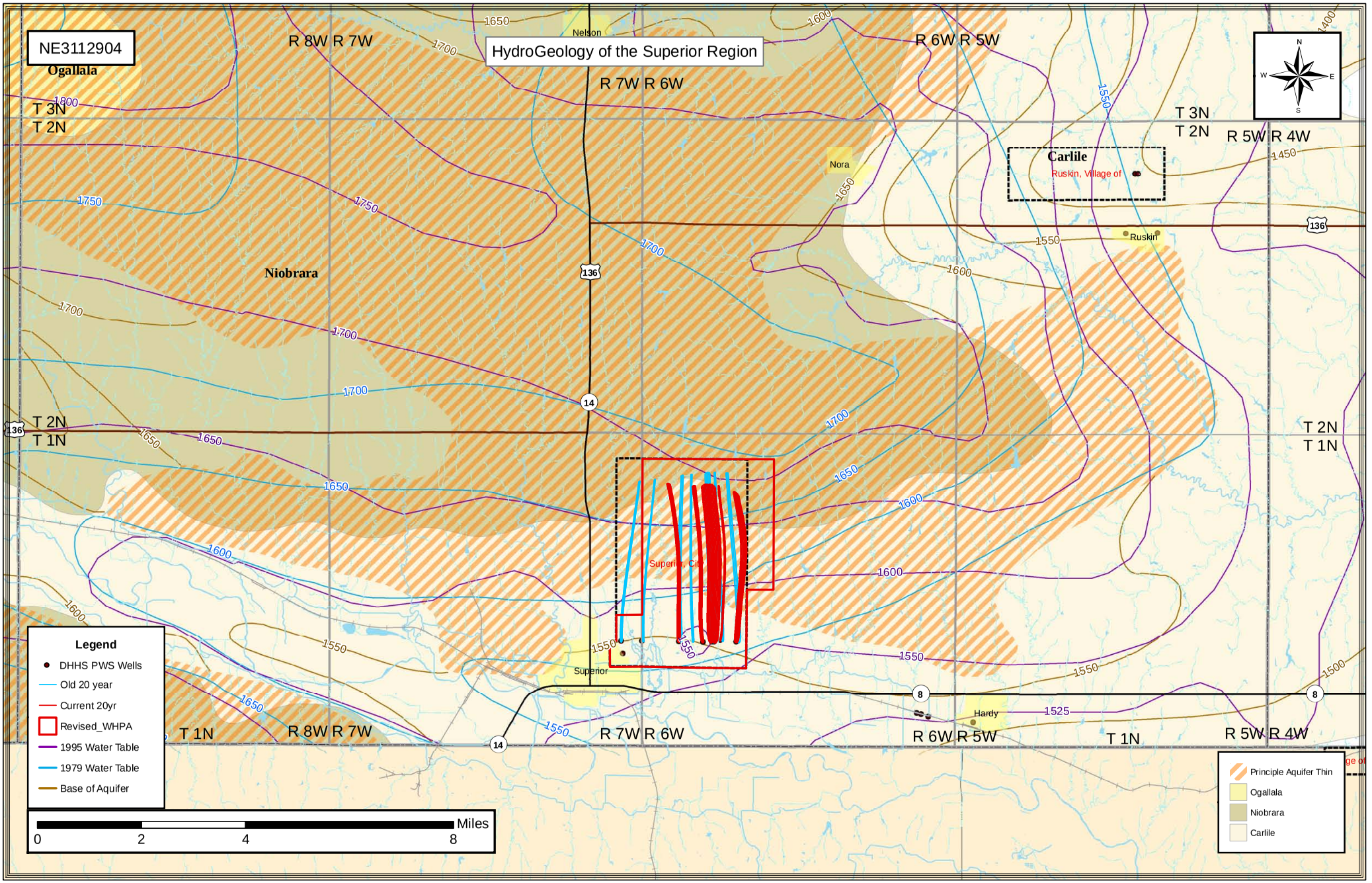
G-040079
Well 73-4
Well #9
1000'
Time of Travel
0-1 Year
1-2 Year
2-10 Year
10-20 Year
Time-of-Travel lines are created using the U.S. EPA's Wellhead Analytic Element Model, WhAEM2000, 3.2.1 which assumes steady-state flow and average groundwater travel times. This model is a representation of reality based on the best known geologic, water level, and pumping information available. NDEQ will continue to update and revise wellhead protection areas as new information becomes available.
The wellhead protection boundary was deliberately drawn slightly larger than time-of-travel lines shown on the map to allow for seasonal changes and some natural variability in the aquifer. The wellhead protection boundary is also drawn to conform to property boundaries, section lines, and water bodies to allow for easier land management and identification.
Miles
0
0.5
1
2
Superior
SUPERIOR
NUCKOLLS COUNTY
Drawn by Nebraska Department of Environmental Quality, Wellhead Protection Program, October 2014
JW


NE3112904
HydroGeology of the Superior Region
Ogallala
Niobrara
Carlile
Ruskin, Village of
Nelson
Nora
Ruskin
Superior
Hardy
R 8W R 7W
R 7W R 6W
R 6W R 5W
R 5W R 4W
T 3N
T 2N
T 1N
Legend
DHHS PWS Wells
Old 20 year
Current 20yr
Revised_WHPA
1995 Water Table
1979 Water Table
Base of Aquifer
Principle Aquifer Thin
Ogallala
Niobrara
Carlile
Miles
0
2
4
8

3.02 WELLHEAD PROTECTION AREA LAND COVER

Difference in land cover type has a potential to effect sources of pollution potential. NPS occurs over a wide area and does not have a single source of outfall. NPS pollution may be related to runoff from rainfall or snowmelt moving over and through the ground. As the runoff travels across a surface or through the ground, it carries away pollutants that may eventually be deposited into lakes, rivers, wetlands, coastal waters and groundwater. Certain types of ground cover are commonly associated with varying potential for different types of contaminates, as shown in Figure 13, below. An inventory of land cover will provide Superior specific and appropriate management strategies to reduce potential contamination.

A

B

C

Figure 13: Varying Types of Landuse. (A) Row crops; (B) Abandoned gas station in an urban setting; (C) Natural vegetation

Agriculture areas, particularly row-crops may contribute to NPS through agricultural runoff, which can potentially contribute to nitrates flowing into surface water, and nitrates infiltrating through the soil into groundwater aquifers. Irrigated cropland is particularly vulnerable to increased nitrogen leaching.

Urban land areas, particularly areas of impervious surfaces, may contribute to NPS through various sources, such as increased run off of parking lots, application of lawn fertilizers, or other industrial land uses. However, urban areas can also be a particular area of concern due to the high concentration of facilities or land uses which can contribute to water pollution.

Natural vegetation, such as trees, grasses, and shrubbery are generally considered to have the capability of improving or protecting water quality. Natural vegetation may serve as a buffer and filter between pollutant sources and water bodies. The vegetation often removes some or all of contaminants and nutrients before they enter the water supply.

Land cover in the Superior WHPA was determined by GIS analysis of the 2013 USDA-NRCS's Cropland Data Layer (CDL), which is available at the GeoSpatial Data Gateway (http://datagateway.nrcs.usda.gov/). The CDL is a complete, geographically referenced classification of all satellite ortho-imagery data within a state by crop or land cover. By using imagery from multiple times of the year, the CDL is able to classify pastures, trees, and other permanent vegetation separately from annual crops. The CDL is spot-checked for accuracy during the potential contaminant source inventory. Table 5, below, displays the land cover in the Superior WHPA. The percentages of land cover are approximate. The Superior WHPA's land cover consists almost exclusively of agricultural land use areas.

Strategies to limit NPS water pollution may vary greatly throughout the WHPA because of the varying land uses. See Figure 14 for a map of the land cover. Several management strategies are discussed to limit NPS in Section 6: Management Strategies.

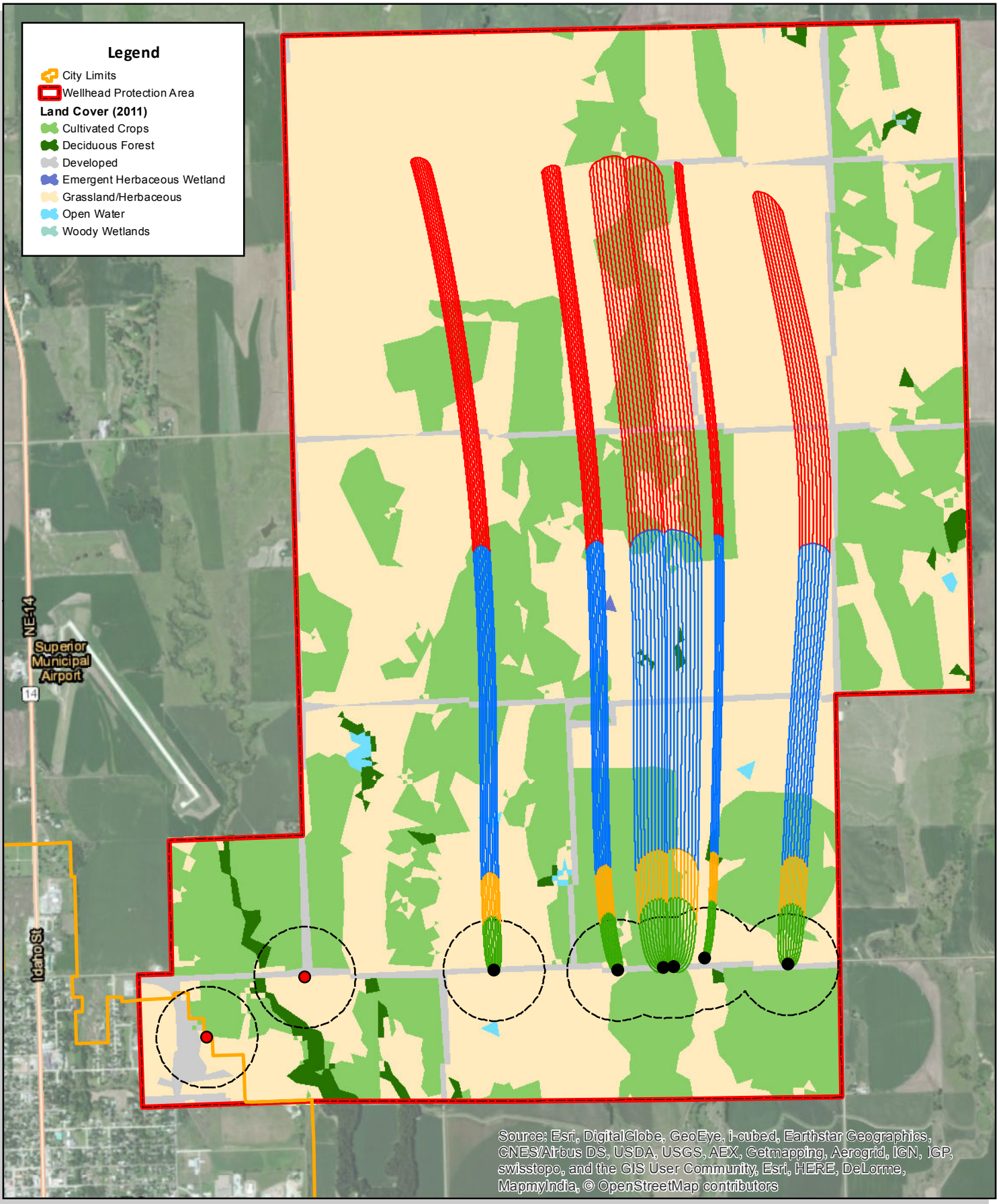
Land cover types included in the summary are as follows:

- **Developed** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for about 5.6 percent of total cover.
- **Developed, Open Space** - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for 4.2 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, gravel roads and ditches, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes
- **Deciduous Forest** - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Less than 1 percent of the tree species shed foliage simultaneously in response to seasonal change.
- **Grassland/Herbaceous** - Areas dominated by herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing. Only about 9 percent of the total cover is grasslands.
- **Cultivated (Row) Crops** - Areas used for the production of annual crops, such as corn, soybeans, vegetables, wheat, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 78.3 percent of total vegetation. This class also includes all land being actively tilled.
- **Woody Wetlands** - Areas where forest or shrub-land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water. Woody wetlands accounts for less than 1 percent of the total cover.
- **Open Water** – All areas of open water, generally with less than 25 percent of vegetation or soil. Open water accounts for less than 1 percent of the total cover.
- **Pasture/Hay** - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle.
- **Alfalfa** – Areas used for the production of alfalfa for livestock, typically on a perennial cycle.
- **Herbaceous/Emergent Wetlands** - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Table 5: Superior WHPA Land Cover Breakdown

Land Cover Type (2011)	Total Acres in WHPA	Percent of Total in WHPA
Cultivated Crops	2,226	35%
Deciduous Forest	73	1%
Grassland/Pasture/Hay	3,796	60%
Open Water	12	0%
Alfalfa	0	0%
Wetlands	2	0%
Developed	217	3%
Total	6,327	100%
Summary		
Cultivated Crops	2,226	35%
Developed (Roads, Town, etc.)	217	3%
Grassland/Forested/Water	3,884	61%

Source: 2011 Cropland Data Layer, provided by USDA-NRCS GeoSpatialDataGateway



Created By: SMS
Date: 7/21/2014
Software: ArcGIS 10.2
File: 130070

This map was prepared using information from record drawings supplied by JEO and/or other applicable city, county, federal, or public or private entities. JEO does not guarantee the accuracy of this map or the information used to prepare this map. This is not a scaled plat.

Superior Wellhead Protection Plan

Figure 14: Superior WHPA Land Cover

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SECTION 4. POTENTIAL CONTAMINANT SOURCE INVENTORY

The purpose of a potential contaminant source inventory (CSI) is to identify potential drinking water contaminants or sources that contaminants may originate from. Strategies to limit NPS may vary greatly within the WHPA because of the varying types of potential contaminant sources. See Figure 14 for a map of the land cover. Several management strategies are discussed to limit NPS in Section 6: Management Strategies. Identifying potential sources of contamination provides an outline to a community to plan for potential accidental releases of pollutants. The inventory is compiled from existing databases and on-the-ground observations. Even if identified in the CSI, a feature may not be contributing to contamination presently.

UNDERSTANDING WHAT POTENTIAL CONTAMINANT SOURCES EXISTS WITHIN THE WHPA, ALLOWS A COMMUNITY TO MAKE INFORMED DECISIONS TO SAFELY MANAGE THEIR DRINKING WATER SUPPLY.

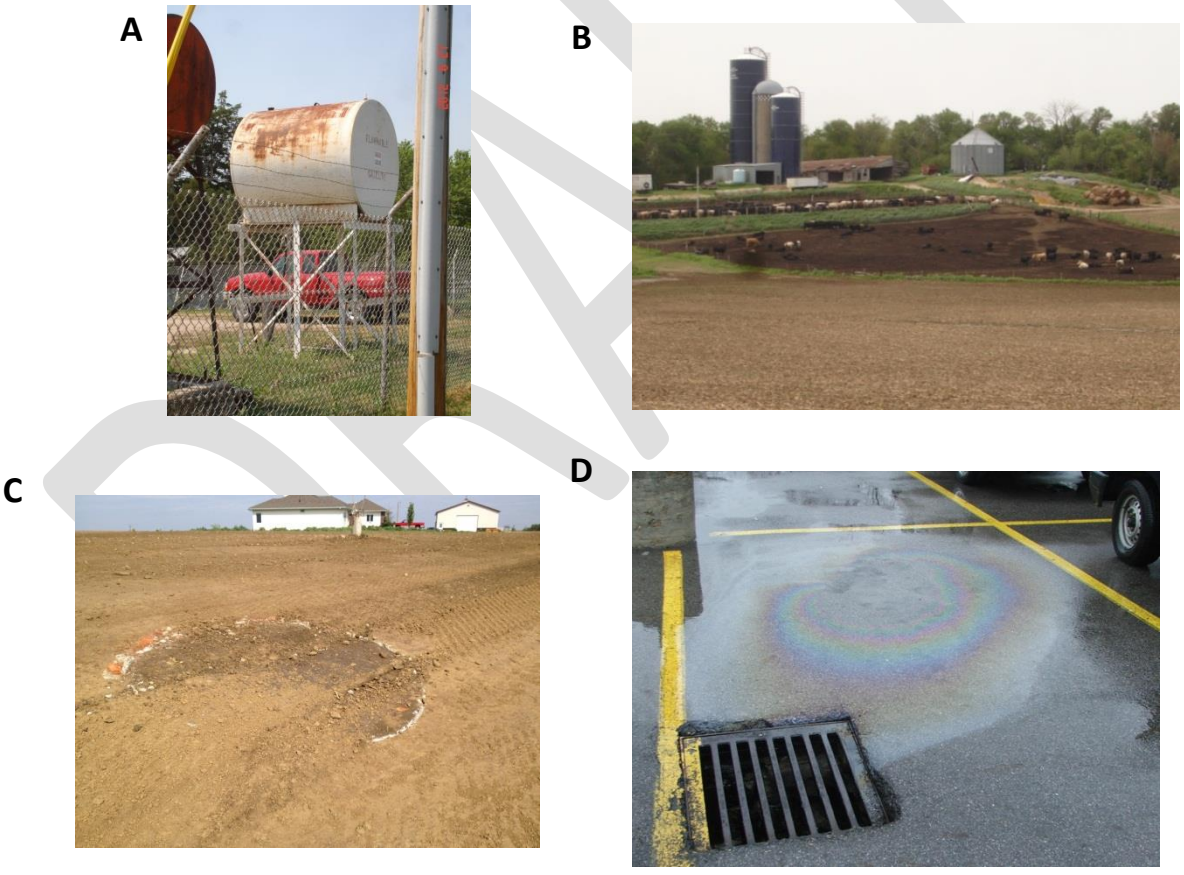


Figure 15: Common Potential Contaminant Sources. (A) Leaking Fuel Drums; (B) Livestock Waste; (C) Abandoned Wells; (D) Parking Lot Runoff

It is important to note that this inventory only represents a snapshot to the history of the area. There can be features which have already contributed to groundwater contamination, but there is no record of occurrence. Just as likely, is that, features recorded may not be actively operating, but have in the past. Due to the long period of time it requires for an aquifer to respond to changes in the land surface or for contaminants to migrate through the aquifer, historical land use and activities are important to record.

Based on guidance provided by NDEQ, the inventory typically consists of:

Agricultural
- Fuel Storage
- Grain Storage
- Water Wells
- Chemigation
- Livestock
- Abandoned Wells

Commercial and Light Industrial
- Auto Repair
- Dry Cleaners
- Fuel Stations
- Machine Shops
- Rail Yards
- Large Parking Lots

Industry
- Manufacturing Plants
- Gas/Oil Wells
- Junk Yards
- Landfills
- Sewage Treatment Facilities

Other
- Cemeteries
- Golf Courses
- Highway/Road Maintenance Yards
- Transportation Corridors
- Others

Superior's potential CSI is a compilation of multiple sources*:

- NDEQ provided:
  - NDEQ Regulated Facilities Database
  - Above & Below Ground Storage Tank Database (maintained by State Fire Marshall)
  - Gas and Oil Wells Database (maintained by Nebraska Oil and Gas Conservation Commission)
  - Agriculture Chemical Storage & Manufacturer Database (maintained by Nebraska Department of Agriculture)
- DNR provided:
  - Registered Wells Database
- JEO Consulting Group, Inc. conducted:
  - On-the-ground field inventory completed July 29, 2014
  - Georeferencing of previously completed CSI (2001)

**The data made available through outside agencies was furnished for interpretive reasons. To the extent possible, the data is current, accurate, and reliable. However, there may be discrepancies in the information and not all map location coordinates have been verified. In addition, the NDEQ assumes no legal responsibility, either implied or expressed, about the accuracy, completeness, reliability, or appropriateness of this data made available through or retrieved from its web site.*

To complete this, the original (2001) CSI datasheets were obtained from The City and georeferenced with a Geographic Information System (GIS). The CSI was loaded into a geodatabase. NDEQ and DNR data was then added to the database. The field inventory was completed on July 29, 2014 using a tablet PC with GIS software and aerial photography. JEO prepared a CSI geodatabase to collect data on potential contaminant sources as identified in the field through a windshield survey. The CSI is a major step in establishing a wellhead protection plan and includes recording locations and information on potential contaminant sources such as fuel storage, onsite wastewater systems, illegal wells, and many others.

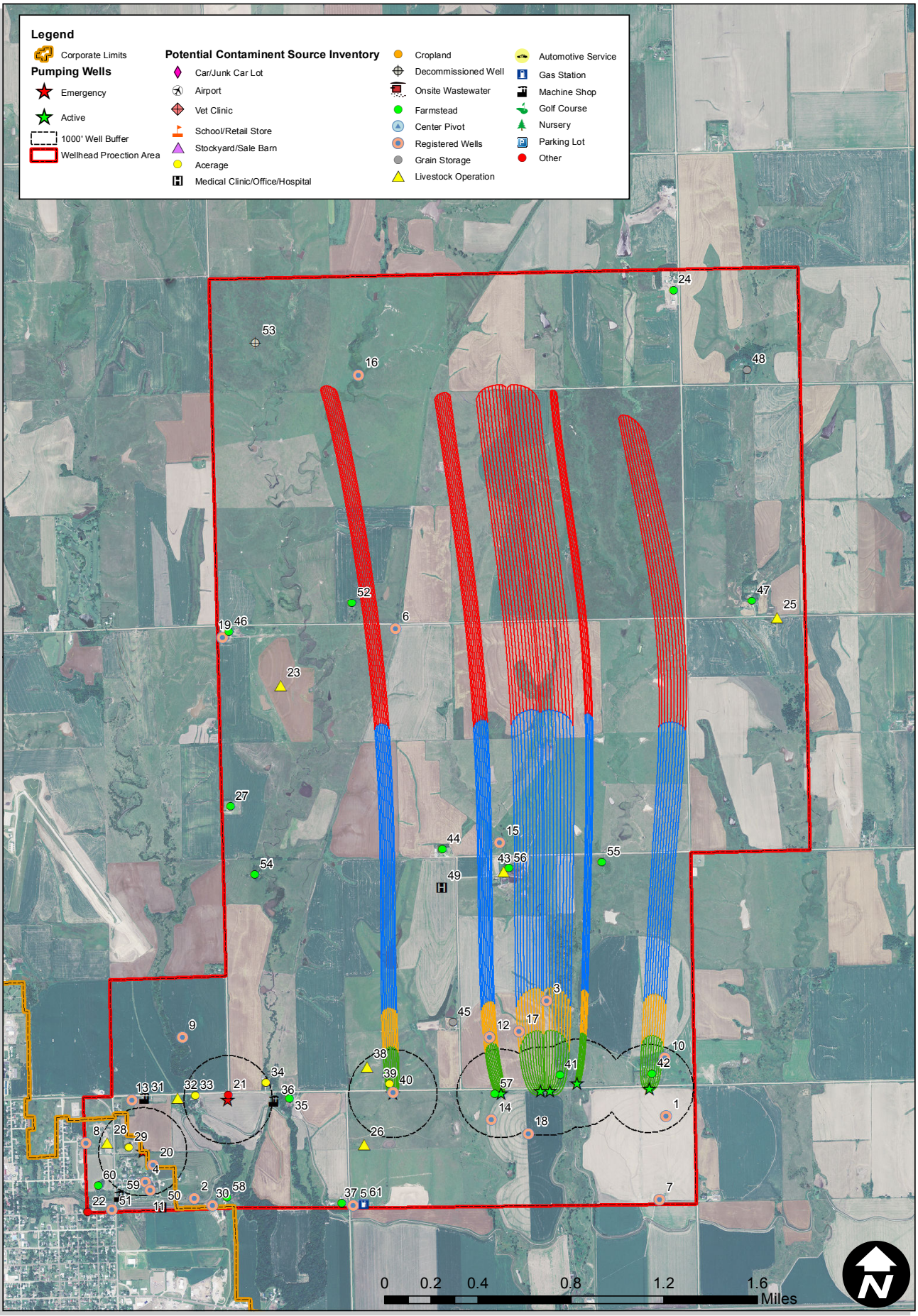
Due to the use of a laptop computer with GIS, field data sheets were not used to collect data on potential contaminant sources. Information collected in the field was entered directly into a database as seen in the CSI database tables below. A CSI allows a community to plan for and manage potential contaminant sources and decide where to focus educational and management efforts to minimize the likelihood of source water contamination. Table 6 displays a summary count of potential contaminant sources found in the Superior WHPA. A full map of Superior's CSI is found below in Figure 16, where each potential contaminant is numbered on the map and then included in a database (Table 7), with information on each potential contaminant.

Potential Contaminant Source	Total
Acreage	4
Airport	0
Automotive Service	0
Car/Junk Car Lot	0
Center Pivot	0
Farmstead	16
Gas Station	1
Golf Course	0
Grain Storage	2
Livestock Operation	7
Machine Shop	3
Medical Clinic/Hospital/Office	2
Nursery	0
Onsite Wastewater/Septic System	0
Other	2
School/Retail Store	0
Stockyard/Sale barn	0
Vet Clinic	0
Well	24
Total	**61**

Table 6: Superior Potential Contaminant Source Summary

The planning team reviewed and discussed the potential contaminant source inventory to ensure local accuracy, to add any historical items that may not be recorded in state-maintained databases, and to ensure nothing was missed in the field inventory.

All rural residences (farmsteads and acreages) were assumed to have both a private well and septic system. Asides from residences, wells were found to be the primary potential contaminant source at 27. A high number of "other" sites were identified, most of which were old businesses or other storage facilities.



SUPERIOR NEBRASKA
START HERE, GROW HERE

Superior Wellhead Protection Plan
Figure 16: Potential Contaminant Sources Inventory Map

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Table 7: Superior Potential Contaminant Source Inventory

ID Number	Site Type	Above Ground Fuel Storage	Below Ground Fuel Storage	Automotive Chemicals	Solvents	Fertilizer Storage	Chemical Storage	Septic System	Private Well	Stock Well	Adandoned Well	Chemigation Site	Grain Fumigant	Structure Fumigant	Site Description
1	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
2	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
3	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
4	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
5	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
6	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
7	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
8	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
9	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
10	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
11	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
12	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
13	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
14	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
15	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
16	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
17	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
18	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
19	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
20	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	
21	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	Valley Vegetables Cooperative
22	Other	No	Yes	No	No	No	No	No	No	No	No	No	No	No	Bostwick Irrigation District
23	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	Glen Langer Livestock
24	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	Ken Corman Livestock
25	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	Leslie Erickson Livestock
26	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	Irvin Braun Livestock
27	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	Ideal Farms Inc.
28	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	Horses
29	Acerage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	House with a swimming pool
30	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	Water condition facility
31	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	
32	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	
33	Acerage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	
34	Acerage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	
35	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
36	Machine Shop	No	No	No	No	No	No	No	No	No	No	No	No	No	Farm equip storage
37	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
38	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	
39	Acerage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	
40	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	City well
41	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
42	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
43	Livestock Operation	No	No	No	No	No	No	No	No	No	No	No	No	No	
44	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
45	Grain Elevator	No	No	No	No	No	No	No	No	No	No	No	No	No	Grain bins
46	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
47	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
48	Grain Elevator	No	No	No	No	No	No	No	No	No	No	No	No	No	Grain bins
49	Medical Clinic/Office/Hospital	No	No	No	No	No	No	No	No	No	No	No	No	No	
50	Medical Clinic/Office/Hospital	No	No	No	No	No	No	No	No	No	No	No	No	No	Nuckolls County Road Dept.
51	Well	No	No	No	No	No	No	No	No	No	No	No	No	No	City well location for chemicals to add to system
52	Farmstead	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	
53	Decommissioned Well	No	No	No	No	No	No	No	No	No	No	No	No	No	Old Windmill
54	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
55	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	Abandoned
56	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
57	Farmstead	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No	No	Propane Storage
58	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	

ID Number	Site Type	Above Ground Fuel Storage	Below Ground Fuel Storage	Automotive Chemicals	Solvents	Fertilizer Storage	Chemical Storage	Septic System	Private Well	Stock Well	Adandoned Well	Chemigation Site	Grain Fumigant	Structure Fumigant	Site Description
59	Machine Shop	No	No	No	No	No	No	No	No	No	No	No	No	No	Concrete Storage
60	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	
61	Gas Station	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	Gas Tank

SECTION 5. MANAGEMENT STRATEGIES

This WHPP lays out a baseline approach for protecting Superior's drinking water source. Superior should develop a comprehensive management strategy to implement actions over the next 10 to 20 years, at a minimum. The following may serve as the starting point for discussion or ideas, as enactment and success will require continued efforts from City officials, residents, and land owners to actively protect Superior's drinking water.

In areas where non-point contamination is likely, BPMs will assist in maintaining and improving well water quality. Management practices must be accepted and applied at the regional scale and not in isolated fields. In instances where well water contamination has been affected by local activities and sources of contamination (bacterial), improved conditions around individual wells are necessary (Gosselin, 1997).

THE FOLLOWING LIST OF STRATEGIES IS NOT INTENDED TO BE A "STEP BY STEP" GUIDE, BUT RATHER A HIGHLIGHT OF THE POTENTIAL ACTIVITIES WHICH COULD BENEFIT GROUNDWATER PROTECTION.

The ultimate goal of the management practice recommendations below is to provide the community with the best possible management strategies, which are both implementable and protective of the water supply for the community. It is important to note that the management strategies outlined below, while endorsed by the NDEQ, were developed based on the potential pollution sources identified through the potential contaminant source inventory, land use evaluation, and comments gathered through the community planning process.

Figure 17: Samples brought in through a Test-Your-Well Event

Educational activities and voluntary approaches should be considered the core of the recommended management strategies for Superior's WHPP because these can be implemented now. Furthermore, even though the City is owner and operator of the community water system, it does not have jurisdiction over all of the land identified in the WHPAs. Consequently, educational activities and voluntary approaches offer the greatest potential for more immediate and successful plan implementation.

For example, the City could host a "Test-Your-Well Night", where area residents with private well could bring samples of their water (Figure 17) for Nitrate testing and to learn more about source water protection.

Management strategies outlined below are general in nature; however they should not be considered the only options available. Specific strategies should be developed on a case-by-case basis through working with landowners, the NRD, the wellhead protection stakeholder committee, and the community. Some areas within the WHPA may provide opportunities to work directly with willing landowners. These opportunities often are the low hanging fruit in a wellhead protection program, and should be pursued on a priority basis, whenever feasible.

5.01 POTENTIAL MANAGEMENT ACTIVITIES

Public Education – *Education is often the first step in a successful wellhead protection program*. Superior has provided education opportunities in the past and will continue to provide opportunities to educate all ages of citizens and property owners, in and around the WHPA, about the importance of source water protection. There are many entities which could assist in education efforts such as local schools, the NRD, the Groundwater Foundation, University Extension, and the Nebraska Rural Water Association.

Public education efforts may include, but are not limited to:

- Focus groups
- Community workshops
- Press releases
- "Test Your Well" nights
- Distributing brochures
- School poster contests
- News/information articles
- Utility bill stuffers
- Others

Education could be on a variety of topics, such as:

- Proper animal waste handling
- Aquifer and Groundwater Basics
- Private Well and Lagoon Management
- Urban and Rural BMP practices
- Others

Wellhead Protection Area Signage – Superior has posted WHPA signs in the affected areas to alert property owners to the issues. Nebraska Department of Roads (NDOR) can install signs on the State Highway System where it intersects with the WHPA's. These signs could be supplemented with information regarding existing land use regulations and directing property owners to contact the City.

Figure 18: Example of Installed WHPA Signage

Decommission Abandoned Wells – Abandoned wells can directly channel contaminated surface water into groundwater, and so pose a considerable risk to water supplies. Abandoned wells must be decommissioned (filled, sealed, and plugged) according to state regulations or they are deemed "illegal". The NRD could help implement this program as they currently offer cost-share assistance in decommissioning abandoned wells.

Infrastructure Security – Focusing on infrastructure security can help to reduce the immediate risk to drinking water. Installing locks, adding lighting to well houses, and installing fencing around equipment are all examples of work that is easily implementable and has an immediate effect.

Deep Soil Sampling Cost Share– Deep soil sampling (36 inches in depth) enables producers to better manage fertilizer application by knowing what exists in the full crop root zone. The City and NRD can encourage producers to perform deep soil sampling. If the results are used to inform management decisions, this may ultimately reduce nitrate introduction into the source aquifer.

Groundwater Sampling – Groundwater monitoring wells can help with evaluation of whether management practices implemented in the WHPA are effective. Groundwater sampling can help the City determine the current nitrate concentrations in the WHPAs.

Vadose Zone Soil Sampling - In order to better understand the potential level of nitrate contamination, the City or NRD could conduct vadose testing of nitrate levels in the WHPA. This would help to determine future areas of concern for nitrate contamination of the groundwater and would help establish management strategies as part of the source water plan.

Easements and Contracts – Some areas within the WHPA may provide opportunities to work with willing landowners. Conservation easements, cost share assistance, land purchasing/managed leasing or contracting with land owners for land use restrictions may be viable options to protect areas outside the City's jurisdictional power.

Conservation Reserve Program (CRP) – Agricultural producers with farmed land in a WHPA are eligible for increased payment amounts for enrolling land in the CRP when located in a WHPA. The local NRD and NRCS office would assist in this.

Water Conservation Planning – This encompasses polices, strategies, and activities to manage fresh water in a sustainable manner. It generally includes ways in which communities, business, households, individuals and agriculture produces work to reduce the amount of water used or wasted. See Section 7.04 for additional information.

Installation of Monitoring Wells – Monitoring wells are used to monitor the groundwater level and can also be used to sample the groundwater quality. Installation at different levels can allow for discrete samples to be taken at varying elevations at the same map location. The City could work with the NRD and NDEQ to install these. Data from these well could be used as a trigger as part of a conservation plan or as additional information for future planning.

Irrigation Water Management - can help reduce the movement of pollutants from cropland into both groundwater and surface water by making irrigation systems more efficient. Some of these practices include irrigation scheduling, installing flow meters, using more efficient application practices, variable rate irrigation systems, and soil moisture probes. Education, outreach, and cost-share programs will be the most effective means to get agricultural users to incorporate these types of practices.

Advanced Vulnerability Assessment – Understanding the vulnerability to groundwater contamination is important to the implementation of management activities. Currently, no detailed model of Superior's source water's vulnerability exists. The DRASTIC model in Figure 6 is not a detailed model and only gives a general vulnerability of areas near the City. A tailored and up-to-date modeling effort, including a detailed hydrogeological study, would be beneficial to the City. Additional chemical analysis can also be performed to identify specific pollutant sources, and source tracking can be performed to more accurately identify and sources of contamination.

Best Management Practices – Both urban and agricultural BMPs offer an effective prevention strategy or solution to reduce the threat of contamination of groundwater. Agriculture BMPs focus on management of agricultural inputs and general land management to provide for economic, environmental, and agronomic efficiency in an operation. Selection of the most appropriate BMP or combination of BMPs under a voluntary approach is each land owner's decision. Additionally, The NRD, NRCS, and others could offer incentives to increase the amount of BMPs implemented. Additional information on BMP's can be obtained from the NRD or the local NRCS office.

Agricultural BMPs

- Vegetative and tillage practices
- Increase the amount of soil sampling
- Encourage no-till or low-till agriculture
- Irrigation Management
- Pesticide Management
- Livestock Waste Management
- Windbreak Management
- Nitrogen Management
- Use of Nitrogen Inhibitors
- Buffer, Filter Strips, or Strip Cropping
- Establish permanent cover on marginal cropland
- Integrated Pest Management
- Adoption of "smart technology"
- Irrigation Scheduling
- Domestic Well Registration
- Soil Moisture sensors
- Cover Crops
- Flow Meters
- Others

Urban BMP Incentives

- Use of native plants in lawns and landscapes
- Recycling
- Soil Sampling of lawns
- Mulching Lawn Clippings
- Rain Barrels/Rain Gardens
- Household hazardous waste collection
- Rain sensor rebate program
- Domestic Well Registration
- Others

SECTION 6. REGULATORY AUTHORITY

JEO makes NO judgment or guarantee as to the legality or effectiveness of any approach and recommends consulting with legal counsel before enacting any ordinances, zoning, regulations, or entering into any legally binding agreement.

6.01 CITY OF SUPERIOR

Due to the different threats and limits of jurisdiction in the well field, it is important that any current or future ordinances and/or zoning districts are flexible, enforceable, and developed with citizen/landowner input.

SUPERIOR MUNICIPAL CODE

Ordinances are part of the police power authority of a community, which is simply the power of the to regulate, in order to protect the public health, safety, and general welfare of its residents. Currently, several sections of the City's municipal code provide protection of the community's drinking water, within the City and its jurisdiction. A summary of applicable codes are given below, however the actual text of the Municipal Code can be found online at http://www.cityofsuperior.org/

At the time this plan was being developed, well setback distances are established in the latest version of Nebraska Title 179 – *Public Water Systems*, Chapter 7 (Effective date April 4, 2010). The City of Superior recognizes these through Title 15, Chapter 150 in the Code of Ordinances, which allows them to be modified automatically in accordance with updates to Title 179 Chapter 7.

Title V of the Superior Municipal Code provides regulation for public works. Chapter 51 provides regulations on water service, construction, and connections; while Chapter 52 provides regulations on sewer construction and connections, including private/onsite wastewater treatment systems.

In all cases, those provisions not covered by City Code, are governed by State Law and statute allows the municipality to be stricter in its regulations.

ZONING CONTROLS

The City of Superior has an adopted comprehensive plan, zoning ordinance and set of subdivision regulations that were updated in 2004. Through the exercise of planning and zoning, Superior gained land use control up to one mile beyond the corporate limits, through the adoption of an extraterritorial jurisdiction (ETJ). Additional jurisdiction may be ceded to the City by the county through resolution and ordinance in accordance Nebraska Revised Statute 13-327. Figure 19 illustrates the location of the City's ETJ, in relation to the 2014 WHPA. Not all of the WHPA falls within the City's ETJ. The Superior Zoning Ordinances may only be applied to areas within the City's ETJ and Superior has the ability to enact a

wellhead protection overlay district or adjust the current zoning to allow for regulations to the land use portions of the City's zoning jurisdiction.

Nuckolls County does not have a comprehensive plan, according to the Nebraska Association of County Officials, and therefore has no authority to enact zoning.

The Superior Zoning Ordinances does not currently provide for a wellhead protection district. With the adoption of Wellhead Protection Plan, the City should amend the zoning ordinance by creating a new overlay district with wellhead protection regulations. Such amendment would involve a public hearing and recommendation by the Planning Commission and a public hearing and ordinance adoption by the City Council. The wellhead protection overlay district would be illustrated on the Official Zoning Map and any adopted wellhead regulations would take priority over the underlying zoning district. Changes to the zoning would most likely be a long-term process and should involve public input and periodic review of any adopted regulations.

Should the City need to pursue protection to their WHPA outside of their ETJ in the future, the City is able to utilize the Nebraska Revised Statute 17-536 (the 15-mile Statute). This State Law, which applies to villages and second class cities, allows communities to protect sources of drinking water outside the community's ETJ.

If Nuckolls County, in the future, adopts a comprehensive plan, and enacts zoning, the City should work with the County Planning Commission and Board of Commissioners to apply such an overlay district to the area within the county's jurisdiction. The zoning overlay district within the county should be compatible to the City's wellhead protection overlay district to help protect the public drinking water.

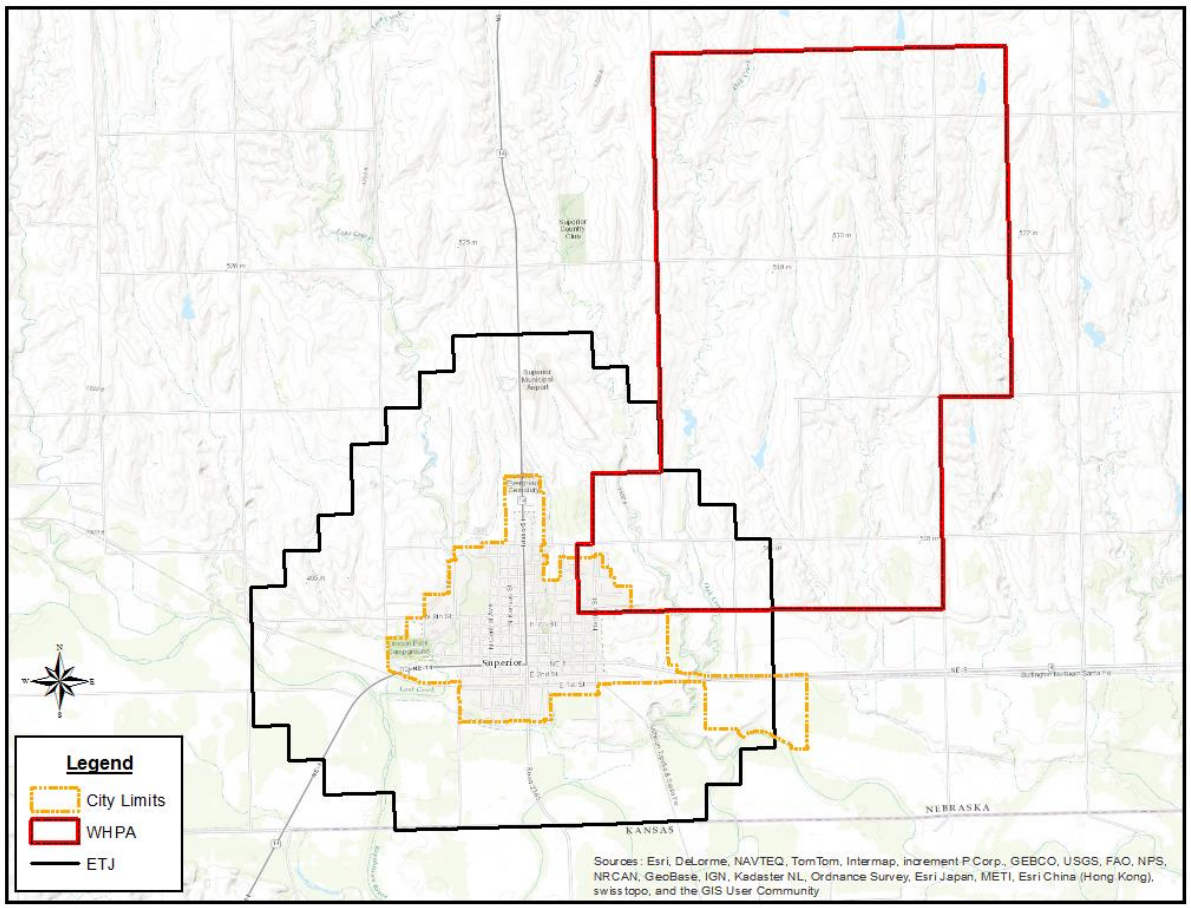

Figure 19: Superior's Extraterritorial Jurisdiction (ETJ) and 2014 WHPA

6.02 LOWER REPUBLICAN NATURAL RESOURCES DISTRICT

GROUNDWATER MANAGEMENT PLAN SUMMARY

The Lower Republican NRD has been designated as fully appropriated; however, the settlement agreement reached between the states of Nebraska, Kansas, and Colorado has prompted the LRNRD to implement a number of groundwater Management Controls. The controls implemented have been for the preservation and conservation of groundwater, and for compact compliance.

The LR NRD, along with the DNR adopted one of the first Integrated Management Plans (IMP) in the state in 2005. The most recent IMP was adopted in October 2011. IMPs address every phase of groundwater management. The IMP is used in conjunction with its Groundwater Management Plan (GWMP) to manage the groundwater resources of the district and serves as a foundation for decision-making.

Nebraska NRDs are authorized to form special areas to protect groundwater quantity and/or quality. Within these areas, NRDs can encourage, require, or control actions that have an impact on groundwater. The groundwater management area may address both groundwater quantity and quality issues. The Superior-Hardy Special Protection Area was established in 1991.

A complete copy of the Lower Republican NRD Groundwater Management Rules and Regulations and Integrated Management Plan was not included in this document due to size. For a complete copy of the Plan and related rules or information, contact the NRD:

Lower Republican Natural Resources District
30 North John St.
P.O. Box 618
Alma, NE 68920
308.928.2182/800.353.1297
E-mail: lrnrd@lrnrd.org

6.03 STATE OF NEBRASKA

State statues and laws are summarized in Appendix B as well as a listing of Nebraska's legislature statutes that allow local jurisdictions to protect public health and safety. NDEQ administers the WHPP and provides technical assistance to any controlling entity designating a WHPA.

SECTION 7. EMERGENCY, CONTINGENCY, AND LONG TERM PLANNING

7.01 EMERGENCY PLANNING

Superior's Public Water System Emergency Response Plan is located in Appendix C.

The City is not currently a member of the Nebraska Water/Wastewater Agency Response Network (NEWARN). NEWARN is a statewide Water/Wastewater Agency Response Network (WARN) of "utilities helping utilities" to:

- Prepare for the next natural or human-caused emergency.
- Organize response according to established requirements.
- Share personnel and other resources statewide, by agreement.

NEWARN provides water and wastewater utilities with:

- A Mutual Aid Agreement and process for sharing emergency resources among water and wastewater agencies statewide.
- A mutual assistance program consistent with other statewide mutual aid and assistance programs and the National Incident Management System.
- The resources to respond and recover more quickly from a natural or human caused disaster.
- A forum for developing and maintaining emergency contacts and relationships.

Additional information can be found at http://www.newarn.org/

7.02 CONTINGENCY PLANNING

Superior's Public Water System Emergency Response Plan (copy located in Appendix C) contains emergency water supply contact information, contingency plans, and emergency contact information to deal with the following emergencies/contingencies:

- Power failure at wells, reservoirs, elevated tanks, or service center
- Water main or service line breaks
- Chemical or bacteriological contamination
- Loss of storage
- Floods, tornadoes, earthquakes, or other acts of nature

7.03 LONG TERM PLANNING

Currently the City has an adequate supply and acceptable quality of source drinking water. Even still, identifying future sources of water is important. Given the extensive amount of time it may take to locate, construct, and bring online a new well it is important to start sooner rather than later.

Figure 20: Test Wells are often helpful in identifying future well fields

No potential well locations were analyzed as part of this planning effort. However, the City has, as part of future planning, began to explore areas for locating a new well. The City has identified three (3) areas for future water exploration, and has plans to move forward in one area, after completion of this wellhead protection plan. Additional information has been omitted from this plan due to privacy concerns, however, it can be provided by the City.

Moving forward, the City will need to ensure siting criteria (Title 179, NHHS-R&L) are met. Identifying a new well or well field will be a long term process outside the scope of this plan; however, a few considerations have been identified during the development of this plan:

- Establishing a Conservation Plan, will help extend the lifespan of the existing water system. See Section 7.04, below.
- Superior could utilize the NRD's groundwater monitoring and sampling program to aid in preliminarily identifying future well locations.
- Vadose zone sampling could be completed, to identify if there is a high load of nitrates percolating into the aquifer in the potentially new wellhead protection area
- The City could consider staying in the same areas as the existing well fields to utilize the infrastructure
- Some of the City's wells are aging and therefore, replacing them lead to an improved future water supply
- An evaluation of existing capacity of the infrastructure will need to be explored
- The City should obtain a provisional WHPA from NDEQ in order to identify potential contaminant sources before the future well site is chosen. The provisional WHPA will ensure that groundwater is protected until it is needed. This should include a contaminant source inventory. Assistance from DHHS, including site inspections, will be beneficial.
- The City should obtain an option or purchase a property for the new well once the site is identified.
- Purchasing new land, drilling wells, and building infrastructure are expensive undertakings. The City should establish or maintain a dedicated fund to assist with these efforts.

7.04 DROUGHT CONSERVATION PLANNING

Drought is defined as an extended period of time across a region with a deficit water supply and absence of precipitation. Effects from the absence of water are ecosystem and environmentally related. Prolonged effects will have adverse impacts to agriculture, people, and wildlife. Although influences of drought may have severe and far reaching impacts, it is not as tangible as other disasters, such as wildfires or tornadoes (Drought Ready Communities Guide).

Agriculture is the primary sector affected by drought; however, impacts on rural and municipal water supplies can be quite severe: conflicts between water users increase during water-short periods, water systems develop operational problems; large, industrial, independent water users may overdraft available supplies, and wells experience water quality and quantity problems.

The best approach is to anticipate these conflicts and issues well in advance in drought and initiate appropriate actions to avoid problems. A drought plan can be an effective means to improve information flow on drought conditions severity, and impact, and thus the timeliness of mitigation and emergency response actions. Mitigation actions for water supply systems commonly fall under the following categories:

- Assessment programs
- Water supply augmentation/development of new supplies
- Public awareness/education programs
- Water use conflict resolution
- Drought Contingency Plans

WATER CONSERVATION PLAN

A water conservation plan is a written document developed by a public drinking water system that evaluates current and projected water use, assesses infrastructure, operations, and management practices, and describes actions to be taken to reduce water losses, waste, or consumption and increase the efficiency with which water is used, treated, stored, and transmitted.

Developing a water conservation plan also helps to optimize existing facilities and may reduce or eliminate the need to undertake new drinking water and/or wastewater projects. In addition, water conservation leads to increased energy conservation and cost savings for utilities and their customers. A water conservation plan should address conservation on the supply side (i.e., leak detection and repairs, metering, etc); as well as on the demand side (i.e., reductions in consumer usage). Recommended actions/elements of a plan include:

- Conduct Water Use Audits for Consumers
- Offer fixture retrofits and replacements
- Offer rebates and incentives

- Promote water reuse and recycling
- Encourage landscape efficiency
- Reduce excessive distribution system pressure
- Identify Voluntary or Mandatory Water-Use Restrictions

DROUGHT READY COMMUNITIES

The National Drought Mitigation Center, located at the University of Nebraska Lincoln, has developed a program known as "Drought-Ready Communities". The intent of the program and associated "Guide to Community Drought Preparedness" is to help communities understand and reduce their drought risk. A certified drought ready community has taken steps to:

1. Involve a representative cross section of the community;
2. Learn how drought has affected them in the past and how it would likely affect them in the future;
3. Set up a system to monitor and communicate about drought conditions in the community;
4. Prepare and document a set of actions to take before and in response to drought;
5. Educate the public about water, drought, and community's drought plan.

Currently, Superior is not a certified Drought Ready Community.

Additional Information can be found at:
http://drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx

WATER CONSERVATION ORDINANCE DEVELOPMENT

Often, the most visible result of a water conservation plan is the development of a water conservation ordinance. Typically, a water conservation ordinance is written to guide water conservation promotion and impose water use restriction, when necessary. An ordinance enables a community to:

1. Keep water use within pumping capacity and delivery capability, based on professional judgment, water conditions, weather forecasts, water system operations, and groundwater conditions
2. Define procedures to be used when the above criteria cannon be met, and
3. Familiarize citizens, businesses, and industry with the procedures which may be implemented when voluntary or mandatory water restrictions are required

Currently, Superior has no comprehensive water conservation plan or ordinance.

SECTION 8. PUBLIC EDUCATION AND NOTIFICATION

8.01 OPPORTUNITY FOR PUBLIC INPUT

In order for a plan to be approved by the NDEQ, there must be proper documentation of public involvement. The Superior Wellhead Protection Plan approval format has followed the guidance of NDEQ to ensure proper opportunity for public input. Due to efforts to satisfy all public comments and concerns, the Superior WHPP project went through multiple public meetings and the documentation materials for each of the opportunities (copy of newspaper notices, affidavit of publication, minutes, etc) is located in Appendix D. The following steps below are the basic minimum requirements that must be documented:

1. Prepare a Wellhead Protection Plan
2. The WHP Plan is made available for public review at least 30 days prior to the meeting where public comment will be taken on the Plan.
3. Public comment is taken at a regularly scheduled meeting of the "controlling entity" (meaning the village board, city council, Rural Water District board, etc)

8.02 PLANNING STAKEHOLDER COMMITTEE

A 13-member stakeholder committee was established at the initiation of the planning process. As shown in Table 8, below. The Stakeholder Committee was responsible for plan review, and serving as local contacts to residents to provide information during the planning period.

Table 8: Superior Wellhead Protection Stakeholder Committee Members

Name	Title	Representing
Dan Corman	County Commissioner	County and area Farmers
Steve Fox	City Councilmember	City of Superior
Seth Going	FFA Teacher	Superior Public Schools
Luke Meyer	Owner, Meyers Aerial Service	Local Aerial Applicator
Bob Sloane	Wastewater Plant Foreman	City of Superior
Kim Young	Planning Committee Member	City of Superior
Larry Brittenham	Utility Manager	City of Superior
Derek Clark	City Planner	City of Superior
Marc Caldwell	Manager	Crop Services
Tom Ostdiek	Owner	Mid-States Well Work
Jamie Blackstone	Owner	B-Green Lawn Care
Sam Capps	Wellhead Protection Coordinator	NDEQ
Adam Rupe	Environmental Planner	JEO Consulting Group, Inc.

8.03 MEETING SUMMARY

During the establishment of the wellhead protection plan, Superior offered a series of community meetings/workshops, established a wellhead protection committee, and a held public open meeting to offer residents and property owners an opportunity to voice their opinion or ask any questions about wellhead protection and the plan. Below is a summary of the types and dates of meetings. Sign-in sheets and other public notification materials are located in Appendix D.

Figure 21: Children participating in the Groundwater Foundation's Library Event in Superior

Stakeholder Meeting #1 – September 10, 2014

The first Stakeholder meeting was held on September 10, 2014. The group discussed their responsibilities, plan progress and schedule, the WHPA map, the contaminant source inventory process, issues and ideas about the development of the plan, and potential timing of the next WHP Committee meeting, and Public Open House.

Notification: Committee members were invited to the meeting by phone calls, letters, and word to mouth.

WHP Stakeholder Meeting #2 – October 22, 2014

The first Stakeholder meeting was held on September 10, 2014. The group discussed their responsibilities, plan progress and schedule, the WHPA map, the contaminant source inventory process, issues and ideas about the development of the plan, and potential timing of the next WHP Committee meeting, and Public Open House.

Notification: Committee members were invited to the meeting by phone calls, letters, and word to mouth.

Public Open House – November 17, 2014

SUMMARY TO BE INSERTED AFTER OPEN HOUSE

REFERENCES

Conservation and Survey Division – IANR – UNL. "The Groundwater Atlas of Nebraska" 1986

Drought Ready Communities: A Guide to Community Drought Preparedness. Published online by the National Drought Mitigation Center at: http://drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx

Gosselin, D. C., Headrick, J., Tremblay, R., Chen, X.-H. and Summerside, S. (1997), Domestic Well Water Quality in Rural Nebraska: Focus on Nitrate-Nitrogen, Pesticides, and Coliform Bacteria. Groundwater Monitoring & Remediation, 17: 77–87. doi: 10.1111/j.1745-6592.1997.tb01280.x

National Research Council. (1993). Groundwater vulnerability assessment, contamination potential under conditions of uncertainty. National Academy Press, Washington, DC, 210pp.

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Nebraska Natural Resources Commission Data Bank. DRASTIC Methodology. Accessed via web: ftp://ftp.dnr.ne.gov/Pub/nrd/drast_doc.html

New Hampshire Department of Environmental Services (NHDES). (2006). "Environmental Fact Sheet; Nitrate and Nitrite: Health Information Summary."

Rahman, A. A GIS based DRASTIC model for assessing groundwater vulnerability in shallow aquifer in Aligarh, India. Applied Geography 28 (2008) 32-53.

US Department of the Interior, Bureau of Reclamation, in cooperation with the Nebraska Natural Resources Commission. December 1999. "Nitrate and Nebraska's Small Community and Rural Domestic Water Supplies: An Assessment of Problems, Needs, and Alternatives."

Guidance available from NDEQ:

- "Documenting Public Input – WHP Plan". July 25, 2013
- Thomas O'Connor. "Contaminant Source Management Options for Wellhead Protection". September 2002
- "Wellhead Protection Area Management Planning Manual: A Community-based Approach to the Wellhead Protection Area Management Planning Process in Nebraska" (2008)
- "Wellhead Protection Plan Guidance Checklist"

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LIST OF APPENDICES