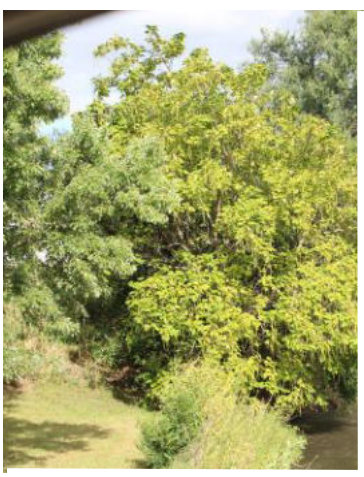



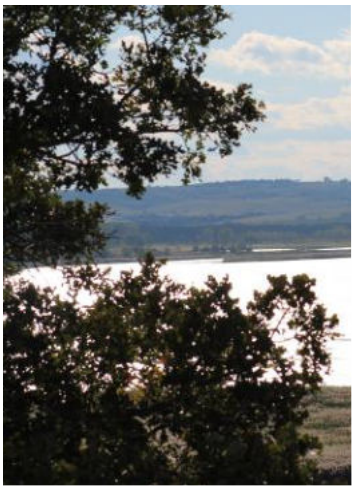
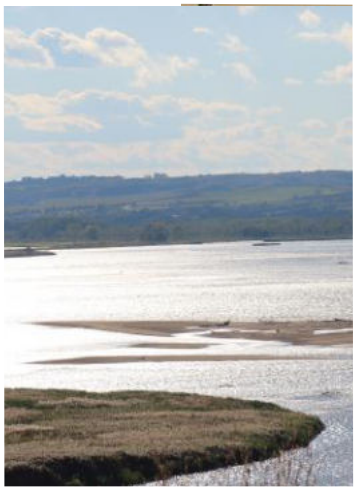

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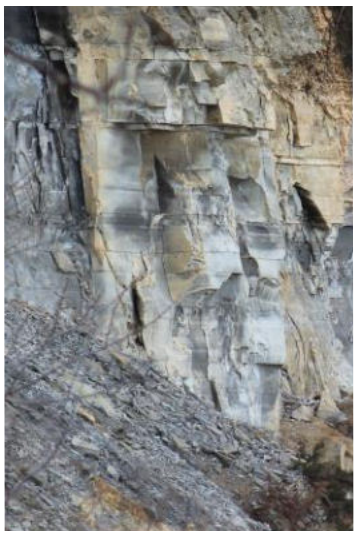

Plan Participants

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Robert Ganz
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Vacant

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MARVIN PLANNING CONSULTANTS

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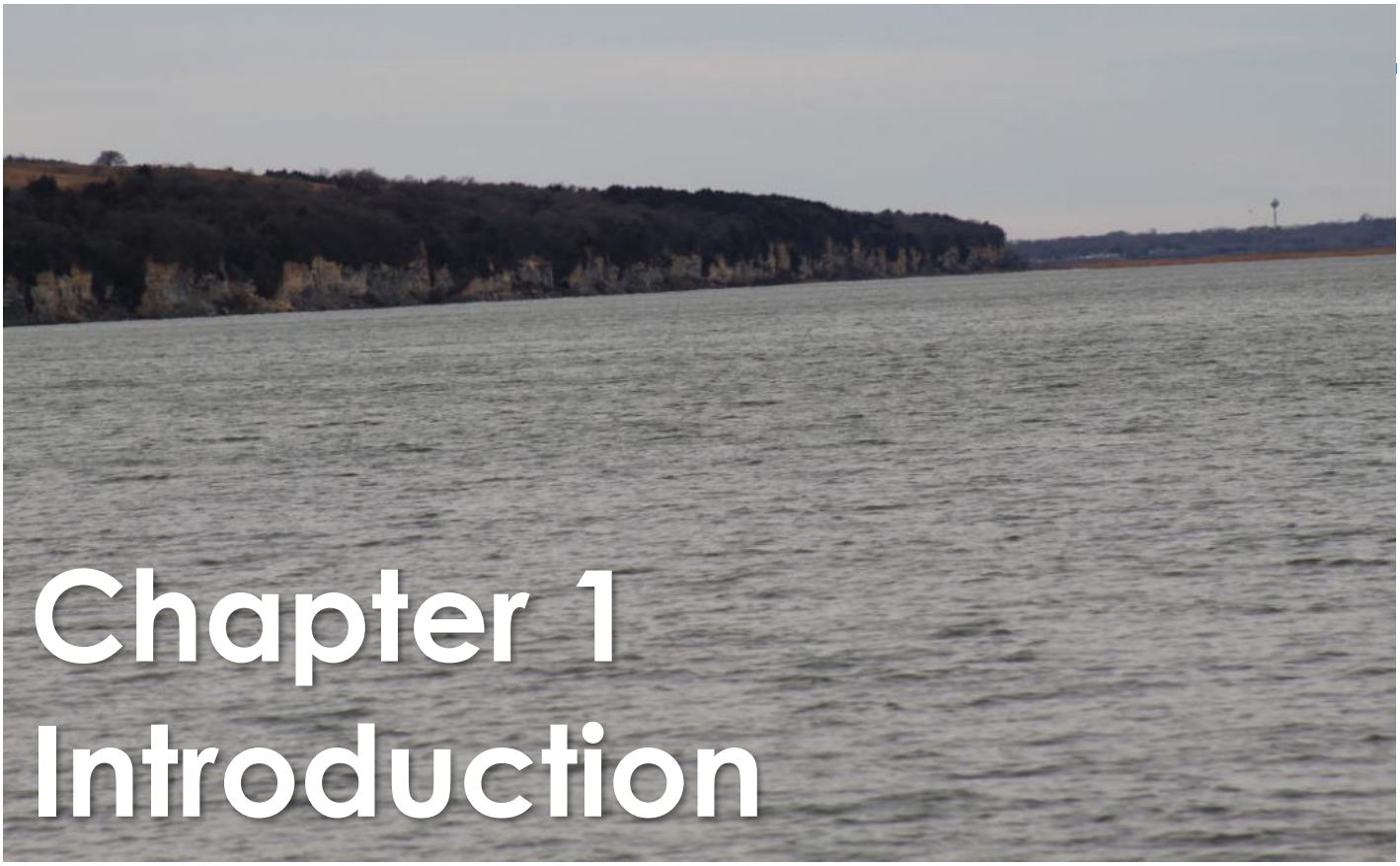

Chapter 1 Introduction

Location

Knox County is located in northeast Nebraska, along the Nebraska-South Dakota state line. The county is bounded on the north by the State of South Dakota; on the east by Cedar County; on the south by Antelope and Pierce Counties; on the west by Boyd and Holt Counties.

The county has eight highways crossing the county including Nebraska Highways 12, 13, 14, 59, 84, 54C 54D and 121. The county is home to the communities of Bazile Mills, Bloomfield, Center (county seat), Creighton, Crofton, Niobrara, Santee, Verdel, Verdigre, Wausa, and Winnetoon. In addition, Knox County has the unincorporated community of Lindy.

Comprehensive Development Planning

The Knox County Comprehensive Development Plan is designed to promote orderly growth and development for the county, as well as providing policy guidelines to enable citizens and elected officials to make informed decisions about the future of the county.

The Comprehensive Development Plan will provide a guideline for the location of future developments and uses within the planning jurisdiction of Knox County. The Comprehensive Development Plan is intended to encourage a strong economic base for the County so all goals can be achieved.

The Comprehensive Development Plan is intended as an information and management tool for County leaders to use in their decision-making process when considering future developments. The Comprehensive Development Plan is not a static document; it should evolve as changes in the land use, population or local economy occur during the planning period.

The Planning Process

The Comprehensive Development Plan begins with the development of general goals and policies, based upon current and future issues faced by the County and its residents. These are intended to be practical guidelines for addressing existing conditions and guiding future growth.

In conjunction, the data collection phase will be occurring. Data is collected to provide a snapshot of the past and present conditions within the county. Analysis of data provides the basis for developing forecasts for future land use demands, as well as future needs regarding housing and facilities.

The Comprehensive Development Plan is a **blueprint**....designed to identify, assess, and develop actions and policies in the areas of population, land use, transportation, housing, economic development, county facilities, and utilities. The Comprehensive Development Plan contains recommendations, when implemented, that will be of value to the County and its residents.

The Comprehensive Development Plan identifies the tools, programs, and methods necessary to carry out the recommendations. Nevertheless, the implementation of the development policies contained within the Comprehensive Plan is dependent upon the adoption of the Plan by the governing body, and the leadership exercised by the present and future elected and appointed officials of the County.

Plan Preparation

The Plan was prepared under the direction of Knox County Planning Commission, with the assistance and participation of the Knox County Board of Supervisors; County staff; the Plan Review Committee and citizens of Knox County. The time period for achieving the goals, programs, and developments identified in the Knox County Comprehensive Plan is 20 years. However, the County should review the Plan annually and update the document every 10 years (2029), or when major, unanticipated opportunity arises.

Completing updates every ten years or so will allow the County to incorporate ideas and developments not known at the time of the present comprehensive planning process.

Comprehensive Plan Components

Nebraska State Statutes require the inclusion of certain elements in a Comprehensive Plan. A "Comprehensive Development Plan," as defined in Neb. Rev. Stat. § 23-114.02 (Reissue 1997), "shall consist of both graphic and textual material and shall be designed to accommodate anticipated long-range future growth." The Comprehensive Plan is comprised of the following chapters and sections:

- Introduction Chapter
- Community Engagement Chapter
- Population Statistics Chapter
- Housing Chapter
- Economics/Economic Development Chapter
- County Facilities Chapter
- Energy Chapter
- Resources/Environmental Chapter
- Land Use Chapter
- Transportation Chapter
- Implementation Chapter

Analyzing past and existing demographic, housing, economic and social trends permit the projection of likely conditions in the future. Projections and forecasts are useful tools in planning for the future; however, these tools are not always accurate and may change due to unforeseen factors. Also, past trends may be skewed or the data may be inaccurate, creating a distorted picture of past conditions. Therefore, it is important for Knox County to closely monitor population, housing and economic conditions that may impact the County. Through periodic monitoring, the County can adapt and adjust to changes at the local level. Having the ability to adapt to socio-economic change allows the County to maintain an effective Comprehensive Development Plan for the future, to enhance the quality of life, and to raise the standard of living for all residents.

The Comprehensive Development Plan records

where Knox County has been, where it is now, and where it likely will be in the future. Having this record in the Comprehensive Development Plan will serve to inform County officials as much as possible.

The Comprehensive Development Plan is an information and management tool for County leaders to use in their decision-making process when considering future developments. The Comprehensive Development Plan is not a static document; it should evolve as changes in the land-use, population or local economy occur during the planning period. This information is the basis for Knox County's evolution as it achieves its physical, social, and economic goals.

The Comprehensive Development Plan is a vision presented in text, graphics and tables representing the desires of the County and its residents for the future.

The Plan is only one of several tools within the toolbox that helps guide the community into the future.

Jurisdictional Organization

The Knox County Board of Supervisors, which is a board of elected officials, performs the governmental functions for the County. Each incorporated community in Knox County also has elected officials and officers overseeing how their community is governed.

Planned growth will make Knox County more effective in serving residents, more efficient in using resources, and able to meet the standard of living and quality of life every individual desires.

The planning and zoning jurisdiction of Knox County, pursuant to Neb. Rev. Stat. § 23-114 (Reissue 1997), includes all of the unincorporated portions of the County, excluding the established extraterritorial jurisdiction of each incorporated city or village.

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Chapter 2 Community Engagement

Community Engagement

Community engagement is important to a successful planning effort. The use of public participation makes it possible to have a clearer understanding of how the residents feel regarding different parts of the community. However, there are limited numbers of individuals concerned about the effort either because things are going in a good direction or specific issues do not impact them.

Community Engagement

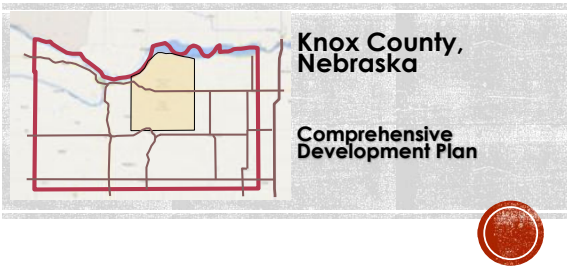
Community engagement in Knox County was designed as a major component of the project and the process included multiple approaches. It was structured in a manner allowing for stakeholders to be involved in numerous ways throughout the process. Some key elements will include:

- Education: Planning 101
- Use of a steering committee
- SurveyMonkey
- Facebook
- Public hearings

Planning 101

Planning 101 forms the educational foundation for the entire project. In this process, there was one workshop. This workshop addressed:

- What is a Comprehensive Plan?
- How the plan is used?
- How does the plan impact me?



PLANNING 101 WORKSHOP

Steering Committee Meetings

The Steering Committee for the Knox County Comprehensive Plan consisted of the Knox County Planning Commission and county staff.

The steering committee acts as a sounding board during the entire process; this allows all pieces/Chapters of the plan to be reviewed and commented on at regularly scheduled meetings. The steering committee is one of the more critical components of the process.

SurveyMonkey

SurveyMonkey, a web based survey tool was utilized for gathering specific input on Knox County. The survey process allows individuals to provide input while remaining totally anonymous. The survey was advertised using specially designed cards, announcements on the project, Facebook page, and on posters hung up throughout the county and communities.

One specific survey was developed for use within the rural areas of Knox County. The survey contained a total of 31 questions relating to the county. These question can be viewed in the Appendices of the Plan.
In all 71 individuals chose to answer the survey. The overall general results can be seen in the office of the Zoning Administrator.

Facebook

A special Facebook page was established for the Knox County Comprehensive Plan. The Facebook page served as a means to notify people about the survey as well as providing another medium for asking questions. In addition, the Facebook page provided a location to upload links to parts of the Comprehensive Plan as they were completed and reviewed.

Town Hall Meetings

The team attended four meetings throughout Knox County. The meetings were:

- February 25, 2019 in Creighton
- February 25, 2019 in Crofton
- February 28, 2019 in Niobrara
- February 28, 2019 in Bloomfield

Attendance at these meetings was limited; however, there was good discussion regarding the future of the county.

Goals and Poliices

Planning for the future land uses of the county is an ongoing process of goal setting and problem solving aimed at encouraging and enhancing a better county with a better quality of life. Planning focuses upon ways of solving existing problems within the county, and providing a management tool enabling Knox County citizens to achieve their vision for the future.

Visioning is a process of evaluating present conditions, identifying problem areas, and bringing about consensus on how to overcome existing problems and manage change. By determining Knox County's vision, the county can decide where it wants to be in the future, and then develop a "roadmap" guiding decisions of the county. However, the plan cannot only be based upon this "vision" and "road map" concept. The residents of Knox County must also act or implement the necessary steps involved in achieving this "vision".

Vision without action is merely a dream

Action without vision is just passing time

Vision with action can change the world

Joel Barker

Change is continuous, therefore Knox County must decide specific criteria that will be used to judge and manage change. Instead of reacting to development pressures after the fact, the county along with their strategic vision, can better reinforce the desired changes, and discourage negative impacts that may undermine the vision. A shared vision allows Knox County to focus its diverse energies and minimize conflicts in the present, and in the future.

A key component of a Comprehensive Plan is the goals and policies. The issues and concerns of the citizens are developed into a vision. The vision statement can then be further delineated and translated into action statements and/or policies, used to guide, direct, and base decisions for future growth, development and change within Knox County. Consensus on "what is good land use?" and "how to manage change in order to provide the greatest benefit to the community and its residents?" is formed. Knox County's goals and policies attempt to address various issues, regarding the questions of "how" to plan for the future.

Goals are desires, necessities and issues to be attained in the future. A goal should be established in a manner that allows it to be accomplished. Goals are the end-state of a desired outcome. Goals also play a factor in the establishment of policies within a county. In order to attain certain goals and/or policies within County government, they may need to be modified or changed from time to time.

Policies are measurable, definable steps that lead to the eventual completion of the goal. They are specific statements of principle or actions that imply a direction that needs to be undertaken.

These policies will synthesize the information from the goals, as well as the responses from the participants of the various input processes. Policies play an important role in the Comprehensive Development Plan because they direct the different actions that will need to be taken to meet the goals.

The Knox County Comprehensive Plan provides a broadly painted picture for the county's future. The vision statements and goals describing the desired future conditions provide guidance for land use decisions and other actions, both public and private that collectively will determine the future of the County.

It is important for counties to establish their goals and policies in a manner allowing for both long-term and short-term accomplishments. The short-term goals and policies serve several functions:

- Allow for immediate feedback and success, which fuels the desire to achieve additional goals and better policies.
- Allow for the distribution of resources over time thus assuring a balanced use of public investment.
- Establish certain policies that need to be followed before the long-term goals can be accomplished.

Knox County Vision and the Plan

The Knox County Comprehensive Plan provides a broadly painted picture for the county's future. The vision statements and goals describing the desired future conditions provide guidance for land use decisions and other actions, both public and private that collectively will determine the future of Knox County.

The core premise embedded in the Knox County Plan 2019 is designed to maintain and enhance the health, safety and welfare of the county during times of change, to promote our ideals and values as changes occur, and to meet the needs of today without sacrificing the ability of future generations to meet their needs. The plan acknowledges the importance of the connections between economic, environmental, and social components of the county. The plan is a combination of practicality and vision, and provides guidelines for sustaining the rich fabric of Knox County.

Knox County Plan Goals & Policies

The goals and policies for the Knox County Comprehensive Plan will be contained throughout the following Chapters.

Goals are intended as a long-range desire; however, as the Plan is implemented and different things in the world around Knox County changes, then the goals need to be modified to address the new direction and factors. Therefore, goals need to be flexible to ensure success and positive outcomes.

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Chapter 3 Population

Population Profile

Population is the major catalyst driving everything in a municipality or a county including housing, local employment, economies and fiscal stability. It is critical to understand how past population trends when applied to the future impacts the overall area. Knox County needs to understand where the County has been, where it is currently, and where it appears to be going.

Understanding the historic populations aid in identifying where the population may go in the future and aids in determining potential impacts on future housing, retail, medical, employment, and educational needs within Knox County. In addition, when future populations appear to be declining, it provides a benchmark from which to direct and gauge economic development activities.

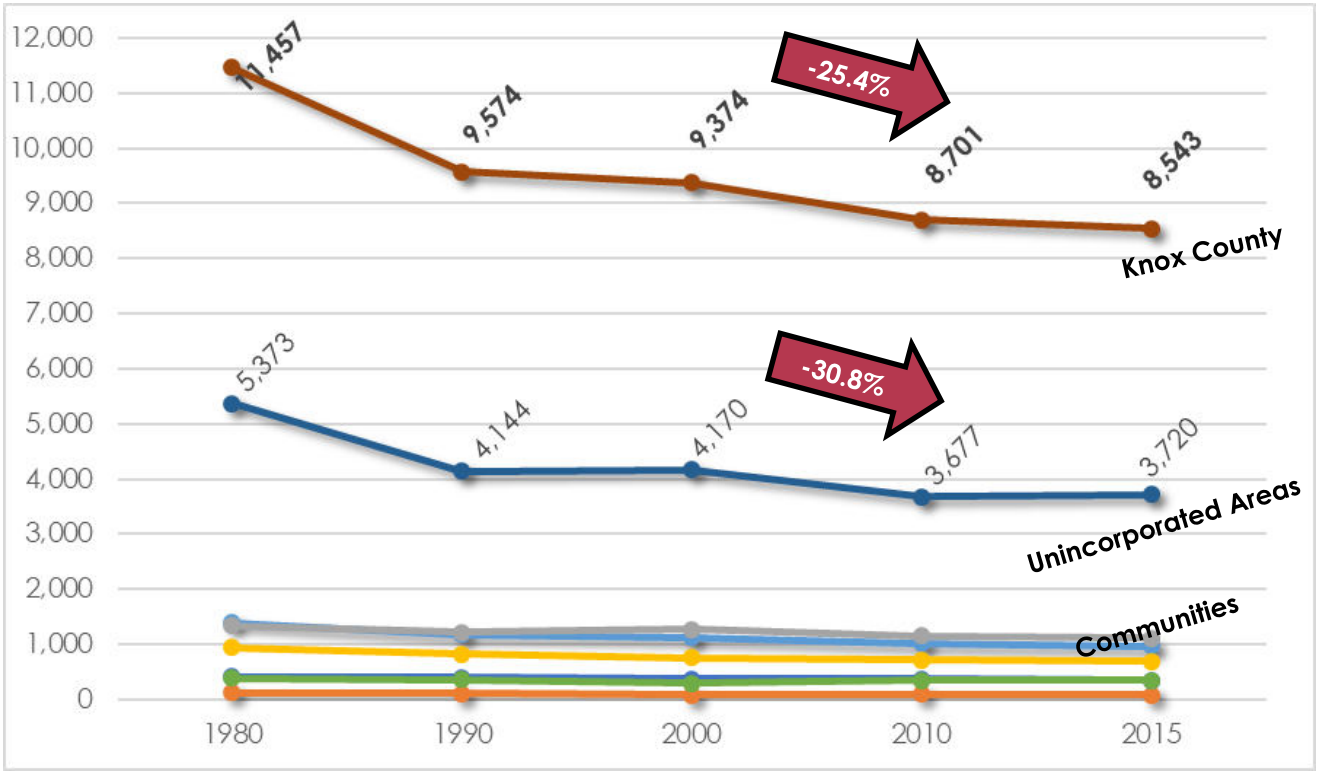
Projections provide an estimate for the County to base future land use and development decisions. However, population projections are only estimates and unforeseen factors may affect projections significantly.

Population Trends and Analysis

The population from 1980 until the 2015 estimates can be found in Figure 3.1 for Knox County, the incorporated communities within the county, and the unincorporated areas. The data provide a look at where the county has been and allows for the eventual projection of populations in the County. Figure 3.2 contains the population data for each community, for the same period, but shown at a legible scale.

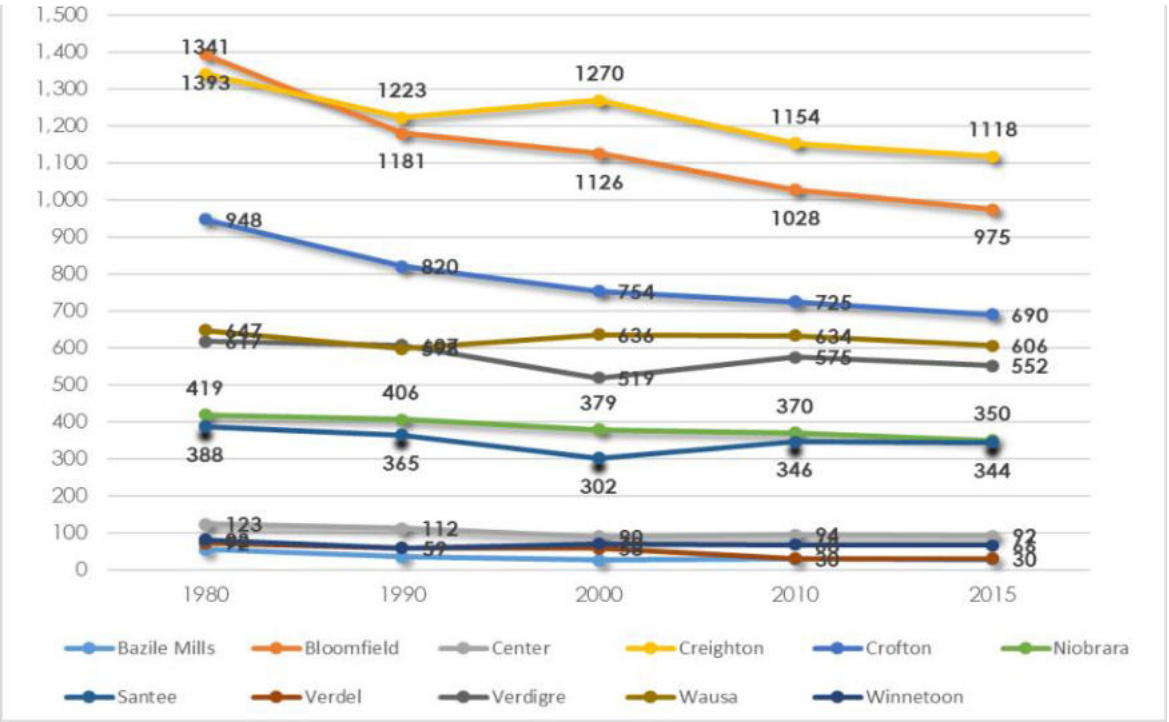
Overall, Knox County has seen a –25.4% (-2,914 people) decline in population from 1980 to 2015. This decrease was based upon the overall decrease in the unincorporated portions of the county. The unincorporated portions of Knox County declined by 1,653 people or –30.8% from 1980 to 2015. Growth within the municipalities has declined, however, their decline has been a little flatter than the unincorporated areas and the County as a whole.

FIGURE 3.1: POPULATION TRENDS AND ANALYSIS KNOX COUNTY 1980 TO 2015



Source: U.S. Census Bureau 1980 - 1990, 2000, 2010, 2015

FIGURE 3.2: COMMUNITY POPULATIONS KNOX COUNTY 1980 TO 2015



Source: U.S. Census Bureau 1980 - 1990, 2000, 2010, 2015

Migration Analysis

Migration Analysis is a toll which allows the County to understand critical dynamics of the population shifts. Total Migration indicates the population size migrating in or out of the County over a given period of time.

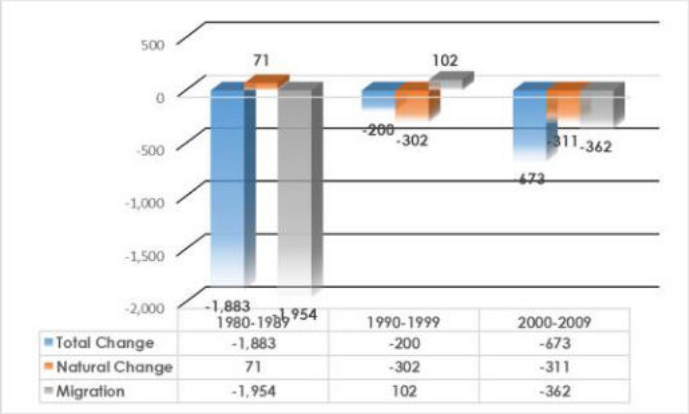


Figure 3.3: Migration Analysis Knox County 1980 to 2010

Sources: Nebraska DED 1994-2009
Nebraska DHHS, Vital Statistics Reports, 1980 – 1994

Figure 3.3 indicates the overall population change, countywide, as well as the two key components of population change, migration and natural change.

Overall from 1980 to 2010, Knox County has declined by 2,756 people. The overall decline was associated with out-migration, which saw 2,214 people move out of Knox County.

During the 30 year period births exceeded deaths only once, between 1980 and 1990. During the time period, there were 71 more births in Knox County than deaths. Finally, only between 1990 and 2000 did Knox County experience in-migration with 102 more people moving into the county than left.

Age Structure Analysis

Age structure is another important component of population analysis. By analyzing age structure, one can determine a key dynamic affecting the population of Knox County. Note: the data in Figure 3.3 is based on a calendar year and the data in Table 3.1 is as of April 1, 2000 and 2010; therefore the numbers may be slightly skewed.

Each age group affects the population in a number of different ways. For example, the existence of large younger age groups (20-44 years) means there is a greater ability to sustain future population growth compared to large older age groups. Understanding what is happening within the age groups of the county's population is necessary to effectively plan for the future.

	Male and Female Populations			2000-2010	
Age in 2000	2000 population	Age in 2010	2010 population	Cohort Change	% Change
		0-4	522	522	
		5-9	589	589	
0-4	539	10-14	630	91	16.9%
5-9	605	15-19	522	-83	-13.7%
10-14	772	20-24	296	-476	-61.7%
15-19	672	25-29	351	-321	-47.8%
20-24	323	30-34	396	73	22.6%
25-29	351	35-39	394	43	12.3%
30-34	405	40-44	454	49	12.1%
35-44	1,297	45-54	1,326	29	2.2%
45-54	1,279	55-64	1,242	-37	-2.9%
55-64	964	65-74	894	-70	-7.3%
65-74	988	75-84	717	-271	-27.4%
75 & older	1,179	85 and over	368	-811	-68.8%
Total	9,374		8,701	-673	-7.2%

Table 3.1: Age/Sex Characteristics

Source: U.S. Census Bureau 2000 and 2010

Table 3.1 contains the age group structure for Knox County in 2000 and 2010. The examination of age structure provides an understanding of where some of the population shifts are occurring. These data allow for a better understanding of what could occur in the future. Reviewing population in this manner permits a detailed analysis of which specific groups are moving in and out of the county. Negative changes in a group indicate out-migration or a combination of out-migration and deaths.

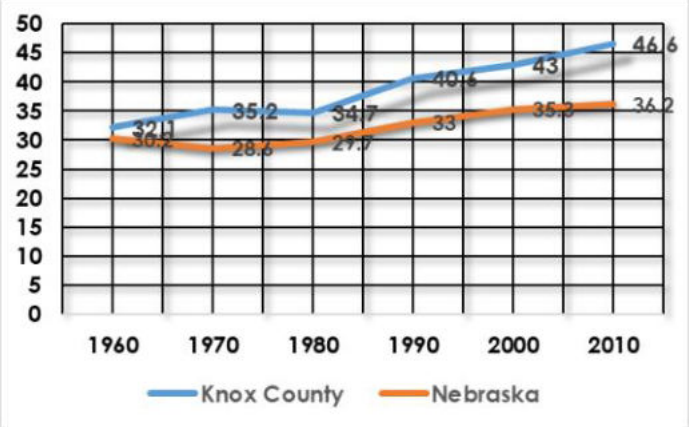
Knox County saw growth in seven age groups. The 0-4 and 5-9 groups are always an increase, since these individuals were not alive for the 2000 Census. Outside of the 2010 age groups of 0-4 and 5-9 years, the other increases were in the 10-14, 30-34, 35-39, 40-44, and 45-54 age groups. Overall, there was an increase of 1,396 persons in these age groups. When you eliminate the first two younger populations, there were 285 people that actually moved into Knox County during this period. This population increase consisted primarily of family aged adults and children.

There were seven age groups from 2000 that declined by 2010. The group with the greatest loss was the 85 years+ (2010), which lost 811 persons over the period. This loss can be attributed to two causes: 1) people moving on after 75 years to other communities and senior care facilities, or 2) a dying population base. The latter is likely the largest reason since between 2000 and 2010 there were 1,313 resident deaths in Knox County. Overall, Knox County had a more balanced population pattern occur during the ten year period compared to decreases seen in other decades. This included solid in-migration from family age groups and births.

Median Age

Between 1960 and 2010, the median age in Knox County increased from 32.1 years to 46.6 years. This increase equaled 2.9 years per decade or 45.2% for the entire period. During this period, the county saw a dip in the median age; it dropped to 34.7 years in 1980 and then began to climb again to its current level.

Figure 3.4: Median Age - 1960 to 2010



Source: U.S. Census Bureau 1950-2010

During the same period, Nebraska saw an increase in Median Age from 30.2 to 36.2 or 6.0 years (19.9%). Even though Nebraska's Median Age is increasing at a slower rate it has see a significant change for this period of time.

Dependency Ratio

Dependency ratios examine the portion of Knox County supporting age groups historically dependent upon others for survival (those under 18 years and those 65 years and older). See the box above for details on calculating the ratio. The importance of this ratio focuses on the number of dependent persons and is there enough employed persons in the county to support these populations as well as themselves.

Dependency Ratio

The dependency ratio examines the portion of a community's earnings that is spent supporting age groups typically and historically dependent on the incomes of others.

< 1: 1 Independent resident is able to support more than 1 Dependent resident

=1: 1 Independent resident able to support 1 Dependent resident

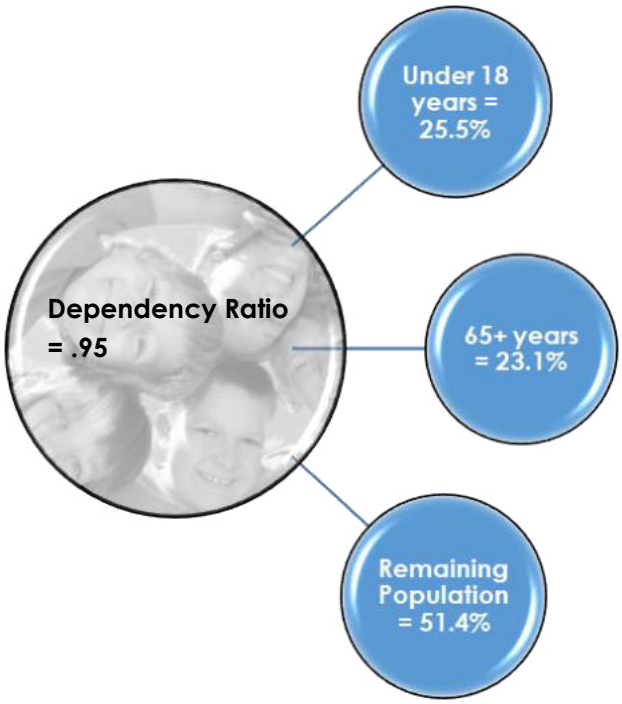
>1: 1 Independent resident able to support less than 1 Dependent resident

(%18 years and younger + %65 years and older)
% of remaining population

Figures 3.5 and 3.6 indicate the dependency ratios for 2000 and 2010 in Knox County. The portion of persons less than 18 years of age decreased by 5.5% between 2000 and 2010; while those aged 65 years and older increased by 3.5% overall.

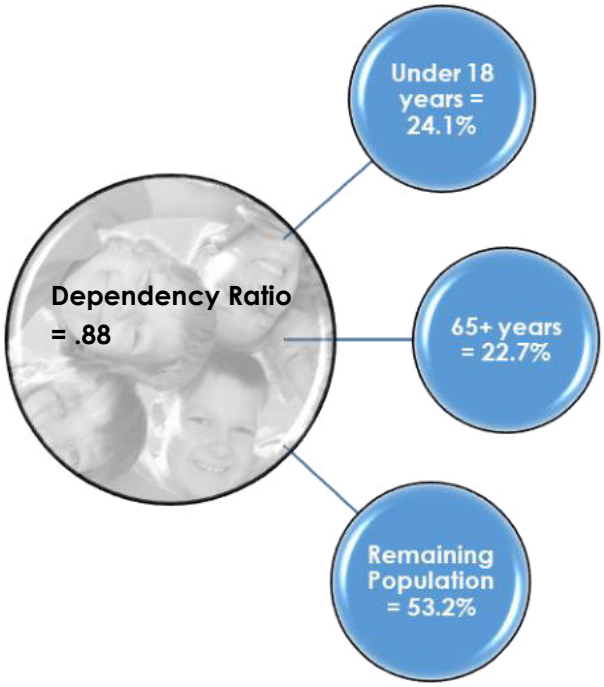
In 2000, Knox County had a Dependency Ratio of 0.95 (48.6%/51.4%); however, by 2010 the Ratio had decreased to 0.88 (46.8%/53.2%). This is supported by the slight decrease in the 18 and under age group, plus the slight increase in the 65 and older group.

Figure 3.5: Dependency Ratio - 2000



Source: U.S. Census Bureau 2000-2010

FIGURE 3.6: DEPENDENCY RATIO – 2010



Source: U.S. Census Bureau 2000-2010

ETHNICITY

Knox County during the past decade has seen a shift in the ethnicity within the County. Analysis of the ethnicity provides more detail as to the changes being seen in a county. Ethnicity is more than additional people living in the county since these new residents bring their own cultures and beliefs to the area; some of these may not mesh well with those already in place. The changes in Knox County saw increases in all non-white ethnic groups between 2000 and 2010; except for the Asian and Pacific Islander which lost two people and Other, non-Hispanics which lost 12 people during the period.

TABLE 3.2: POPULATION BY ETHNICITY

Race	2000		2010		2000-2010	
	Number	% of total	Number	% of total	Net Change	% change
White, not Hispanic	8,589	91.6	7,753	89.1	-836	-9.7
Black or African Am.	8	0.1	8	0.1	0	0.0
Am. Indian & AK. Native	667	7.1	786	9.0	119	17.8
Asian & Pacific Islander	19	0.2	17	0.2	-2	-10.5
Other, not Hispanic	32	0.3	20	0.2	-12	-37.5
Hispanic	85	0.9	155	1.8	70	82.4
Mexican	58	0.6	111	1.3	53	91.4
Puerto Rican	9	0.1	15	0.2	6	66.7
Cuban	0	0.0	2	0.0	2	-
Other Hispanic	18	0.2	27	0.3	9	50.0

Source: U.S. Census 2000 and 2010

The largest change was the Hispanic population, primarily Mexicans. The Hispanic population grew by 70 people between 2000 and 2010, the largest was those of Mexican ethnicity which accounted for 53 of the 70 people.

The second largest ethnic group was those classified as Other, not Hispanic. This classification saw nine new people come to Knox County between 2000 and 2010. In Nebraska, in recent years, these typically are people from Sudan and Somalia. These two groups present new issues for counties and communities, especially for law enforcement since these two cultures have historically not got along.

In addition, the White population had a 9.7% decrease overall, which equaled 836 fewer Caucasian people in the County. The County, communities, and school districts need to track these changes annually in order to minimize any potential fiscal impacts.

POPULATION PROJECTIONS

Population projections are estimates based upon past and present circumstances. The use of population projections allows Knox County to estimate the potential population in future years by looking at past trends. By scrutinizing population changes in this manner, the County will be able to develop a baseline of change from which future scenarios can be generated. A number of factors (demographics, economics, social, etc.) may affect projections positively or negatively.

At the present time, these projections are the best crystal ball Knox County has for predicting future population changes. There are many methods to project the future population trends; the projection technique used below are intended to give Knox County a broad overview of the possible population changes that could occur in the future.

TREND LINE ANALYSIS

Trend Line Analysis is a process of projecting future populations based upon changes during a specified period of time. In the analysis of Knox County, four different trend lines were reviewed: 2000 to 2010, 1980 to 2010, 1990 to 2010, and 1960 to 2010. A review of these trend lines indicates Knox County will see varied levels of population changes between now and 2040. The following projections summarize the decennial population for Knox County through 2040.

SUMMARY OF POPULATION PROJECTIONS

Three population projection scenarios were selected and include (1) a Low Series; (2) a Medium Series; and, (3) a High Series.

Knox County Trend Analysis

Year	1960 to 2010
2010	8,701 persons
2020	7,993 persons
2030	7,343 persons
2040	6,745 persons

Year	1980 to 2010
2010	8,701 persons
2020	7,938 persons
2030	7,243 persons
2040	6,608 persons

Year	1990 to 2010
2010	8,701 persons
2020	8,312 persons
2030	7,941 persons
2040	7,586 persons

Year	2000 to 2010
2010	8,701 persons
2020	8,076 persons
2030	7,496 persons
2040	6,958 persons

Low = *1980 to 2010*

2020	7,938 persons
2030	7,243 persons
2040	6,608 persons

Medium = *2000 to 2010*

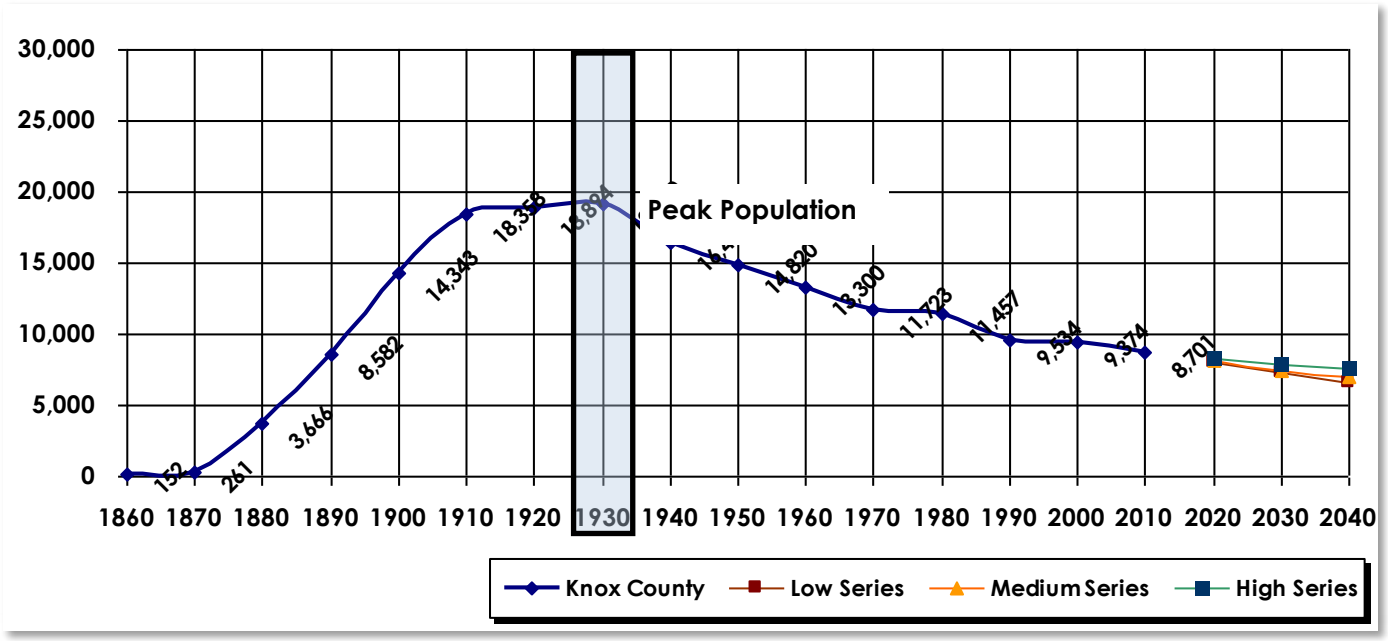
2020	8,076 persons
2030	7,496 persons
2040	6,958 persons

High = 1990 to 2010

2020	8,312 persons
2030	7,941 persons
2040	7,586 persons

Figure 3.7 reviews the population history of Knox County between 1860 and 2010, and identifies the three population projection scenarios into the years 2020, 2030, and 2040. Figure 3.5 indicates the peak population for Knox County occurred in 1890.

FIGURE 3.7: POPULATION AND PROJECTIONS



Source: U.S. Census Bureau 1980 - 1990, 2000, 2010, 2015

Chapter 4 Housing

Housing Profile

The Housing Profile identifies existing housing characteristics and conditions for Knox County. The primary goal of the housing profile is to allow the County to examine past and present conditions; while, identifying potential needs including provisions for safe, decent, sanitary, and affordable housing for every family and individual residing within the County.

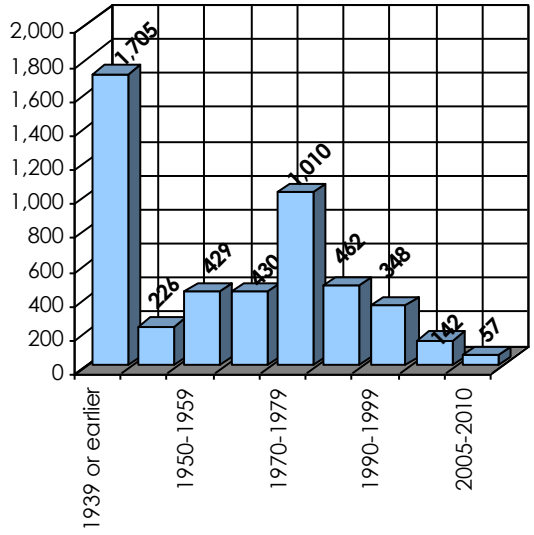
Projecting future housing needs requires several factors to be considered. These factors include population change, household income, employment rates, land use patterns, and residents' attitudes.

The following tables and figures provide the information to aid in determining future housing needs and develop policies designed to accomplish the housing goals for Knox County.

Age of Existing Housing Stock

An analysis of the housing stock age can reveal a great deal about population and economic conditions of the past. Examining the housing stock is important in order to understand the overall quality of housing in Knox County.

Figure 4.1: Age of Existing Housing Stock Knox County 2010



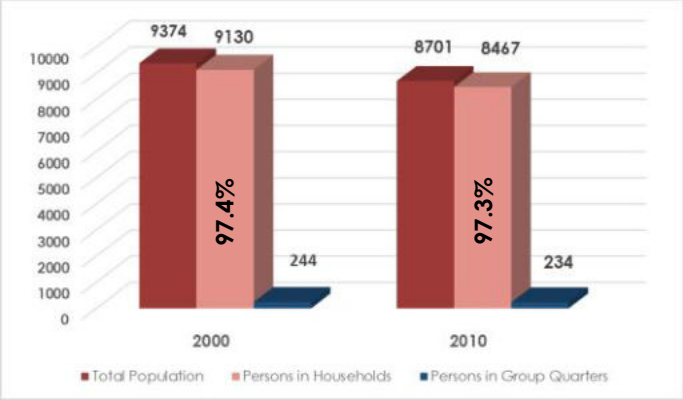
Sources: U.S. Census Bureau
American Community Survey 2010

Figure 4.1 indicates 1,705 homes, or 35.4% of Knox County's 4,809 total housing units, were constructed prior to 1940. This statistic is county-wide, including each community, and will consist of older well-kept homes as well as homes likely in need of repair or demolition.

Knox County saw very positive construction activity between 1950 and 1990 with 2,331 (48.5%) homes constructed. This was especially true between 1970 and 1980 which saw 1,010 (21.0%) new homes built during the decade. These data indicate the economy was relatively good during these decades. However, in recent years the construction of new homes has slowed.

A total of 79.0% of all housing units in Knox County were constructed prior to 1980. Due to the age of these homes, there may be a need for special weatherization programs in the County and communities to bring these homes up to current energy efficiency standards.

FIGURE 4.2: HOUSING POPULATIONS



Sources: U.S. Census Bureau
American Community Survey 2010

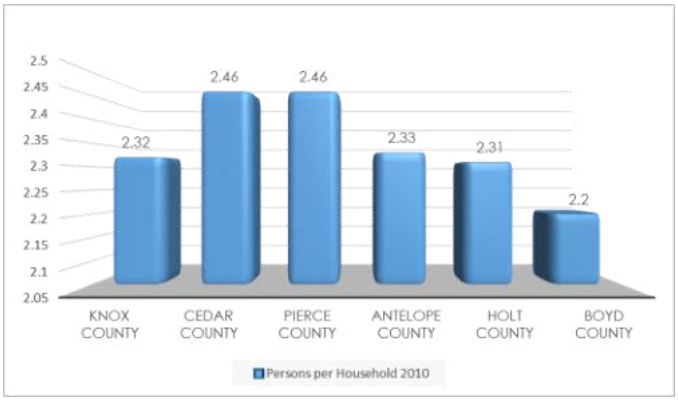
HOUSING CHARACTERISTICS

Figures 4.2 through 4.10 identify several different housing characteristics in Knox County. The figures indicate the breakdown between owner– and renter-occupied housing as well as the number of people living in group quarters.

Persons in Households/Group Quarters

In 2010 there were 673 fewer people living in households than in 2000, this represents a change of -7.2%. The decrease in persons in households is identical to the actual population decrease of 7.2% seen for the same period. Between 2000 and 2010, the number of people living in group quarters went from 244 people in 2000 to 234 in 2010, a change of –4.1%.

FIGURE 4.3: PERSONS PER HOUSEHOLD - 2010



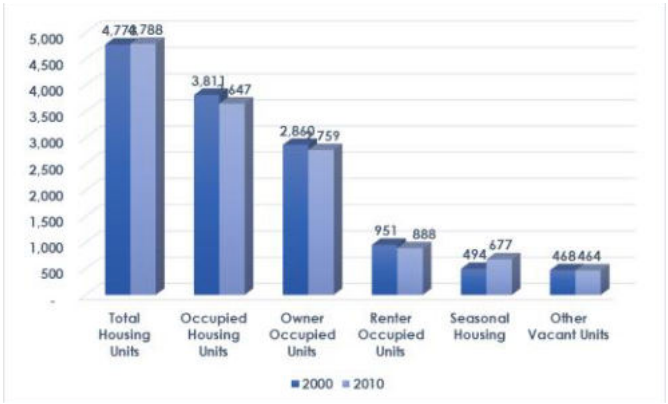
Sources: U.S. Census Bureau, American Community Survey 2010

Persons per Household

Figure 4.3 also includes the number of persons per household. The average persons per household in Knox County decreased from 2.40 to 2.32 persons between 2000 and 2010. The trend nationally has been towards a declining household size; however, the persons per household in Knox County is slightly less than surrounding counties with the exception of Holt and Boyd Counties. The surrounding counties in 2010 were:

- Cedar County has 2.46 persons/household
- Pierce County has 2.46 persons/household
- Antelope County has 2.33 persons/household
- Holt County has 2.31 persons/household
- Boyd County has 2.20 persons/household

FIGURE 4.4: OCCUPIED VS. VACANT HOUSING



Sources: U.S. Census Bureau, American Community Survey 2000/2010

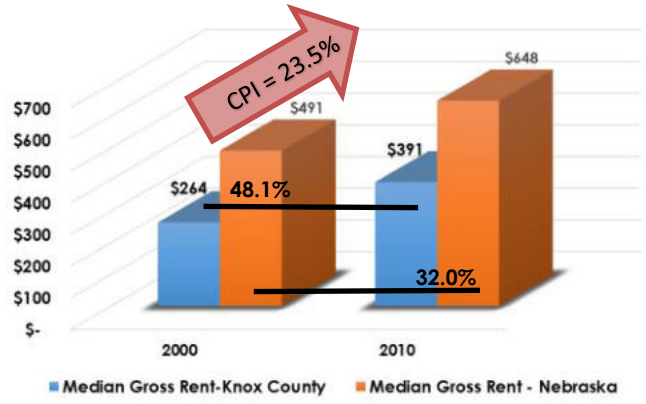
Occupied vs. Vacant Housing Units

Occupied housing units in the County decreased by 4.3% between 2000 to 2010; this was a 164 unit decrease over 2000. During the same time frame, vacant housing units grew from 962 units to 1,141 units or 18.6%. The largest increase in vacancy rates was in the renter-occupied units. The overall percentage for owner– and renter-occupied units in 2010 was at 1.4% and 10.2% respectively. Owner-occupied units showed a decreases over 2000; while, renter occupied increased for the same period.

FIGURE 4.5: VACANCY RATES BY TYPE OF UNIT

Sources: U.S. Census Bureau, American Community Survey

FIGURE 4.6: MEDIAN GROSS RENT KNOX COUNTY AND NEBRASKA 2000-2010



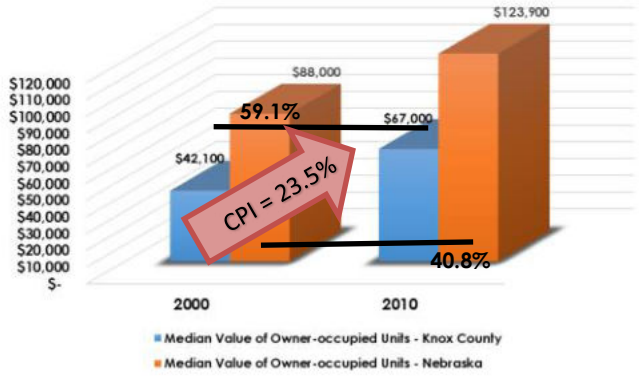
Sources: U.S. Census Bureau, American Community Survey 2000/2010

Median Gross Rent

Median gross rent in Knox County increased from $264 per month in 2000 to $391 per month in 2010, or 48.1%. The State's median monthly gross rent increased by 32.0%. This indicates Knox County has seen a gross rent increase 1.5 times more than the State. However, the County's median gross rent was 53.7% of the State's median gross rent in 2000 and 60.3% in 2010.

Comparing changes in monthly rents between 2000 and 2010, with the Consumer Price Index (CPI), enables the local housing market to be compared to national economic conditions. Inflation between 2000 and 2010 increased at a rate of 23.5%, indicating Knox County's rents increased by nearly double the rate of inflation for the 10-year period. Thus on average, Knox County tenants were paying considerably more in monthly rents in 2010, in terms of real dollars, than they were in 2000. Landlords were potentially making more on their investment.

FIGURE 4.7: MEDIAN VALUE OWNER-OCCUPIED KNOX COUNTY AND NEBRASKA 2000-2010



Sources: U.S. Census Bureau, American Community Survey 2000/2010

Median Value of Owner-Occupied Units

The Median value of owner-occupied housing units in Knox County increased from $42,100 in 2000 to $67,000 in 2010, and represents an increase of 59.1%. The median value for owner-occupied housing units in the State showed an increase of 40.8%. Housing values in Knox County grew at approximately 1.5 times faster than the state. In addition, the median value of an owner-occupied unit in Knox County was 47.8% of the state median in 2000 and 54.0% in 2010.

In comparison to the CPI, the local value of owner-occupied housing increased at a rate greater than the CPI. This indicates housing values in the County were worth more in 2010 compared to 2000 dollars.

Persons Per Household

Figure 4.8 and 4.9 show tenure (owner-occupied and renter-occupied) of households by number and age of persons in each housing unit. Analyzing these data gives Knox County the opportunity to determine where there may be a need for additional housing.

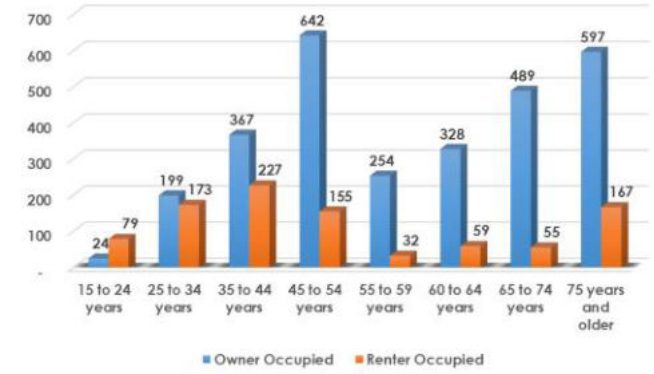
FIGURE 4.8: PERSONS BY HOUSEHOLD TYPE - 2010

Sources: American Community Survey 2010

In 2010, the largest section of owner-occupied housing in Knox County was in the two-person household, with 1,285 units or 44.3% of the total owner-occupied units. By comparison, the largest household size for rentals was the single-person households with 435 renter-occupied housing units, or 45.9% of the total renter-occupied units.

In 2010, the age cohorts representing the largest home ownership group were those 45 to 54 years. Of the total residents living in owner-occupied housing units, 22.1% were between 45 and 54 years of age. The 75 and over was a close second with 20.6% of the total owner-occupied units.

FIGURE 4.9: AGE BY HOUSEHOLD TYPE - 2010

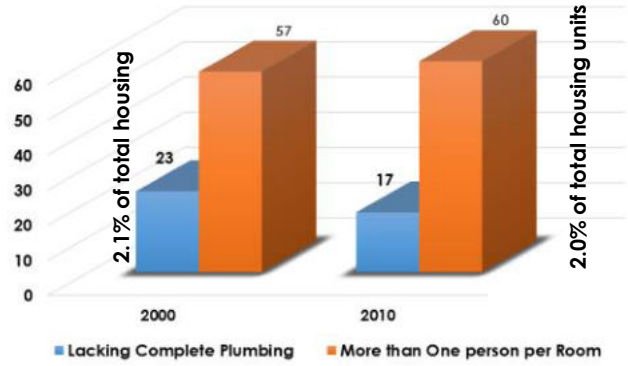


Sources: American Community Survey 2010

The renter-occupied housing was also dominated by the three different cohort groups; 35 to 44 (23.9%), 25 to 34 years (18.3%) and 75 years and older (17.6%). These three cohorts represent 59.8% of all the renter-occupied units in 2010.

Knox County was comprised of 2,665 1- or 2-person households, or 69.3% of all households; which represents 7/10 households in Knox County. Countywide, households with 5- or more persons accounted for 352 units, or 9.2% of the total.

FIGURE 4.10: SUBSTANDARD HOUSING CONDITIONS



Sources: U.S. Census Bureau 2000, ACS 2010

Substandard Housing

According to the U.S. Department of Housing and Urban Development (HUD) guidelines, housing units lacking complete plumbing or that are overcrowded are considered substandard housing units. HUD defines a complete plumbing facility as hot and cold-piped water, a bathtub or shower, and a flush toilet; overcrowding is more than one person per room. In addition, anytime there is more than 1.0 persons per room, the housing unit is considered overcrowded, thus substandard.

This criteria, when applied to Knox County, 80 units were substandard in 2000. This figure was reached by adding the number of housing units meeting one criterion to the number of housing units meeting the other criterion. However, the largest amount of substandard units was based on overcrowding with 57 units.

In 2010, the total number of substandard housing units decreased to 77 units. The primary contributing factor was overcrowding, which accounted for nearly 78% of the substandard issue.

What these data fail to consider are housing units that have met both criterion and counted twice. Even so, the County should not assume these data overestimate the number of substandard housing. Housing units containing major defects requiring rehabilitation or upgrading to meet building, electrical, or plumbing codes should also be included in an analysis of substandard housing. A comprehensive survey of the entire housing stock should be completed every five years to determine and identify the housing units that would benefit

from remodeling or rehabilitation work. This process will help ensure that a county maintains a high quality of life for its residents through protecting the quality and quantity of its housing stock.

Housing Goals, Objectives and Policies

Housing Goal 1

Provide quality housing throughout the county.

Housing Policies and Strategies

H-4.1.1 The county should work with local agencies to provide quality housing.

H-4.1.2 A program to identify substandard housing units throughout Knox County should be a priority and substandard housing units should be repaired or demolished.

H-4.1.3 The County should continually work with each community as they strive to provide better housing within the corporate limits.

Housing Goal 2

Affordable housing should be available throughout the county.

Housing Policies and Strategies

H-4.2.1 The county should continue to focus on affirmatively furthering fair housing throughout the entire county area.

H-4.2.2 The zoning and subdivision regulations should accommodate specific tools such as planned unit developments in order to aid in minimizing required improvements within developments.

H-4.2.3 The County should continually work with each community as they strive to provide better housing within the corporate limits.

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Chapter 5 Economy and Economic Development

Economic and Employment Profile

Economic data are collected in order to understand local changes in economic activity and employment needs and opportunities within Knox County. In this section, employment by industry, household income statistics, and commuter analyses were reviewed for Knox County and Nebraska.

Income Statistics

Income statistics for households are important in determining the earning power of households in a county. The data within show household income levels for Knox County in comparison to the state. These data were reviewed to determine whether households experienced income increases at a rate comparable to the state of Nebraska and the Consumer Price Index (CPI).

Figure 5.1 indicates the number of households in each income range for Knox County for 2000 and 2010. In 2000, the household income range most commonly reported was $15,000 to $24,999, which accounted for 20.8% of all households.

In 2010, the income range reported most was the $50,000 to $74,999 and represented 24.1% of the total households.

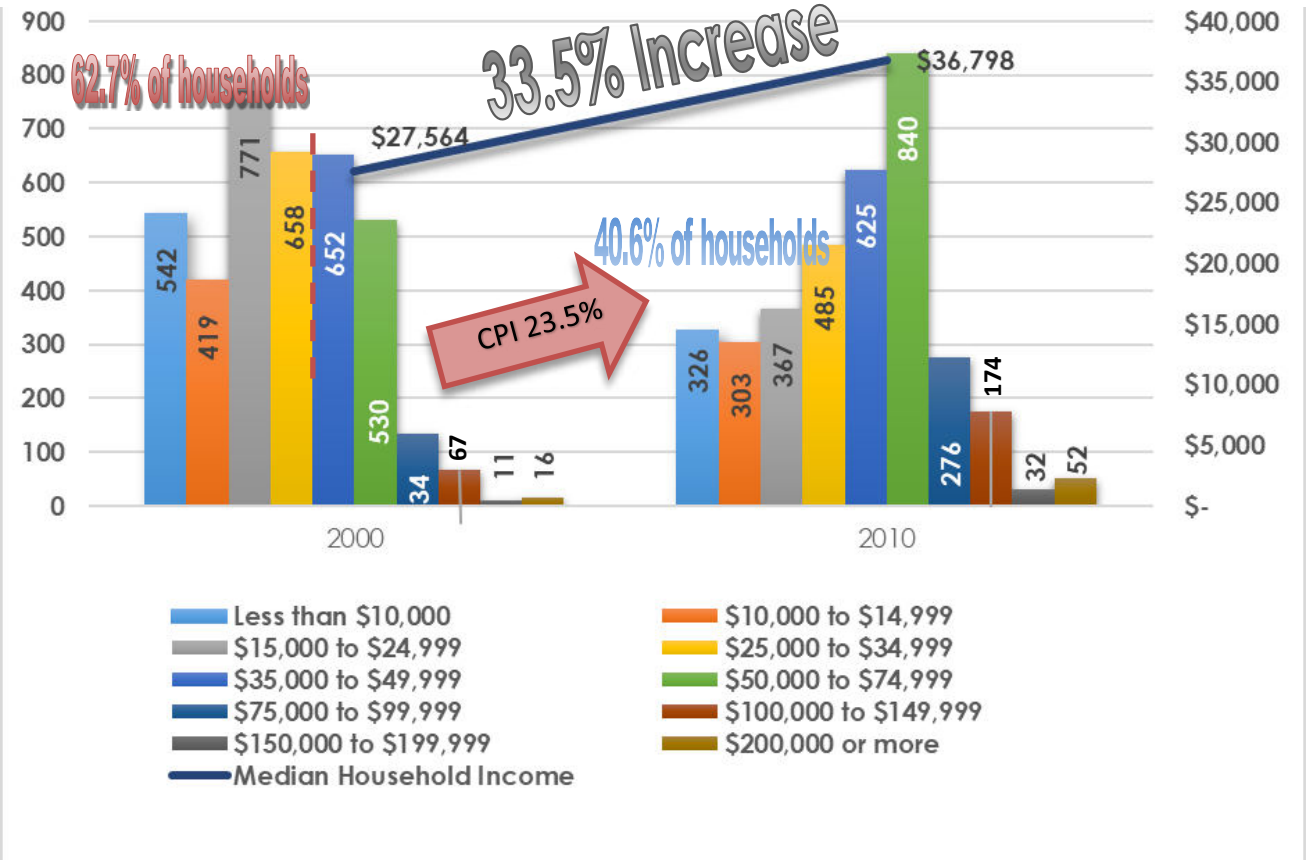
Those households earning less than $15,000 decreased from 26.0% in 2000 to 18.1% in 2010. The level of change was based upon more households moving into the middle to lower-high income ranges. However, those households earning less than $15,000 account for the poorest of the poor in the county.

In addition, the households earning less than $35,000 in 2000 accounted for 64.6% of the households. By 2010 these households had decreased to 42.6% of the households.

The median household income for Knox County was $27,564 in 2000, which was considerably less than State median income of $39,250. By 2010, the median household income increased to $36,798 or an increase of 33.5%. However, the 2010 median household income was still less than the 2000 State of Nebraska median household income.

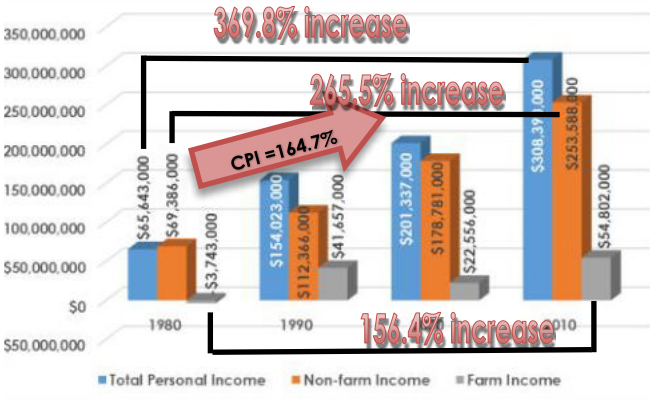
The CPI for this period was 23.5%, which indicates household incomes in Knox County exceeded inflation. Therefore, households were actually earning more in real dollars in 2010 than in 2000. This difference basically indicates for every $1.00 earned in a household during 2000, it was earning $1.10 in 2010.

FIGURE 5.1: HOUSEHOLD INCOME



Source: U.S. Census Bureau, 2000, American Community Survey 2006-2010

FIGURE 5.2: INCOME BY SOURCE 1980 TO 2010



Source: BEA, Regional Economic Information System, 2016

Income Source/Public Assistance

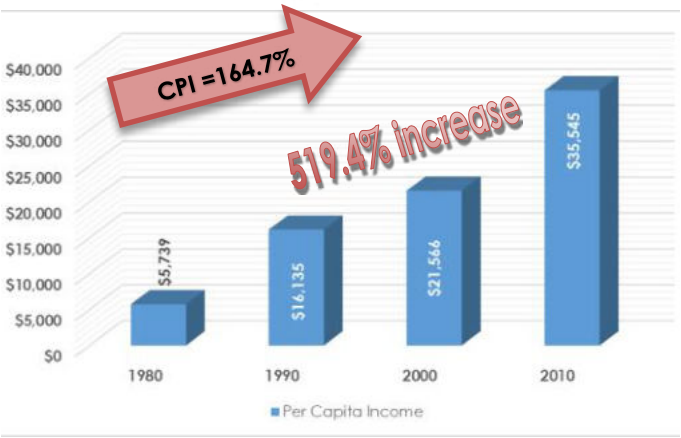
The graph to the left shows personal income by source for Knox County. These data are compared to the CPI, in order to determine if increases are consistent with inflation and in terms of real dollars. Between 1980 and 2010, the CPI was 164.7%.

Overall Personal Income in Knox County went from $65,643,000, in 1980, to $308,390,000, in 2010 or an overall increase of 369.8%. Total personal income for the county increased at over twice the rate of inflation over the 30 year period.

Non-farm and Farm Income

Non-farm income increased from $69,386,000 in 1980 to $253,588,000 in 2010, or an increase of 365.5%, which was 1.6 times the CPI. By 2010, farm income had risen from $-3,743,000 to $54,802,000, or 156.4%, which is slightly less than the CPI.

FIGURE 5.3: PER CAPITA INCOME



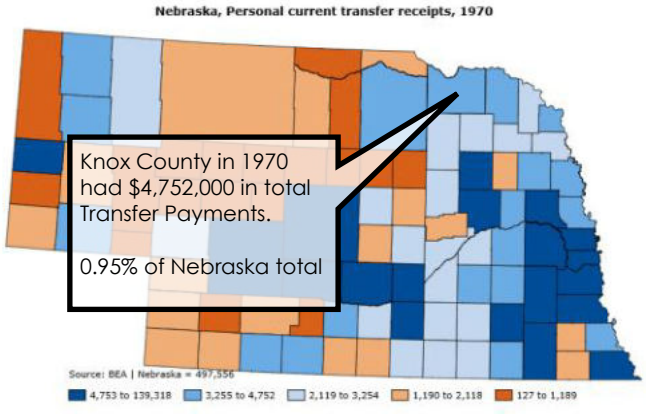
Source: BEA, Regional Economic Information System, 2016

Per Capita Income

The per capita income in Knox County increased from $5,739 in 1980 to $35,545 in 2010, or an increase of 519.5%, which was over three times the CPI. Knox County's per capita income was 88.6% of the state's per capita income level of $40,023.

Another income source deserving examination is the amount of Transfer Payments to individuals in Knox County from 1970 to 2010, which is provided in Figure 5.4 and 5.5. Note the total amount of Transfer Payments equals Government Payments to Individuals plus Payments to Non-Profit Institutions plus Business Payments. The remaining categories listed in the table are subsets of the Government Payments to Individuals category.

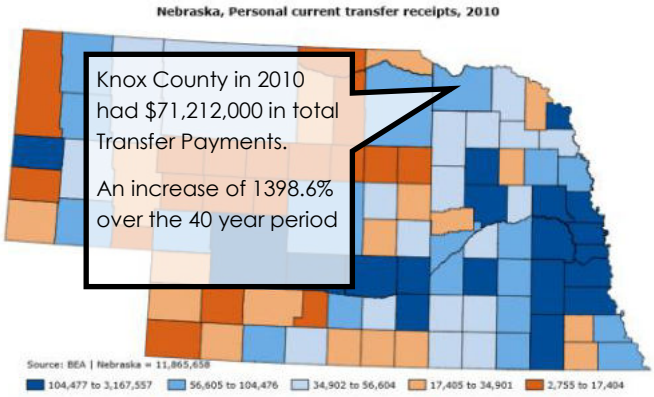
FIGURE 5.4: TRANSFER PAYMENTS 1970



Source: Bureau of Economic Analysis, Regional Economic Information System, 2016

In 1970, Total Transfer Payments to Knox County added up to $4,752,000. By 2010, Total Transfer Payments to Knox County were $71,212,000, or an increase of 1,398.6. Figure 5.6 shows in 2010, transfer payments per capita in Knox County were $6,614.

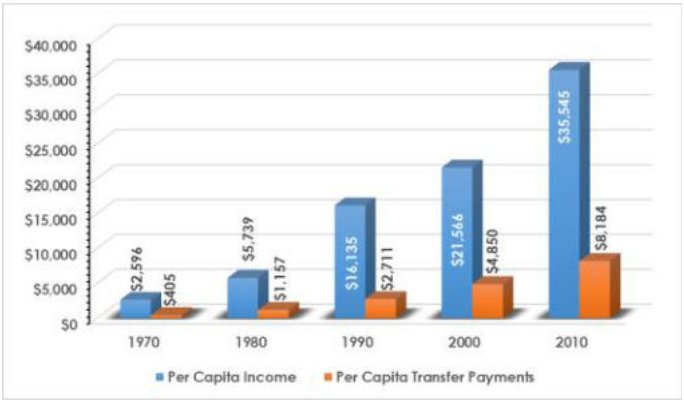
FIGURE 5.5: TRANSFER PAYMENTS 2010



Source: Bureau of Economic Analysis, Regional Economic

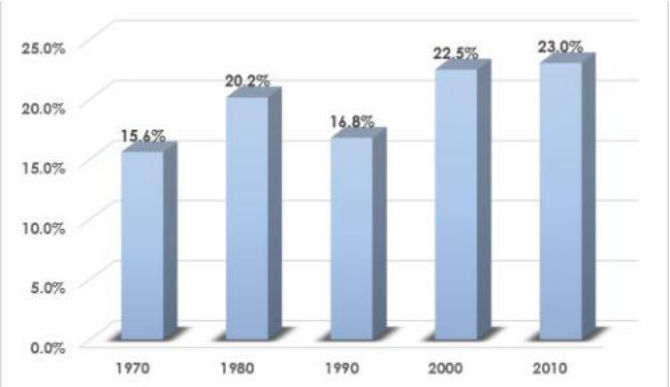
The trend for transfer payments per capita between 1970 and 2010 indicates payments increased significantly to individuals in Knox County, increasing by over 1,920% in 40 years. However, transfer payments, as a proportion of per capita income, increased at a much lower rate between 1970 and 2010. In 1970, transfer payments comprised 15.6% of total per capita income, and in 2010, transfer payments were 23.0% of total per capita income, which is an annual increase of 1.9%.

FIGURE 5.6: TRANSFER PAYMENTS PER CAPITA



Source: Bureau of Economic Analysis, Regional Economic

FIGURE 5.7: TRANSFER PAYMENTS PER CAPITA/PER CAPITA INCOME 1970 –2010



Source: Bureau of Economic Analysis, Regional Economic

Industry Employment

Analyzing employment by industry assists a community in determining the key components of their labor force. This section indicates the type of industries making up the local economy, as well as identifying particular occupations employing residents. Figure 5.8 indicates employment size by industry for Knox County for 2000 and 2010 (these data indicate the types of jobs residents have, not the number of jobs locally).

The employment sector with the most employees in 2000 was Education, health, and social services. This sector employed 1,165 people or 27.7% of the total employed residents in 2000. In 2010, the largest employment sector was still Educational, health, and social services with 1,028 employees or 24.2% of the total. Knox County has seen major fluctuations during the time period in Figure 5.8.

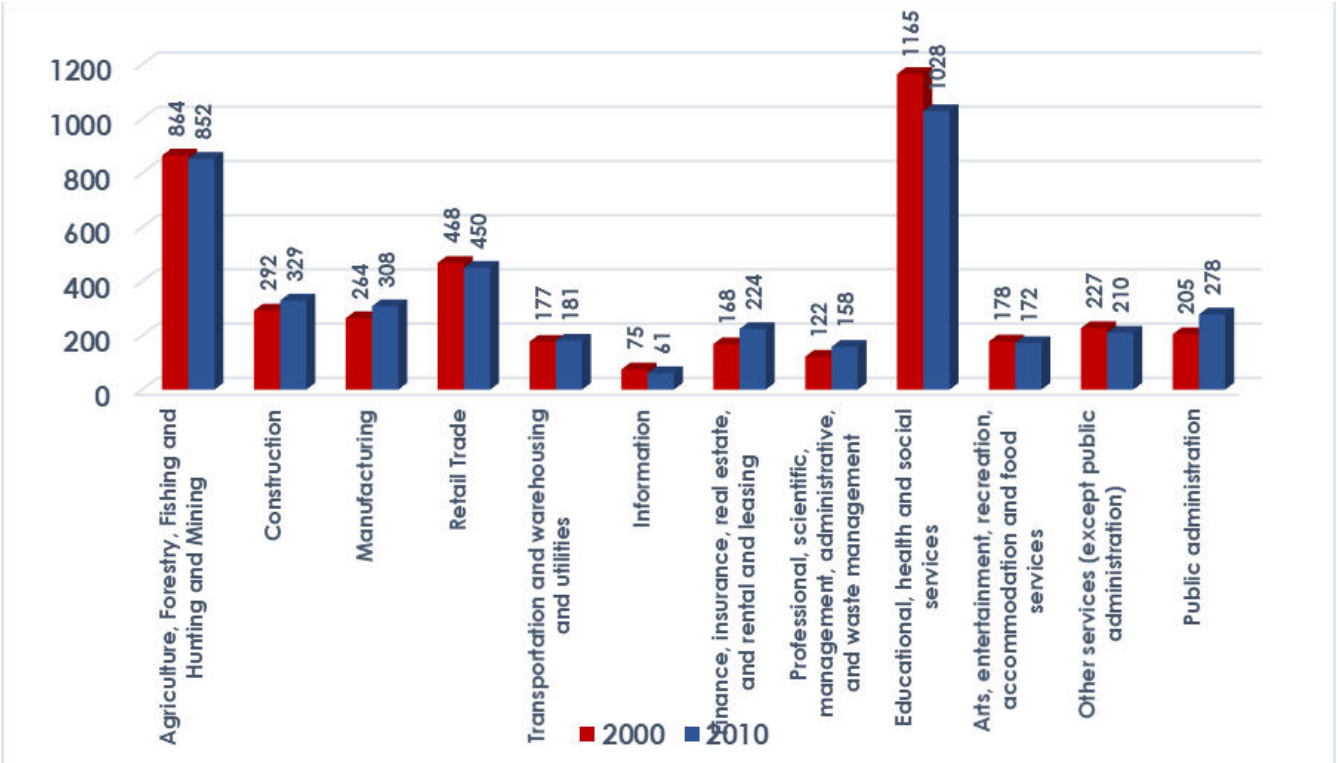
Overall the top five industries in Knox County for 2000 were as follows:

Industry	***People***
• Educational, health, and social services	1,165
• Ag./forestry/Fishing/and Hunting and Mining	864
• Retail Trade	468
• Construction	292
• Manufacturing	364

By 2010, the overall top five industries in Knox County were as follows:

Industry	***People***
• Educational, health, and social services	1,028
• Ag./forestry/Fishing/and Hunting and Mining	852
• Retail Trade	450
• Construction	329
• Manufacturing	308

FIGURE 5.8: EMPLOYMENT BY INDUSTRY (NUMBERS)



Source: U.S. Census Bureau 2000, American Community Survey 2005-2009

Regional Basic/Non-Basic Analysis

The following data examine five occupational areas established by the U.S. Census Bureau to evaluate trends in employment and the area economy. Basic employment and non-basic employment are defined as follows:

> ***Basic employment is business activity providing services primarily outside the area through the sale of goods and services, the revenues of which are directed to the local area in the form of wages and payments to local suppliers.***
>
> ***Non-Basic employment is business activity providing services primarily within the local area through the sale of goods and services, and the revenues of such sales re -circulate within the community in the form of wages and expenditures by local citizens.***

In order to establish a number of Basic jobs, a comparative segment or entity must be selected. For purposes of this analysis, the state of Nebraska will be used. This allows the analysis to establish where Knox County is seeing exports from the state as a whole.

TABLE 5.1: BASIC/NON-BASIC BY OCCUPATIONS - 2010

Location	Management business, science, and arts occupations	Service occupations	Sales and office occupations	Natural Resources, construction and maintenance occupations	Production, transportation, and material moving occupations	Base Multiplier
Knox County	**35.2%**	**18.0%**	20.1%	**14.6%**	12.2%	**13.9**
Cedar County	33.5%	15.5%	20.6%	**15.4%**	**15.0%**	**14.4**
Pierce County	31.6%	15.9%	17.9%	**13.9%**	**20.8%**	**8.3**
Antelope County	**36.5%**	11.4%	23.9%	**15.4%**	12.8%	**13.3**
Holt County	34.2%	**17.0%**	20.7%	**15.5%**	12.7%	**15.1**
Boyd County	**40.5%**	**16.4%**	16.5%	**15.9%**	10.7%	**7.5**
Nebraska	34.8%	16.2%	25.0%	10.1%	13.8%	NA

Source: American Community Survey 2006-2010

This analysis is used to further understand which occupational areas are exporting goods and services outside the area, thus importing dollars into the local economy. The five occupational categories used in the analysis are listed below:

- Managerial business, science, and arts occupations
- Service occupations
- Sales and office occupations
- Natural Resources, construction and maintenance occupations
- Production, transportation and material moving occupations

A related concept to the basic/non-basic distinction is the Base Multiplier. The base multiplier is a number, which represents how many non-basic jobs are supported by each basic job. A high base multiplier means that the loss of one basic job will have a large potential impact on the local economy if changes in employment occur. The rationale behind this analysis is that if basic jobs bring new money into a local economy, that money becomes the wages for workers in that economy. Therefore, more money brought in by basic jobs creates more non-basic jobs that are supported.

Basic Employment

The occupation categories are compared to the same categories for the state and where Knox County's percentage exceeds the state's percentage there is Basic employment. Table 5.1 indicates there are three categories having Basic employment with the largest being Natural Resources, construction and maintenance occupations. The other two occupation sectors are Service occupations, and Management business, science, and arts occupation.

Overall, 6.7% of the employment base in Knox County is tied to the exportation of goods or services. The county needs to continually work on their Business Retention and Expansion process in

order to make these employers stay in Knox County.

Base Multiplier

The information in Table 5.1 shows Knox County has a base multiplier of 13.9, which means for every job considered to be basic, 13.9 other jobs in the county are supported and/or impacted. This is illustrated by comparing the basic and non-basic percentages against each other.

This indicates for every job tied to exportation of goods or services, there are 13.9 jobs created/ supported by the dollars coming into the community. Therefore, if Knox County lost just one of the jobs tied to exports then there is the potential to lose approximately 13.9 jobs from the non-basic employment side.

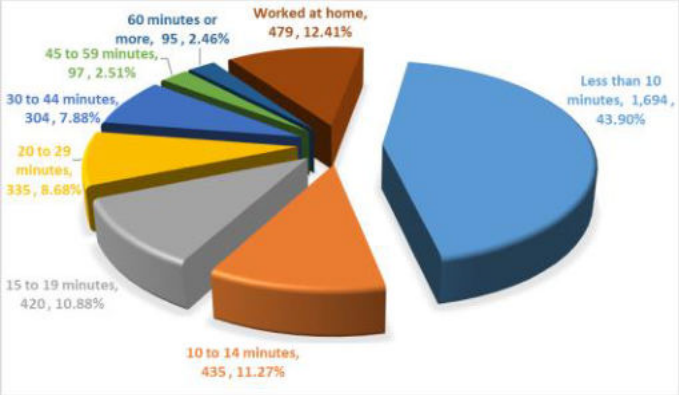
There is no magical multiplier a county can aim to achieve. Every county is different and the dynamics involved are different. The unique and ever changing dynamics are what make a particular county unique and attractive to different employers. It is critical for a county to determine their future vision for business and industry and work towards that end. As previously mentioned it is also critical to diligently work towards a successful Business Retention and Expansion program to support those employers already located in the county. Some counties become too focused on attracting the next big catch and forget about the opportunities existing employers can offer through expansion of their operations.

Commuter Trends

Figure 5.9 show the commuter characteristics for Knox County in 2010. Travel time to work is another factor used to gauge where Knox County's workforce is employed. Figure 5.9 shows how many residents of Knox County travel to work in each of several time categories.

Figure 5.9 indicates, in 2010, 43.9% of the commuters were traveling 10 minutes or less to work. In addition, 479 people or 12.41% work from home. Those traveling 20 minutes or more to work totaled 831 people or 21.53% of those driving to work.

Figure 5.9: Travel Time to Work - 2010



Source: American Community Survey 2005-2010

Agricultural Profile

Table 5.2 identifies key components affecting Knox County's agricultural profile. This Table examines the number of farms, size of these farms, cropland data, and certain value criteria for these farms. The data are for 1997 through 2017.

Number of Farms

The table indicates the number of farms within Knox County decreased between 1997 and 2017, which was the norm throughout Nebraska. The total number of farms decreased from 1,053 in 1997 to 956 in 2017, a change of –9.2%.

Land in Farms/Average size of Farms/Cropland

Table 5.2 also shows the total land in farms within Knox County. From 1997 to 2017, Knox County actually had an increase in the total land considered to be in farms. The overall increase was 0.9% or an approximate increase of 5,000 acres. The total land in farms accounts for 82.4% of the total acres in Knox County, which is a increase from 81.6% in 1997.

The average size of each farm increased from 566 acres in 1997 to 628 in 2017. This trend has been the norm across Nebraska and the United States for the last several decades. The overall increase was 11.0%. The total cropland in Knox County decreased from 327,165 acres in 1997 to 323,551 acres in 2017.

The next data to review is harvested cropland. Harvested cropland is as it sounds- cropland actually harvested and yielded a crop. In 1997, the Harvested Cropland in Knox County was 242,595 (74.2%) of Total Cropland and only 40.7% of the Total Land in Farms). By 2017 the Harvested Cropland increased to 275,534 acres (85.2%) of Total Cropland and only 45.8% of the Total Land in Farms).

Estimated Market Value

Table 5.2 also shows the Estimated Market Values of Land and Buildings, both by average per farm and average per acre. In 1997 the average value per farm acre was $497. The average value increased in every Census of Agriculture until it reached an average per acre of $3,345 in 2017; an increase of 573.0%. The CPI for this same period was approximately 46.7%; therefore the average value per acre increased at over 10 times the rate of inflation in Knox County.

The increase in the average per acre also translates into an increase in the average per farm. The average value per farm in 1997 was $294,024 and increased to $2,102,065 in 2017, an overall increase of 614.9%. Again, this increase exceeded the CPI and the rate of inflation for the period. The average per farm, statewide, was $550,705 in 1997 and $2,674,492 in 2017, an increase of 385.6%. Therefore, the average farm value in Knox County is slightly less than the state average but the value has been growing at a greater rate than the state.

Table 5.3 indicates the number of farms by size from 1997 to 2017. The category with the greatest increases were in the farms averaging 10 to 49 acres, increasing by 37 farms or 46.8%. However, the farms with 500 or more acres saw an overall decline, going from 423 farms in 1997 to 355 farms in 2017, a total change of –16.1%. Overall, Knox County went from 1,053 farms in 1997 to 956 farms in 2017 or a change of –9.2% for the period.

TABLE 5.3: NUMBER OF FARMS BY SIZE KNOX COUNTY 1992 TO 2017

Farm Size (acres)	1997	2002	2007	2012	2017	% Change 1997-2017
1 to 9	49	28	19	47	56	14.3%
10 to 49	79	66	79	142	116	46.8%
50 to 179	189	201	178	201	201	6.3%
180 to 499	313	298	219	279	228	-27.2%
500 to 999	262	248	206	219	171	-34.7%
1,000 or more	161	175	162	192	184	14.3%
Total	**1,053**	**1,016**	**863**	**1,080**	**956**	**-9.2%**

Source: U.S. Census of Agriculture, 1997, 2002, 2007, 2012, 2017

Table 5.4 indicates the number of farms and livestock by type for Knox County between 1997 and 2017. The predominant livestock raised in Knox County have been cattle and calves. Cattle and calves have been followed closely by Hogs and Pigs. Both types of livestock production saw decreases in the total operations in place. Both of these operation types saw an increase in the Average Number of Livestock Per Farm; Cow and calves went from 167 animals in 1997 to 225 per farm in 2017, which is the peak during the period. Hogs and pigs went from 433 per farm in 1997 to 1,673 per farm in 2017. There were two categories which actually saw an increase in both farms and animals; Beef Cows and Sheep and Lambs.

TABLE 5.2: AGRICULTURAL PROFILE KNOX COUNTY 1997 TO 2012

Agricultural Characteristics	1997	2002	2007	2012	2017	% Change 1997-2017
Number of Farms	1,053	1,016	863	1,080	956	-9.2%
Land in Farms (acres)	595,537	599,468	536,457	627,735	600,822	0.9%
Average size of farms (acres)	566	590	622	581	628	11.0%
Total area for Knox County	729,408	729,408	729,408	729,408	729,408	0.0%
Percentage of land in farms	81.6%	82.2%	73.5%	86.1%	82.4%	0.9%
Total cropland (acres)	327,165	332,418	273,593	326,636	323,551	-1.1%
Harvested cropland (acres)	242,595	262,274	243,266	276,631	275,534	13.6%
Estimated Market Value of Land & Bldg (avg./farm) $	294,024	451,954	905,312	1,612,287	2,102,065	614.9%
Estimated Market Value of Land & Bldg (avg./acre) $	497	726	1,456	2,774	3345	573.0%

Source: U.S. Census of Agriculture, 1997, 2002, 2007, 2012, 2017

Table 5.4: Number Farms and Livestock by Type

Type of Livestock	1997	2002	2007	2012	2017	% Change 1997 to 2017
Cattle and Calves						
farms	788	729	559	700	627	-20.4%
animals	131,918	129,734	115,709	123,103	140,970	6.9%
average per farm	167	178	207	176	225	34.3%
Beef Cows						
farms	325	599	469	570	540	66.2%
animals	39,720	45,585	41,230	44,503	51,039	28.5%
average per farm	122	76	88	78	95	-22.7%
Milk cows						
farms	69	40	17	22	24	-65.2%
animals	3,531	2,803	1,437	1,380	1,996	-43.5%
average per farm	51	70	85	63	83	62.5%
Hogs and Pigs						
farms	267	127	77	48	37	-86.1%
animals	115,603	70,508	69,652	69,074	61,909	-46.4%
average per farm	433	555	905	1,439	1,673	286.5%
Sheep and lambs						
farms	39	48	41	41	58	48.7%
animals	1,590	2,803	2,087	1,512	3,421	115.2%
average per farm	41	58	51	37	59	44.7%
Chickens (layers and pullets)						
farms	32	38	40	55	43	34.4%
animals	(D)	(D)	(D)	(D)	(D)	-
average per farm	-	-	-	-	-	-
Chickens (broilers)						
farms	1	3	3	8	1	0.0%
animals	(D)	165	65	350	(D)	-
average per farm	-	55	22	44	-	-

Source: U.S. Census of Agriculture, 1997, 2002, 2007, 2012, 2017

Beef cows went from 325 farms in 1997 to 540 farms in 2017 an increase of 66.2%. In addition, the category went from 39,720 beef cows in 1997 to 51,039 beef cows in 2017 an increase of 28.5%; however, even with both of these increases the animal per farm actually went down.

Table 5.5 indicates the number of farms and crop by type for the period from 1997 to 2017. The table shows the prominent crops grown in the county. In addition, the table indicates the total number of farms producing the specific crop and finally an average per farm.

Corn and soybeans have been the two most frequently raised crops in Knox County since 1997. Three of the eight categories shown increased in acres farmed; these include Corn for Grain, Wheat, and Soybeans. The crop with the largest percentage increase (acres) was Wheat at 74.8%, while Soybeans increased by 50.6% and Corn for Grain increased by 20.8%.

Comparing Table 5.4 and 5.5, the noted increase in Corn for Silage is directly connected to the increase in Beef Cows shown in Table 5.4.

Agriculture has historically been a major part of the Knox County economy. It appears its importance will only grow during the planning period of this document. It will be critical to maintain a balance in the type of livestock and grains raised in order to minimize future economic downturns.

Table 5.5: Number Farms and Crops by Type

Type of Crop	1997	2002	2007	2012	2017	% Change 1997 to 2017
Corn for Grain						
farms	641	493	475	413	449	-30.0%
acres	101,004	89,848	114,953	102,141	122,054	20.8%
average per farm	158	182	242	247	272	72.5%
Corn for Silage						
farms	213	269	121	286	109	-48.8%
acres	9,312	20,406	6,000	35,611	9,126	-2.0%
average per farm	44	76	50	125	84	91.5%
Sorghum						
farms	21	8	2	3	4	-81.0%
acres	724	263	(D)	(D)	100	-86.2%
average per farm	34	33	-	-	25	-27.5%
Wheat						
farms	14	2	28	19	11	-21.4%
acres	602	(D)	3,211	(D)	1,052	74.8%
average per farm	43	-	115	-	96	122.4%
Oats						
farms	189	104	81	45	54	-71.4%
acres	8,655	5,211	4,600	1,926	4,427	-48.9%
average per farm	46	50	57	43	82	79.0%
Soybeans						
farms	453	395	311	383	397	-12.4%
acres	50,950	62,737	49,072	63,931	76,708	50.6%
average per farm	112	159	158	167	193	71.8%
Dry Edible Beans excluding Limas						
farms	-	-	-	-	-	-
acres	-	-	-	-	-	-
average per farm	-	-	-	-	-	-
Potatoes						
farms	-	-	2	2	-	-
acres	-	-	(D)	(D)	-	-
average per farm	-	-	-	-	-	-

Source: U.S. Census of Agriculture, 1997, 2002, 2007, 2012

Economic Development Goals and Policies

Economic Development Goal 5.1

Promote Knox County on a full-time basis

Economic Development Policies and Strategies

Economic Development Goal 5.1

Promote a balanced economic development program that strives to add value to the agricultural base of the county.

Economic Development Policies and Strategies

ED-5.1.1 Agriculture and agricultural employment, including value-added agricultural businesses, should be promoted throughout Knox County.

ED-5.1.2 Knox County should encourage economic development projects, which do not conflict with the agricultural character of the County.

ED-5.1.3 Work with businesses and agricultural operators to build new vertically integrated economic systems from the current agricultural uses in place.

ED-5.1.4 Work to establish new or existing public and/or private research facilities in Knox County.

ED-5.1.4 Continue to promote the county's Livestock Friendly status.

Economic Development Goal 5.2

Recruit or retain the youth of the county during or after college.

Economic Development Policies and Strategies

ED-5.2.1 Develop programs and jobs to address the needs of the youth in order to attract them back to the area after completion of their post-secondary education.

ED-5.2.2 The youth of Knox County should be involved in the identification and development of these projects.

ED-5.2.3 The county should also attract the youth back to the county that are commuting to Grand Island and other communities in the region.

Economic Development Goal 5.3

Develop new industrial sites within Knox County that have rail access.

Economic Development Policies and Strategies

ED-5.3.1 Work with BNSF Railroad to identify strategies for expanding rail access in Knox County.

Economic Development Goal 5.4

Examine the potential and promote Knox County as a great place to work and telecommute.

Economic Development Policies and Strategies

ED-5.4.1 Develop a promotional campaign to promote the quality of life issues of Knox County as a place to live and "Work from".

ED-5.4.2 Economic Development activities should focus on growing local businesses, established by county residents, as opposed to pursuing the ultimate "smokestack(s). Homegrown businesses and industries will contribute more to the local communities and county and will be a part of the community.

ED-5.4.3 Identify businesses and professions where telecommuting would be appropriate and functional.

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Photo Source: http://www.courthouses.co/us-states/n/nebraska/knox-county/

Chapter 6 County Facilities

County Facilities

State and local governments provide a number of services to their citizens and are referred to as public facilities. Public facilities represent a wide range of buildings and services built and maintained by the different levels of government.

It is important for all levels of government to anticipate the future demand for their services if they are to remain strong and vital. The analysis of existing facilities and future services are contained in the County Facilities Chapter. Alternatively, in some instances, there are a number of services not provided by the local or state governmental body and are provided by non-governmental private or non-profit organizations for the community as a whole. These organizations are important providers of services and are in integral part of the community.

County Facilities Plan

The Facilities Plan component of a Comprehensive Development Plan reviews present public and private facilities and services.
The Facilities Plan for Knox County is divided into the following categories:

- County Buildings
- Historic Sites and Places
- Education
- Health Care

County Buildings

County Courthouse

The original Knox County Courthouse, within Center, was completed in 1902. This original courthouse was a wood-framed building. The current courthouse replaced the original courthouse in 1934. The current courthouse is a masonry structure. The county in 2013 completed an addition to the facility.

The courthouse houses the offices of the Clerk, Assessor, Treasurer, Clerk of the District Court, County Court, Election Commissioner, Board of Supervisors, Emergency Management, Economic Development, Planning and Zoning, Register of Deeds, Veteran's Service Officer, Sheriff's Office and Extension Office.

Photograph 6.1 Knox County Courthouse Complex
Source: Google Earth

Knox County Fairgrounds

The Knox County Fair takes place in August each year in Bloomfield and is operated by the Knox County Ag Society.

Photograph 6.2 Knox County Fairgrounds
Source: Google Earth

Source: www.knoxcountyfairgrounds.com/

Historic Buildings and Site

Niobrara River Bridge

In 1902 the C.& N.W. constructed a wooden bridge across the mouth of the Niobrara River near the town of Niobrara. The structure consisted of three truss spans and a series of shorter approach spans over the flood plain. Despite attempts to shield the timber structure from flooding and weather, the Niobrara River Bridge had deteriorated to the point of replacement by the late 1920s. In 1929 the C.& N.W. designed a replacement structure, had it fabricated using steel rolled by the Illinois Steel Company, and erected it using a railroad construction crew. The lengths of the old and new structures were similar. The principal difference between them lay in the materials used. The 1902 bridge relied almost exclusively on timber for both super-and substructure; the 1929 replacement used an all steel superstructure and concrete substructure to form a heavier, more durable structure.

Source: Nebraska Historical Society

Congregational Church and Manse

The Pilgrim Congregational Church and Manse recall the work of the Reverend Alfred Riggs, a Congregational missionary who devoted most of his life to the Santee Normal Training School and to the education of the Santee Sioux Indians. The Reverend and Mrs. Riggs came to the Santee Reservation in June 1870. The church was constructed in 1870-71, shortly after the Reverend Riggs's arrival, and served both as a chapel and a training school.

Source: Nebraska Historical Society

Photograph 6.3 Niobrara River Bridge (Destroyed in March 2019 flooding)
Source: Nebraska Historical Society

Episcopal Church (Church of Our Most Merciful Savior)

The church, built in 1884, is a one-story structure with board and batten siding. The building played an important role in the religious life at the Santee Indian Reservation and is the only surviving Episcopal mission there. The Reverend Samuel D. Hinman, a prominent early missionary on the Santee reservation, is credited with building the first mission.

Photograph 6.4 Episcopal Church
Source: Nebraska Historical Society

Source: Nebraska Historical Society

Knox County Courthouse; MP

The county was organized in 1857 as L'Eau Qui Court County. In 1873 the county received its present name. The river town of Niobrara was the first county seat, achieving that designation in 1857. The community remained county seat until 1902 when Center, the present county seat, acquired the coveted status. Following the move, county

officials acted quickly to build a courthouse in Center. According to supervisors' records, the facility was built to be a temporary expedient. In April 1902 the county board held its first official meeting in the new building. In February 1934 construction began on a new courthouse, which was completed in October of the same year.
Source: Nebraska Historical Society

Photograph 6.5 Knox County Courthouse
Source: Nebraska Historical Society

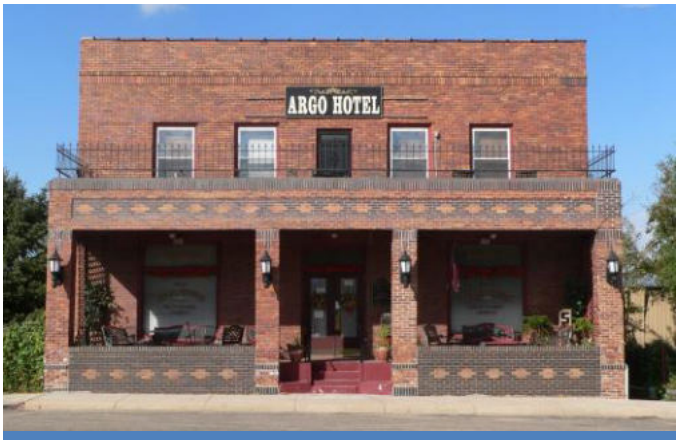
ZCBJ Opera House; MP
Located in Verdigre, the one-story brick Czech community hall was constructed in 1903 by Lodge Bila Hora (White Mountain) 5, with a rear addition made in 1913. Access to the opera house is through double doors on the front facade. The interior features a balcony and a stage with an elaborate proscenium arch, scenery curtains, and a prompter's box.
Source: Nebraska Historical Society

Photograph 6.6 ZCBJ Opera House
Source: Nebraska Historical Society

Commercial Hotel (Verdigre Hotel)
The Commercial Hotel, constructed in 1900 in Verdigre, is an excellent representative of first generation hotels built between 1854 and 1900. The hotels constructed during this period were typically two-story frame buildings without "modern" conveniences, such as indoor plumbing and gas or electric lighting. In many instances these buildings were constructed in anticipation of the railroad passing through the community, or in response to business activity that resulted from an existing railroad line.
Source: Nebraska Historical Society

Winnetoon Jail
The Winnetoon Jail, was built in 1907 in the town of Winnetoon. It is a good representative example of an early twentieth century jail designed for a small community, where its use would normally be limited.
Source: Nebraska Historical Society

Argo Hotel
With the building boom of second generation hotels that was occurring on a statewide basis during the first quarter of the twentieth century. The hotels built during this period, as exemplified by the Argo, were multi-floor, brick buildings that offered the most modern conveniences (such as indoor plumbing and gas or electric lighting), and catered especially to the businessmen who traveled on the railroad. Aside from providing pleasant quarters for travelers, the new hotels became the symbol of a prospering community with a bright future. For this reason, towns and cities of all sizes thought it was important to showcase a "modern" hotel as an indication of their prominent standing in the state. It is within this context that the importance of the Argo Hotel is realized. The building is also significant for its association with health and medicine. In 1940, the hotel was converted into a health clinic which provided a much needed service to Crofton and the surrounding area.
Source: Nebraska Historical Society



Photograph 6.7 Argo Hotel
Source: Nebraska Historical Society

Museums

Ponca Tribe Museum

The Ponca Museum and Library houses artifacts, historical archives, a Tribal Library, and a Community Learning Center, and Culture Department offices.

In 1999, the Ponca Tribe repatriated several items from the Smithsonian Museum in Washington, D.C. Now on display are two headdresses, tools, beadwork, jewelry, musical instruments, and various carvings.

Source: https://www.poncatribe-ne.org/culture/tribal-museum/

Creighton Historical Center

The Creighton Historical Center is located in downtown Creighton. The Center houses displays focused on:

- Military
- Typical 1929 Bedroom
- Historic Chapel Pulpit
- Infant gowns from the early 1900's
- Older medical equipment from the early 1900's
- Typical 1930's laundry equipment
- Paintings
- Rose Hill Cemetery plat
- Cedar Hill Cemetery plat
- Various plat books
- Older photography equipment
- Millinery from the 1890's and 1900's
- School memorabilia
- Older office equipment from the 1900's

Source: http://knoxne.us/chc/office.htm

Bloomfield Community Historical Society

The Bloomfield Community Historical Society manages the museum, which is housed in the former library. The museum, established in 2000, is a great place to find out more about Bloomfield's rich history. Check out the museum during the Bloomfield Appreciation Dayz/BHS Alumni Reunion or by appointment.

Verdigre Heritage Museum

The Verdigre Heritage Museum shows the history of Verdigre through its many visual displays. There are many things displayed, such as old businesses and personal items of prominent people.

Of the things displayed, some of the first you will see are the ones showing past military uniforms, and other military memorabilia. There is also a display of the old hospital, and its equipment. Also displayed are old tobacco and alcohol products sold in the town by the local stores. There is also old displays of clothing and old beauty items commonly used by women of the time.

The museum is open during Kolache Days for daytime hours. Tours are available by request.

Source: http://www.verdigre.org/museum-page/

Memories of Old Niobrara Museum

The Memories of Old Niobrara Museum is located in the Village of Niobrara in northwest Knox County.

Education

Public Schools

The public schools in Nebraska are grouped into six classes, depending upon the type of educational services provided and the size of the school district. The six classes, as defined by the State of Nebraska, are:

Class 1 Dissolved by Legislative action

Class 2 Any school district with territory having a population of 1,000 inhabitants or less that maintains both elementary and high school grades under the direction of a single school board.

Class 3 Any school district with territory having a population of more than 1,000 and less than 100,000 that maintains both elementary and high school grades under the direction of a single school board.

Class 4 Any school district with territory having a population of 100,000 or more and less than 200,000 inhabitants that maintains both elementary and high school grades under the direction of a single school board.

Class 5 Any school district with territory having a population of 200,000 or more that maintains both elementary and high school grades under the direction of a single school board.

Class 6 Any school district that maintains only a high school under the direction of a single school board. The territory of Class 6 district is made up entirely of Class 1 districts (or portions thereof) that have joined the Class 6.

Knox County is served by a total of seven public school districts:

- Bloomfield Community Schools
- Creighton Community Public Schools
- Crofton Community Schools
- Nebraska Unified School District #1
- Niobrara Public Schools
- Santee Community Schools
- Wausa Public Schools

Bloomfield Community Schools

Bloomfield Community School District provides an educational opportunity to students in Knox and Cedar counties. The district employs highly qualified staff using effective instructional strategies where students incorporate technology across all curricular areas. The curriculum is designed to meet the needs of all students, and to prepare them to function productively and responsibly in a continuously changing society. The mission of Bloomfield Community Schools, in partnership with parents and community members, is to empower students to become responsible citizens in a safe and secure educational environment. The Districts two facilities include:

- Bloomfield Elementary School
- Bloomfield Junior/Senior High School

Source: https://reportcard.education.ne.gov/Default.aspx?AgencyID=54-0586-000

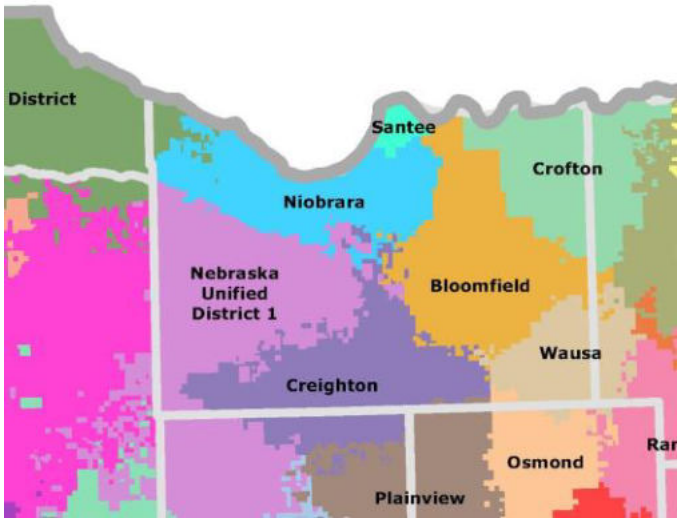
Creighton Community Public Schools

Creighton Community Public Schools is located in Creighton, Nebraska, which is in southern Knox County. The district provides Pre-K through 12th grade.

Crofton Community Schools

The Crofton Community Schools are based in Crofton in the northeast corner of Knox County. The Crofton District serves residents in both Knox and Cedar Counites. The school offers grades K through 12.

FIGURE 6.1: KNOX COUNTY SCHOOL DISTRICTS 2017– 2018 SCHOOL YEAR



Source: https://www.education.ne.gov/comm/esu-district-resources/

Nebraska Unified School District #1

The Nebraska Unified District #1 was established in 1999 with Mr. Al Schlueter at the helm. This development was made possible as incentive money was available for schools. Verdigre Public School, Orchard Public School, and Clearwater Public School formed what is now known as the Nebraska Unified District #1, allowing each community to maintain their school buildings.

In July of 2001, Mr. William Kuester took over the superintendent role as Mr. Schlueter retired. Many changes took place for the Unified District as Verdigre Public School built a new school and Clearwater and Orchard schools reorganized. Mr. Kuester retired in December of 2011. Mr. Dale Martin and Mr. Michael Sanne then shared the position of superintendent for the remainder of the district's school year.

In July of 2012, Mr. Dale Martin took over the position and remains in the position today. In the summer of 2017, the Clearwater-Orchard reorganization separated back to Clearwater Public and Orchard Public Schools. The Unified District is celebrating its 19th year and is recognized as the longest running unified district.

Source: http://www.neunified1.org/home.html

Niobrara Public Schools

Niobrara Public Schools are based in Niobrara. The district offers preschool as well as grades K through 12.

Photograph 6.8 History od Santee Tribe Mural
Source: http://www.santeeschools.org/vnews/display.v/ART/537cb48e08817

Santee Community Schools

The Indian people's wishes were finally realized in 1976, when a school was built at Santee. At first

limited to kindergarten through eighth grade, it subsequently added a four-year high school. It was financed by a $2.1 million federal grant. Although the school is of the most modern design, with sky lights and carpeting, the traditions and heritage of the Santee have not been forgotten. A mural in the school (pictured below) depicts the history of the Santee.

Today, the Santee Community School has an enrollment of 145 students, with a ninety-eight percent Native American population. There is one administrator, twenty-three certified teachers, and sixteen classified staff members. The curriculum offers a variety of classes ranging from the basic math, English, and Social Studies classes to Industrial Technology and computer classes. Every other year a class in Santee History is offered to the junior and senior classes. All of the students are involved with various other cultural activities throughout the school year with the school's Culture Club.
Source: http://www.santeeschools.org/vnews/display.v/ART/537cb48e08817

Wausa Public Schools

Wausa Public Schools is based in Wausa, Nebraska (southeastern corner of Knox County). The district serves portions of Knox County; Pierce County; and Cedar County. The districts provides education to grades Pre-K through 12.

Other Public Districts serving portions of Knox County (based outside of the county)

- Boyd County District
- Osmond Public Schools
- Plainview Public Schools

Parochial Schools serving Knox County

There are two parochial schools located in Knox County.

- St Rose Catholic School in Crofton, offers grades K through 8.
- St. Ludger Catholic Elementary in Creighton.
- Parochial Middle and High School is served by Cedar Central Catholic in Hartington.

Post-Secondary Education

There is one post-secondary educational facility located in Knox County, which is the Indian College operated by the Santee Sioux. Otherwise, the residents of Knox County and the surrounding area have additional selections of in-state post-secondary schools to select.

Some Nebraska institutions include:

- Northeast Community College
- Wayne State College
- University of Nebraska-Lincoln
- Hastings College
- Nebraska Wesleyan
- Union College
- Southeast Community College
- Central Community College
- University of Nebraska-Kearney
- University of Nebraska-Omaha
- Creighton University
- University of Nebraska Medical Center
- Methodist College of Nursing and Allied Health
- Midland Lutheran College

Some nearby Out-state institutions include:

- Augustana College - Sioux Falls, SD
- Dakota Wesleyan University - Mitchell, SD
- Globe University - Sioux Falls, SD
- Mitchell Technical Institute - Mitchell, SD
- Mount Marty College - Yankton, SD
- Southeast Technical Institute - Sioux Falls, SD
- University of Sioux Falls - Sioux Falls, SD
- University of South Dakota - Vermillion, SD
- Briar Cliff College - Sioux City, IA

Health Care

Health care facilities in Knox County are limited. There is only one hospital located in the county. The facility is Avera Creighton Hospital located in Creighton. Avera is based in Sioux Falls, SD and is a Christian based operation.

Santee Health and Wellness Center is the hub for Tribal members residing on the Santee Sioux Reservation, offering: outpatient medical - dental - mental health and substance abuse services. In addition to the medical, lab, radiology, and dental suites, the Center also houses:

- the health administration offices
- a wellness center
- physical therapy room
- a therapy pool with large adjacent whirlpool
- an employee training/emergency shelter area
- an optometry suite and
- EMS quarters and ambulance bay

All areas were designed with accessibility in mind for clients and employees with disabilities. The Facility is currently staffed by a physician, Nurse Practitioner, dentist, and physical therapist.
Source: http://santeesiouxnation.net/santee-health-center.html

Other nearby health care facilities

- CHI-Plainview - Plainview, NE
- Niobrara Valley Hospital - Lynch, NE
- Faith Regional Health Services - Norfolk, NE
- Osmond General Hospital - Osmond, NE
- Avera Sacred Heart Hospital - Yankton, SD
- Providence Medical Center - Wayne, NE
- St. Luke's Regional Medical Center - Sioux City, IA
- Methodist Hospital - Omaha
- Children's Hospital and Medical Center—Omaha
- Methodist Jennie Edmundson - Sioux City, IA
- University of Nebraska Medical Center - Omaha

Goals and Policies

Educational Goals

Educational Goal 1

Quality education is a vital component of positive growth. Although the County's role is limited, objectives and policies need to be established with regard to locating development to insure cost effective use of existing facilities.

Educational Policies and Strategies

ED-1.1 Continue to cooperate with the school systems in expanding public uses of educational facilities.

ED-1.2 The school districts should review all new development proposed within the zoning jurisdiction of Knox County so they can accommodate future school populations.

Educational Goal 2

The county should coordinate with the school districts to insure adequate areas for future educational needs. Above all, the main goal is to encourage excellence in the school curriculum and facilities.

Educational Policies and Strategies

ED-2.1 Cooperate with school systems on any future expansion or the development of new joint facilities.

ED-2.2 Work with students to continually identify new facilities needed in the future.

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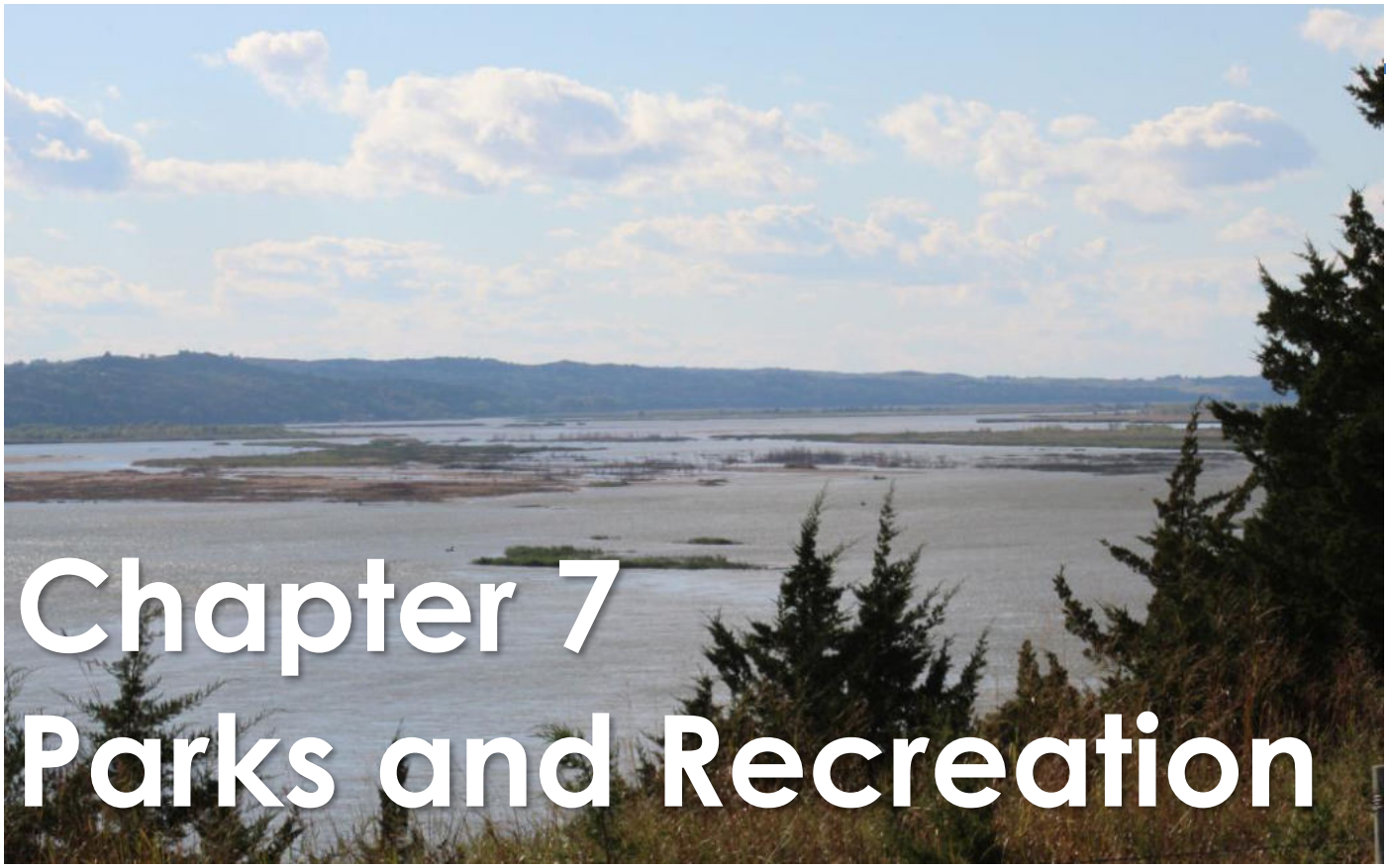
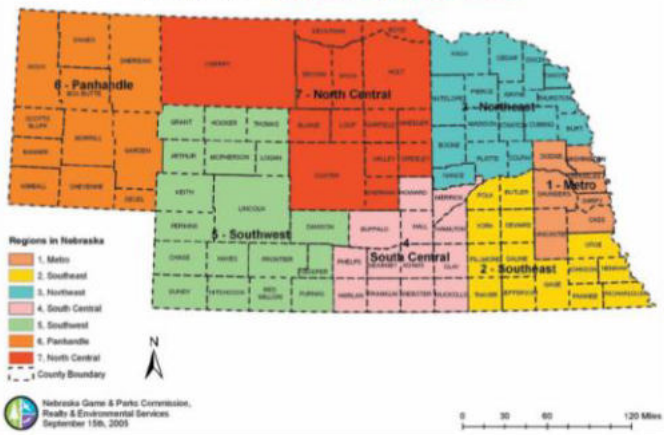


Chapter 7
Parks and Recreation

Parks and Recreation

Knox County is located in Nebraska's Northeast Recreation Planning, Region 3, and a region within the Nebraska Department of Game and Parks system. The Region includes 15 counties in Northeastern Nebraska.

FIGURE 7.1: NEBRASKA GAME AND PARKS REGIONS



Source: Nebraska Game and Parks Commission

COMMUNITY PARKS AND FACILITIES

The following facilities and programs can be found in the identified communities of Knox County. These parks will be located within the communities of Knox County.

Bloomfield Parks and Recreation

The City of Bloomfield has two parks. The "City Park" is located in the south central part of the city. This park features a picnic shelter, horseshoe pits, two basketball hoops with concrete pads, and restrooms. The city park became home to new playground equipment in 2006.

The second park is the **"Robin Schulz Memorial Park."** This park is located in the north part of the city. The park features a lighted regulation size softball field with enclosed dugouts, sheltered bleachers, restrooms, equipment rooms, and a concession stand. A second softball field, added in 1997, features enclosed dugouts and a ground level press box.

Bloomfield Swimming Pool

The municipal outdoor heated swimming pool was built in 1977, with a number of equipment replacements and upgrades since 1993, including the addition of a handicap accessibility lift system in 1994. The pool is located in the south central part of the city and is open from early June to early August. A picnic area with shelter is located adjacent to the swimming pool. A new slide and basketball hoop were added in 2000.

Source: Nebraska Game and Parks Commission

Creighton Parks and Recreation

Bruce Park

Bruce Park is Creighton's only park and has the following amenities:

- Baseball diamond including underground sprinklers, covered bleachers, batting cage, new concession stand.
- Softball field, including a recently constructed concession stand
- Swimming pool (Renovated in 2002)
- Playground equipment
- Arboretum
- Tennis/Sand Volleyball Courts
- Horseshoes
- Campground
- Picnic Tables and Open Shelter
- RV Dump Station
- Home of Santaland.

Bruce Park also features a Nebraska Statewide Arboretum started in 1992. The arboretum is considered a green oasis where park visitors can relax. With a unique collection of tree and shrub species the arboretum serves as an outdoor classroom for students in Creighton and as an informal laboratory to test the adaptability of plants in northeast Nebraska extreme climate. In total, the arboretum features 175 different, labeled, woody plants, memorial trees, native grass plantings, and a butterfly garden.

Source: Creighton Comprehensive Plan 2007

Santa Land

Santa Land Santa Land is Creighton's annual holiday lights display located in Bruce Park during the month of December. Setting up the display usually begins early November and over 2,000 man hours later, the 300,000 lights and displays are attracting visitors from many miles away. In addition to the large number of outdoor displays, Santa Land also houses Santa's Workshop. Sixteen of Santa's motorized elves can be seen hard at work making toys and packing the sleigh. Visitors to the workshop can visit with Santa and enjoy holiday refreshments provided by local businesses. Th e display is maintained by the Creighton Area Chamber of Commerce and other volunteers.

Source: Creighton Comprehensive Plan 2007

Elizabeth's Gardens

Elizabeth's Gardens In 1999, a dream became reality when a garden was created for the City of Creighton. For a long time, residents of the Creighton Care Centre and their families had commented that the view from their windows was rather plain. Helen Borgmann, the daughter of resident Elizabeth Rothenberger, shared this opinion, and approached the Creighton Area Health Services Auxiliary about the possibility of creating a garden for the residents of the Care Centre and the City of Creighton to enjoy.

The project was financed largely by a generous donation from a benefactor, Betty Radosti, given in memory of her sister, Margery Otradovsky who was an avid gardener. Other donations and volunteer help advanced the project quickly, and the new garden was dedicated as Elizabeth's Garden. Large trees provide shade as you stroll through Elizabeth's Garden and the wide, curving walks wind throughout the garden to provide opportunities to get a closer look at the many beautiful annuals and perennials. Guests can relax on one of the comfortable benches and picnic tables or stop in the gazebo, located in the center of the garden. A raised planter even gives Care Centre residents the chance to take part in caring for the flowers and plants. Visitors and citizens of Creighton are welcome in this tranquil haven, found at the Creighton Care Centre, next to the hospital on the west end of town.

Source: Creighton Comprehensive Plan 2007

Crofton Parks and Recreation

Crofton has three parks located in the community. They are South Park; Northside Park; and East Park.

South Park

South Park contains new playground equipment, stage gazebo, American Legion Memorial and the Avenue of Flags.

Northside Park

Northside Park hosts the community's swimming pool, Arbor, Walkway, and Memorial Rose Garden.

East Park

East Park is adjacent to Crofton Baseball Park and contains picnic grounds.

Crofton Courts Arboretum

This salute to nature has continued to grow over the years. The Northside Park includes Arbor Walkway and the Memorial Rose Garden. The South Park, along Nebraska Highway 12, contains Flagview Gazebo, Veteran's Memorial and Avenue of Flags. Southside Park also contains more than 59 species of trees and shrubs that are labeled for easy identification. Crofton is also proud of maintaining its Tree City USA status since 1991

Source: http://crofton-nebraska.com/recreation-attractions/

Verdigre Parks and Recreation

Chalupnik Park

J.J. Chalupnik donated land which is located on Main Street at the north end of the Verdigre business district. In 1979 the American Legion funded a drive to build a stage and shelter as memorial there to all men & women who had served in the American armed services. A playground also exists in the park. The gazebo built in 1987, an exact replica of the band pavilion which stood on the corner of Third and Main from 1913 to 1919, was moved from the park to Main Street in 1992.

Source: http://www.verdigre.org/chalupnik-park/

Wildwood Acres Park/Verdigre Pool

Wildwood Acres Park got its start in 1972 when Dr. James G. Carlson donated 70 acres of land on the southeast edge of Verdigre. The 12 feet deep heated swimming pool located in the middle of the park has a capacity for 210 swimmers and includes low and high diving board. The complex includes a wading pool for youngsters, a shower house and basket room. Lifeguards are on duty at all times. The pool usually opens on Memorial weekend and closes in the middle of August. The complex includes two fenced concrete tennis courts, basketball hoops and a bandstand. Just west of the pool is a large playground and a picnic shelter with a large stone fireplace.

A camping area with two sleeping cabins and 27 camper pads is situated among the tall trees to the south of the tennis courts. A sand volleyball court and bathrooms with showers are located at the south end of the park. The softball field is located on the northwest end, with a covered sandpile and small crows nest playground equipment nearby. A concession stand with restrooms is located by the softball field. A cement walk path runs between the softball field and the camping area. Verdigre's Organized Women (VOW) sponsors the Avenue of Flags which includes approximately 200 U.S. flags lining the winding entrance road to Wildwood Acres Park. These flags are flown on Flag Day, Memorial Day, Veterans Day, Kolache Days, and Independence Day each year.

Source: http://www.verdigre.org/wildwood-acres/

Wausa Parks and Recreation

Gladstone Park

Gladstone Park is located in Wausa. The park contains a ball diamond, playground, two open shelters, an enclosed shelter, and eight camper.

At the time of this Plan, the Village was planning on updating the pool with a new bathhouse.

Niobrara Parks and Recreation

Niobrara Park

The park in Niobrara is located in the northwest corner of the community. The park has included playground equipment, tennis courts, sand volleyball courts, ballfield, and the Rough Rider rodeo arena. The park was damaged during the March 2019 flooding.

Regional Recreation

Regional recreational areas are a combination of state, federal, and major private facilities that attract people into the Knox County area.

The following is a brief description of the facilities operated by Knox County and Nebraska Game and Parks Commission in and around Knox County.

Niobrara State Park

The park is situated at the confluence of the Niobrara and Missouri Rivers in northern Knox County. The park offers cabins, both primitive and RV camping, picnicking, boating, swimming, horseback trails, hiking, hunting, fishing, and wildlife watching.

Photograph 7.1 View of Niobrara State Park
Source: Nebraska Game and Parks Commission
http://outdoornebraska.gov/niobrara/

The park also contains the J. Alan Cramer Interpretive Center and during the summer months offers Buffalo cookouts.

Lewis and Clark State Recreation Area

Nebraska's second largest reservoir, Lewis and Clark straddles the state's northeast border with South Dakota. The lake draws its name from the Lewis and Clark expedition, which camped nearby during the famous journey to explore the Louisiana Purchase. Lewis and Clark offers modern cabins, boating, fishing, hunting, bird watching and scenic vistas.

Source: http://outdoornebraska.gov/ponca/

Ponca State Park

One of Nebraska's most visited state parks, Ponca State Park is popular for its forested hills, scenic vistas, great wildlife watching, Missouri river access and beautiful and varied lodging options. During the spring months, the wetlands at Ponca State Park are a popular layover spot for many migrating bird species, and the park draws many bird watchers. The park offers many seasonal activities, including guided bird tours during the spring, naturalist events and family activities during the summer, haunted hayrack rides complete with local actors and impressive props during the fall and its nationally famous Fruitcake Fling each winter. Comfortable lodging, unique events and sweeping views of the river have made Ponca state park a popular destination for all types of family gatherings, from family vacations to weddings.

Source: http://outdoornebraska.gov/ponca/

Ashfall Fossil Beds State Historical Park

Nearly 12 million years ago, volcanic ash engulfed this ancient watering hole, entombing innumerable animals. National Geographic has called it the Pompeii of prehistoric animals. Because of its scientific importance, the 360-acre historical park between Orchard and Royal was acquired in 1987 and is a joint project of the Game and Parks Commission and the University of Nebraska State Museum. See paleontologists dig the site and prepare fossils unearthed. Interpretive facilities include a visitor center and rhino barn

Source: http://outdoornebraska.gov/ashfall/

Golf Courses

There are a number of golf courses serving the Knox County area.

Course	Community
Creighton Community Golf Course	Creighton
Crofton Lakeview Golf Course	Crofton
Hillcrest Golf & Country Club	Yankton, SD
Fox Run Municipal Golf Course	Yankton, SD
Hartington Golf Club	Hartington
Rolling Hills Country Club	Wausa
Niobrara Valley Golf Course	Niobrara
Tatanka Golf Course (Ohiya Casino)	Niobrara
Springfield Golf Club	Springfield, SD
Bon Homme Country Club	Tyndall, SD
Plainview Country Club	Plainview
Pierce Golf Course	Pierce
Randolph Golf Course	Randolph
Cedar View Country Club	Laurel

Goals and Policies

Parks and Recreational Goals

Parks and Recreation Goal 1

Development of a county-wide trails system will aid in the long-term recreational and walkability needs as well as creating a tourism destination for the county.

Parks and Recreation Policies and Strategies

PR-1.1 The County should complete a long-range trails Master Plan in order to identify specific locations, routes and amenities to connect.

PR-1.2 The County should work with the NRD's to determine potential funding for the planning and construction of recreational trails within Knox County.

PR-1.3 The County should, as the paved county roads are repaired, overlaid, etc. work to incorporate a standard trail width to the shoulder of the roadway.

PR-1.4 A trail system should work to connect different entities within Knox County together as well as connect to other regional trails in the area.

Parks and Recreation Goal 2

Knox County will continue to work closely with different entities including the community's and NRD to maintain and enhance the existing parks, camps, riverfront, and lakes.

Parks and Recreation Policies and Strategies

PR-2.1 The County should continue promoting the areas recreational destinations.

PR-2.2 The County should continue to promote local Agri-tourism.

Chapter 8 Public Safety

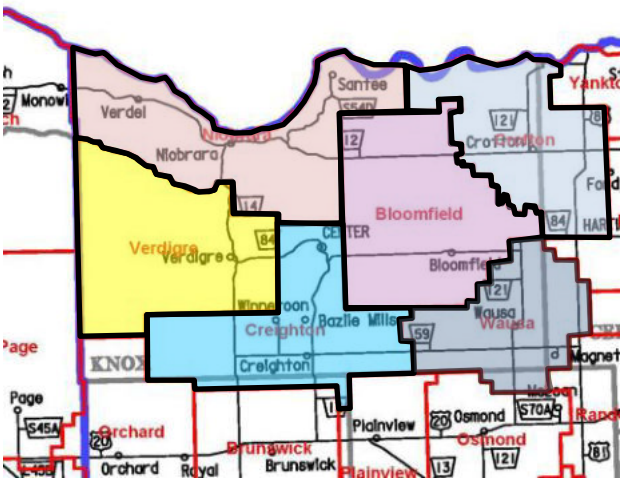
Fire Protection

Fire and Rescue

Fire and rescue in Knox County is handled through eight different departments / agencies:

- Bloomfield
- Creighton
- Crofton
- Niobrara
- Orchard (Antelope County based)
- Wausa
- Verdigre
- Yankton, SD

FIGURE 8.1: KNOX COUNTY FIRE DISTRICTS



Source: Nebraska Department of Transportation

Each of the fire districts listed above, provide varying levels of fire and rescue service to their respective territories. Detailed information is not provided since the type and age of equipment can vary annually.

Figure 8.1 shows a map of the eight fire agencies serving Knox County:

Bloomfield Volunteer Fire Department/Ambulance Service

The Bloomfield Fire Department and Bloomfield Rural Fire Department operate as a volunteer organization with 35 members. The service area includes the City of Bloomfield and the surrounding rural fire district area consisting of approximately 342 square miles. On-going training and mutual aid coordination is handled at regular monthly meetings, with special training sessions provided several times each year. The Bloomfield Fire Department, which works in conjunction with the Bloomfield Ambulance Service.

The Bloomfield Ambulance Service provides service to the city of Bloomfield and the Bloomfield Rural Fire District. Bloomfield has 30 certified Emergency Medical Technicians (EMT) functioning on a volunteer basis. The ambulance service building was constructed in 1992. A public access defibrillator has been installed at the Bloomfield Community Center.

Source: https://bloomfieldnebraska.com/our-community/

Creighton Volunteer Fire Department

The Creighton Volunteer Fire Department has nearly 60 firefighters and EMT's covering nearly 240 square miles. The main facility is located in Creighton.

Crofton Volunteer Fire Department

The Crofton Volunteer Fire Department is located at 205 W. Iowa Street in Crofton. The department has 24 volunteer firefighters. Their territory covers the community of Crofton and most of northeast Knox County including all of the lake developments along the northern edge of the county.

Verdigre Volunteer Fire Department

Verdigre's Volunteer Fire Department and Rural Fire District are equipped with five pumpers and tankers and an equipment carrier among other equipment. Their fundraisers include an annual Fireman's Dance.

Verdigre is also supported by the Verdigre Rescue Squad which serves the community and surrounding area. In addition, it provides mutual aid to all Knox County Rescue Squads. The Rescue Squad attends over 1,000 hours of training each year. The Rescue Squad sponsors the Red Cross Bloodmobile four times a year, a New Year's Eve dance, annual Lions Club Mobile Health Screening, provided EMT's for the Knox County Fair, conducts trash pick-up twice a year along Highway 14. They helped organize the Knox County 911 Emergency Services System-enhanced "911" and have had benefits for individuals in need. Thirty certified EMT's make up this volunteer group, along with two rescue units, a jaws of life, five defibrillators, a John Deere Gator used for remote rescue, Fire Department assist, sporting events, and mutual aid for entire area.

Source: http://www.verdigre.org/clubs-organizations/

Wausa Volunteer Fire Department

The Wausa Volunteer Fire Department is located at 405 E. Broadway in Wausa. The department has 25 volunteer firefighters. Their territory covers the community of Wausa and most of southeast Knox County.

Law Enforcement

Knox County Sheriff's Department

Knox County is served by the Knox County Sheriff's Department, which provides policing services to a majority of the county as well as support and operation of the county courts and jail facilities.

The following are other law enforcement agencies in Knox County:

- Bloomfield Police Department
- Creighton Police Department
- Crofton Police Department
- Niobrara Police Department
- Wausa Police Department
- Santee Sioux Tribal Police
- Bureau of Indian Affairs

Based upon data from the Nebraska Commission on Law Enforcement and Criminal Justice, the Knox County Sheriff's Department had five full-time sworn officers in 2017. Table 6.1 shows the employment levels for several years. When examining the number of sworn officers per 1,000 people, the Knox County Sheriff's Department had an average of 0.6 sworn officers per 1,000 people in from 2015 to 2017. Table 6.1 also shows the Crofton Police Department has maintained one sworn officers from 2014 to 2016, which equates to 1.8 sworn officers per 1,000 people. Santee was listed with local police departments in 2015 and 2016 but did not indicate a department in 2017. Wausa listed a police department in 2015 but nothing in 2016 and 2017.

Table 8.1: Sworn Officer Comparison

Agency	2015		2016		2017	
	Sworn Officers FT/PT	Officers per 1,000 Population	Sworn Officers FT/PT	Officers per 1,000 Population	Sworn Officers FT/PT	Officers per 1,000 Population
Knox County Sheriff	**5/2**	**0.6**	**5/2**	**0.6**	**5**	**0.6**
Holt Co. Sheriff	4/2	0.6	4/2	0.6	6	0.9
Pierce Co. Sheriff	4	1	NA	NA	NA	NA
Antelope Co. Sheriff	4/7	0.8	5/7	1.0	5	1.1
Boyd Co. Sheriff	1/5	0.5	3/4	1.5	NA	NA
Cedar Co. Sheriff	4/3	0.5	6	0.7	7	0.9
Crofton PD	1/3	0	1/3	1.4	1	1.8
Santee PD	4	0	5	14.4	NA	NA
Wausa PD	1	0	NA	NA	NA	NA

Source: Nebraska Commission on Law Enforcement and Criminal Justice 2015 through 2016

The ratio of law enforcement officers per 1,000 persons in the population for any given area is influenced by many factors. The determination of law enforcement strength for a certain area is based on such factors as population density, size and character of the county, geographic location and other conditions existing in the area. The data indicate Knox County has been maintaining a ratio of 1.9 sworn officers per 1,000 people over a period of time; apparently this is a good balance for Knox

County. Table 6.1 also shows the number of sworn officers and officers per 1,000 persons in the surrounding counties.

Emergency Management

Knox County Emergency Management is a local agency addressing the county's needs. The local Agency has a director; however, the county's office works directly under the state agency, Nebraska Emergency Management Agency (NEMA). The local offices were created under the Nebraska Emergency Management Act of 1996.

The Nebraska Emergency Management Agency (NEMA) is part of the Military Department. The state's Adjutant General serves as the director of the agency as well as the commanding officer of the Army National Guard and the Air National Guard. The three units comprise the Military Department.

Originally, the agency was located in a bunker built in the 1960s during the height of the Cold War. It was intended to serve as Nebraska's government headquarters if nuclear confrontation was likely. In 2012, the agency headquarters was relocated to the Joint Force Headquarters, on the Nebraska National Guard base in Lincoln. NEMA is a small agency with less than 40 full-time and part-time employees. Day-to-day operations are managed by the assistant director.

Emergency management in the United States has been divided into four phases: preparedness, response, recovery, and mitigation. Even with the emphasis on terrorism since the 9/11 attacks, emergency management's role has not changed a great deal. Nebraska must still deal with a host of hazards, both natural and man-made.

Preparedness

During the preparedness phase, NEMA monitors the situation across the state. This is accomplished by using a duty officer system; state, National Weather Service and North American Warning and Alert System (NAWAS); local emergency management organizations, police and fire departments across the state and the general public.

A member of NEMA staff serves as the duty officer on a rotational basis taking calls for a host of incidents in addition to severe weather such as tornadoes, floods and blizzards. A terrorist attack would be handled in the same manner as a tornado strike or flood.

During the preparedness phase, the agency coordinates the state Radiological Emergency Preparedness Program (REP), which develops emergency plans for the two nuclear power plants – Cooper and Ft. Calhoun Nuclear Stations.

The agency also monitors low-level and high-level radiological material shipments, which traverse the state by highway and railway. Any abnormality can trigger a call to the duty officer and alert the rest of Nebraska government.

NEMA conducts an extensive training program for emergency managers and first responders, such as police, fire and emergency medical personnel. The training classes cover a wide range of topics, including counter terrorism, hazardous materials, radiological emergency, public information and incident management. Classes, schedules and other information are listed on NEMA's training page.

An important part of preparedness is the development of state and local emergency operations plans, which NEMA coordinates. The agency has also developed an emergency operations exercise program that assists local jurisdictions in exercising their emergency plans.

Each year, once in the spring and again in the fall, the agency conducts public awareness campaigns. The severe weather awareness campaign tests the state's emergency systems in advance of the spring thunderstorm season and the winter weather awareness campaign does the same before winter. Both are sponsored by NEMA and the National Weather Service.

Response

In the event of an emergency anywhere in the state, the local jurisdictions are responsible for first response to the emergency. If local resources are inadequate to deal with the situation, the local political leader declares an emergency and requests state assistance.

Normally, the agency would be aware of the developing situation and would have alerted the governor's office and other state agencies. NEMA could also activate the State Emergency Operations Center (SEOC) located in the agency headquarters. The SEOC becomes the center for any state response. Depending upon the nature of the emergency, state teams can be dispatched to the disaster area.

If deemed necessary the Federal Emergency Management Agency' s (FEMA) Region VII office,

which is located in Kansas City, can be alerted. They, in turn, can notify FEMA National in Washington, D.C.
Upon the advice of the agency director, the governor can proclaim a state emergency and sign a declaration. This declaration formalizes the state response and places all the state's resources at the disposal of the adjutant general. This can involve the National Guard, State Patrol, Department of Roads, Game and Parks Commission, Department on Aging, Health and Human Resources or any other agency that can be of assistance.

The formal declaration process also allows the adjutant general to use money in the governor's Emergency Fund to pay for the disaster costs. This fund, which was created and is maintained by the Legislature, usually is kept at around $1 million.

If the governor determines state resources are not sufficient to deal with the emergency, a federal disaster declaration can be requested. The issuance of a Presidential Disaster Declaration means all the resources of the federal government can be brought to bear on the emergency.

Recovery
Under a Presidential Disaster Declaration, NEMA and FEMA coordinate state and federal activities in a Joint Field Office. The two disburse recovery funds for two types of federal disasters. A Presidential Disaster Declaration can be for public assistance, individual assistance or both.

Public assistance is used to help local and state governments recover their disaster expenses. Public assistance is used to pay for roads, bridges, public buildings and other facilities damaged in the disaster and to pay for costs such as the National Guard, police, fire and public works employee salaries and other costs. Normally, the Federal Government pays 75 percent of all eligible public costs. Traditionally, the state and local governments equally split the remaining 25 percent.

Individual assistance is provided to the survivors of the disaster. Individual assistance can come in the form of low interest loans both to families and businesses, or individual family grants to pay for losses to families or businesses that are not eligible for loans.

Mitigation
Following a federally-declared disaster, the state receives funding assistance for hazard mitigation. This can amount to substantial sums of money, because 15 percent of the total federal share of the disaster is earmarked for mitigation. Hazard mitigation is designed to lessen or mitigate the impacts of future disasters.

For example, hazard mitigation for flooding might mean the buyout of flood-prone structures in the disaster area, or it might involve raising structures above the 100-year flood level. In the case of tornadoes, mitigation might involve better warning systems or structural improvements. The state and federal governments must agree to whatever mitigation projects that are designed.
Source: https://nema.nebraska.gov/overview/nema-overview

Public Safety Goals and Policies

Public Safety Goals

Public Safety Goal 1
The goal of Knox County (residents) is to maintain fire protection, rescue and ambulance programs by exploring programs and alternative services to insure optimum service levels and public costs.

Public Safety Policies and Strategies
PS -1.1 The different fire and rescue organizations and the county should continue to work to maintain quality equipment levels.
PS-1.2 The fire departments should continue to expand fire safety education and prevention throughout the county.

Public Safety Goal 2
The goal of Knox County is to maintain quality law enforcement throughout the county.

Public Safety Policies and Strategies
PS-2.1 Continue to identify specific ways to work cooperatively with the County Sheriff regarding protection in Knox County.
PS-2.2 Continue to support minimum standards regarding equipment used by law enforcement.

Public Safety Goal 3
The goal of Knox County is to maintain regulations to protect the general health and safety of all residents.

Public Safety Policies and Strategies
PS-3.1 Establish regulations protecting the county residents from the secondary effects of adult entertainment.

Chapter 9 Communications, Utilities and Energy

Communications

Telephone Services

The primary telephone provider in Knox County is Great Plains Communications.

Radio Stations

There is one locally operated, Low Power station in Knox County, KNIL 95.9 based in Creighton. Other than KNIL there are no other commercial radio stations based in Knox County, the county receives many commercial radio frequencies based in surrounding areas such as Yankton, Norfolk, and O'Neil.

Television Stations

Presently there are no local television stations located in Knox County. The over the air stations that serve the area originate out of South Dakota and Omaha.

Internet/World Wide Web Service Providers (ISP)

High speed Internet service in Knox County is primarily provided by Great Plains Communications. There are various other small providers in the area.

Cellular Service

All of the mainstream cellular providers have a presence in Knox County.

Newspapers

The residents of Knox County are served locally by the Knox County News, and Verdigre Eagle.

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Listed below are newspapers with circulation within the Knox County area:

- Wausa Gazette
- Niobrara Tribune
- Crofton Journal
- Omaha World-Herald
- Yankton Press and Dakotan
- Norfolk Daily News

Utilities

Electricity

The Nebraska Public Power District provides power to Knox County retail and wholesale to local public power districts. There are three primary rural public power districts serving Knox County:

- Cedar Knox Public Power District
- North Central Public Power District, and
- Niobrara Valley Electric Membership Corporation

Niobrara Valley Electric Membership Corporation

Electrical power by Niobrara Valley Electric Membership Corporation serves only a small portion of Knox County. NVEMC is a non-profit organization with the goal of providing essential service at the lowest possible cost.

Niobrara Valley EMC's present headquarters, located at 427 North 4th street in O'Neill, was originally built by contract in the summer of 1956. In 1972, an addition was built that doubled the size of the building.
Source: http://nvemc.org/index.html

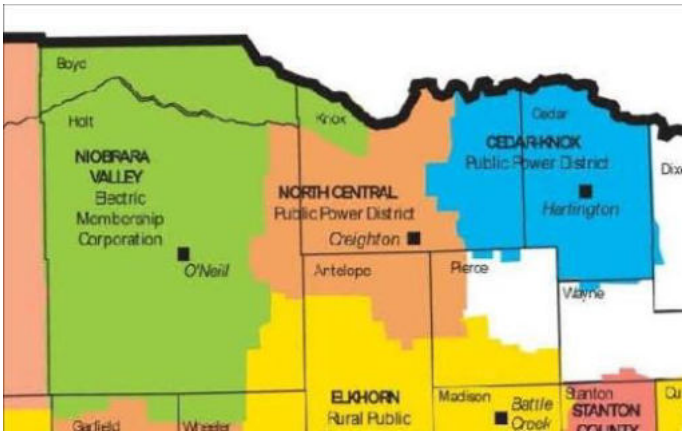
North Central Public Power District
North Central Public Power District, headquartered in Creighton, Nebraska, is geographically the largest rural public power district serving Knox County.

North Central PPD supplies electric power through 1,650 miles of 7.2/13kV distribution lines and 121 miles of 69 kV and 34.5 kV transmission lines within the district. The district has 5,700 meters hooked to their system.

Cedar Knox Public Power District
Cedar-Knox PPD is a non-profit electrical utility that is a political subdivision of the state of Nebraska. Cedar-Knox PPD provides electrical service to rural, town, irrigation, industrial, and resale customers within the chartered area of our District. Counties served by CKPPD include all of Cedar, and parts of Knox, Pierce, Wayne, and Dixon counties in northeast Nebraska.

North Central PPD supplies electric power through 1,969 miles of distribution lines. The district has 7,336 meters hooked to their system.

Figure 9.1: Public Power District Service Areas



Electrical Distribution
The overall distribution systems are in good condition. The systems are owned and operated by each of the power districts. The distribution systems not only supply power throughout Knox County but are the foundation for power transmitted to other customers in northeast Nebraska.

Natural Gas
Natural gas supplies in Knox County is provided by SourceGas.

Sanitary Sewer Systems
The sanitary waste in the rural parts of Knox County is handled via individual septic systems. The level and complexity of these systems varies greatly throughout Knox County due to different soil conditions, see Chapter 11: Natural Resources and Solis for more detail.

Sanitary waste within the communities of Knox County are typically addressed via community-wide collection and treatment systems.

Water Systems
Water in Knox County is supplied by wells drawing groundwater up for consumption or other uses. The unincorporated communities and the farmsteads, acreages, and homes along the river area typically have individual wells supplying the needs of the public. However, within the primary incorporated communities of the county, the wells are owned and operated by the local government. The local government runs a centralized system.

In addition to individual wells the portions of western Knox County are served by the West Knox Rural Water System and on the east by the Cedar/ Knox Rural Water System.

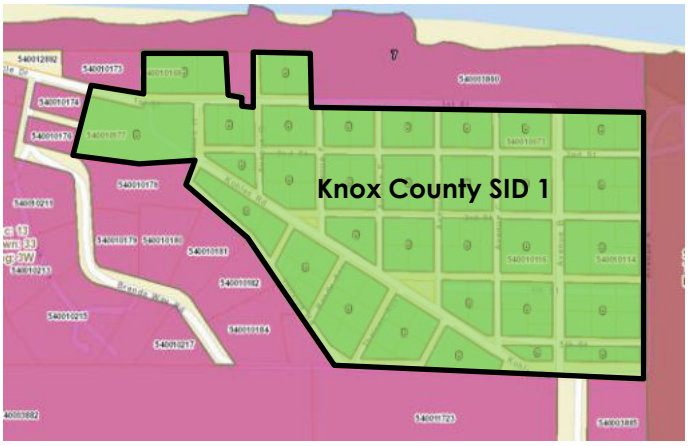
Solid Waste
Sanitation collection in Knox County is provided by private haulers.

Sanitary Improvement Districts (SIDs)
Sanitary Improvement Districts in Nebraska are a form of taxation which allows a development group and/or homeowner's association to establish a special taxing district for purposes of installing or improving infrastructure such as a water system and/or a sanitary sewer collection and treatment system. SID's may also construct and/or maintain streets within such a district. The creation of an SID is controlled by the District Courts of Nebraska.

Knox County has two SID's within the county. SID 1 is located along the northern boundary of Knox County, just north of County Road C54, in Section 13, Township 33, Range 3 West. See Figure 9.2

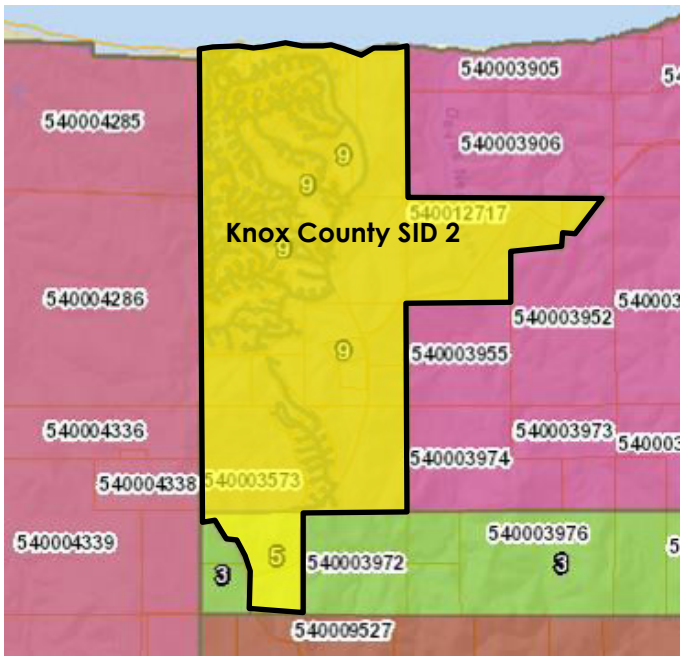
SID 2, in Knox County, is located in the Devil's Nest area of the county. See Figure 9.3.

Figure 9.2: Knox County SID 1 Boundary



Source: Knox County GIS

Figure 9.3: Knox County SID 2 Boundary



Source: Knox County GIS

ENERGY

Energy usage in the early 21st Century is becoming a critical issue throughout Nebraska as well as the entire United States. Our dependency on non-renewable energy sources has increased significantly over the past 100 years.

Energy consumption comes in several forms, such as:

- Lighting our homes, businesses, and industries
- Cooling and heating our homes, businesses, and industries
- Heating our water for homes, businesses, and industries
- Food preparation
- Transportation – both personal and business related
- Agricultural equipment
- Recreation and Entertainment – vehicular, computers, music, etc.

~~The 21st Century ushered in an increased concern for energy usage and its impacts on the environment. This increased concern for the environment created a better understanding of the carbon footprint generated by any one individual as well as striving towards modifying our behavior patterns in order to lessen the footprint. In addition, the phrase and concept of sustainability has become more widely used, even in Nebraska.~~

~~Energy and the issues connected to the different sources are becoming more critical every year. The need for the Energy Element in the Knox County Comprehensive Development Plan should be something desired as opposed to required.~~

SUSTAINABILITY

Sustainability, in today's discussions, has a number of meanings. According to Webster's Third International Dictionary, the verb "sustain" is defined as "to cause to continue...to keep up especially without interruption, diminution or flagging". However, the American Planning Association has come up with the following definition:

> ***"Planning for 'sustaining places' is a dynamic, democratic process through which communities plan to meet the needs of current and future generations without compromising the ecosystems upon which they depend by balancing social, economic, and environmental resources, incorporating resilience and linking local actions to regional and global concerns".***

In other words, sustainability is the ability of present day generations to live without jeopardizing the ability of future generations to sustain life as we know it today.

~~All of us living in today's world need to begin switching gradually to cleaner and more renewable resources. By doing so it will aid future generations with their quality of life. The more renewable energy sources become the norm for our generation, the more likely these sources will be second nature and common in the future.~~

~~Americans have grown to rely more heavily on electricity. However, state and federal policies have been more insistent on curbing the level of our reliance on electricity; especially, those sources produced by non-renewable fossil fuels such as oil and coal. Federal policy has set a goal for 20% of all electricity, by 2020, in the United States be from renewable sources such as solar and wind.~~

~~So, what can Knox County do to be more sustainable? There are a number of activities that can be undertaken and pursued to make an impact. The following information will meet at a minimum, the requirements of LB 997 but will also provide basic strategies Knox County can undertake to make a contribution to the overall energy solution.~~

Energy Use by Sector

This section analyzes the energy use by residential, commercial, industrial and other users and will examine the different types of energy sources that are utilized by these different sectors.

Residential Uses

Within Knox County, residential uses are provided a number of options for both power and heating and cooling. These include electrical power (both fossil fuel and renewable resources), natural gas, oil, propane, and wood. The most dominant of the energy sources available and used by the residents of Knox County is electricity produced from both fossil fuels and renewable resources.

The use of natural gas, oil, propane and wood will be found typically as heating sources during the winter months. The type of fuel used will depend a great deal on where a residence is located within the county. Residents located within the more urbanized parts of Knox County are more likely to have natural gas heating or electrical furnaces. Propane and wood stoves are most likely found in the rural parts of the county where natural gas infrastructure is not always available.

Commercial Uses

Knox County's commercial uses also have a number of options for both power and heating and cooling. These include electrical power (both fossil fuel and renewable resources), natural gas, propane, oil and wood. The type of energy source is very dependent upon the specific commercial use and the facilities employed to house the use. The most dominant of the energy sources available is electricity produced from both fossil fuels and renewable resources.

Similar to residential uses, the use of natural gas, oil, propane and wood will be found typically as heating sources during the winter months. The type of fuel used will depend a great deal on the type of commercial use and the construction of the building(s) involved. The location of the commercial uses will also dictate, similar to residential uses, what type of heating fuels are used. However, in commercial uses such as repair garages and other uses in larger metal buildings, they may be dependent upon recycling used motor oils to heat their facilities.

Industrial Uses

Knox County's industrial uses will be very similar to those discussed within the commercial section. However, in some cases, diesel fuel can play a role in both power generation and heating and cooling.

Short-term and Long-term Strategies

As the need and even regulatory requirements for energy conservation increases, residents of Knox County will need to:

1. Become even more conservative with energy usage
2. Make use of existing and future programs for retrofitting houses, businesses, and manufacturing plants
3. ~~Increase their dependence on renewable energy sources.~~

Residential Strategies

There are a number of different strategies that can be undertaken to improve energy efficiency and usage in residences. These strategies range from simple (less costly) to complex (costly). Unfortunately not all of the solutions will have an immediate return on investment. As individual property owners, residents will need to find strategies that fit their budgets to invest in the long-term savings.

There are several ways to make a residence more energy efficient. Some of the easiest include:

- Converting all incandescent light bulbs and Compact Florescent Lights (CFL) or Light Emitting Diodes (LED) or the most recent technology to conserve energy.
- Installing additional insulation in the attic.
- Converting standard thermostats to digital/ programmable thermostats.
- Changing out older less efficient air conditioners and furnaces/boilers to newer high-efficiency units
- Changing out older appliances with new

EnergyStar appliances.
- Exchanging less efficient water heaters with EnergyStar units or on demand systems.

Some of the more costly ways to make a residence more energy efficient include:
- New insulation in exterior walls.
- Addition of solar panels for either electrical conversion and/or water heater systems.
- Adding individual scale wind energy conversion systems.
- Installing a geothermal heating and cooling system.
- Installation of energy-efficient low-e windows.

Commercial/Industrial Strategies

Strategies for energy efficiency within commercial/ industrial facilities are more difficult to achieve than those for residential uses. Typically, these improvements will require a greater amount of investment due to the size of most of these facilities.

There are a number of different strategies that can be undertaken to improve energy efficiency and usage in commercial and industrial facilities. Again, not all of the solutions will have an immediate return on investment. Businesses and industries will need to find strategies that will fit into their ability to pay for savings at the present time.

There are several ways to make businesses/industries more energy efficient. Some of the easiest include:
- Converting all incandescent light bulbs and CFL's to LED's or better on small fixtures.
- Converting all florescent lights to more efficient florescent systems.
- Converting standard thermostats to digital/ programmable thermostats.
- Installing additional insulation in an attic space.
- Changing out older less efficient air conditioners and furnaces/boilers to newer high-efficiency units.
- Exchanging less efficient water heaters with EnergyStar units or on demand systems.

Some of the more costly ways to make a business more energy efficient include:
- Installation of energy-efficient low-e windows and/or storefronts.
- New insulation in exterior walls.
- Addition of solar panels for either electrical conversion and/or water heater systems.
- Adding individual scale wind energy conversion systems.
- Installing a geothermal heating and cooling system.
- New storefronts with insulated panels and insulated Low-E glazing.

Public Strategies

Energy efficiency strategies for public facilities are similar to those of commercial and industrial users. Typically, these improvements will require a greater amount of investment due to the size of most of these facilities. However, in some cases there are grants available from time to time to assist public agencies with these improvements.

There are a number of different methods that can be undertaken to improve energy efficiency and usage in public facilities, including:
- Converting all incandescent light bulbs and CFL's to LED's or better on small fixtures.
- Converting all florescent lights to more efficient florescent systems.
- Converting standard thermostats to digital/ programmable thermostats.
- Installing additional insulation in an attic space.
- Changing out older less efficient air conditioners and furnaces/boilers to newer high-efficiency units.
- Exchanging less efficient water heaters with EnergyStar units or on demand systems.

Some of the more costly ways to make public facilities more energy efficient include:
- Installation of energy-efficient low-e windows and/or storefronts
- New insulation in exterior walls
- Addition of solar panels for either electrical conversion and/or water heater systems
- Adding individual scale wind energy conversion systems
- Installing a geothermal heating and cooling system
- New storefronts with insulated panels and insulated Low-E glazing

Renewable Energy Sources

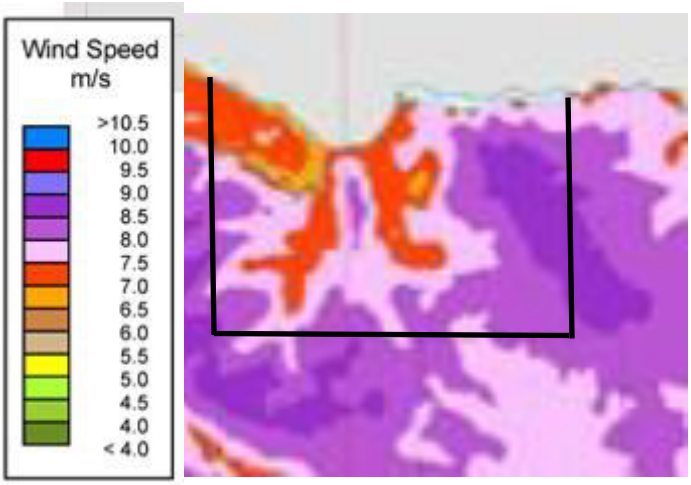
Renewable energy sources, according to most definitions, include natural resources such as the wind, the sun, water, and the earth (geothermal) that can be used over and over again with minimal or no depletion, as well as tapping into sources of methane (from natural resources or man-made conditions). The most common sources of renewable energy used in Nebraska are the wind, the sun, water and earth. The following are examples of how these renewable resources can be used to reduce dependency on fossil fuels.

WIND

The wind is one of those resources in abundance in Nebraska. Wind is not a new technology in Nebraska; the pioneers that settled in Nebraska used wind mills for power and to work the water wells on their farms and ranches.

Wind can be used to produce electricity through the construction of small-scale or utility/commercial grade wind conversion systems (wind turbines). However, not all areas of the state have the ideal levels needed to produce electricity on a utility or commercial level; but the use of small-scale wind turbines on homes and businesses will work in most parts of Nebraska.

9.4: Annual Average Wind Speed at 80 Meters



Source: AWS Truepower, NREL

Wind Energy in the Knox County area

Elkhorn Ridge Wind Farm

The first wind farm constructed in Knox County was Elkhorn Ridge located north of Bloomfield. The Elkhorn Ridge Wind Farm is an 80MW project located approximately 6 miles north of Bloomfield in Peoria Township, Knox County, Nebraska and will interconnect into the Nebraska Public Power District's transmission system. The project has executed a twenty-year Power Purchase Agreement with the Nebraska Public Power District.

Elkhorn Ridge is composed of 27 3.0MW turbines spread out over 3,400 acres of rolling farm land in one of the premier wind resources in Nebraska. Elkhorn Ridge also has a Community Based Energy Development (C-BED) component in which 33% of the ownership is Nebraska residents. Elkhorn Ridge complies with all the requirements of State Legislature LB629.

(Source: http://midwestwind.com/projects/show.php?1D=13)

Crofton Bluffs Wind Farm

The Crofton Bluffs Wind Energy Facility was a joint effort between NPPD and Edison Mission Group. There are 22 Vestas V90 wind turbines - some sized at 1.8 MW and others at 3 MW - at this site. In all, the project is capable of producing 42 MW of power. From this project, NPPD will take 20 MW, Omaha Public Power District 13 MW, the Municipal Energy Agency of Nebraska four, and Lincoln Electric System three.

Source: http://www.kansasenergy.org/NE_wind_projects_case.htm

~~**Verdigre Wind Farm**~~

~~This project of NextEra U.S. company based in Juno Beach, Florida. This project is located in Southwest Knox County. A sodar unit was installed in October 2010 and two 60 meter meteorological towers were installed in February 2011. Over 6,900 acres of agricultural crop and grazing land are under long-term control. Long-term estimated wind speeds for this project are 8.2 m/s.~~

~~**North Fork Wind Farm**~~

~~This project was originally developed by Midwest Wind Energy LLC, though in March 2013, MWE sold it's wind farm development portfolio to Geronimo Energy of Edina, Minnesota, including this project. The project is expected to be around 1,200 to 1,500 MW in size and contain up to 600 wind turbines.~~

ETHANOL PRODUCTION

There are no petroleum or ethanol facilities located within Knox County; however, Husker AG, LLC has an ethanol facility just south of the Knox County line in Plainview. Husker Ag is an ethanol production facility built by Fagen Inc. of Granite Falls, MN and designed by ICM of Colwich, KS. Husker Ag expanded its operations in the fall of 2007. This expansion was designed and built by ICM. With the expansion, Husker Ag now utilizes over 26 million bushels of corn per year to produce about 76 million gallons of denatured ethanol. Husker Ag also produces about 450,000 tons of modified wet distillers' grain per year which is fed by area cattle feeders. Husker Ag currently employs 49 full time employees from several surrounding communities including: Norfolk, Pierce, Randolph, Osmond, Plainview, Creighton, Bloomfield, Brunswick, Elgin, and Tilden.

(Source: http://www.huskerag.com/index.cfm?show=1 0&mid=1 2)

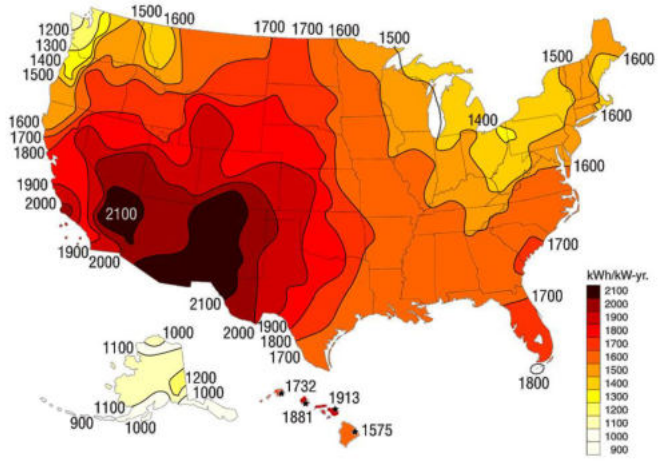
~~SOLAR~~

~~Solar energy has been around for decades and it last hit a high in popularity in the 1970's. However,~~

today's solar energy design is much more efficient and aesthetically pleasing. Some of the aesthetic improvements have to do with the fact that today's systems are not as bulky as their ancestors. Today, solar is being used much like wind turbines, on a small-scale level (home or business) or a much grander level (solar farms).

Based upon the diagram below there is great solar potential in the state of Nebraska. A majority of the state lies within some of the better areas in the country for solar potential.

Figure 9.5: Solar Contours



Source: Solar Energy Industries Association

Geothermal Energy

Geothermal energy is typically utilized through a process where a series of pipes are lowered into vertical cores called heat-sink wells. The pipes carry a highly conductive fluid that either is heated or cooled by the constant temperature of the ground. The resulting heat exchange is then transferred back into the heating and cooling system of a home or other structure. This is called a geothermal heat exchange system or ground source heat pump. The California Energy Commission estimates the costs of a geothermal system can earn net savings immediately when financed as part of a 30-year mortgage *(Source: American Planning Association, PAS Memo January/February 2009)*.

Methane Energy

The use of methane to generate electricity is becoming more cost-effective to use in Nebraska. Methane electrical generation can be accomplished through the use of a methane digester which takes the raw gas, naturally generated from some form of decomposing material, and converts the gas into electrical power.

There have been some attempts to take the methane generated from animal manure and convert it into electricity; most have been successful but were costly to develop. Another approach to methane electrical generation is to tap into the methane being generated from a solid waste landfill; instead of burning off the methane, it can be piped into a methane convertor and generated into electricity for operating a manufacturing plant or placed on the overall grid for distribution.

Methane convertors make use of unwanted gases and are able to produce a viable product. As long as humans need to throw garbage into a landfill or the production of livestock is required, there will be a source of methane to tap for electrical generation.

State Programs

The following provides a basic history and description of some newer programs in Nebraska; interested parties should contact the State of Nebraska Energy Office or the local power districts.

C-BED Program

In May 2007, Nebraska established an exemption from the sales and use tax imposed on the gross receipts from the sale, lease, or rental of personal property for use in a community-based energy development (C-BED) project. The Tax Commissioner is required to establish filing requirements to claim the exemption. In April 2008 L.B. 916 made several amendments to this incentive, including: (1) clarified C-BED ownership criteria to recognize ownership by partnerships, cooperatives and other pass-through entities; (2) clarified that the restriction on power purchase agreement payments should be calculated according to gross and not net receipts; (3) added language detailing the review authority of the Tax Commissioner and recovery of exempted taxes; and (4) defined local payments to include lease payments, easement payments, and real and personal property tax receipts from a C-BED project.

A C-BED project is defined as a new wind energy project that meets one of the following ownership conditions:

For a C-BED project that consists of more than two turbines, the project is owned by qualified owners with no single qualified owner owning more than 15% of the project and with at least

33% of the power purchase agreement payments flowing to the qualified owner or owners or local community; or

For a C-BED project that consists of one or two turbines, the project is owned by one or more qualified owners with at least 33% of the power purchase agreement payments flowing to a qualified owner or local community.

In addition, a resolution of support for the project must be adopted by the county board of each county in which the C-BED project is to be located.

A qualified C-BED project owner means:
a Nebraska resident;
a limited liability company that is organized under the Limited Liability Company Act and that is entirely made up of members who are Nebraska residents;
a Nebraska nonprofit corporation;
An electric supplier(s), subject to certain limitations for a single C-BED project.

In separate legislation (LB 629), also enacted in May 2007, Nebraska established the Rural Community-Based Energy Development Act to authorize and encourage electric utilities to enter into power purchase agreements with C-BED project developers.

Local Government and Renewable Energy Policies

Local governments can take steps to encourage greater participation in wind generation. Cities and counties can pursue strategies to make these projects more attractive, including:

- Develop or amend existing zoning regulations to allow small-scale wind turbines as an accessory use in all districts.
- Develop or amend existing zoning regulations to exempt small-scale turbines from maximum height requirements when attached to an existing or new structure; provided, they meet all building codes and manufacturers requirements for attachment.
- Work with the local power districts on ways to use wind turbines on small-scale individual projects or as a source of power for the community.

Net Metering in Nebraska

LB 436, signed in May 2009, established statewide net metering rules for all electric utilities in Nebraska. The rules apply to electricity generating facilities which use solar, methane, wind, biomass, hydropower or geothermal energy, and have a rated capacity at or below 25 kilowatts (kW). Electricity produced by a qualified renewable energy system during a month shall be used to offset any kilowatt-hours (kWh) consumed at the premises during the month.

Any excess generation produced by the system during the month will be credited at the utility's avoided cost rate for that month and carried forward to the next billing period. Any excess remaining at the end of an annualized period will be paid out to the customer. Customers retain all renewable energy credits (RECs) associated with the electricity their system generates. Utilities are required to offer net metering until the aggregate generating capacity of all customer-generators equals one percent of the utility's average monthly peak demand for that year.

State Law of Solar and Wind Easements

Nebraska's solar and wind easement provisions allow property owners to create binding solar and wind easements for the purpose of protecting and maintaining proper access to sunlight and wind. Originally designed only to apply to solar, the laws were revised in March 1997 (LB 140) to include wind. Counties and municipalities are permitted to develop regulations, or development plans protecting access to solar and wind energy resources if they choose to do so. Local governing bodies may also grant zoning variances to solar and wind energy systems that would be restricted under existing regulations, so long as the variance is not substantially detrimental to the public good.

LB 568, enacted in May 2009, made some revisions to the law and added additional provisions to govern the establishment and termination of wind agreements. Specifically, the bill provides that the initial term of a wind agreement may not exceed forty years. Additionally, a wind agreement will terminate if development has not commenced within ten years of the effective date of the wind agreement. If all parties involved agree to extend this period, however, the agreement may be extended.

Current Renewable Energy Programs/Funding Sources

There are several programs available through the power districts to assist in purchasing and installing more energy efficient equipment in residences and businesses. In addition, there are funding opportunities through the Nebraska Energy Office.

Energy in Knox County

Knox County will continue to encourage the development of energy-related goals, policies and strategies.

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Chapter 10 Hazards

Introduction

This Chapter of the Knox County Comprehensive Plan contains the description of specific hazards within the planning area. Good planning would dictate the need to include such issues as Hazards within the Comprehensive Plan. The information found in this Chapter has been taken from the current Hazard Mitigation Plan written for the counties of Antelope, Holt and Knox. The discussion herein will be focused on those with a land use impact and only for Knox County.

Since 1967 Knox County has been directly involved in 11 Presidential Disaster Declarations including: floods, ice jams, tornadoes, severe storms, and severe winter storms. The most recent was during the development of this Comprehensive Plan, March 2019.

Hazards Section

One of the key items within the hazard mitigation plan is a risk assessment for the future. The assessment is based upon the type of hazard event and likelihood of it occurring again in the future.

The type of hazards assessed are:

- Severe Winter Storms
- Severe Thunderstorms
- Tornadoes
- Floods
- Extreme Heat
- Drought
- Dam Failure

Hazard Mitigation Plan

Chapter 3 of the ***Multi-jurisdictional Hazard Mitigation Plan*** rates the seven different hazards and rates them on Location, Maximum Probable Extent, Probability of Future Events, and Overall Significance.

It is critical to monitor hazards, even the ones rated as a Low Risk. The key to successfully addressing these incidents is to follow through with the Goals and Strategies developed to mitigate the issues. Successful mitigation will aid in minimizing the overall loss occurring from any hazard situation.

Figure 10.1: Hazard Identification and Risk Assessment Antelope, Holt and Knox Counties - 2016

Hazard	Location	Maximum Probable Extent	Probability of Future Events	Overall Significance
Severe Winter Storms	Extensive	Moderate	Highly Likely	Medium
Severe Thunderstorms	Significant	Moderate	Highly Likely	Medium
Tornadoes	Extensive	Severe	Highly Likely	Medium
Floods	Significant	Moderate	Highly Likely	Medium
Extreme Heat	Extensive	Severe	Unlikely	Medium
Drought	Extensive	Severe	Likely	High
Dam Failure	Significant	Severe	Unlikely	Low

Source: 2016 Multi-jurisdictional Hazard Mitigation Plan

The following tables extracted directly from the Hazard Mitigation Plan are the definitions for the terms listed in Table 10.1. The definitions are taken from the Federal Emergency Management Agency (FEMA).

Definition of Location

Classification	Definition
Negligible	Less than 10 percent of planning area or isolated single-point
Limited	10 to 25 percent of the planning area or limited single-point
Significant	26 to 75 percent of planning area or frequent single-point occurrences.
Extensive	76 to 100 percent of planning area or consistent single-point occurrences.

Definition of Maximum Probable Extent

Classification	Definition
Weak	Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
Moderate	Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
Severe	Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
Extreme	Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Definition for Probability of Future Hazards

Classification	Definition
Unlikely	Less than 1 percent probability of occurrence in the next year or a recurrence interval of greater than every 100 years.
Occasional	1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
Likely	11 to 90 percent probability of occurrence in the next year or a recurrence interval of 1 to 10 years.
Highly Likely	91 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1

Definition for Probability of Future Hazards

Classification	Definition
Low	Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
Medium	The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
High	The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

Earthquakes, landslides, wildfires, and levee failure were not evaluated in the plan update. During the hazard identification and risk assessment these hazards were deemed to be of low significance to Knox County. The hazard mitigation team eliminated these hazards from further consideration in development of mitigation actions due to: the risk of a hazard event in the planning area is unlikely or non-existent; the vulnerability of the planning area is low; and/or capabilities are already in place to mitigate negative impacts. Additional the following reasons were used to decide to not evaluate these four hazards:

Earthquakes

- Knox County, NE has a very low earthquake risk, with a total of 1 earthquakes since 1931. The USGS database shows that there is a 1.00% chance of a major earthquake within 50km of Frontier County, NE within the next 50 years. The largest earthquake within 30 miles of Knox County, NE was a 3.6 Magnitude in 1996.

Landslides

- Knox County, NE does not have any current landslides.
- Note: Until the storm of March 2019, Knox County had not seen any major landslides according to the most current Hazard Mitigation Plan; however, Since March 2019 the county has experienced numerous landslides.

Wildfires

In referencing the Nebraska Statewide Forest Action Plan there are low forested areas in the planning region and thereby the threat of wildfires is relatively low as well. Most trees in this region only follow the rivers and streams and are in the more urban areas. On the north side of Knox County there is a small portion of the Niobrara River Valley that is of some concern for wildfires but numerous other groups and agencies are addressing overall mitigation of this region under the Community Wildfire Protection Plans. There is also a predominance of prairie or pasture land in the planning area and prairie-fires are as likely to occur but also a low enough threat that the jurisdictions are not doing a full assessment of this hazard for this plan. The main actions that can occur for this hazard is to have appropriate grass-fire-fighting equipment at the volunteer fire departments and MOA's with other districts to assist as necessary and the potential of tilling under the prairie as a means of providing a fire-break. Both measures are really an operationally focused endeavor and not rooted in mitigation. For the Niobrara Valley any mitigation measures, such as fuels reduction and defensible space, are addressed in the Missouri River NE or the Northcentral Nebraska CWPP.

Levee Failure

Review of state and federal databases indicated there are no levees in, or proximate to, the planning area. There may be an undetermined number of agricultural levees present in the three-county area, but their potential failure would be limited to crop or pasture land and would have minimal or no impact on critical infrastructure, such as roads, bridges, buildings or any population center.

Post Hazard Mitigation Plan

Since the completion of the Hazard Mitigation Plan in 2016, the storms, floods, and ice jams of March 2019 created havoc on the northwestern portion of Knox County. Interestingly enough, the one disaster deemed to have the least risk occurred and was part of a disaster condition never seen before. The incident was the failure of Spencer Dam, located in Holt and Boyd Counties, but upstream from Niobrara along the Niobrara River.

The overall storm has been referred to as a "Bomb Cyclone" A "Bomb Cyclone" is defined as "*A type of extratropical cyclone characterized by high winds, a high level of precipitation, and rapid*

development".

Mitigation Action Summary - Knox County

The following table is the Action Summary portion for Knox County and represents continuing and new actions during the planning period of five-years for Hazard Mitigation.

During this planning period and beyond, it will be critical to continue participating in the updating of the Hazard Mitigation Plan (HMP). In the future, it is hopeful, Knox County will continue to participate in these projects as a multi-jurisdictional effort. Developing a Hazard Mitigation Plan consumes a lot of time, effort and money. The multi-jurisdictional approach aids in dividing the cost and effort. Current Federal policy, requires jurisdictions to address key hazards and plan for future mitigation efforts in order to be eligible for Federal Disaster Funding. These plans are also required to be updated periodically in order to remain current and eligible.

All potential hazards have the potential to create chaos and havoc in a county and its communities. No one hazard is greater than another, intensity, timing and how prepared a community is play critical roles in how intense a specific hazard hits the community. Knox County has seen its share of these hazards in the past and they will happen again. Hazard Mitigation Plans are intend to learn from the past and become better prepared for the next one to hit.

During the Hazard Mitigation participation process, Knox County determined existing or future flooding potential was a high concern. The following are the main strategies identified in the HMP.

Participate or Maintain Good Standing in the National Flood Insurance Program

Background
Participate in the National Flood Insurance Program (NFIP) or maintain good standing with the NFIP including floodplain management practices/ requirements and regulation enforcements and updates.

Benefits
Enable property owners to purchase insurance protection against flood losses. Good standing enables participants to apply for Pre-Disaster Mitigation Grant Program and Hazard Mitigation Grant Program cost-share.

Responsible Agency & Partners
Knox County Staff

Cost Estimate & Funding
$5,000, Tax Revenue, grants, bequeaths

Timeline
Continuous

Priority
High

Status
Continued Action from previous plan that requires ongoing action.

Flood-Prone Property Acquisition

Background
Voluntary acquisition and demolition of properties prone to flooding will reduce the general threat of flooding for communities. Additionally, this can provide flood insurance benefits to those communities within the National Flood Insurance Program. Repetitive loss structures are typically highest priority.

Benefits
Voluntary acquisition and demolition of properties prone to flooding will reduce the damages associated with flooding for communities. Additionally, this can provide flood insurance benefits to those communities within the National Flood Insurance Program. Communities must be in good standing with National Flood Insurance Program to be eligible for Hazard Mitigation Grant Program.

Responsible Agency & Partners
Knox County, Public Works, Utility, and/or Floodplain Management Department

Cost Estimate & Funding
$10,000+; Hazard Mitigation Assistance Grant Programs, Community Development Block Grant, Natural Resources Districts

Timeline
1-3 years

Priority
High

Status
Continued Action from previous plan that requires ongoing action.

Storm Shelter and Safe Rooms

Background
Assess, design and construct fully supplied safe rooms in highly vulnerable urban and rural areas such as mobile home parks, campgrounds, schools, and other such areas throughout the planning area. Assess the adequacy of current public buildings to be used as safe rooms. Construct safe rooms in areas of greatest need, either as new construction or retrofitting.

Benefits
Reduce the risk of death or injury in areas vulnerable to tornados, severe thunderstorms and other hazards.

Responsible Agency & Partners
Knox County Administration, Planning, and/or Emergency Management Departments

Cost Estimate & Funding
$400 to $500/square foot (stand-alone), $350 to 400/square foot (addition/retrofit); Hazard Mitigation Assistance Grant Programs

Timeline
1-3 years

Priority
High

Status
Continued Action from previous plan that has not been completed yet due to insufficient funding.

Backup Generators

Background
Provide a portable or stationary source of backup power to redundant power supplies, municipal wells, lift stations, and other critical facilities and shelters.

Benefits
Reduce the danger to human life/health by keeping utilities operating. Reduce the economic downtime associated with utility loss.

Responsible Agency & Partners
Knox County Administration

Cost Estimate & Funding
$20,000 to $35,000/generator; Hazard Mitigation Assistance Grant Programs

Timeline
1-3 years

Priority
High

Status
Continued Action from previous plan that has not been completed yet due to insufficient funding.

New Water Well, Tower, and Standpipe

Background
Evaluate the need to expand water storage capacity through a new water tower, stand pipe, etc. to provide a safe water supply for the community and additional water for fire protection. Communities can evaluate the need to install a new well to provide a safe backup water supply for the community, replace existing wells affected by drought, and additional water for fire protection.

Benefits
Establish back-up supplies of municipal water to supply the needs of citizens. Identify adequate water sources to mitigate potential damages or expenses due to drought. Provide a dependable and ready supply of water so fire districts don't have to rely on equipment and personnel to move water from local water sources to the fire.

Responsible Agency & Partners
Knox County Partners

Cost Estimate & Funding
$150,000 to $450,000; Hazard Mitigation Assistance Grant Programs, Community Development Block Grant, State Revolving Loan Fund

Timeline
3-5 years

Priority
Medium

Status
Continued Action from previous plan that has not been completed yet due to insufficient funding.

Road and Embankment Improvements

Background
Identify, design, and construct road and embankment improvements as necessary for proper drainage and to adequately manage the traffic load.

Benefits
Properly designed and constructed roads and embankments promote safer travel and allow for increased emergency response.

Responsible Agency & Partners
Knox County Board of Commissioners and Planning and Zoning Commission

Cost Estimate & Funding
$50,000+; Hazard Mitigation Assistance Grant Programs

Timeline
1-3 years

Priority
Medium

Status
This a continued action from past plan that is an ongoing action.

Alert and Warning Sirens

Background
Perform an evaluation of existing alert sirens to determine sirens which should be replaced or upgraded. Install new sirens where lacking and remote activation.

Benefits
Reduces the risk of death/injury associated with severe weather; promoting awareness and ensures people take shelter when needed.

Responsible Agency & Partners
Knox County, Individual City or Villages Public Works Departments and/or Emergency Management Departments, Natural Resources Districts

Cost Estimate & Funding
$25,000+; Hazard Mitigation Assistance Grant Programs, Natural Resources Districts

Timeline
1-3 years

Priority
Medium

Status
Continued Action from previous plan that has not been completed yet due to insufficient funding.

Civil Service Improvements

Background
Improve emergency rescue and response equipment and facilities by providing additional, or updating existing emergency response equipment. This could include fire equipment, ATVs, water tanks/truck, snow removal equipment, pumps, etc. This would also include developing backup systems for emergency vehicles, identifying and training additional personnel for emergency response, or continuing educational opportunities for current personnel.

Benefits
Having appropriate and up to date equipment along with adequately trained and numbered personnel increases safety and reduces the risk of damage.

Responsible Agency & Partners
Knox County, Individual City or Villages Public Works Departments and/or Emergency Management Departments

Cost Estimate & Funding
$5,000+; Hazard Mitigation Assistance Grant Programs

Timeline
1-3 years

Priority
Medium

Status
Continued Action from previous plan that requires ongoing action.

Public Awareness and Education Campaigns

Background
Through activities such as outreach projects, distribution of maps and environmental education increase public awareness of natural hazards to both public and private property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards. In addition, educate citizens on erosion control and water conservation methods.

Benefits
Public awareness reduces the risk of property loss and damage, injury and death. It increases knowledge on emergency procedures, facilities, conservation, and is key to preparedness.

Responsible Agency & Partners
Knox County, Individual City or Villages Departments (Fire, Police, Administration, Public Works, Parks, Floodplain Management, Utility, Roads, and/or Emergency Management Department(s); School Boards; Neighborhood/ Homeowner Associations), Natural Resources Districts, Nebraska Emergency Management Agency, Nebraska Department of Environmental Quality, Nebraska Department of Natural Resources

Cost Estimate & Funding
$1,000+; Hazard Mitigation Assistance Grant Programs

Timeline
1-3 years

Priority
Medium

Status
Continued Action from previous plan that requires ongoing action.

Drainage Assessment For Bridge and Culvert Improvements

Background
Preliminary drainage studies and assessments can be conducted to identify and prioritize design improvements to address site specific localized flooding/drainage issues to reduce and/or alleviate flooding. Stormwater master plans can be conducted to perform a community-wide stormwater evaluation, identifying multiple problem areas and potential drainage improvements.

Benefits
Proactive steps to identify all potential problems/ issues can lead to effectively addressing improvements and prioritizing the projects to improve conditions. These improvements can serve to more effectively convey runoff within jurisdictions, preventing interior localized flooding resulting in damages. This ensures that the most beneficial projects are done first and could possibly eliminate the need for others.

Responsible Agency & Partners
Knox County, Public Works, Utility, and/or Floodplain Management Department

Cost Estimate & Funding
$10,000 to $100,000+; Hazard Mitigation Assistance Grant Programs, Community Development Block Grant, Natural Resources Districts

Timeline
1-3 years

Priority
Low

Status
Continued Action from previous plan that requires ongoing action.

Floodplain Development Ordinance Enforcement

Background
Continue or improve floodplain management practices such as adoption and enforcement of floodplain management requirements (regulation of construction in significant flood hazard areas), floodplain identification and mapping (local requests for map updates), description of community assistance and monitoring activities, explanation for failure to participate in the National Flood Insurance Program, Community Rating System (CRS), and participation in Federal Emergency Management Agency's Cooperating Technical Partners Program (CTP) to increase local involvement in the flood mapping process. Continue to enforce local floodplain regulations for structures located in the 100-year floodplain. Strict enforcement of the type of development and elevations of structures should be considered through issuance of floodplain development permits by any community or County. Continue education of building inspectors or Certified Floodplain Managers. Encourage building

regulations for storm resistance structures.

Benefits
Continue compliance with the National Flood Insurance Program. Good standing enables participants to apply for Pre-Disaster Mitigation Grant Program and Hazard Mitigation Grant Program cost-share. Ensures that no new structures built will be vulnerable to flooding. Reducing damages and health risks associated with flooding.

Responsible Agency & Partners
Knox County Administration and/or Floodplain Management Departments, Nebraska Department of Natural Resources

Cost Estimate & Funding
$5,000+; Hazard Mitigation Assistance Grant Programs, Community Development Block Grant

Timeline
1-3 years

Priority
Low

Status
Continued Action from previous plan that requires ongoing action.

Stream Bank Stabilization

Background
Stream bank/bed degradation can occur along many rivers and creeks. Stabilization improvements including rock rip rap, vegetative cover, j-hooks, boulder vanes, etc. can be implemented to reestablish the channel banks. Grade control structures including sheet-pile weirs, rock weirs, ponds, road dams, etc. can be implemented and improved to maintain the channel bed. Channel stabilization can protect structures, increase conveyance and provide flooding benefits. Flood protection for critical and/or highly vulnerable facilities, areas, populations, and infrastructure is key.

Benefits
Stream bed/grade stabilization improvements can serve to more effectively protect structures, increase conveyance, prevent down cutting, and provide flooding benefits.

Responsible Agency & Partners
Knox County, Public Works, Utility, and/or Floodplain Management Department

Cost Estimate & Funding
$50,000 to $100,000+; Hazard Mitigation Assistance Grant Programs, Natural Resources Districts

Timeline
1-3 years

Priority
Low

Status
Continued Action from previous plan that requires ongoing action.

Warning Systems

Background
Improve city cable TV interrupt warning system and implement telephone interrupt system such as Reverse 911.

Benefits
Reduces the risk of death/injury associated with severe weather; promoting awareness and ensures people take shelter when needed.

Responsible Agency & Partners
Knox County, Public Works, Utility, and/or Floodplain Management Department

Cost Estimate & Funding
$5,000+; Hazard Mitigation Assistance Grant Programs, Natural Resources Districts

Timeline
1-3 years

Priority
Low

Status
Continued Action from previous plan that requires ongoing action.

Weather Radios

Background
Conduct an inventory of weather radios at schools and other critical facilities and provide new radios as needed.

Benefits
Reduces the risk of death/injury associated with severe weather conditions by communication.

Responsible Agency & Partners
Knox County, Individual City or Villages Public Works Departments and/or Emergency Management Departments

Cost Estimate & Funding
$75/radio; Hazard Mitigation Assistance Grant Programs

Timeline
1-3 years

Priority
Low

Status
Continued Action from previous plan that has not been completed yet due to insufficient funding.

Flood-prone Property Acquisition

Background
Voluntary acquisition and demolition of properties prone to flooding will reduce the general threat of flooding for communities. Additionally, this can provide flood insurance benefits to those communities within the National Flood Insurance Program. Repetitive loss structures are typically highest priority.

Benefits
Voluntary acquisition and demolition of properties prone to flooding will reduce the damages associated with flooding for communities. Additionally, this can provide flood insurance benefits to those communities within the National Flood Insurance Program. Communities must be in good standing with National Flood Insurance Program to be eligible for Hazard Mitigation Grant Program.

Responsible Agency & Partners
Knox County, Public Works, Utility, and/or Floodplain Management Department

Cost Estimate & Funding
$10,000+; Hazard Mitigation Assistance Grant Programs, Community Development Block Grant, Natural Resources Districts

Timeline
1-3 years

Priority
Low

Status
Continued Action from previous plan that requires ongoing action.

Hazard Goals and Policies

Hazard Goal 1
The goal of Knox County is to continually work on implementing the Hazard Mitigation Plan

Hazard Policies and Strategies

HZ -1.1 The Zoning Administrator, Planning Commission, and County Board should refer to the Hazard Mitigation Plan prior to decisions that may impact hazards such as flooding.

HZ-1.2 Knox County should continue to be apart of the National Flood Insurance Program during the planning period.

Hazard Goal 2
The goal of Knox County is to continue to update the Hazard Mitigation Plan as needed.

Hazard Policies and Strategies

HZ-2.1 The Hazard Mitigation Plan should be updated at least every five years.

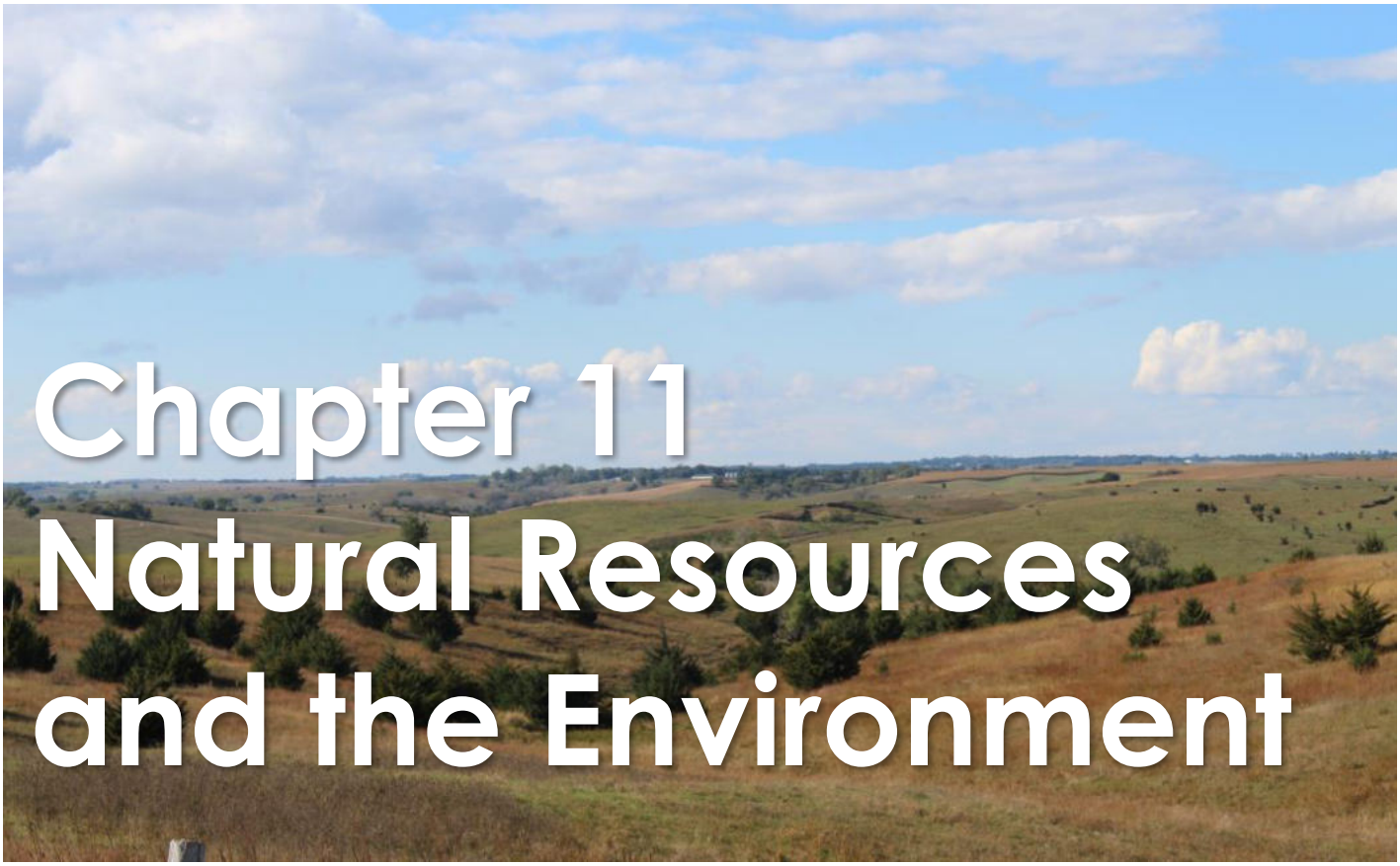
HZ-2.2 Knox County Planning and Zoning should play a role in the Knox County portion of the Hazard Mitigation Plan updates.

HZ-2.3 The Knox County Comprehensive Plan should update this chapter to reflect future changes to the Hazard Mitigation Plan.

Public Safety Goal 3
The goal of Knox County is to maintain regulations to protect the general health an

Conclusion

This Chapter is not intended to replace the Hazard Mitigation Plan adopted in August 11, 2016 by the County Board of Supervisors. Any specific information that is needed in this area not contained herein should be obtained by reviewing the entire Hazard Mitigation Study.



Chapter 11
Natural Resources and the Environment

Introduction

In order to formulate a truly valid and "comprehensive" plan for the future development of Knox County, it is first necessary to evaluate the environmental and man-made conditions currently existing in order to determine the impacts these factors may have on future land uses in the County. This component of the Knox County Comprehensive Plan provides a general summary of the environmental and man-made conditions, which are present in the County, and identifies and qualifies the characteristics of each which will directly or indirectly impact future land uses in the County.

Natural Environmental Conditions

- Climate
- Geology
- Relief and Drainage
- Wildlife
- Wetlands
- Soil Association
- Capability Grouping
- Prime Farmland
- Soil Limitations

Natural Conditions

Climate

(This information was taken from the Knox County Soil Survey by the United States 1997 with some data updated from more recent data)

Knox County is cold in winter. Summers are quite hot but have occasional cool spells. Precipitation during the winter frequently occurs as snowstorms. During the warm months precipitation mainly consists of showers, often heavy, that occur when warm, moist air moves in from the south. Total annual rainfall is normally adequate for corn, soybeans, and small grain.

Data on temperature and precipitation for the survey area as recorded at Niobrara, Nebraska, in the period 1951 to 1987.

In winter, the average temperature is 23 degrees F and the average daily minimum temperature is 10.2 degrees. The lowest temperature on record, which occurred at Niobrara on January 29, 1966, is -31 degrees. In summer, the average temperature is 74 degrees and the average daily maximum temperature is 87 degrees. The highest recorded *temperature,* which occurred on July 27, 1952, is 109 degrees.

The total annual precipitation is about 23 inches. Of this, more than 17 inches, or nearly 80 percent, usually falls in April through September. The growing season for most crops falls within this period. Thunderstorms occur on about 49 days each year.

The average seasonal snowfall is about 29 inches. On the average, 27 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 14 miles per hour, in spring.

Tornadoes and severe thunderstorms occasionally occur. These storms are local in extent and of short duration. They can result in sparse damage in narrow areas. Hailstorms occur at times during the warmer part of the year. They occur in irregular patterns and in relatively small areas.

Geology and Groundwater

(This information was taken from the Knox County Soil Survey by the United States Department of Agriculture – Soil Conservation Service – 1997)

The bedrock in Knox County consists of layers of sandstone, chalk, and shale of Cretaceous age. Two rock units of Late Cretaceous age are exposed within the county. The Niobrara Formation is the lower of these units. It is composed of chalk, calcareous shale, and shaly limestone. It is overlain by the Pierre Shale, a formation consisting of bentonitic shale, calcareous shale, shaly chalk, and claystone.

In the topographically higher parts of the county, remnants of the Ogallala Group of Miocene (Tertiary) age overlie the bedrock. This rock unit is composed of beds of sand, lime-cemented sandstone, and sandy silt that has areas of lime.

Continental ice sheets advanced over the eastern part of Knox County at least twice during the Pleistocene (Quaternary) age. When these ice sheets melted, they left deposits of clayey and silty till throughout most of the area east of a line between the present sites of the towns of Niobrara and Creighton. Glacial meltwater deposited sand and clayey sand west of this line. Layers of wind-deposited limy silt (loess) mantle these ice-age deposits. The lower part of these wind-deposited sediments is pale pink. It is known as Loveland loess. The upper part is grayish yellow. It is called Peorian loess. Most of the upland soils formed in these loess deposits.

The Missouri River, which forms the northern boundary of Knox County, has cut a valley through the Pierre Shale and into the Niobrara Formation. The lower areas of Ponca Creek and the Niobrara River also are incised into the Niobrara Formation. Verdigris Creek, which flows into the Niobrara River, and Bazile, Lost, and Weigand Creeks, which flow into the Missouri River, are the principal tributary streams draining the upland part of the county. Stream terraces and flood plains in the valleys of the Missouri and Niobrara Rivers and Ponca Creek and other creeks are underlain by stream-deposited sediments (alluvium) of Quaternary age. Ground-water supplies that are sufficient for irrigation are mostly limited to those parts of the county that are underlain by the Ogallala Group and by coarse textured Quaternary deposits. In other areas ground-water supplies that are sufficient for domestic and livestock use are in sand lenses of till and alluvial deposits.

In fractured areas the Niobrara Formation is a potential source of water. This water, however, is likely to be very alkaline. Another potential source of water is the Dakota Sandstone of Early Cretaceous age. Wells must be drilled to a depth of 500 feet or more to tap this water.

Many springs occur along valley sides. They provide natural outlets for water in the Ogallala Group and Quaternary deposits.

Physiography, Relief, and Drainage

(This information was taken from the Knox County Soil Survey by the United States Department of Agriculture – Soil Conservation Service – 1997)

The county includes a wide variety of exposed geologic materials. The surface features are the result of wind and water acting on these materials. The general character of the surface relief in a particular area is related to the severity of geologic erosion to which the soil in that area has been subjected, to the erosive resistance of the formations that were exposed, and to the surface features of the formations at the time they were covered by the later deposits.

Geologic erosion has been most severe in the western and northern parts of the county. It has

resulted in the development of three major physiographic areas—the loess hills, the Holt Table, and the Pierre shale plains and hills. About 60 percent of the county, in the southeastern part, is covered by the loess hills area. The northern boundary of this area extends diagonally across the central part of the county from southwest to northeast. Throughout most of this area, the mantle of loess is intact. In places the surface relief is nearly level or gently undulating. The nearly level areas make up 10 percent or less of the loess hills area. Gently rolling to steep areas make up the rest of the loess hills area. The eastern part of the county is characterized by round-topped hills and divides. The drainage pattern is fairly intricate. Only a comparatively small percentage of the surface is rough and gullied. The relief in the areas that have a mantle of loess probably is not so much the result of erosion but is caused by the nature of the surface layer beneath the loess.

In the central and western parts of the county, the mantle of loess has been severely eroded by the headwater of Bazile and Verdigris Creeks. These creeks are entrenched at a depth of 150 to 200 feet below the general level of the uplands. A few small, tablelike remnants of loess remain, but most of the loess material has been carved into a succession of sharp divides and narrow, steep-sided valleys. The loess has been eroded in large areas, exposing the underlying formation. In areas where the exposed material is sand, drainage channels are poorly developed and the land surface is gently rolling or hummocky. In areas where erosion has cut through the loose sand into the underlying sandstone formation of Tertiary age, such as areas adjacent to the headwater of Merriman and Verdigris Creeks, the relief is pronounced. Most of the lower valley slopes are gradual, but they become steeper as elevation increases. Although the tops of most of the divides are narrow, few of them are sharp. In areas where the divides are covered by loess, they have surfaces that are nearly level to extremely rough and broken, depending on the severity of erosion to which they have been subjected. In areas where the divides are covered by sandy material, they are rolling or hummocky.

The physiographic area known as the Holt Table makes up about 12 percent of the county. This area extends into the county from the west. It is in all of the upland areas south of the Niobrara River, west of Verdigris Creek, and north of the loess hills.

The surface features in the area of the Holt Table in Knox County were largely formed by wind. The loess mantle has been removed from all but about 15 percent of the Holt Table, and the underlying sand deposits have been exposed. These sand deposits, although fairly stable because of the large admixture of loess, have been reworked and shifted by the winds, resulting in a strongly undulating or gently rolling appearance.

The surface is modified in places by hummocky sands that have been deposited into low mounds and ridges, by nearly level areas of the loess mantle, and by strongly rolling or hilly areas where stream erosion has gullied the surface of the loess remnants or has cut through both the loess and sand into the underlying *Pierre* shale. In places, drifting sand has modified the irregularities formed by water, and in most areas the surface features are well rounded.

The area of Pierre shale plains and hills makes up about 18 percent of the county. It is fairly continuous across the northern edge of the county. It includes the uplands between the Niobrara and Missouri Rivers in the northwestern part of the county, the upland areas in the Verdigris Creek drainage basin south of Verdigre in the west-central part of the county, and upland areas between the loess hills and the Missouri River that range from 1 to 7 miles in width. The Pierre shale plains and hills have been more severely eroded than either the loess hills or the Holt Table. Areas of the Pierre shale plains and hills include some of the roughest surfaces in the county but also include rather large areas where the surface is undulating or rolling. The more gentle relief is in areas of loess between the Niobrara and Missouri Rivers. In these areas, a thin covering of loess covers about 40 percent of the surface, including the higher divides. Throughout the remainder of the area, erosion has removed the loess mantle and the underlying glacial deposits and exposed the Pierre shale. The relief in areas of the shale ranges from strongly sloping to extremely rough and broken. In many of the deeper valleys, the shale has been eroded and the streams have carved vertical channel walls in the underlying chalk rock. Vertical exposures of chalk rock also are numerous on the lower slopes of the high, blufflike escarpment that borders the Missouri River.

The stream terraces and flood plains occur along the streams. The stream terraces occur at several distinct levels, depending on the depth to which the streams had cut prior to deposition of the

alluvial material. The highest and most extensive development of stream terraces is between the flood plains and uplands on the south side of the Niobrara River. In these areas several of the stream terraces are more than a mile wide and are 75 to 90 feet above the stream channel. Lower and smaller stream terraces border the flood plains along the Missouri River. Low stream terraces occur along the Niobrara River, Bazile Creek, and Verdigris Creek and some of their tributaries. The stream terraces are nearly level or gently undulating, except in areas where the surface is slightly hummocky and sandy.

The flood plains make up the lowest parts of the landscape. The surface of the flood plains is only a few feet above the streams. The broadest flood plains are along the Missouri River. They are discontinuous and, in places, are as much as 2 miles wide. Continuous strips, ranging from one-eighth mile to about one-half mile in width, are along most of the creeks and their larger tributaries. The flood plain is nearly level but is modified in places by stream channels and remnant stream terraces.

Knox County has an average elevation of about 1,600 feet above sea level. The lowest elevation, approximately 1,220 feet above sea level, is in an area where the Missouri River crosses the northeast corner of the county. The highest elevation, about 2,000 feet above sea level, is in the uplands in the southeastern part of the county. Niobrara has an elevation of 1,248 feet above sea level; Verdigre, 1,345; Creighton, 1,600; Winnetoon, 1,645; Bloomfield, 1,703; and Wausa, 1,780.

Drainage is northward to the Missouri River through Beaver, Weigand, Bazile, and Verdigris Creeks and their tributaries. A small area in the northwestern part of the county drains eastward to the Missouri River through the Niobrara River and Ponca Creek. Areas in a few townships in the southeast corner of the county drain southward to the Elkhorn River.

The rivers, creeks, and tributaries provide ample drainage throughout practically all parts of the county. In large areas, surface runoff is rapid and erosion is severe. Areas that are poorly drained are in small, scattered, basinlike depressions on the more nearly level parts of the uplands (3). Poorly drained soils are along most of the creeks in the county, especially at the upper end of drainage systems where there is seepage and the stream channel is not deep.

WETLANDS

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods during the year, including during the growing season. Water saturation (hydrology) largely determines the soil development and the types of plant and animal communities living in and on the soil.

Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions favoring the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. Two general categories of wetlands are recognized: coastal or tidal wetlands and inland or non-tidal wetlands.

Inland wetlands found in Knox County are most common on floodplains along the Missouri River, Niobrara River and other creeks (riparian wetlands), in isolated depressions surrounded by dry land (for example, playas, basins, and "potholes"), along the margins of lakes and ponds, and in other low-lying areas where the groundwater intercepts the soil surface or where precipitation sufficiently saturates the soil (vernal pools and bogs). Inland wetlands include marshes and wet meadows dominated by herbaceous plants, swamps dominated by shrubs, and wooded swamps dominated by trees.

Certain types of inland wetlands are common to particular regions of the country:

- wet meadows or wet prairies in the Midwest
- prairie potholes of Nebraska

Many of these wetlands are seasonal (dry one or more seasons every year). The quantity of water present and the timing of its presence in part determine the functions of a wetland and its role in the environment. Even wetlands can appear dry, at times, for significant parts of the year - such as vernal pools - often provide critical habitat for wildlife adapted to breeding exclusively in these areas.

The federal government protects wetlands through regulations (like Section 404 of the Clean Water Act), economic incentives and disincentives (for example, tax deductions for selling or donating wetlands to a qualified organization and the "Swampbuster" provisions of the Food Security Act),

cooperative programs, and acquisition (for example, establishing national wildlife refuges).

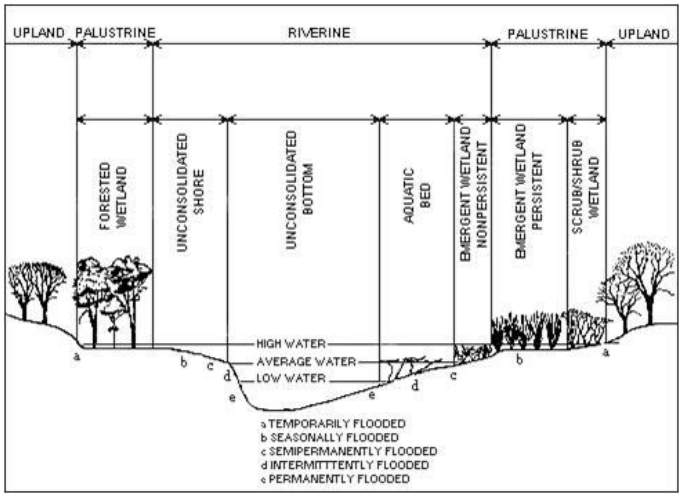
Partnerships to manage whole watersheds have developed among federal, state, tribal, and local governments; nonprofit organizations; and private landowners. The goal of these partnerships is to implement comprehensive, integrated watershed protection approaches. A watershed approach recognizes the interconnection of water, land, and wetlands resources and results in more complete solutions that address more of the factors causing wetland degradation.

The government achieves the restoration of former or degraded wetlands under the Clean Water Act Section 404 program as well as through watershed protection initiatives. Together, partners can share limited resources to find the best solutions to protect and restore America's natural resources. While regulation, economic incentives, and acquisition programs are important, they alone cannot protect the majority of our remaining wetlands. Education of the public and efforts in conjunction with states, local governments, and private citizens are helping to protect wetlands and to increase appreciation of the functions and values of wetlands. The rate of wetlands loss has been slowing. Approximately 75 percent of wetlands are privately owned, so individual landowners are critical in protecting these areas.

Wetlands play an important role in the ecology of Knox County. Wetlands are home to many species of wildlife, many of which live only in wetland areas. Wetlands also provide an important service to nearby areas by holding and retaining floodwaters. These waters are then slowly released as surface water, or are used to recharge groundwater supplies. Wetlands also help regulate stream flows during dry periods.

The U.S. Fish and Wildlife Service (FWS) produce information on the characteristics, extent, and status of the Nation's wetlands and deep-water habitats. This information has been compiled and organized into the National Wetlands Inventory (NWI).

Figure 11.1: Riverine Wetland System



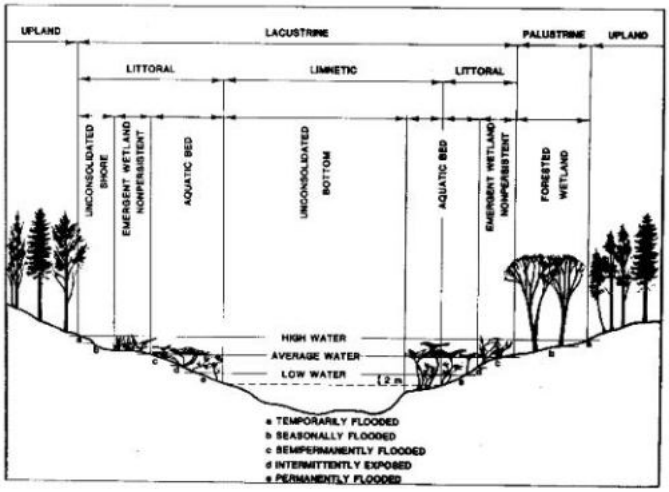
Source: National Wetlands Inventory

Wetlands are categorized in several classifications, each more detailed and specific than the previous. The NWI uses five systems; marine, estuarine, riverine, lacustrine, and palustrine. Within each system, there are subsystems, classes, subclasses, and dominance types to describe different wetland characteristics. The system classification refers to wetlands sharing similar hydrologic, geomorphologic, chemical, or biological factors. The following are definitions and examples of three of the five systems used to describe wetlands. The Marine and Estuarine wetland systems are located in and near the open ocean; therefore, they do not occur in Nebraska. Further information, through NWI, on specific classifications is available.

Knox County experiences each of these three other wetland systems. The majority of the wetlands in the county occur, mostly along the Platte River and as meadow areas. However, there are smaller wetland pockets scattered around Knox County.

Figures 11.1, 11.2, and 11.3 depict common examples of the riverine, lacustrine, and palustrine wetlands, respectively. Figure 11.4 shows the occurrence of wetlands in Knox County. These figures were produced by the United States Fish and Wildlife Service, and are taken from their 1979 publication entitled "Classification of Wetlands and Deepwater Habitats of the United States", some enhancement was completed in order to place accents on key areas.

Figure 11.2: Lacustrine Wetland System



Source: National Wetlands Inventory

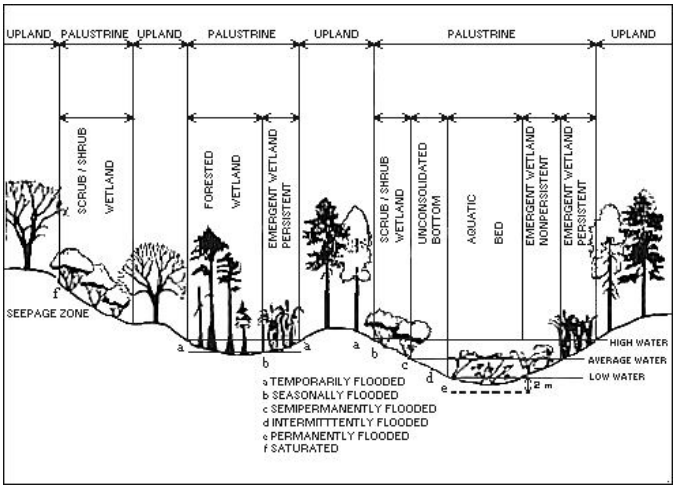
Figure 11.1 shows the riverine system includes all wetlands occurring in channels, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergent, emergent mosses, or lichens, and (2) habitats with water containing ocean derived salts in excess of 0.5%. A channel is an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water. Therefore, water is usually, but not always, flowing in the riverine system.

Springs discharging into a channel are also part of the riverine system. Uplands and palustrine wetlands may occur in the channel, but are not included in the riverine system. Palustrine Moss-Lichen Wetlands, Emergent Wetlands, Scrub-Shrub Wetlands, and Forested Wetlands may occur adjacent to the riverine system, often in a floodplain.

The Lacustrine System includes all wetlands with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent moss or lichens with greater than 30% area coverage; and (3) total area exceeds 20 acres. Similar wetland areas totaling less than 20 acres are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 6.6 feet (2 meters) at low water.

The Lacustrine System includes permanently flooded lakes and reservoirs (e.g. Lake Superior), intermittent lakes (e.g. playa lakes), and tidal lakes with ocean-derived salinities below 0.5% (e.g. Grand lake, Louisiana). Typically, there are extensive areas of deep water and there is considerable wave action. Islands of Palustrine wetlands may lie within the boundaries of the Lacustrine System.

Figure 11.3: Palustrine Wetland System



Source: National Wetlands Inventory

The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergent, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 20 acres; (2) lacking active wave-formed or bedrock shoreline features; (3) water depth in the deepest part of basin less than 6.6 feet (2 meters) at low water; and (4) salinity due to ocean-derived salts less than 0.5%.

The Palustrine System was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent, or intermittent water bodies often called ponds. These wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers.

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

NATIONAL WETLANDS INVENTORY MAP

LEGEND

- City/Town
- Wetland
- Lake
- River/Stream
- State Highway
- County Road
- Santee Reservation
- County Boundary

MARVIN PLANNING CONSULTANTS

Specializing in Municipal, County and Neighborhood Planning

PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

N

0 2 4 8 Miles

1 " = 4 miles

N

S O U T H D A K O T A

98°15' 98°00' 97°45' 97°30' 42°45' 42°30'

Missouri River

Lewis and Clark Lake

BOYD COUNTY

KNOX COUNTY

CEDAR COUNTY

HOLT COUNTY

ANTELOPE COUNTY

PIERCE COUNTY

T 34 N T 33 N T 32 N T 31 N T 30 N T 29 N

R8W R7W R6W R5W R4W R3W R2W

Verdel Santee Niobrara Lindy Crofton Center Verdigre Bloomfield Winnetoon Bazile Mills Creighton Wausa

NIOBRARA STATE PARK

SANTEE INDIAN RESERVATION

Niobrara River Verdigris River Bazile Creek Middle Branch North Elkhorn River

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

1 MOODY-BAZILE-TRENT association

2 CROFTON-NORA-ALCESTER association

3 BETTS-CROFTON-ALCESTER association

4 THURMAN-BAZILE-ORTELLO association

5 VALENTINE-SIMEON-THURMAN association

6 SIMEON-MEADIN-O'NEILL association

7 BRUNSWICK-PAKA-SIMEON association

8 LABU-LYNCH-SANSARC association

9 AOWA-SHELL-KEZAN association

10 FLUVAQUENTS-ALBATON-SOLOMON association

11 INAVALE-BARNEY-ORWET association

* The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1989

GENERAL SOIL MAP

KNOX COUNTY, NEBRASKA

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

Soil Formation and Classification

The general soil map shows broad areas having a distinctive pattern of soils, relief, and drainage. Each map unit, or soil association, on the general soil map is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. The associations are named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

Because of its scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one soil association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

(The following information has been inserted directly from the Knox County Soils Survey dated 1997)

Soil Associations

1.Moody-Bazile-Trent Associations

General Soil Description

Very deep, nearly level to gently sloping, well drained and moderately well drained, loamy and silty soils; on uplands and stream terraces

This association consists of soils on ridgetops and side slopes along upland drainageways. These soils formed in silty and sandy sediments and loess. Slopes range from 0 to 6 percent.

This association has a total area of about 118,100 acres, or about 17 percent of the county. It is about 39 percent Moody soils, 29 percent Bazile soils, 17 percent Trent soils, and 15 percent minor soils.

The Moody soils are on flat ridgetops and smooth side slopes in the uplands. These well drained soils are nearly level to gently sloping. Typically, the surface layer is dark grayish brown, firm silty clay loam about 7 inches thick. The subsoil is firm silty clay loam about 41 inches thick. The upper part is grayish brown, and the lower part is pale brown and very pale brown. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam.

The Bazile soils are on ridgetops and side slopes in the uplands and on stream terraces along drainageways. These well drained soils are nearly level to gently sloping. Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable clay loam about 10 inches thick. The subsoil is about 14 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is pale brown, friable clay loam. The underlying material to a depth of more than 60 inches is very pale brown sand.

The Trent soils are in swales on uplands. These well drained and moderately well drained soils are nearly level. Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 12 inches thick. The subsoil is firm silty clay loam about 34 inches thick. The upper part is dark grayish brown, and the lower part is brown. The underlying material to a depth of more than 60 inches is pale brown, calcareous silty clay loam.

Of minor extent in this association are the Crofton, Kezan, Nora, Paka, and Thurman soils. Crofton soils are calcareous at or near the surface. They are on gently sloping to strongly sloping ridgetops and side slopes. Kezan soils are poorly drained. They are on bottom land along narrow drainageways below the major soils. Nora and Paka soils are shallower to carbonates than the Moody soils. They are on gently sloping to strongly sloping side slopes. Paka soils have weakly cemented siltstone bedrock below a depth of 40 inches. Thurman soils are sandy. They are on gently sloping side slopes.

The major soils in this association are used for diversified farming. Most farms combine grain and livestock enterprises. More than half of the area is dry-farmed. Corn, soybeans, oats, and alfalfa are the main crops. Some areas are irrigated with sprinkler systems. Water for irrigation is supplied by deep wells, Figure 11.6. A few small areas support introduced grasses or native grasses used for grazing or hay. Some farms have dairy herds. Some livestock is fattened in feedlots and then marketed. The forage crops generally are used as winter feed for cattle.

The main management concerns in cultivated areas are reducing the rate of runoff, controlling water erosion, conserving soil moisture, and maintaining soil fertility and tilth. The efficient use of irrigation water is a management concern in irrigated areas. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Proper grazing use,

timely deferment of grazing and haying, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition.

FIGURE 11.6:
TYPICAL LANDSCAPE OF MOODY-BAZILE-TRENT ASSOCIATIONS

2. Crofton-Nora-Alcester Association

General Soil Description

Very deep, gently sloping to very steep, well drained, silty soils; on uplands and foot slopes

This association consists of soils on ridgetops and side slopes along intermittent drainageways. These soils formed in loess and silty colluvial and alluvial sediments. Slopes range from 2 to 60 percent, Figure 11.7.

This association has a total area of about 231,900 acres, or about 33 percent of the county. It is about 50 percent Crofton soils, 16 percent Nora soils, 14 percent Alcester soils, and 20 percent minor soils.

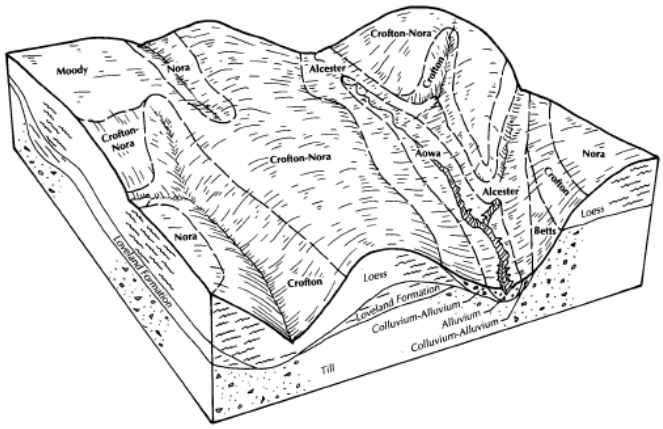
The Crofton soils are on ridgetops, side slopes, and short breaks along drainageways. These well drained soils are gently sloping to very steep. Typically, the surface layer is grayish brown, friable, calcareous silt loam about 6 inches thick. Below this is a transitional layer of brown, friable, calcareous silt loam about 5 inches thick. The underlying material to a depth of more than 60 inches is pale brown and very pale brown, calcareous silt loam.

The Nora soils are on smooth divides and long smooth side slopes along intermittent drainageways. These well drained soils are gently sloping to moderately steep. Typically, the surface layer is dark grayish brown, friable silty clay loam about 6 inches thick. The subsurface layer also is dark grayish brown, friable silty clay loam. It is about 5 inches thick. The subsoil is about 27 inches thick. The upper part is brown, friable silty clay loam, and the lower part is pale brown, friable, calcareous silt loam. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam.

The Alcester soils are on short, smooth, slightly concave foot slopes below areas of the Crofton and Nora soils and along narrow, intermittent drainageways. These well drained soils are gently sloping and strongly sloping. Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 16 inches thick. The subsoil is about 37 inches thick. The upper part is brown, friable silt loam, and the lower part is pale brown, firm, calcareous silty clay loam.

Of minor extent in this association are the Aowa, Bazile, Betts, Moody, and Thurman soils. Aowa soils are silty. They are on bottom land along narrow drainageways below the Alcester soils. Bazile soils formed in loamy material over sandy sediments. They are on smooth ridgetops and side slopes. Betts soils formed in glacial till. They are on side slopes below the Crofton soils. Moody soils are silty. They are commonly on smooth, gentle slopes above the Crofton and Nora soils. Thurman soils are somewhat excessively drained and sandy. They are on ridgetops and gently sloping to steep side slopes.

FIGURE 11.7:
CROFTON-NORA-ALCESTER ASSOCIATIONS



The major soils in this association are used for diversified farming. Most farms combine grain and livestock enterprises. Most of the gently sloping to

moderately steep areas are dry-farmed. Corn, soybeans, oats, and alfalfa are the main crops. Some areas are irrigated with sprinkler systems. Water for irrigation is supplied by deep wells. Corn and soybeans are the main irrigated crops. Most areas of the steep and very steep Crofton soils support native grasses used for grazing. A few steep areas support bromegrass or alfalfa and are used for grazing or hayland. Some farms have dairy herds. Some livestock is fattened in feedlots and then marketed.

The main management concerns in cultivated areas are reducing the rate of runoff, controlling water erosion, conserving soil moisture, and maintaining fertility and tilth. The efficient use of irrigation water is a management concern in irrigated areas. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Proper grazing use, timely deferment of grazing and haying, and a system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition.

3. Betts-Crofton-Alcester Association

General Soil Description

Very deep, gently sloping to very steep, well drained, loamy and silty soils; on uplands and foot slopes

This association consists of soils on ridgetops and side slopes along intermittent drainageways. These soils formed in glacial till, loess, and colluvial and alluvial sediments. Slopes range from 2 to 60 percent.

This association has a total area of about 18,700 acres, or about 3 percent of the county. It is about 64 percent Betts soils, 18 percent Crofton soils, 5 percent Alcester soils, and 13 percent minor soils.

The Betts soils are on short to long side slopes and breaks along drainageways. These well drained soils are strongly sloping to very steep. Typically, the surface layer is very dark grayish brown, friable clay loam about 5 inches thick. The subsoil is light brownish gray, friable clay loam about 21 inches thick. The underlying material to a depth of more than 60 inches is light gray clay loam. The soils are calcareous throughout. A few pebbles and stones are on the surface and throughout the profile.

The Crofton soils are on narrow ridgetops and short to long side slopes. These well drained soils are gently sloping to very steep. Typically, the surface layer is grayish brown, friable silt loam about 6 inches thick. Below this is a transitional layer of brown, friable silt loam about 5 inches thick. The underlying material to a depth of more than 60 inches is friable silt loam. It is pale brown in the upper part and very pale brown in the lower part. The soils are calcareous throughout.

The Alcester soils are on smooth, slightly concave foot slopes below the Betts and Crofton soils and along narrow, intermittent drainageways. These well drained soils are gently sloping and strongly sloping. Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 16 inches thick. The subsoil is about 37 inches thick. The upper part is brown, friable silt loam, and the lower part is pale brown, firm, calcareous silty clay loam.

Of minor extent in this association are the Brunswick, Meadin, Paka, Simeon, and Thurman soils. Brunswick soils are moderately deep over weakly cemented sandstone bedrock. They are commonly on side slopes below the Betts and Crofton soils. Meadin soils are excessively drained and are shallow over gravelly coarse sand. They are on ridgetops and the upper side slopes between areas of the Betts and Crofton soils. Paka soils are loamy. They have weakly cemented siltstone bedrock below a depth of 40 inches. They are commonly on the lower side slopes. Simeon soils are excessively drained and sandy. They are on ridgetops and the upper side slopes. Thurman soils are somewhat excessively drained and sandy. They are on side slopes.

The major soils in this association are used for diversified farming. Most farms combine livestock and grain enterprises. The most common livestock enterprises are cow-calf herds and dairy operations. About half of this association supports native grasses and is used for range. The steep and very steep areas are too erosive to be used as cropland. Some of the strongly sloping to steep areas are used as hayland. The other areas of this association are used for cultivated crops or support introduced grasses used for grazing. Corn, alfalfa, and oats are the main crops.

Water erosion is a hazard. Constructing dams can help to control erosion. The main management concerns in cultivated areas are reducing the rate of runoff, controlling water erosion,

conserving soil moisture, and maintaining fertility and tilth. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Proper grazing use, timely deferment of grazing, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition.

4. Thurman-Bazile-Ortello Association

General Soil Description

Very deep, nearly level to steep, somewhat excessively drained and well drained, sandy and loamy soils; on uplands and stream terraces

This association consists of soils on uplands and in valleys. These soils formed in loamy and sandy sediments, loess, and sandy eolian material. Slopes range from 0 to 30 percent, Figure 11.8.

This association has a total area of about 91,000 acres, or about 13 percent of the county. It is about 44 percent Thurman soils, 10 percent Bazile soils, 8 percent Ortello soils, and 38 percent minor soils.

FIGURE 11.8:
TYPICAL LANDSCAPE OF THURMAN-BAZILE-ORTELLO ASSOCIATIONS

The Thurman soils are on undulating or smooth slopes on uplands or stream terraces. These somewhat excessively drained soils are nearly level to steep. Typically, the surface soil is very friable loamy fine sand about 14 inches thick. It is grayish brown in the upper part and dark grayish brown in the lower part. The next layer is grayish brown, loose fine sand about 4 inches thick. The underlying material extends to a depth of more than 60 inches. It is pale brown fine sand in the upper part and very pale brown sand in the lower part.

The Bazile soils are on ridgetops and side slopes in the uplands and on stream terraces. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is grayish brown, very friable loamy fine sand or friable loam about 6 inches thick. The subsurface layer is dark grayish brown, very friable loamy fine sand or friable clay loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is pale brown, very friable loamy fine sand or firm silty clay loam, and the lower part is pale brown, friable silt loam. The underlying material to a depth of more than 60 inches is very pale brown sand.

The Ortello soils are on ridgetops and side slopes in the uplands and on stream terraces. These well drained soils are nearly level to gently sloping. Typically, the surface layer is grayish brown, friable fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown, friable fine sandy loam about 7 inches thick. The subsoil is friable fine sandy loam about 26 inches thick. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of more than 60 inches is very pale brown loamy sand.

Of minor extent in this association are the Blendon, Boelus, Crofton, Loretto, and Simeon soils. Blendon soils have a thick, dark solum. They are in upland swales. Boelus soils have a sandy surface soil and loamy underlying material. They are on side slopes in the uplands and on stream terraces. Crofton soils are silty and calcareous. They are on ridgetops, side slopes, and short, steep breaks along upland drainageways. Loretto soils are loamy. They are on upland ridgetops and side slopes. Simeon soils are excessively drained and sandy. They are on the upper side slopes in the uplands.

The major soils in this association are used for diversified farming. Most farms combine grain and livestock enterprises. More than half of the nearly level to strongly sloping areas are used for dryland farming or as irrigated cropland. Corn, soybeans, oats, rye, and alfalfa are the main dryland crops. Irrigation is mainly by center-pivot systems. Water for irrigation is supplied by deep wells. Corn, soybeans, and alfalfa are the main irrigated crops. The areas of pasture or native grasses are used for grazing or hayland. A few farms have

dairy herds. Some livestock is fattened in feedlots and then marketed. The forage crops generally are used as winter feed for cattle.

The main hazard in cultivated areas is soil blowing. Water erosion also is a hazard on the long, smooth side slopes. In some years, insufficient rainfall is a limitation affecting the production of dryland crops. Management concerns include maintaining fertility and organic matter content. A conservation tillage system that leaves crop residue on the surface helps to control soil blowing. Proper grazing use, timely deferment of grazing, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition.

5. Valentine-Simeon-Thurman Association

General Soil Description

Very deep, nearly level to steep, excessively drained and somewhat excessively drained, sandy soils; on uplands

This association consists of soils on nearly level to steep uplands. These soils formed in sandy eolian material and sandy alluvium or outwash material. Slopes range from 0 to 30 percent.

This association has a total area of about 19,300 acres, or about 3 percent of the county. It is about 34 percent Valentine soils, 22 percent Simeon soils, 21 percent Thurman soils, and 23 percent minor soils.

The Valentine soils are on uplands and occur mostly as areas of sandhills. These excessively drained soils are mainly gently sloping to steep. Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sand.

The Simeon soils are on upland divides and on side slopes along entrenched drainageways. These excessively drained soils are nearly level to steep. Typically, the surface layer is grayish brown, loose sand about 5 inches thick. Below this is a transitional layer that is also grayish brown, loose sand. It is about 8 inches thick. The underlying material to a depth of more than 60 inches is sand. It is very pale brown in the upper part and white in the lower part.

The Thurman soils are on upland ridgetops and side slopes and in swales. These somewhat excessively drained soils are nearly level to strongly sloping. Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. The subsurface layer is dark grayish brown, loose fine sand about 7 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sand.

Of minor extent in this association are the Inavale, Ortello, and Verdigre soils. Inavale soils are sandy. They are in narrow areas of bottom land along drainageways. Ortello and Verdigre soils are loamy. Ortello soils are in upland swales. They are lower on the landscape than the major soils. Verdigre soils formed in shale. They are on side slopes below the major soils.

Farms and ranches in this association are mainly cow-calf livestock enterprises. Most of the acreage supports native grasses used for range. Some of these areas are mowed for hay, which is used as winter livestock feed. A few areas are used for dryland farming or as irrigated cropland. Irrigation is by sprinkler systems. Water for irrigation is supplied by deep wells. Corn, oats, and alfalfa are the main crops.

Soil blowing is a severe hazard in cultivated areas. Using a system of conservation tillage, stripcropping, and seeding cover crops in the fall can help to control soil blowing. In some years, insufficient rainfall is a limitation affecting the production of dryland crops. The main management concern in areas of range is the production of grasses. Proper grazing use, timely deferment of grazing, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition.

6. Simeon-Meadin-O'Neill Association

General Soil Description

Very deep, nearly level to steep, excessively drained and well drained, sandy and loamy soils that are shallow and moderately deep over gravelly coarse sand; on uplands and stream terraces

This association consists of soils on uplands and stream terraces. These soils formed in sandy alluvium or outwash material and sandy or loamy

material deposited over gravelly coarse sand. Slopes range from 0 to 30 percent.

This association has a total area of about 11,200 acres, or about 1 percent of the county. It is about 37 percent Simeon soils, 20 percent Meadin soils, 15 percent O'Neill soils, and 28 percent minor soils.

The Simeon soils are on narrow ridgetops and side slopes in the uplands and on stream terraces. These excessively drained soils are nearly level to steep. Typically, the surface layer is grayish brown, loose sand about 5 inches thick. Below this is a transitional layer that is also grayish brown, loose sand. It is about 8 inches thick. The underlying material to a depth of more than 60 inches is sand. It is very pale brown in the upper part and white in the lower part. A few pebbles are throughout the profile.

The Meadin soils are on ridgetops and broad side slopes in the uplands and on stream terraces. These excessively drained soils are gently sloping to steep. Typically, the surface layer is dark grayish brown, friable sandy loam about 7 inches thick. Below this is a transitional layer of dark grayish brown, friable gravelly sandy loam about 5 inches thick. The underlying material to a depth of more than 60 inches is gravelly coarse sand. It is light yellowish brown in the upper part and very pale brown in the lower part.

The O'Neill soils are on convex ridgetops and side slopes in the uplands and on stream terraces. These well drained soils are gently sloping to steep. Typically, the surface layer is grayish brown, friable sandy loam about 6 inches thick. The subsurface layer is dark grayish brown, friable sandy loam about 3 inches thick. The subsoil is brown, friable sandy loam about 14 inches thick. The underlying material to a depth of more than 60 inches is very pale brown gravelly coarse sand.

Of minor extent in this association are the Brunswick, Inavale, Paka, Thurman, and Valentine soils. Brunswick and Paka soils are lower on the landscape than the major soils. Brunswick soils formed in material weathered from weakly cemented sandstone bedrock. Paka soils are loamy. They are on upland side slopes. Inavale soils are in narrow areas of sandy bottom land along drainageways. Thurman and Valentine soils have less medium and coarse textured sand than the major soils. They commonly are higher on the landscape than the major soils. They are hummocky.

Farms and ranches in this association are mainly a combination of grain and livestock enterprises. Some farms have dairy herds. Most of this association supports native grasses used for range. The soils are commonly too steep, too sandy, or too droughty to be farmed. Alfalfa, oats, and rye are the main dryland crops. In most areas the water supply is sufficient for livestock and domestic use but not for irrigation. Some gravel is mined from open pits.

Proper grazing use, timely deferment of grazing, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition. Soil blowing is a hazard in cultivated areas. Water erosion is a hazard. The low available water capacity is a limitation affecting crop production in most years. Keeping crop residue on the surface, stripcropping, and minimizing tillage help to control erosion and conserve soil moisture.

7. Brunswick-Paka-Simeon Association

Moderately deep, deep, and very deep, nearly level to steep, well drained and excessively drained, loamy and sandy soils; on uplands and stream terraces

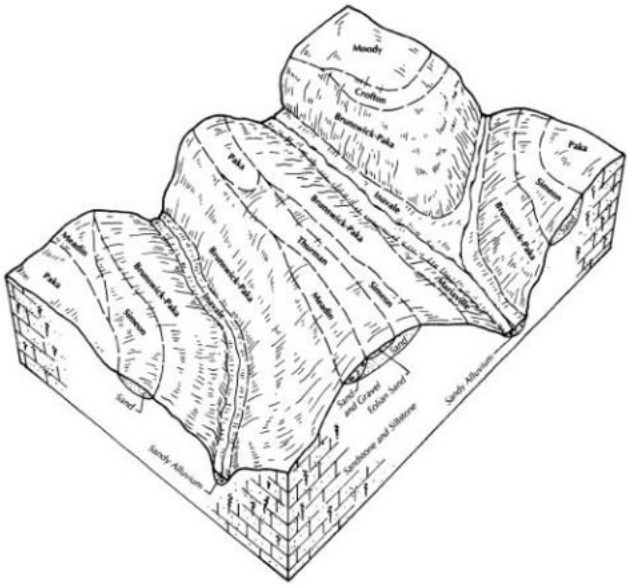
This association is in an area of dissected uplands. The narrow ridges are gently sloping to strongly sloping, and the side slopes are moderately steep to steep. The drainageways are mainly intermittent or are spring-fed tributaries of Verdigris Creek. The soils in this association formed in material weathered from sandstone bedrock or siltstone bedrock and sandy alluvium or outwash material. Slopes range from 0 to 30 percent, Figure 11.9.

This association has a total area of about 53,700 acres, or about 8 percent of the county. It is about 34 percent Brunswick soils, 29 percent Paka soils, 9 percent Simeon soils, and 28 percent minor soils.

The Brunswick soils are on upland side slopes.

These well drained soils are strongly sloping to steep. Typically, the surface layer is dark grayish brown, friable fine sandy loam about 5 inches thick. The subsoil is friable, fine sandy loam about 11 inches thick. The upper part is grayish brown, and the lower part is light gray. The underlying material is light gray fine sandy loam about 20 inches thick. White, weakly cemented sandstone bedrock is at a depth of about 36 inches.

FIGURE 11.9:
THURMAN-BAZILE-ORTELLO ASSOCIATIONS



The Paka soils are on ridgetops and side slopes along drainageways. These well drained soils are gently sloping to steep. Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsurface layer is dark grayish brown, firm silty clay loam about 3 inches thick. The subsoil is about 22 inches thick. The upper part is light brownish gray, firm silty clay loam, and the lower part is light gray, firm, calcareous silty clay loam. The underlying material is light gray and white, calcareous silty clay loam about 22 inches thick. White, calcareous, weakly cemented siltstone bedrock is at a depth of about 54 inches.

The Simeon soils are on ridgetops and side slopes in the uplands and on some stream terraces along drainageways. These excessively drained soils are nearly level to steep. Typically, the surface layer is grayish brown, loose sand about 5 inches thick. Below this is a transitional layer that is also grayish brown, loose sand. It is about 8 inches thick. The underlying material to a depth of more than 60 inches is sand. It is very pale brown in the upper part and white in the lower part.

Of minor extent in this association are the Crofton, Inavale, Mariaville, Meadin, Moody, and Thurman soils. Crofton and Mariaville soils are in landscape positions similar to those of the major soils. Crofton soils are silty and calcareous throughout. Mariaville soils have weakly cemented siltstone bedrock at a depth of 10 to 20 inches. Inavale and Thurman soils are sandy. Inavale soils are on bottom land along drainageways below the major soils. Thurman and Meadin soils are higher on the landscape than the major soils. Thurman soils are slightly hummocky. Meadin soils have gravelly coarse sand at a depth of 8 to 20 inches. Moody soils are silty. They formed in loess on the ridges and broad divides.

Farms and ranches in this association are mainly a combination of grain and cow-calf livestock enterprises. Some farms have dairy herds. Most of this association supports native grasses used for range. The steep areas are too erosive for farming. Some areas are mowed for hay. Cultivated areas are nearly level to moderately steep. Alfalfa, oats, and rye are the main dryland crops. In the few areas that are irrigated, alfalfa and corn are the main crops. Irrigation wells can be drilled in only a few areas of this association. The water from wells generally is sufficient for livestock and domestic use, except in the northern part of the county.

Water erosion and soil blowing are hazards in cultivated areas. Keeping an adequate cover of crop residue on the surface helps to control erosion and conserves soil moisture. Proper grazing use, timely deferment of grazing, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition.

8. Labu-Lynch-Sansarc Association

General Soil Description

Moderately deep and shallow, strongly sloping to very steep, well drained, clayey soils; on uplands

This association consists of soils on ridgetops and side slopes in the uplands. These soils formed in material weathered from shale. Slopes range from 6 to 60 percent, Figure 11.10.

This association has a total area of about 105,100 acres, or about 15 percent of the county. It is about 40 percent Labu soils, 14 percent Lynch soils, 11 percent Sansarc soils, and 35 percent minor soils.

The Labu soils are on long side slopes and smooth, rounded knolls. They are moderately deep and formed in dark shale bedrock. These well drained soils are strongly sloping to steep. Typically, the surface layer is dark grayish brown, firm, calcareous silty clay about 4 inches thick. The subsoil is about 21 inches thick. The upper part is grayish brown, very firm, calcareous silty clay, and the lower part is light olive gray, very firm, calcareous clay. The underlying material is light olive gray, calcareous clay about 9 inches thick. Light gray, calcareous

shale bedrock is at a depth of about 34 inches. In some areas the soils are noncalcareous.

The Lynch soils are on long side slopes and smooth, rounded knolls. They are moderately deep and formed in light colored shale bedrock. These well drained soils are strongly sloping to steep. Typically, the surface layer is light brownish gray, firm, calcareous silty clay about 5 inches thick. The subsoil is firm, calcareous silty clay about 15 inches thick. It is light brownish gray in the upper part and mixed light gray and light yellowish brown in the lower part. The underlying material is mixed light olive gray and olive yellow, calcareous clay about 15 inches thick. Mixed pale yellow and light gray, calcareous shale bedrock is at a depth of about 35 inches. The soils have a high content of gypsum in seams below a depth of 12 inches.

The Sansarc soils are on very steep side slopes, steep shoulders, and narrow ridgetops. They are shallow and formed in dark shale bedrock. Catsteps are common. Typically, the surface layer is dark grayish brown, very firm, calcareous clay about 4 inches thick. Below this is a transitional layer of olive gray, very firm, calcareous clay about 5 inches thick. The underlying material is light olive gray, calcareous clay about 9 inches thick. Light gray, calcareous shale bedrock is at a depth of about 18 inches.

FIGURE 11.10:
TYPICAL LANDSCAPE OF LABU-LYNCH-SANSARC ASSOCIATIONS

Of minor extent in this association are the Bristow, Eltree, Gavins, Redstoe, Verdel, and Verdigre soils. Bristow soils are on very steep side slopes, steep knolls, and narrow ridgetops. They are shallow over light colored shale bedrock and contain a high percentage of gypsum. Eltree soils are very deep and loamy. They are on stream terraces below the major soils. Gavins soils are on the steep and very steep lower side slopes. They are shallow over siltstone bedrock. Redstoe soils are on the lower, strongly sloping to steep side slopes. They are moderately deep and loamy over siltstone bedrock. Verdel soils are on foot slopes or nearly level stream terraces. They have a thick, dark surface layer and a very deep, clayey profile.

Verdigre soils are on side slopes and ridgetops. They are deep. They have a loamy surface layer and clayey underlying material.

Large farms and ranches in this association are mainly cow-calf livestock enterprises. Some combine livestock and grain enterprises. Some farms have dairy herds. About 75 percent of this association supports native grasses and is used for range. Most of the areas that support native grasses are too steep and erosive for use as cropland. Some of the moderately steep and steep areas are used as hayland. The rest of this association is used for dry-farming. Alfalfa, grain sorghum, oats, and wheat are the main crops. A few areas support introduced grasses. These grasses are cut for hay or are used for grazing. In most areas runoff that collects in farm ponds provides water for livestock. In some areas springs and artesian wells provide water for livestock. Wells in this area are very deep and generally yield water of poor quality. In many places pipelines that originate in areas outside the association provide a source of water for domestic and livestock use.

Proper grazing use, timely deferment of grazing, and a grazing system in which two or more pastures are alternately grazed and rested and the order of the grazing and rest periods is changed each year help to maintain or improve the range condition. Water erosion and droughtiness are management concerns in areas that are cultivated or used as range. Gully erosion is a hazard. It can be overcome by constructing dams. Landslides are a severe hazard along roads.

9. Aowa-Shell-Kezan Association

General Soil Description

Very deep, nearly level, well drained and poorly drained, silty soils; on bottom land

This association consists of soils on bottom land along the North Fork of the Elkhorn River and along other major creeks and their tributaries. These soils

formed in silty alluvium. They are subject to occasional and frequent flooding. Slopes range from 0 to 2 percent.

This association has a total area of about 32,800 acres, or about 4 percent of the county. It is about 33 percent Aowa soils, 23 percent Shell soils, 15 percent Kezan soils, and 29 percent minor soils.

The Aowa soils are on bottom land along narrow drainageways. They are well drained and subject to occasional and frequent flooding. Typically, the surface layer is grayish brown, friable, calcareous silt loam about 7 inches thick. The underlying material to a depth of 30 inches is stratified grayish brown and pale brown, calcareous silt loam. Below this, to a depth of 54 inches, is a buried soil that is very dark grayish brown silt loam. The next layer to a depth of more than 60 inches is stratified grayish brown and dark grayish brown silt loam.

The Shell soils are in wide areas of bottom land characterized by deeply entrenched stream channels. The soils are well drained and subject to occasional flooding. Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 19 inches thick. The underlying material, to a depth of about 33 inches, is grayish brown silt loam. Below this, to a depth of 50 inches, is a buried soil that is dark grayish brown silty clay loam. The next layer to a depth of more than 60 inches is grayish brown silty clay loam.

The Kezan soils are along narrow drainageways. They are poorly drained and subject to occasional and frequent flooding. Depth to an apparent seasonal high water table ranges from about 1 foot in wet years to about 3 feet in dry years. Typically, the surface layer is stratified grayish brown and brown, mottled, friable, calcareous silt loam about 10 inches thick. The underlying material extends to a depth of more than 60 inches. It is stratified grayish brown and light brownish gray, mottled, calcareous silt loam in the upper part; dark gray silt loam in the next part; and dark gray, mottled silty clay loam in the lower part.

Of minor extent in this association are the Coleridge, Hobbs, Hord, and Obert soils. Coleridge, Hobbs, and Obert soils are on bottom land that is occasionally flooded. Coleridge soils are silty and somewhat poorly drained. The well drained Hobbs soils are noncalcareous and silty. Obert soils are very poorly drained and have a thick, dark surface layer. The well drained Hord soils are silty. They are on nearly level stream terraces.

Farms in this association are a combination of grain and livestock enterprises. Most of the acreage is used for cultivated crops. Corn, soybeans, and alfalfa are the main crops. Most areas are dry-farmed. Some areas are irrigated. Both gravity and center-pivot irrigation systems can be used. The wetter areas along narrow drainageways and stream channels are mainly used for pastures of introduced or native grasses. Some farms have dairy herds. Some livestock is fattened in feedlots.

The hazard of flooding and small areas of poorly drained and very poorly drained soils are the main management concerns. In some years the wetness delays fieldwork in the spring. Maintaining fertility is an additional management concern in cultivated areas. A few areas are suitable only for wildlife habitat.

10. Fluvaquents-Albaton-Soloman Association

General Soil Description

Very deep, nearly level, poorly drained and very poorly drained, silty and clayey soils; on bottom land

This association consists of soils on bottom land along the Missouri River. These soils formed in silty and clayey alluvium. They are subject to occasional and frequent flooding. Slopes range from 0 to 2 percent.

This association has a total area of about 11,500 acres, or about 1 percent of the county. It is about 46 percent Fluvaquents, 13 percent Albaton soils, 7 percent Solomon soils, and 34 percent minor soils.

The Fluvaquents are on bottom land along the Missouri River. They are very poorly drained and are under water most of the year because of frequent flooding, a very high water table, or a combination of both. The seasonal high water table is about 2 feet above the surface in wet years to about 1 foot below the surface in dry years. The soils are stratified silty material to a depth of more than 60 inches. Typically, the surface layer is black, mottled silt loam mixed with partially decayed organic matter. It is about 10 inches thick. The underlying material extends to a depth of more than 60 inches. It is dark gray, mottled silt loam in the upper part and light gray or white, stratified silt loam in the lower part.

The Albaton soils are commonly in wide areas of bottom land. They are poorly drained and very poorly drained and are subject to occasional and frequent flooding. A seasonal high water table is about 6 inches above the surface in wet years to about 3 feet below the surface in dry years. Typically, the surface layer is dark grayish brown, very firm, calcareous silty clay about 6 inches thick. The underlying material extends to a depth of more than 60 inches. It is stratified grayish brown and light brownish gray, mottled, calcareous silty clay in the upper part; gray, mottled, calcareous clay in the next part; and light gray and light olive gray, mottled, calcareous silty clay in the lower part.

The Solomon soils are in the slightly higher areas of bottom land. They are poorly drained and subject to occasional flooding. A seasonal high water table is at the surface in wet years or is at a depth of about 2 feet in dry years. Typically, the surface layer is dark grayish brown, very firm, calcareous silty clay loam about 6 inches thick. The subsurface layer is dark gray, mottled, very firm, calcareous silty clay about 14 inches thick. The subsoil is grayish brown, mottled, very firm, calcareous silty clay about 20 inches thick. The underlying material to a depth of more than 60 inches is grayish brown, mottled, calcareous silty clay.

Of minor extent in this association are the Barney, Blyburg, Gibbon, Inavale, and Onawa soils. Barney soils are in low areas and in old stream channels that are frequently flooded. They are poorly drained and have a calcareous, loamy surface layer and sandy underlying material. Blyburg and Inavale soils are in the higher areas of bottom land that are rarely flooded. Blyburg soils are well drained and are calcareous and loamy. Inavale soils are excessively drained and sandy. Gibbon soils are in the slightly higher areas of bottom land that are occasionally flooded. They are somewhat poorly drained and are calcareous and loamy. Onawa soils are in the slightly higher areas of bottom land that are rarely flooded. They are somewhat poorly drained. They formed in calcareous, clayey alluvium over loamy underlying material.

Farms and ranches in this association generally have their headquarters in adjoining associations. They are mainly a combination of cow-calf herds and grain enterprises. Corn, soybeans, alfalfa, and some small grain are the main crops. Nearly all of the very poorly drained soils are covered by trees, brush, and hydrophytic vegetation. Areas close to the rivers are used mostly for recreational activities. The areas of Fluvaquents also provide excellent habitat for wetland wildlife. The very poorly drained areas along the rivers are used for range.

The main management concerns are the hazard of flooding and the wetness. Tilling in the spring is generally delayed because of the seasonal high water table. Maintaining fertility is an additional management concern in cultivated areas. In areas of poorly drained and very poorly drained soils that support native grasses, timely deferment of grazing during the spring helps to maintain or improve the range condition and prevents the development of bogs.

11. Inavale-Barney-Orwet Association

General Soil Description

Very deep, nearly level, excessively drained and poorly drained, sandy and loamy soils; on bottom land

This association consists of soils on bottom land along the Niobrara River and Verdigris Creek. These soils formed in sandy and loamy alluvium. They are subject to flooding. Slopes range from 0 to 2 percent.

This association has a total area of about 14,195 acres, or about 2 percent of the county. It is about 54 percent Inavale soils, 12 percent Barney soils, 10 percent Orwet soils, and 24 percent minor soils.

The Inavale soils are in areas of high bottom land that are rarely flooded and in dissected stream channels that are frequently flooded. These soils are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 9 inches thick. The underlying material to a depth of more than 60 inches is light gray fine sand that has thin strata of fine sandy loam.

The Barney soils are in the lower areas of bottom land that are frequently flooded. These soils are poorly drained. A seasonal high water table is at the surface in wet years or at a depth of about 2 feet in dry years. Typically, the surface layer is gray, mottled, friable, calcareous loam about 7 inches thick. Below this is a transitional layer that is also gray, mottled, friable, calcareous loam. It is about 3 inches thick. The underlying material extends to a depth of about 60 inches. It is light gray, mottled fine sand in the upper part and light gray sand in the lower part. In some places the lower layers have strata of gravelly coarse sand.

The Orwet soils are in areas of bottom land that are rarely flooded. They are poorly drained. Depth to an apparent seasonal high water table ranges from about 1 foot in wet years to about 3 feet in dry years. Typically, the surface layer is dark gray, friable, calcareous loam about 10 inches thick. The subsurface layer also is dark gray, friable, calcareous loam. It is about 9 inches thick. Below this is a transitional layer of light brownish gray, mottled, very friable loamy sand about 6 inches thick. The underlying material to a depth of more than 60 inches is light gray, mottled sand.

Of minor extent in this association are the Boel, Elsmere, Hord, and Ord soils. Boel and Ord soils are in areas of low bottom land that are occasionally flooded. Boel and Elsmere soils are somewhat poorly drained and sandy. Ord soils are also somewhat poorly drained. They have a calcareous, loamy surface layer and sandy underlying material. Elsmere soils are in areas of high bottom land that are rarely flooded. Ord soils are nearly level, well drained, and silty. They are on stream terraces.

Farms in this association are livestock and grain enterprises. More than half the acreage supports native grasses used as range. Trees and shrubs are scattered throughout some of the areas used for grazing and provide excellent habitat for wildlife. The Barney soils are typically too wet for use as cropland, but some areas are mowed for hay. Some of the larger areas of Inavale soils are used as cropland. Alfalfa, corn, grain sorghum, and oats are the main crops. Wells on the bottom land along the Niobrara River are used to irrigate a few areas, but most of the water used for irrigation is pumped from streams. Cow-calf herds or dairy cows are the main livestock enterprises.

The main management concerns are the wetness and the hazard of flooding. Maintaining fertility also is a management concern. The high water table is a limitation in areas of the Barney and Orwet soils. Dikes may be needed in some areas to control streambank erosion and reduce the damage caused by flooding. Soil blowing is a hazard in cultivated areas of the Inavale soils. Keeping most of the crop residue on the surface helps to control soil blowing. Proper grazing use, timely deferment of grazing, restricted grazing during wet periods, and timely haying can improve the range condition.

Soil Suitability

The characteristics of soils play a major role in determining the potential compatibility of certain uses on the land. The ability to absorb certain liquids such as water and wastewater are different for certain types of soils. In addition, how sensitive an area is to erosion or how shallow the soils are in an area can have a major impact on the ability to develop a specific area of Knox County. These conditions and how they factor into a soils ability to support certain types of uses is referred to limitations.

Finally, if a soil has some level of limitation, it does not mean the different land uses cannot be undertaken in those soils. However, the key focus needs to be on the types of special engineering solutions needing to be implemented in order to overcome these specific soil limitations.

Soil Limitations

The interpretations are based on the engineering properties of soils, on test data for soils in the survey area and others nearby or adjoining, and on the experience of engineers and soil scientists familiar with the soils of Knox County.

Soil limitations are indicated by the ratings Not Limited, Somewhat Limited, and Very Limited.

Not Limited means soil properties are generally favorable for the stated use, or in other words, that limitations are minor and easily overcome.

Somewhat Limited means some soil properties are unfavorable but can be overcome or modified by special planning and design.

Very Limited means soil properties may be so unfavorable and difficult to correct or overcome as to require various degrees of soil reclamation, special designs, or intensive maintenance.

Dwellings without Basements

Figure 11.11 shows the soil suitability conditions for constructing dwelling without a basement (slab on-grade construction). In addition Table 11.1 provides the suitability by soil types and the specific conditions impacting the soil.

Very Limited Conditions
Based on Table 11.1, a majority of the soils in Knox County are considered Very Limited for a Dwelling Unit without a Basement. There are six major conditions impacting the soils (not all six are present in any one soil type). The conditions present in the different soils are:

- Shrink-Swell
- Flooding
- Depth to saturation zone
- Ponding
- Slope
- Subsidence Risk

Again, these conditions may or may not eliminate the ability of a land owner to build a slab-on-grade dwelling unit, but specific conditions will need to be engineered to overcome potential problems in the future.

Somewhat Limited Conditions
Besides the Severe soils, there are some soils considered Somewhat Limited which is less of an issue when developing. The conditions that are creating the Somewhat Limited classification are:

- Slope
- Shrink-swell

Dwellings with Basements

Figure 11.10 shows the soil suitability conditions for constructing Dwellings with basements. In addition Table 11.12 provides the suitability by soil types and the specific conditions impacting the soil.

Very Limited Conditions
Based on Table 11.1, the Very Limited conditions are very similar to Dwellings without Basements. As noted above, a majority of the soils in Knox County are considered Very Limited for a Dwelling Unit with a Basement. There are five major conditions impacting the soils (not all five are present in any one soil type). The conditions present in the different soils are:

- Shrink-Swell
- Flooding
- Depth to saturated zone
- Ponding
- Subsidence Risk

Again, these conditions may or may not eliminate the ability of a land owner to build a dwelling unit, but specific conditions will need to be engineered to overcome to eliminate potential problems in the future.

Somewhat Limited Conditions
There are fewer Somewhat Limited rated soils having fewer issues when developing. The conditions creating the Somewhat Limited classification are:

- Slope
- Shrink-swell
- Depth to Soft Bedrock

Septic Tank and Absorption Fields

Figure 11.13 shows the soil suitability conditions for placement of a septic tank and absorption field in Knox County. Table 11.1 provides the suitability by soil types and the specific conditions impacting the soil.

Very Limited Conditions
Based upon the Table 11.1, there are eight conditions impacting the use of septic tanks and absorption fields in Knox County. The major conditions impacting the soils are:

- Flooding
- Depth to saturated zone
- Ponding
- Slow water movement
- Slope
- Filtering Capacity
- Seepage
- Depth to Bedrock

Again, these conditions may or may not eliminate the ability of a land owner to use a septic tank and absorption field but specific conditions will need to be engineered to overcome to eliminate potential problems in the future.

Somewhat Limited Conditions
The issues present creating Somewhat problems for septic tanks are:

- Flooding
- Slow water movement
- Slope

TABLE 11.1: SOIL PROPERTIES BY TYPE AND USE

Soil Symbol/Soil Name Bolded soil represents specific soil in a complex		Dwellings without Basements		Dwellings with Basements		Septic tank and absorption fields		Sewage Lagoons		Sanitary Landfill		Small Commercial Businesses	
		Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions
7711	Albaton	2	2,4,6,7	2	2,4,6,7	2	4,6,7,9	2	4,6,7,8	2	4,6,7,12	2	2,4,6,7
7708	Albaton	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
7710	Albaton	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
7709	Albaton	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
6601	Alcester	1	1,2	1	1,2	2	1,9	2	1,8	1	1,12	2	1,2
6603	Alcester	1	1,2	1	1,2	2	1,4,6,8,9	1	1	1	1,12	1	1,2
6302	Aowa	2	2,4,6	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	2,4,6
6301	Aowa	2	2,4,6,7	2	2,4,6,7	2	4,6,8,9,10	2	4,6,7,8	2	4,6,7,12	2	2,4,6,7
6300	Aowa	2	4,6	2	4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	4,6
6303	Aowa	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
6312	Barney	2	4,6	2	4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	4,6
6304	Barney	2	4,6	2	4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	4,6
6500	Bazile	1	0	0	0	2	8,9	2	8	2	8,12	1	2
6605	Bazile	1	2	0	0	2	8,9	2	1,8	2	1,12	1	1,2
6606	Bazile	1	1,2	1	1	2	1,4,6,8,9	2	1,4,6,8	2	1,4,6,8,12	2	1,2,4,6
6608	Bazile	1	2	0	0	2	8,9	2	8	2	8,12	1	2
6609	Bazile	1	2	0	0	2	8,9	2	1,8	2	8,12	1	1,2
6610	Bazile	1	1,2	1	1	2	1,8,9	2	1,8	2	1,8,12	2	1,2
5475	Betts	1	1,2	1	1,2	2	1,9	2	1,8	1	1,12	2	1,2
5476	Betts	2	1,2	2	1,2	2	1,9	2	1,8	2	1,12	2	1,2
5477	Betts	2	1,2	2	1,2	2	1,9	2	1,8	2	1,12	2	1,2
5478	Betts	1	1,2	1	1,2	2	1,9	2	1,8	1	1,12	2	1,2
5479	Betts	1	1,2	1	1,2	2	1,4,6,9	2	1,4,6,8	1	1,12	2	1,2,4,6
6508	Blendon	0	0	0	0	2	4,6,8,9	2	4,6,8	2	4,6,8,12	0	0
7764	Blyburg	2	2,4,6	2	2,4,6	1	4,9	2	4,8	1	4,12	2	2,4,6
8420	Boel	2	4,6	2	4,6	2	4,6,8,11	2	4,6,8	2	4,6,8,12	2	4,6
8427	Boel	2	4,6	2	2,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
6636	Boelus	0	0	0	0	1	9	2	1,6,8	2	6,8	0	0
6637	Boelus	0	0	0	0	1	9	2	1,8	2	8	1	1
6642	Boelus	1	1,2	1	1,2	1	1,9	2	1,8	2	1,8	2	1,2
3918	Bonesteel	2	2,6,7	2	2,6,7	2	6,7,9	2	6,7,8	2	6,7,12	2	2,6,7
3151	Bristow	2	1,3	2	1,3	2	1,11	2	1,3	2	1,11,12	2	1,3
6659	Brunswick	1	2	1	1,3	2	1,8,9,11	2	1,3,8	2	1,8,11,12	2	1
6663	Brunswick-Paka	2	1,2	2	1,2,3	2	1,8,9,11	2	1,3,8	2	1,8,11,12	2	1,2
6661	Brunswick-Paka	1	1,2	1	1,2,3	2	1,8,9,11	2	1,3,8	2	1,11,12	2	1,2
3820	Butler	2	2,6,7	2	2,6,7	2	6,7,9	2	6,7,8	2	6,7,12	2	2,6,7
6325	Coleridge	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
6324	Coleridge	2	2,4,6	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,12	2	2,4,6
6673	Crofton	1	1	1	1	1	1,9	2	1,8	1	1,12	2	1
6681	Crofton	2	1,2	2	1	2	1,8,9,10	2	1,8	2	1,8,12	2	1,2
6685	Crofton	1	2	0	0	1	9	1	1,8	1	12	1	1,2
6686	Crofton	2	1,2	2	1	2	1,8,9	2	1,8	2	1,8,12	2	1,2
6687	Crofton	1	1,2	1	1	1	1,9	2	1,8	1	1,12	2	1,2
6674	Crofton	1	1	1	1	1	1,9	2	1,8	1	1,12	2	1

Soil Symbol/Soil Name		Dwellings without Basements		Dwellings with Basements		Septic tank and absorption fields		Sewage Lagoons		Sanitary Landfill		Small Commercial Businesses	
Bolded soil represents specific soil in a complex		Suitability	Conditions	Suitability	Condi-tions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions
6789	Crofton-Nora	1	1,2	1	1,2	1	1,9	2	1,6,8	1	1,12	2	1,2,6
6693	Crofton-Nora	0	0	0	0	1	9	1	1,8	1	12	1	1,2
6694	Crofton-Nora	1	1,2	1	1,2	1	1,9	2	1,8	1	1,12	2	1,2
6670	Crofton-Thurman	1	1	1	1	2	1,8,10	2	1,8	2	1,8	2	1
6671	Crofton-Thurman	2	1	2	1	2	1,8,9	2	1,8	2	1,8,12	2	1
6672	Crofton-Thurman	1	1	1	1	2	1,8,9	2	1,8	2	1,8	2	1
4553	Elsemere	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
4352	Elsmere	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
4354	Elsmere	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
2561	Eltree	0	0	0	0	1	9	1	8	1	12	0	0
2563	Eltree	0	0	0	0	1	9	1	1,8	1	12	1	1
6761	Gavins	2	1,3	2	1,3	2	1,11	2	1,3	2	1,11,12	2	1,3
8470	Gibbon	2	2,4,6	2	4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	2,4,6
8482	Gibbon	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
3561	Hobbs	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
3554	Hobbs	2	2,4,6	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,12	2	2,4,6
8869	Hord	0	0	0	0	1	9	1	8	1	12	0	0
3756	Hord	2	2,4,6	2	2,4,6	1	4,9	1	4,8	1	4,12	2	2,4,6
2330	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
2322	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	1,4,6,8	2	4,6,8,12	2	4,6
2118	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
2119	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8	2	4,6
2327	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
2120	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
2121	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8	2	4,6
2111	Inavale	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
3641	Kezan	2	4,6	2	4,6	2	4,6,9	2	4,6	2	4,6,12	2	4,6
3642	Kezan	2	2,4,6,7	2	2,4,67	2	4,6,7,8,9	2	4,6,7,8	2	4,6,7,8,12	2	2,4,6,7
3645	Kezan	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
3221	Labu	2	1,2	2	2,3	2	1,11	2	1,3	2	1,11,12	2	1,2
3225	Labu-Sansarc	2	1,2,3	2	1,2,3	2	1,9,11	2	1,3	2	1,11,12	2	1,2,3
3404	Longford	2	2	1	2	2	9	1	1	1	12	2	1,2
4182	Longford	2	1,2	1	1,2	2	1,9	2	1	1	1,12	2	1,2
6533	Loretto	0	4	0	0	2	8	2	8	2	8,12	0	0
6790	Loretto	0	0	0	0	2	8	1	1,8	2	8,12	1	1
3232	Lynch-Bristow	2	1,2,13	2	1,2,3,13	2	1,11	2	1,3	2	1,11,12	2	1,2,3,13
3235	Lynch-Verdel	2	1,2,13	2	1,2,3,13	2	1,9,11	2	1,3	2	1,11,12	2	1,2,13
3238	Mariaville	2	1,3	2	1,3	2	1,11	2	1,3	2	1,11,12	2	1,3
3252	Meadin	0	0	0	0	2	8,10	2	8	2	8	0	0
3259	Meadin-O'Neill	2	1	0	1	2	1,8,10	2	1,8	2	1,8,12	2	1
6804	Moody	1	2	1	2	2	6,7,9	1	8	1	12	1	2
6805	Moody	1	2	1	2	2	9	1	1,8	1	12	1	1,2
6808	Moody	1	2	1	2	2	6,7,9	1	8	1	12	1	2

Soil Symbol/Soil Name		Dwellings without Basements		Dwellings with Basements		Septic tank and ab-sorption fields		Sewage Lagoons		Sanitary Landfill		Small Commercial Businesses	
Bolded soil represents specific soil in a complex		Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions
6811	Moody	1	2	1	2	2	4,6,7,9	2	1,8	1	12	1	1,2
6753	Nora	0	0	0	0	1	9	1	1,8	1	12	1	1,2
6758	Nora	1	1,2	1	1,2	2	1,9	2	1,8	1	1,12	2	1,2
6767	Nora	1	1,2	1	1,2	2	1,8,9,10	2	1,8	1	1,12	2	1,2
6359	Norway	2	2,4,6	2	4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	1,4,6
6366	Obert	2	2,4,6,7	2	2,4,6,7	2	4,6,7,8,9	2	4,6,7,8	2	4,6,7,8,12	2	2,4,6,7
6362	Obert	2	2,4,6,7	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	2,4,6
7762	Onawa	2	2,4,6	2	2,4,6	2	4,6,9	1	4,6,8	2	4,6,12	2	2,4,6
7883	Onawa	2	2,4,6	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	2,4,6
3267	O'Neill	0	0	1	0	2	8,10	2	8	2	8,12	0	0
3268	O'Neill	0	0	1	0	2	8,10	2	1,8	2	8,12	1	1
4241	Ord	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
4250	Ord	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	4,6
4244	Ord	2	4,6	2	4,6	2	4,6,8	2	4,6,8	2	4,6,8,12	2	4,6
6845	Orellio	0	0	0	0	2	8,9,10	2	1,8	2	8,12	1	1,22,4,6
6578	Ortello	0	0	0	0	2	8,9,10	2	8	2	8,12	0	0
6369	Orwet	2	2,4,6	2	2,4,6,7	2	4,6,7,8,9	2	4,6,7,8	2	4,6,7,8,12	2	2,4,6,7
6370	Orwet	2	2,4	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	2,4,6
3285	Paka	1	2	1	2	1	8,11	1	3,8	1	8,12	1	2
3290	Paka	1	1,2	2	1,2	1	1,9,11	2	1,3,8	1	1,11,12	2	1,2
3286	Paka	1	2	1	2	1	8,11	1	1,3,8	1	11,12	1	1,2
3287	Paka	1	1,2	2	1,2	1	1,9,11	2	1,3,8	1	1,11,12	2	1,2
7805	Percival	2	2,4,6	2	2,4,6	2	4,6,8,9	2	4,6,8	2	4,6,8,12	2	2,4,6
6828	Redstoe	1	2,13	1	1,3,13	2	1,11	2	1,3,8	2	1,11,12	2	1,13
6829	Redstoe-Gavins	2	1,3,13	2	1,3,13	2	1,11	2	1,3,8	2	1,11,12	2	1,3,13
3320	Sanarc	2	1,2,3	2	1,2,3	2	1,9,10,11	2	1,3,8	2	1,11,12	2	1,2,3
6551	Sardak	2	2,4	2	4,6	2	4,6,8,9	2	1,4,6,8	2	4,6,8,12	2	1,4
6385	Shell	2	2	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4
6557	Shell	2	0	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4
8926	Simeon	0	0	0	0	2	8,10	2	1,8	2	8	0	0
8931	Simeon	2	1	2	1	2	1,8,10	2	1,8	2	1,8	2	1
8933	Simeon	0	0	0	0	2	8,10	2	1,8	2	8	0	0
8938	Simeon-Thurman	2	1	2	1	2	1,8,10	2	1,8	2	1,8	2	1
3617	Solomon	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6	2	4,6,12	2	2,4,6
3618	Solomon	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6	2	4,6,12	2	2,4,6
3619	Solomon	2	2,4,6	2	2,4,6	2	4,6,9	2	4,6,8	2	4,6,12	2	2,4,6
6561	Thurman	0	2	0	0	2	8,10	2	8	2	8	0	0
6726	Thurman	2	1	2	1	2	1,8,10	2	1,8	2	1,8	2	1
6727	Thurman	0	0	0	0	2	8,10	2	1,8	2	8	1	1
6700	Thurman	0	0	0	0	2	6,8,10	2	1,6,8	2	6,8	0	0
6703	Thurman	0	0	0	0	2	6,8,10	2	1,6,8	2	6,8	1	1
6575	Trent	1	2	1	2,6	2	6,7,8,9	1	6,8	2	6,8,12	1	2
6576	Trent	1	0	1	2,6	1	6,9	1	6,8	2	6,7,12	1	2
4791	Valentine	0	0	0	0	2	8,10	2	1,8	2	8	1	1
4796	Valentine	1	1,6	1	1,6	2	1,6,8,10	2	1,6,8	2	1,6,8	2	1

Soil Symbol/Soil Name Bolded soil represents specific soil in a complex		Dwellings without Basements		Dwellings with Basements		Septic tank and absorption fields		Sewage Lagoons		Sanitary Landfill		Small Commercial Businesses	
		Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions	Suitability	Conditions
3328	Verdel	2	2	2	2	2	9	1	1	1	12	2	1,2
3329	Verdel	2	1,2	2	1,2	2	1,9	2	1	1	1,12	2	1,2
3327	Verdel	2	2,4,6	2	2,4,6	2	4,6,9	0	0	1	12	2	2,4,6
3323	Verdel	2	2,4,6	2	2,4,6	2	4,6,9	0	0	1	12	2	2,4,6
3324	Verdel	2	2,4,6	2	2,3,4,6	2	4,6,9	1	1,4,8	1	12	2	1,2,4,6
3330	Verdigre	2	1,2	2	1,2	2	1,9,11	2	1,3,8	2	1,11,12	2	1,2
3331	Verdigre	1	2	1	2	2	9,11	2	1,3,8	1	11,12	1	1,2
3332	Verdigre	1	1,2	1	1,2	2	1,9,11	2	1,3,8	1	1,11,12	2	1,2
3337	Verdigre	2	1,2	2	1,2	2	1,9,11	2	1,3,8	2	1,11,12	2	1,2
3335	Verdigre	1	2	1	2	2	9,11	1	1,3,8	1	11,12	1	1,2
3336	Verdigre	1	1,2	1	1,2	2	1,9,11	2	1,3,8	1	1,11,12	2	1,2
8595	Wann	2	4,6	2	4,6	2	4,6,8,10	2	4,6,8	2	4,6,8,12	2	2,6

Depth to saturated zone refers to soils which do not drain well or have a low permeability. This conditions creates an above average existence of wet soils.

Depth to Bedrock means typically a soil that has limited distance to bedrock of some kind.

Depth to Soft Bedrock means bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Flooding is defined as soils located in areas which are prone to flooding.

Poor Filter means soils with rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Slow water movement means soils that do not allow reasonable downward movement of water.

Slope means the inclination of the land surface from the horizontal. Within Knox County the class of slopes are:

Nearly level	0 to 1 percent
	0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	2 to 6 percent
	3 to 6 percent
Strongly sloping	6 to 9 percent
	6 to 11 percent
Moderately sloping	9 to 20 percent
	11 to 15 percent
Steep	15 to 30 percent

Seepage means the movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell means the shrinking of soil when dry and swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Subsidence means the sudden sinking or gradual downward settling of the ground's surface with little or no horizontal motion.

Legend for Table 7.1

Suitability	Conditions
0 = Not Limited	1= Slope
1 = Somewhat Limited	2 = Shrink-swell
2 = Very Limited	3 = Depth to Soft Bedrock
	4 = Flooding
	5 = Hard
	6 = Depth to Saturation Zone
	7 = Ponding
	8 = Seepage
	9 = Slow water movement
	10 = Filtering Capacity
	11 = Depth to Bedrock
	12 = Dusty
	13 = Subsidence Risk

SEWAGE LAGOONS

Figure 11.14 shows the soil suitability conditions for placement of Sewage Lagoons in Knox County. Table 11.1 provides the suitability by soil types and the specific conditions impacting the soil.

Very Limited Conditions

Based on Table 11.1, there are five conditions impacting the use of sewage lagoons in Knox County. The major conditions impacting the soils are:

- Flooding
- Depth to saturated zone
- Slope
- Ponding
- Seepage

Again, these conditions may or may not eliminate the ability of a land owner to use a sewage lagoon but specific conditions will need to be engineered to overcome to eliminate potential problems in the future.

Somewhat Limited Conditions

Besides the Very Limited soils, there are some soils considered Somewhat Limited which is less of an issue when developing. The conditions that are creating the Somewhat Limited classification are:

- Flooding
- Depth to saturated zone
- Slope
- Seepage

Again, these conditions may need special engineering to overcome to eliminate potential problems in the future.

SANITARY LANDFILLS

Figure 11.15 shows the soil suitability conditions for placement of sanitary landfills in Knox County. Table 11.1 provides the suitability by soil types and the specific conditions impacting the soil.

Very Limited Conditions

Based on Table 11.1, there are six conditions impacting the use of sanitary landfills in Knox County. The major conditions impacting the soils are:

- Flooding
- Depth to saturated zone
- Slope
- Ponding
- Dusty
- Seepage

Again, these conditions may or may not eliminate the ability of a land owner to use a sanitary landfill but specific conditions will need to be engineered to overcome to eliminate potential problems in the future.

Somewhat Limited Conditions

Besides the Very Limited soils, there are some soils considered Somewhat Limited which is less of an issue when developing. The conditions that are creating the Somewhat Limited classification are:

- Flooding
- Slope
- Dusty
- Depth to Bedrock

Again, these conditions may need special engineering to overcome to eliminate potential problems in the future.

SMALL COMMERCIAL BUSINESSES

Figure 11.16 shows the soil suitability conditions for placement of small commercial businesses in Knox County. Table 11.1 provides the suitability by soil types and the specific conditions impacting the soil.

Very Limited Conditions

Based on Table 11.1, there are six conditions impacting the use of small commercial buildings in Knox County. The major conditions impacting the soils are:

- Flooding
- Depth to saturated zone
- Slope
- Shrink-swell
- Ponding
- Subsidence Risk

Again, these conditions may or may not eliminate the ability of a land owner to use a small commercial buildings but specific conditions will need to be engineered to overcome to eliminate potential problems in the future.

Somewhat Limited Conditions

Besides the Very Limited soils, there are some soils considered Somewhat Limited which is less of an issue when developing. The conditions that are creating the Somewhat Limited classification are:

- Slope
- Shrink-swell

Again, these conditions may need special engineering to overcome to eliminate potential problems in the future.

Other Factors Impacting Land Uses

The previously discussed uses are typical to counties similar to Knox County. Earlier in this Chapter, the issue of wetlands was covered in some detail and is very closely associated with surface and groundwater. The following topics are greatly influenced by the type of soil and its location in an area. The following paragraphs will focus on Prime Farmland and Percent of Slope.

Prime Farmland

Prime farmland is directly tied to the specific soils and their composition. The map in Figure 11.17 identifies Prime Farmland, Prime Farmland if Drained, Farmland of Statewide Importance, and Not Prime Farmland.

According to the USDA, Prime farmland

> "...is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. It must also be available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding."

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland can be obtained at the local office of the Soil Conservation Service.

About 245,000 acres, or nearly 34 percent, of Knox County meets the soil requirements for prime farmland.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

Soils determined to be prime farmland need to be protected throughout the rural areas of Nebraska.

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - DWELLINGS WITHOUT BASEMENTS

LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Dwellings without Basements

- Not Limited
- Somewhat Limited
- Very Limited

MARVIN PLANNING CONSULTANTS
Specializing in Municipal, County and Neighborhood Planning

PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

0 2 4 8 Miles

1 " = 4 miles

N

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - DWELLINGS WITH BASEMENTS

LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Dwellings with Basements

- Not Limited
- Somewhat Limited
- Very Limited

Chicken Creek
Emanuel Creek
Springfield
Santee
Lewis and Clark Lake
Lewis and Clark Lake
SOUTH DAKOTA
BOYD
Missouri River
Niobrara
Verdel
Santee Reservation
Crofton
Center
Verdigre
Bloomfield
Winnetoon
Bazile Mills
Wausa
Creighton
North Fork Elkhorn River
South Branch Verdigre Creek
HOLT
CEDAR
12
14
84
121
13
59

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

N

0 2 4 8 Miles

1 " = 4 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - SEPTIC TANK ABSORPTION FIELD CONDITIONS

LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Septic Tank Absorption Field Conditions

- Not Limited
- Somewhat Limited
- Very Limited

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

N

0 2 4 8 Miles

1 " = 4 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - SEWAGE LAGOON RATINGS

LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Sewage Lagoon Ratings

- Not Limited
- Somewhat Limited
- Very Limited

MARVIN PLANNING CONSULTANTS
Specializing in Municipal, County and Neighborhood Planning

PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

N

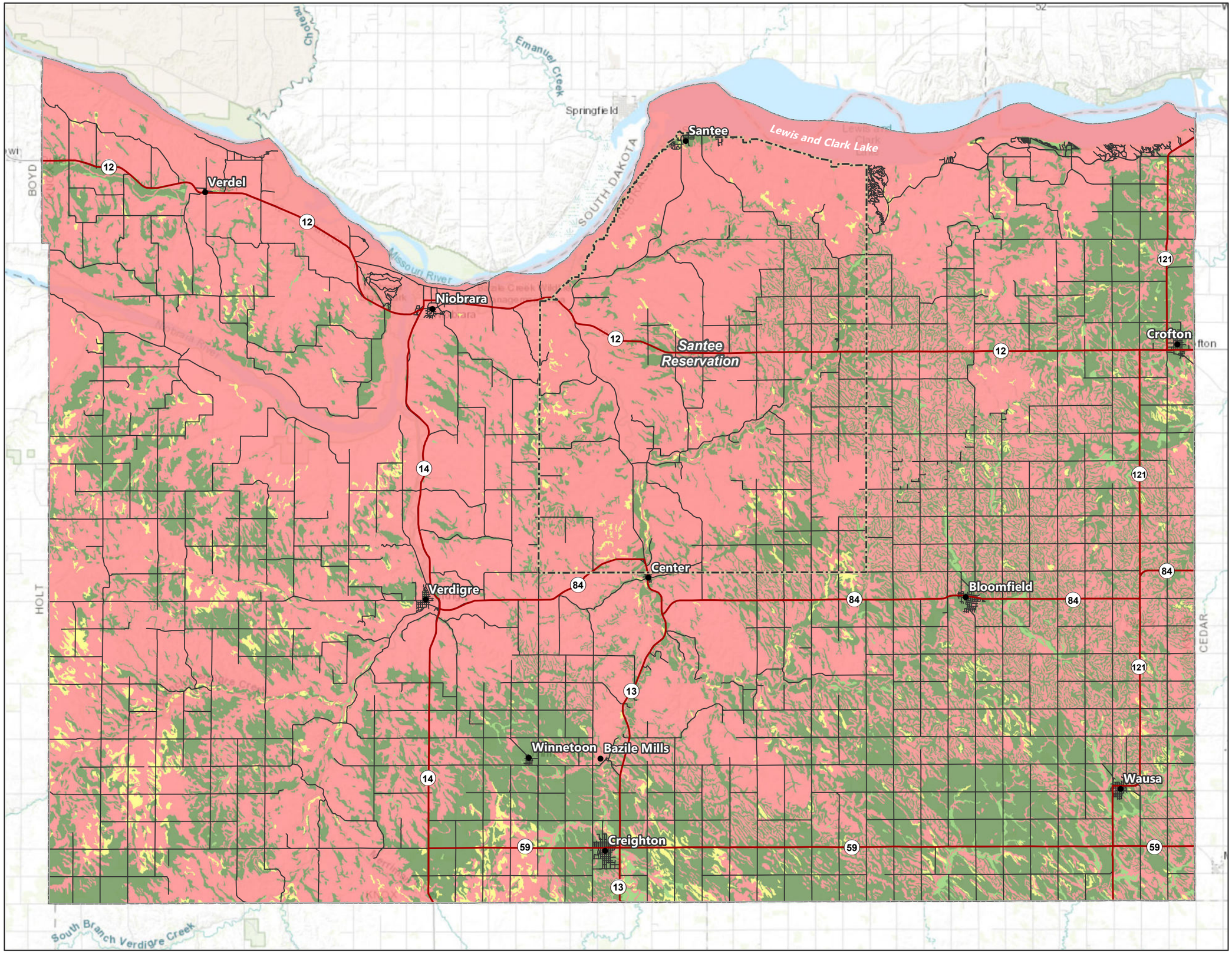
0 2 4 8 Miles

1 " = 4 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - PRIME FARMLAND



LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Prime Farmland

- All Areas are Prime Farmland
- Prime Farmland if Drained
- Farmland of Statewide Importance
- Not Prime Farmland

MARVIN PLANNING CONSULTANTS
Specializing in Municipal, County and Neighborhood Planning

PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

N

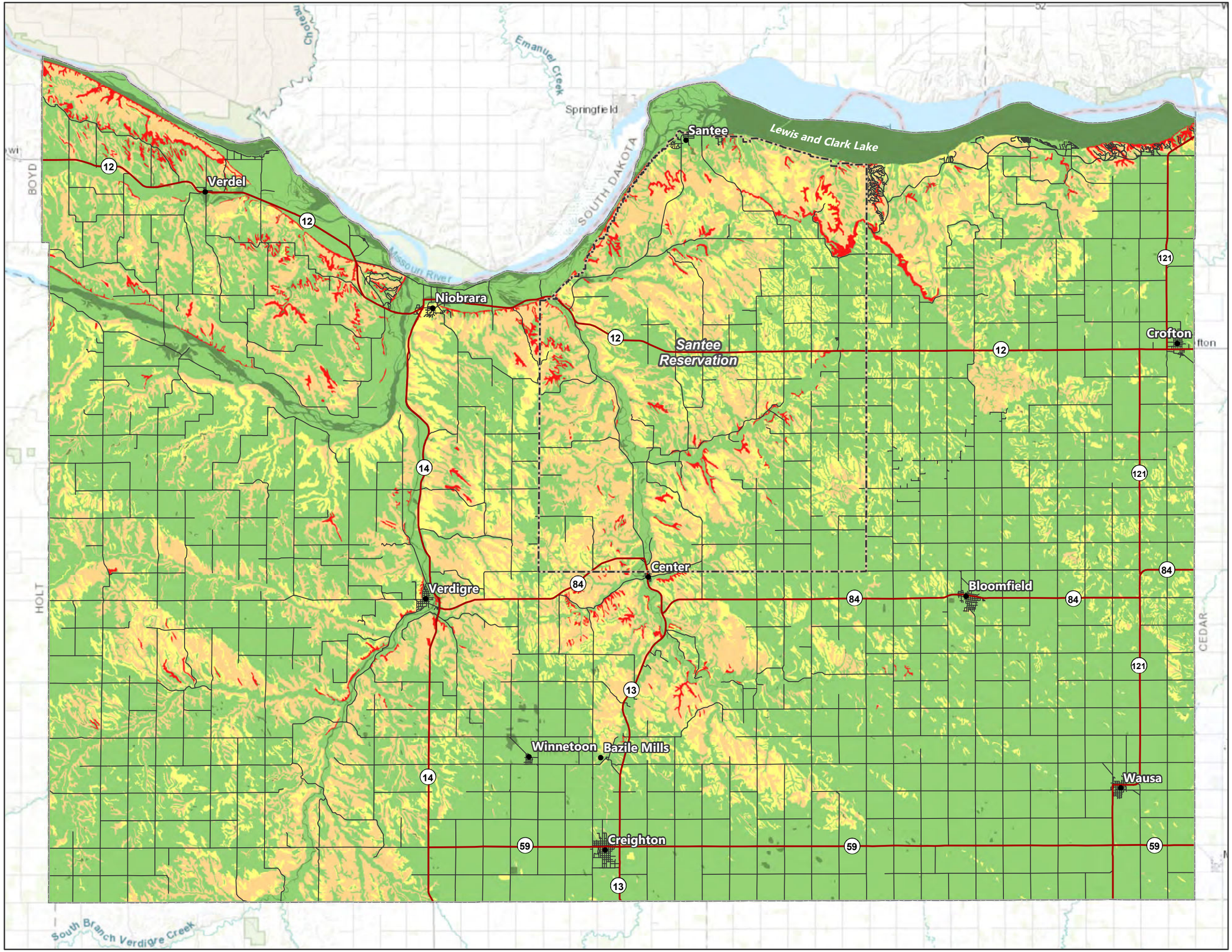
0 2 4 8 Miles

1 " = 4 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - SLOPE GRADIENT



LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Slope Gradient

- <1% Slopes
- 1 - 10% Slopes
- 11 - 20% Slopes
- 21 - 30% Slopes
- >30% Slopes

MARVIN PLANNING CONSULTANTS
Specializing in Municipal, County and Neighborhood Planning

PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.27.2018

N

0 2 4 8 Miles

1 " = 4 miles

These soils are typically the best crop producing lands.

Percent of Slope

The slope of an area is critical to the ability of the area to be used for agricultural purposes to constructing homes and septic systems. Typically the steeper the slope the more difficult these issues become. However, lands with little to no slope can also create problems regarding the inability of water to drain away from a site.

TABLE 11.2: DEFINTION OF SOIL SLOPES

Classes Simple Slopes	Complex Slopes	Slope Gradient Limits	
		Lower Percent	Upper Percent
Nearly level	**Nearly level**	0	3
Gently sloping	**Undulating**	1	8
Strongly sloping	**Rolling**	4	16
Moderately sloping	**Hilly**	10	30
Steep	**Steep**	20	60
Very steep	**Very steep**	>45	

Figure 11.18 shows the percent slope for Knox County. Based upon the map, Knox County has steep slopes throughout the entire county; however, the majority of these slopes are along the northern areas, near the bottom land of the Niobrara and Missouri Rivers and near Lewis and Clark Lake.

Based upon Table 11.1 slope is factor in a few soils/locations in the county. In a number of situations, any soil conditions based upon slope could likely be engineered to become more compatible. However, it is important to involve an engineer, geologist, or soil scientist in the issue in order to make the correct modifications, especially along the Lake Area.

TABLE 11.3: PERMEABILITY/SHRINK-SWELL BY SOIL TYPE

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
7711	Albaton	0-9 9-60 60-80	.01-.2 .01-.06 .01-2	Very High Very High Low
7708	Albaton	0-7 7-79	.6-2 .001-.06	Very High Very High
7710	Albaton	0-6 6-79	.001-.06 .001-.06	Very High Very High
7709	Albaton	0-7 7-79	.6-2 .001-.06	Very High Very High
6601	Alcester	0-8 8-16 16-23 23-47 47-67 67-79	.2-.6 .2-.6 .2-.6 .2-.6 .2-.6 .2-.6	Moderate Moderate Moderate Moderate Moderate Moderate
6603	Alcester	0-8 8-16 16-23 23-47 47-67 67-79	.2-.6 .2-.6 .2-.6 .2-.6 .2-.6 .2-.6	Moderate Moderate Moderate Moderate Moderate Moderate
6302	Aowa	0-8 8-79	.6-2 .6-2	Moderate Moderate
6301	Aowa	0-8 8-80	.6-2 .6-2	Low Low
6300	Aowa	0-7 7-80	.6-2 .6-2	Low Low
6303	Aowa	0-7 7-79	.6-2 .6-2	Moderate Moderate
6312	Barney	0-10 10-80	.6-2 6-20	Low Low
6304	Barney	0-10 10-79	.6-2 6-20	Low Low
6500	Bazile	0-6 6-27 27-30 30-60	.6-2 .2-.6 .6-2 6-20	Low Moderate Moderate Low
6605	Bazile	0-10 10-27 27-30 30-60	.6-2 .2-.6 .6-2 6-20	Low Moderate Moderate Low
6606	Bazile	0-11 11-27 27-30 30-60	.6-2 .2-.6 .6-2 6-20	Low Moderate Moderate Low
6608	Bazile	0-12 12-35 35-60	6-20 .2-.6 6-20	Low Moderate Low
6609	Bazile	0-11 11-35 35-60	6-20 .2-.6 6-20	Low Moderate Low
6610	Bazile	0-10 10-35 35-60	6-20 .2-.6 6-20	Low Moderate Low
5475	Betts	0-4 4-26 26-60	.6-2 .6-2 .2-.6	Moderate Moderate Moderate
5476	Betts	0-5 5-26 26-60	.6-2 .6-2 .2-.6	Moderate Moderate Moderate
5477	Betts	0-4 4-26 26-60	.6-2 .6-2 .2-.6	Moderate Moderate Moderate
5478	Betts	0-7 7-26 26-60	.6-2 .6-2 .2-.6	Moderate Moderate Moderate
5479	Betts	0-4 4-31 31-60	.6-2 .6-2 .2-.6	Moderate Moderate Moderate
6508	Blendon	0-16 16-30 30-60	2-6 2-6 2-20	Low Low Low
7764	Blyburg	0-15 15-79	.6-2 .6-2	Low Low
8420	Boel	0-16 16-80	6-20 6-20	Low Low
8427	Boel	0-16 16-79	6-20 6-20	Low Low
6636	Boelus	0-7 7-28 28-42 42-79	6-20 6-20 .6-2 .6-2	Low Low Moderate Moderate
6637	Boelus	0-7 7-28 28-42 42-79	6-20 6-20 .6-2 .6-2	Low Low Moderate Moderate
6642	Boelus	0-11 11-24 24-40 40-60	6-20 6-20 .6-2 .6-2	Low Low Moderate Moderate
3918	Bonesteel	0-6 6-14 14-39 39-51 54-79	.6-2 .6-2 .001-.06 .2-.6 .2-.6	Moderate High Very High Very High Very High
3151	Bristow	0-6 6-16 16-60	.06-.2 .06-.2 .01-.14	High High -
6659	Brunswick	0-6 6-25 25-35 35-60	.6-6 2-20 2-20 1.4-14	Low Low Low -
6663	Brunswick-Paka	0-5 5-16 16-36 36-60	.6-6 2-20 2-20 1.4-14	Low Low Low -
	Paka	0-7 7-21 21-34 34-60	.6-2 .6-2 .6-2 .01-.14	Moderate Moderate Moderate -
6661	Brunswick-Paka	0-9 9-16 16-36 36-60	.6-6 2-20 2-20 1.4-14	Low Low Low -
	Paka	0-9 9-21 21-34 34-60	.6-2 .6-2 .6-2 .01-.14	Moderate Moderate Moderate -
3820	Butler	0-14 14-60	.6-2 .06-.2	Moderate High

Table 11.3: Permeability/Shrink-Swell by Soil Type cont.

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
6325	Coleridge	0-24	.6-2	Moderate
		24-37	.6-2	Moderate
		37-79	.6-2	Moderate
6324	Coleridge	0-7	.2-2	Moderate
		7-31	.2-2	Moderate
		31-47	.2-2	Moderate
		47-79	.2-.6	Moderate
6673	Crofton	0-6	.6-2	Low
		6-60	.6-2	Low
6681	Crofton	0-5	.6-2	Moderate
		5-11	.6-2	Moderate
		11-80	.6-2	Low
6685	Crofton	0-6	.6-2	Moderate
		6-12	.6-2	Moderate
		12-80	.6-2	Low
6686	Crofton	0-6	.6-2	Moderate
		6-12	.6-2	Moderate
		12-80	.6-2	Low
6687	Crofton	0-6	.6-2	Moderate
		6-11	.6-2	Moderate
		11-80	.6-2	Low
6674	Crofton	0-6	.6-2	Moderate
		6-12	.6-2	Moderate
		12-80	.6-2	Moderate
6789	Crofton-Nora	0-6	.6-2	Moderate
		6-14	.6-2	Moderate
		14-79	.6-2	Low
	Nora	0-7	.6-2	Moderate
		7-17	.2-.6	Moderate
		17-29	.6-2	Low
		29-79	.6-2	Low
6693	Crofton-Nora	0-6	.6-2	Moderate
		6-17	.6-2	Moderate
		17-79	.6-2	Low
	Nora	0-7	.6-2	Moderate
		7-17	.2-.6	Moderate
		17-29	.6-2	Low
		29-79	.6-2	Low
6694	Crofton-Nora	0-6	.6-2	Moderate
		6-14	.6-2	Moderate
		14-79	.6-2	Low
	Nora	0-7	.6-2	Moderate
		7-17	.2-.6	Moderate
		17-29	.6-2	Low
		29-79	.6-2	Low
6670	Crofton-Thurman	0-6	.6-2	Low
		6-60	.6-2	Low
	Thurman	0-10	2-6	Low
		10-60	6-20	Low
6671	Crofton-Thurman	0-6	.6-2	Low
		6-60	.6-2	Low
	Thurman	0-11	2-6	Low
		11-60	6-20	Low
6672	Crofton-Thurman	0-6	.6-2	Low
		6-60	.6-2	Low
	Thurman	0-10	2-6	Low
		10-60	6-20	Low
4553	Elsemere	0-19	6-20	Low
		19-34	6-20	Low
		34-60	6-20	Low
4352	Elsmere	0-15	2-6	Low
		15-80	6-20	Low
4354	Elsmere	0-15	2-6	Low
		15-79	6-20	Low

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
2561	Eltree	0-25	.6-2	Low
		25-42	.6-2	Low
		42-80	.6-2	Low
2563	Eltree	0-19	.6-2	Low
		19-42	.6-2	Low
		42-80	.6-2	Low
6761	Gavins	0-3	.6-2	Low
		3-12	.6-2	Low
		12-60	.01-.14	-
8470	Gibbon	0-12	.6-2	Low
		12-36	.2-.6	Moderate
		36-80	.2-.6	Low
8482	Gibbon	0-12	.6-2	Moderate
		12-29	.6-2	Moderate
		29-79	.6-2	Moderate
3561	Hobbs	0-6	.6-2	Moderate
		6-79	.6-2	Moderate
3554	Hobbs	0-12	.6-2	Low
		12-79	.6-2	Low
8869	Hord	0-20	.6-2	Moderate
		20-36	.6-2	Moderate
		36-79	.6-2	Moderate
3756	Hord	0-8	.6-2	Moderate
		8-45	.6-2	Moderate
		45-79	.6-2	Moderate
2330	Inavale	0-5	6-20	Low
		5-14	6-20	Low
		14-60	6-20	Low
2322	Inavale	0-5	6-20	Low
		5-14	6-20	Low
		14-60	6-20	Low
2118	Inavale	0-6	6-20	Low
		6-12	6-20	Low
		12-79	6-20	Low
2119	Inavale	0-9	6-20	Low
		9-14	6-20	Low
		14-79	6-20	Low
2327	Inavale	0-12	2-6	Low
		12-35	6-20	Low
		35-60	6-20	Low
2120	Inavale	0-16	2-6	Low
		16-26	6-20	Low
		26-79	6-20	Low
2121	Inavale	0-5	6-20	Low
		5-21	6-20	Low
		21-79	6-20	Low
2111	Inavale	0-9	6-20	Low
		9-19	6-20	Low
		19-79	6-20	Low
3641	Kezan	0-12	.6-2	Low
		12-60	.6-2	Low
3642	Kezan	0-10	.6-2	Low
		10-80	.6-2	Low
3645	Kezan	0-10	.6-2	Moderate
		10-79	.6-2	Moderate

TABLE 11.3: PERMEABILITY/SHRINK-SWELL BY SOIL TYPE CONT.

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
3221	Labu	0-6	.06-.2	High
		6-35	.06-.2	High
		35-60	.01-.14	-
3225	Labu-Sansarc	0-5	.001-.06	Very High
		5-25	.001-.06	Very High
		25-33	.001-.06	Very High
		33-43	.06-.2	-
	Sansarc	0-4	.06-.2	Very High
		4-10	.001-.06	Very High
		10-14	.001-.06	Very High
		14-34	.06-.2	-
3404	Longford	0-6	.2-.6	Moderate
		6-28	.06-.2	High
		28-60	.2-.6	Moderate
4182	Longford	0-6	.2-.6	Moderate
		6-28	.06-.2	High
		28-60	.2-.6	Moderate
6533	Loretto	0-14	2-6	Low
		14-30	.6-6	Low
		30-60	.6-6	Low
6790	Loretto	0-10	2-6	Low
		10-30	.6-6	Low
		30-60	.6-6	Low
3232	Lynch-Bristow	0-5	.001-.06	High
		5-35	.06-.2	High
		35-60	.01-.14	-
		0-4	.06-.2	High
		4-16	.06-.2	High
		16-60	.01-.14	-
3235	Lynch-Verdel	0-5	.001-.06	High
		5-35	.06-.2	High
		35-60	.01-.14	-
		0-15	.06-.2	High
		15-60	.06-.2	High
3238	Mariaville	0-6	.6-2	Low
		6-12	.6-2	Low
		12-60	.01-.14	-
3252	Meadin	0-9	.6-2	Low
		9-13	6-20	Low
		13-60	20-99.9	Low
3259	Meadin-O'Neill	0-7	.6-2	Low
		7-12	6-20	Low
		12-60	20-99.9	Low
	O'Neill	0-9	2-20	Low
		9-24	2-6	Low
		24-60	20-99.9	Low
6804	Moody	0-7	.6-2	Moderate
		7-42	.2-.6	Moderate
		42-60	.6-2	Moderate
6805	Moody	0-7	.6-2	Moderate
		7-42	.2-.6	Moderate
		42-60	.6-2	Moderate
6808	Moody	0-7	.2-.6	Moderate
		7-12	.2-.6	Moderate
		12-37	.2-.6	Moderate
		37-46	.2-.6	Moderate
		46-79	.6-2	Low
6811	Moody	0-7	.2-.6	Moderate
		7-12	.2-.6	Moderate
		12-37	.2-.6	Moderate
		37-46	.2-.6	Moderate
		46-79	.6-2	Low

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
6753	Nora	0-7	.6-2	Moderate
		7-12	.2-.6	Moderate
		12-21	.2-.6	Moderate
		21-33	.6-2	Low
		33-79	.6-2	Low
6758	Nora	0-7	.2-.6	Moderate
		7-22	.2-.6	Moderate
		22-33	.2-.6	Low
		33-80	.6-2	Low
6767	Nora	0-9	.2-.6	Moderate
		9-20	.2-.6	Moderate
		20-34	.2-.6	Moderate
		34-80	.6-2	Low
6359	Norway	0-2	6-20	Low
		2-79	6-20	Low
6366	Obert	0-10	.6-2	Moderate
		10-26	.2-6	High
		26-80	.2-2	Moderate
6362	Obert	0-10	.6-2	Moderate
		10-26	.6-2	Moderate
		26-79	.6-2	Moderate
7762	Onawa	0-7	.06-.2	Very High
		7-28	.001-.06	Very High
		28-79	.6-2	Moderate
7883	Onawa	0-10	.2-.6	High
		10-24	.06-.2	High
		24-80	.6-6	Low
3267	O'Neill	0-9	2-20	Low
		9-23	2-6	Low
		23-60	20-99.9	Low
3268	O'Neill	0-18	2-20	Low
		18-23	2-6	Low
		23-60	20-99.9	Low
4241	Ord	0-17	2-6	Low
		17-24	2-6	Low
		24-80	6-20	Low
4250	Ord	0-18	.6-2	Low
		18-24	2-6	Low
		24-79	6-20	Low
4244	Ord	0-18	.6-2	Low
		18-24	2-6	Low
		24-80	6-20	Low
6845	Oretllo	0-6	2-20	Low
		6-14	.6-6	Low
		14-32	2-20	Low
		32-79	2-20	Low
6578	Ortello	0-6	2-20	Low
		6-14	.6-6	Low
		14-32	2-20	Low
		32-79	2-20	Low

TABLE 11.3: PERMEABILITY/SHRINK-SWELL BY SOIL TYPE CONT.

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
6369	Orwet	0-19 19-25 25-80	.6-2 6-20 6-20	Low Low Low
6370	Orwet	0-19 19-25 25-79	.6-2 6-20 6-20	Low Low Low
3285	Paka	0-9 9-25 25-54 54-60	.6-2 .6-2 .6-2 .01-.14	Moderate Moderate Moderate -
3290	Paka	0-10 10-25 25-54 54-60	.6-2 .6-2 .6-2 .01-.14	Moderate Moderate Moderate -
3286	Paka	0-7 7-25 25-54 54-60	.6-2 .6-2 .6-2 .01-.14	Moderate Moderate Moderate -
3287	Paka	0-11 11-25 25-54 54-60	.6-2 .6-2 .6-2 .01-.14	Moderate Moderate Moderate -
7805	Percival	0-9 9-24 24-79	.06-.2 .06-.2 6-20	Very High Very High Low
6828	Redstoe	0-10 10-31 31-60	.6-2 .6-2 .01-.14	Low Low -
6829	Redstoe-Gavins	0-7 7-31 31-60 0-4 4-14 14-60	.6-2 .6-2 .01-.14 .6-2 .6-2 .01-.14	Low Low - Low Low -
3320	Sansarc	0-4 4-10 10-14 14-34	.06-.2 .001-.06 .001-.06 .06-.2	High Very High High -
6551	Sardak	0-6 6-79	6-20 6-20	Low Low
6385	Shell	0-24 24-33 33-80	.6-2 .6-2 .6-2	Low Low Low
6557	Shell	0-24 24-33 33-79	.6-2 .6-2 .6-2	Moderate Moderate Moderate
8926	Simeon	0-9 9-60	6-20 6-20	Low Low
8931	Simeon	0-5 5-60	6-20 6-20	Low Low
8933	Simeon	0-9 9-60	2-6 6-20	Low Low
8938	Simeon-Thurman Thurman	0-7 7-60 0-10 10-30 30-60	6-20 6-20 2-6 6-20 6-20	Low Low Low Low Low

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
3617	Solomon	0-20 20-60	.001-.06 .001-.06	High High
3618	Solomon	0-20 20-79	.06-.2 .06-.2	Very High Very High
3619	Solomon	0-16 16-79	.06-.2 .06-.2	Very High Very High
6561	Thurman	0-16 16-34 34-60	2-6 6-20 6-20	Low Low Low
6726	Thurman	0-10 10-34 34-60	2-6 6-20 6-20	Low Low Low
6727	Thurman	0-12 12-34 34-60	2-6 6-20 6-20	Low Low Low
6700	Thurman	0-6 6-14 14-24 24-41 41-59 59-79	6-20 6-20 6-20 6-20 6-20 6-20	Low Low Low Low Low Low
6703	Thurman	0-6 6-14 14-24 24-41 41-59 59-79	6-20 6-20 6-20 6-20 6-20 6-20	Low Low Low Low Low Low
6575	Trent	0-7 7-17 17-46 46-59 59-79	.2-2 .2-.6 .2-2 .6-2 .2-2	Moderate Moderate Moderate Low Moderate
6576	Trent	0-17 17-38 38-60	.6-2 .6-2 .6-2	Low Moderate Moderate
4791	Valentine	0-6 6-60	6-20 6-20	Low Low
4796	Valentine	0-5 5-12 12-79	6-20 6-20 6-20	Low Low Low
3328	Verdel	0-18 18-60	.06-.2 .06-.2	High High
3329	Verdel	0-10 10-60	.06-.2 .06-.2	High High
3327	Verdel	0-20 20-80	.06-.2 .06-.2	High High
3323	Verdel	0-6 6-16 16-26 26-34 34-46 46-79	.06-.2 .001-.06 .06-.2 .06-.2 .06-.2 .06-.2	Very High Very High Very High Very High High High
3324	Verdel	0-6 6-16 16-26 26-34 34-46 46-79	.06-.2 .001-.06 .06-.2 .06-.2 .06-.2 .06-.2	Very High Very High Very High Very High High High
3330	Verdigre	0-17 17-20 20-36 36-54 54-60	2-6 .2-.6 .06-.2 .06-.2 .01-.14	Low Moderate High High -

TABLE 11.3: PERMEABILITY/SHRINK-SWELL BY SOIL TYPE

Soil Symbol/Soil Name		Depth (inches)	Permeability (inches/hour)	Shrink-Swell potential
3331	Verdigre	0-15	2-6	Low
		15-20	.2-.6	Moderate
		20-36	.06-.2	High
		36-54	.06-.2	High
		54-60	.14-1.4	-
3332	Verdigre	0-18	2-6	Low
		18-20	.2-.6	Moderate
		20-36	.06-.2	High
		36-54	.06-.2	High
		54-60	.14-1.4	-
3337	Verdigre	0-12	.6-2	Low
		12-25	.2-.6	Moderate
		25-42	.06-.2	High
		42-56	.06-.2	High
		56-60	.01-.14	-
3335	Verdigre	0-10	.6-2	Low
		10-25	.2-.6	Moderate
		25-42	.06-.2	High
		42-56	.06-.2	High
		56-60	.01-.14	-
3336	Verdigre	0-9	.6-2	Low
		9-25	.2-.6	Moderate
		25-42	.06-.2	High
		42-56	.06-.2	High
		56-60	.01-.14	-
8595	Wann	0-16	.6-2	Moderate
		16-46	2-6	Low
		46-79	2-6	Low

Permeability

Permeability is defined in the Knox County Soil Survey as..."The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through saturated soils." Permeability is rated as:

Very slow	less than 0.06 inches
Slow	0.06 to 0.20 inches
Moderately slow	0.2 to 0.6 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Table 11.3 indicates the various permeability rates for each soil and at what depth the rating was taken. The Table indicates those considered to moderately rapid or higher in red. There are a number of soils in Knox County that can see a permeability of twenty inches per hour or more.

There are a number of specific uses not compatible for soils rated as Moderately rapid or worse. Soils rated at these levels will move contaminated materials much faster through the profile and into the regional water tables and aquifers. These uses will typically include anything dealing with animal or human sanitary waste systems.

Permeability, as with other soil factors, can be overcome with the proper engineering and construction techniques. Caution is a must when dealing with these conditions since the potential for contaminating an aquifer that feeds an entire area with water is a risk.

WATER IMPACT ON KNOX COUNTY

Water, along with the soils, in one of most restricting environmental conditions faced by Knox County. Damaging either one of these two elements will impact the residents of the county for years to come. As with the soil descriptions and conditions, it is important to discuss the water factors impacting Knox County during the present and coming planning period. Water in this section will apply to two topics, surface water and ground water.

Surface Water

Surface water applies to any water running across a surface and eventually runs into a minor drainage area, eventually ending up in a major waterway such as the Niobrara River or Missouri River. However, a certain portion of surface water is absorbed by the soil in order to support plant life including corn, soybeans, and grass lawns.

FIGURE 11.19: WATERSHEDS AND THE NATURAL RESOURCE DISTRICTS

Source: www.lancaster.unl.edu

Knox County lies in three distinct watersheds, these are defined and drainage areas controlled by the respective Natural Resource District. The primary Natural Resource District is the Lewis and Clark NRD; the second largest is the Lower Niobrara NRD and smallest district is the Lower Elkhorn NRD.

Surface water is what a lot of people think about regarding water due to the lakes, rivers and streams seen in their daily lives. Surface water can be calming and in the right circumstances, it can be very violent, as Knox County residents saw in March 2019. March 2019 saw some of the worst flooding and most disastrous damage done by water in the known history of Knox County and Nebraska.

Most of the major damage occurred along the Niobrara River as water, ice slabs, and most likely remnants of the Spencer Dam, from upstream, which had been destroyed by the same flood waters and ice.

Groundwater/Water Table Elevations

Groundwater refers to water found beneath the surface and includes smaller pockets of water as well as aquifers. This water source is where the residents of Knox County both city and rural, get their potable water for everyday living as well as the irrigation water for crops. The ability to find water meeting these specific needs is critical to the placement of certain uses. These specific needs include water quantity, water quality, and water pressure.

Use of Groundwater

Groundwater use in Knox County is in three forms; domestic and livestock supply, public water supplies, and irrigation. Each use is important to the overall viability of Knox County.

Domestic and Livestock supplies

Typically domestic and most livestock water supplies are obtained through the use of small diameter wells. Most of these wells are drilled only a few feet below the top of the water table, are low production wells, and equipped with electric powered jet or submersible pumps. The water yield of this type of well is usually no more than five gallons of water per minute.

Public water supplies

The public water supply is one of the most critical uses of groundwater resources. These supplies are used by the municipalities supplying water to its residents. In Knox County, all of the incorporated communities, except Stockham, have a publicly owned water supply system.

The State of Nebraska places a great deal of value on these systems across the state. The value is so high that a Wellhead Protection Program is available to municipalities through Nebraska Department of Environmental Quality. This program allows the municipalities, after a series of prescribed steps are completed, to designate special areas around their wells and well fields in order to protect the quality and quantity of the water within the underlying aquifers. Development of a community wellhead protection plan can help communities receive financial assistance to protect and secure the source of drinking water for the community.

Wellhead Protection

A Wellhead Protection Area is a delineated area indicating where a water source is located, as well as the area of travel for a specific well or well field. A wellhead protection area is important from the aspect that correctly implemented, the area will aid in protecting the water supply of a domestic well providing potable water to a community.

In Nebraska, the goal of the Nebraska Department of Environmental Quality's Wellhead Protection Program "...is to protect the land and groundwater surrounding public drinking water supply wells from Contamination". Within the NDEQ's program there are five steps to developing a wellhead protection area, which are:

1. Delineation
2. Contamination Source Inventory
3. Contaminant Source Management
4. Emergency, Contingency, and Long-term Planning
5. Public Education

The mapping process includes the use of computer modeling and other data. From this the NDEQ can generate a map indicating the wellhead Protection Area. However, delineating an area is not sufficient for protecting the groundwater around a public supply well, the governmental entity must adopt an ordinance in order to enforce the area and the regulations used to protect this water supply. Another way to officially regulate a wellhead protection area is for the community to create an interlocal agreement with the County to regulate these areas as part

FIGURE 11.20: WATERSHEDS AND THE NATURAL RESOURCE DISTRICTS

Source: NDEQ

of the county comprehensive plan and zoning regulations.

Figure 11.20 shows the documented wellhead protection areas impacting Knox County. These are only the mapped areas, it is not clear if these communities have actually adopted the proper ordinances to fully protect the water supply.

Irrigation

Irrigation wells in portions of Knox County have been a long standing practice. This process has become increasingly important to the production of crops within Knox County and Nebraska. The water demand for irrigation varies greatly from year to year and is dependent upon the amount of natural precipitation received in the area.

The use of irrigation is critical during the growing and finishing periods of the crop lifecycle. The demand for irrigation can have major impacts on the draw down of the aquifer and the aquifers ability to recharge itself in an appropriate time period.

Irrigation in Knox County does have some limitations based upon the topography/ percentage slope of agricultural grounds. However, if an area can be irrigated in a cost-effective manner then it has a high probability of occurring.

HYDRIC SOILS

Hydric soils are formed under conditions of saturation, flooding, or ponding. The process has to occur long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soils along with hydrophytic vegetation and wetland hydrology are used to define wetlands. (USDA/NRCS, Fall 1996)

Figure 11.21 indicates where the hydric soils are located in Knox County. The soils are classified as the following:

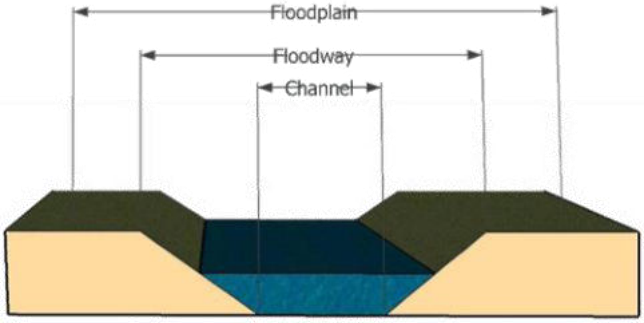
- All Hydric;
- Not Hydric; and
- Partially Hydric, including a percent hydric.

Hydric soils are scattered throughout Knox County and are located in the drainageways between hills and along waterways. Overall, a small amount of soils are considered as 100% Hydric or All Hydric.

FLOODWAYS AND FLOODPLAINS

Flooding is the temporary covering of the soil surface by flowing water from any source, such as streams and rivers overflowing their banks, runoff from adjacent or surrounding slopes, or a combination of different sources. During a flooding event there are a number of components that make up the flooded area. These areas include:

Floodway which is the channel of a watercourse and those portions of the adjoining floodplains which are required to carry and discharge the 100-year flood with no significant increase in the base flood elevation.

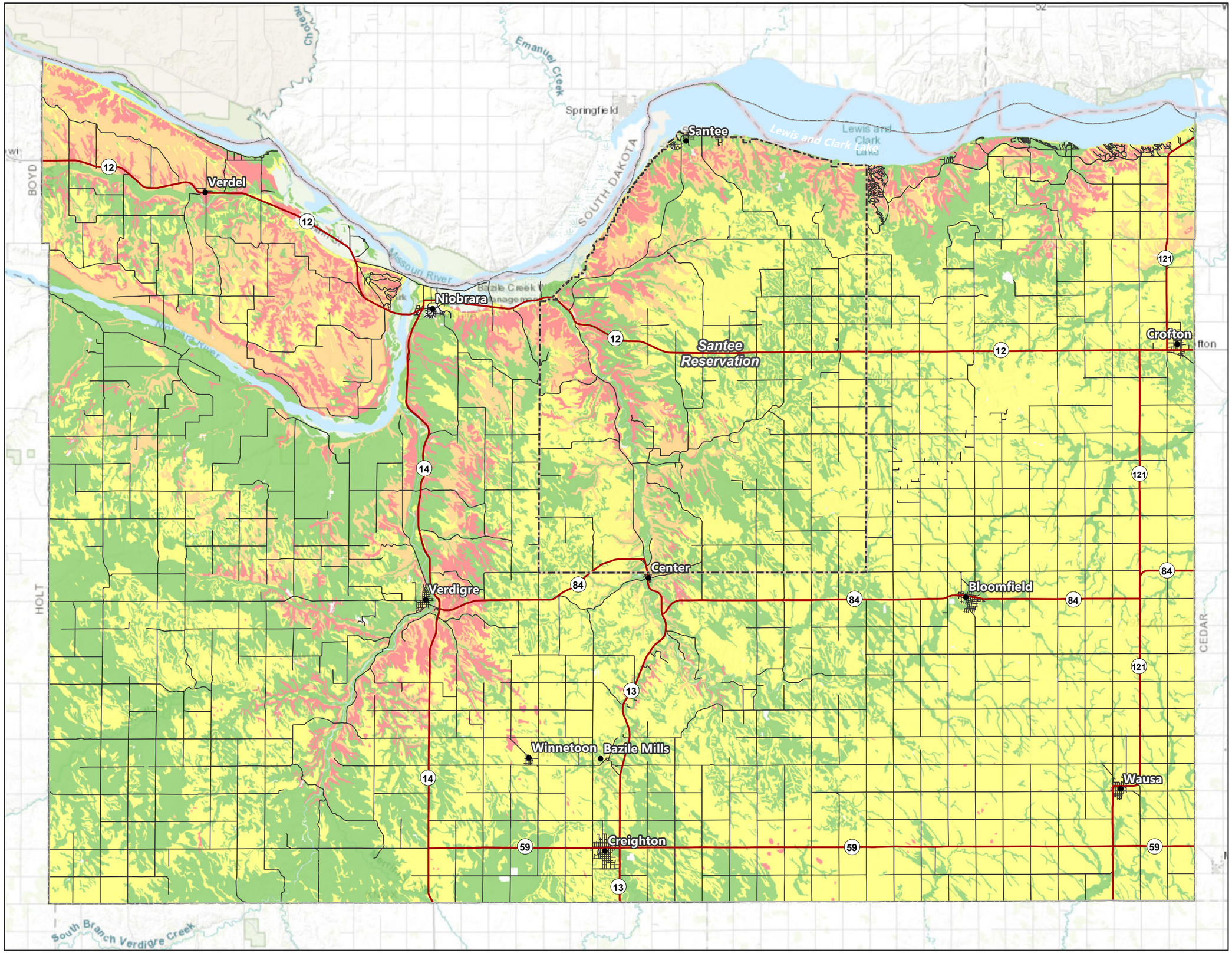


Floodplain which is the low land near a watercourse which has been or may be covered by water from flood of 100-year frequency, as established by engineering practices of the U.S. Army Corps of Engineers. It shall also mean that a flood of this magnitude may have a 1 percent chance of occurring in any given year.

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - PLASTICITY INDEX



LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Plasticity Index

- Low
- Medium
- High
- Very High

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 07.09.2019

N

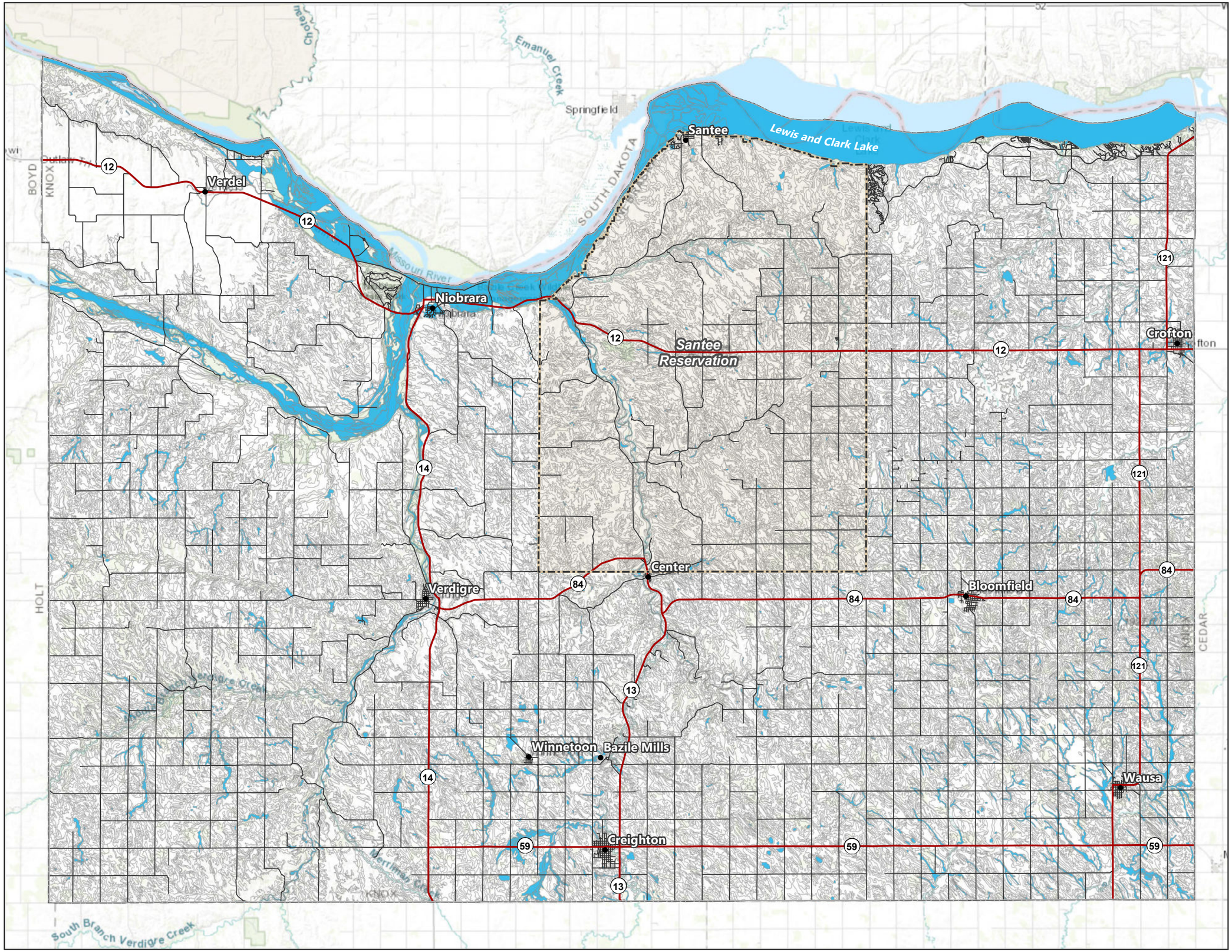
0 2 4 8 Miles

1 " = 4 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - HYDRIC RATING



LEGEND

- City/Town
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Hydric Rating

- Hydric Soil
- Not Hydric

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 06.10.2019

N

0 2 4 8 Miles

1 " = 4 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

FEMA FLOODPLAIN MAP

LEGEND

- City/Town
- 100-Year Floodplain
- Stream
- State Highway
- County Road
- Santee Reservation
- County Boundary

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PROJECTION: NE State Plane (Ft.)

DATUM: NAD 83

DATE: 09.27.2018

0 2 4 8 Miles

1 " = 4 miles

N

A home north of Quincy, Illinois within the 100- year floodplain - river is between 1 and 2-miles away

Same house during the 2008 Mississippi River floods

Floodway Fringe which is that portion of a floodplain that is inundated by floodwaters but is not within a defined floodway. Floodway fringes serve as temporary storage for floodwaters.
The floodplain also includes the floodway and the flood fringe, which are areas covered by the flood, but which do not experience a strong current.

The floodplain area of greatest significance in terms of state and federal regulation is the 100 year floodplain. This area is defined by the ground elevation in relation to the water elevation experienced during a 100 year flood event. The 100 year floodplain is calculated to be the elevation level of flood water expected to be equaled or exceeded every 100 years on average. In other and more accurate words, the 100 year flood is a 1% flood, meaning it defines a flood that has a 1% chance of being equaled or exceeded in any single year.

Preserving the floodplain and floodway are critical to limiting the level of property damage that can occur as well as the level of damage to life of the occupants of the area. Land when not flooded seems to be harmless, but it is those rare times that threaten life and property that need to be controlled.

In recent years there have been numerous flooding occurrences in Nebraska and the Midwest. These events have included the Platte River, the Missouri River, and the Mississippi River, as well as their tributaries. Each of these events have caused significant damage to life and property. In order to protect an individuals property there are specific rules and guidelines that need to be followed. On some occasions these guidelines work and others they may not; most guidelines are developed for 100 year flooding events. The times that the guidelines do not work are typically referred to a 500 year event for lack of a better term. However, in some cases, due to mother nature and increases in development runoff, the area needed to handle the floodway and floodplain (100 year event) have increased due to the amount and speed that the water is reaching the streams and rivers.

Since 2011, Knox County has seen its share of flooding in the county. With the March 2019 disaster and in 2011, when the state of Nebraska and Iowa once again saw similar destruction when the Missouri River flooded. That flooding destroyed large sections of Interstates 680 and I-29 in Iowa, which were laying flat on the ground. In the mid 2000's, Cedar Rapids. Iowa saw numerous structures swept off their foundations and sent downstream creating huge losses and large amounts of recovery dollars to be spent.

Natural Resources/Environment Goals and Policies

Soils

Soil Goal 1

Knox County needs to protect specific soils regarding the suitability of certain uses.

Soil Policies and Strategies

Soil-1.1 The County should require the use of the Planned Unit Development technique for larger developments in highly

sensitive areas.

Soil-1.2 Discourage conversion of designated prime agricultural land and soils to non-agricultural uses by targeting less productive agricultural soils (crops) for urban or non-farm uses.

Water (surface water and groundwater)

Water Goal 1

Protect both the surface water and groundwater that runs through and is under the county.

Water Policies and Strategies

W-1.1 Encourage the preservation of environmentally sensitive areas such as wetlands, wooded areas, waterways (streams, ponds, lakes, rivers, etc.).

W-1.2 Protect all water supplies and aquifers from development activities that may affect the quality of water; development must demonstrate a positive or, at least, a neutral impact on groundwater.

W-1.3 Continue participation in the FEMA National Flood Insurance Program to prevent flood-caused loss of life and property.

W-1.4 Knox County should discourage land use development within the floodplains of the county.

W-1.5 Knox County should support soil and water conservation efforts to aid in erosion, sediment, and run-off control.

W-1.6 Knox County should coordinate with and support city, regional, state and federal water-quality plans and programs so that high water quality will be achieved in the cities and villages of the County.

W-1.7 Knox County should require the protection of riparian vegetation from damage that may result from development.

W-1.8 Water erosion control structures, including riprap and fill, should be reviewed by the appropriate authorities to insure they are necessary and are designed to minimize adverse impacts on water currents, erosion, and accretion patterns.

W-1.9 Knox County should consider the following in any public or private land use determination subject to county review:

1) the impact of filling or drainage of swamps or marshes;
2) the damming of rivers and streams;
3) the location and construction of highways and utility transmission lines; and
4) Any other land development activities which significantly interfere with the vegetation or soil cover or drainage patterns in critical habitat areas.

Chapter 12 Land Use

Introduction

The purpose of the Knox County Land Use Chapter is to provide a general guide to land uses which directs zoning criteria. The resulting land uses are intended to be a guide without creating multiple incompatibilities with current uses existing within Knox County. This Chapter reflects the existing conditions and should be flexible in order to meet the needs of its citizens as well as the vision of the county whenever possible.

The Knox County Land Use Chapter provides the basis for the formulation of land use and the zoning regulations. For this reason, it is imperative to formulate a plan tailored to the needs, desires and environmental limitations of the planning area. The Chapter should promote improvements in all the components of the local economy.

Knox County Land Use Elements

The elements of the Knox County Land Use Chapter include:

- Existing Land Use, and
- Future Land Use Plan

All of these elements are integrated in some manner. Effective evaluations and decisions regarding development decisions require a substantial amount of information to be utilized.

Existing Land Use

The term "Existing Land Use" refers to the current uses in place within a building or on a specific parcel of land. The number and type of uses can constantly change within a county, and produce a number of impacts either benefiting or detracting from the county. Because of this, the short and long -term success and sustainability of the county is directly contingent upon available resources utilized in the best manner given the constraints the county faces during the course of the planning period.

Overall, development patterns in and around Knox County have been influenced by topography, water, soils and manmade features such as five Nebraska highways and some hard-surfaced county roads. These items will likely continue to influence development patterns throughout the course of the planning period.

Existing Land Use Categories

The utilization of land is best described in specific categories providing broad descriptions where numerous businesses, institutions, and structures can be grouped. For the purposes of the Comprehensive Plan, the following land use classifications are used:

- Farmsteads/residential uses
- Commercial uses
- Quasi-Public/Public (includes churches and schools)
- Livestock facilities
- Agriculture

The above land use categories may be generally defined in the following manner:

Agriculture- Row crop, alfalfa, pastureland and all grain crops are considered agriculture land uses. Knox County is an agricultural based county and the existing land use map verifies these uses.

Livestock facilities– These are specific confinement buildings including chicken and swine houses, dairies, and open lots. Since Knox County is considered a Livestock friendly county then it is important to located these facilities so their ability to exist and expand in the future is not encroached upon by other incompatible uses.

Residential– This category includes residential dwellings either as a farmstead, acreage or residential developments located within the county. Residential units of this type are distributed throughout the County.

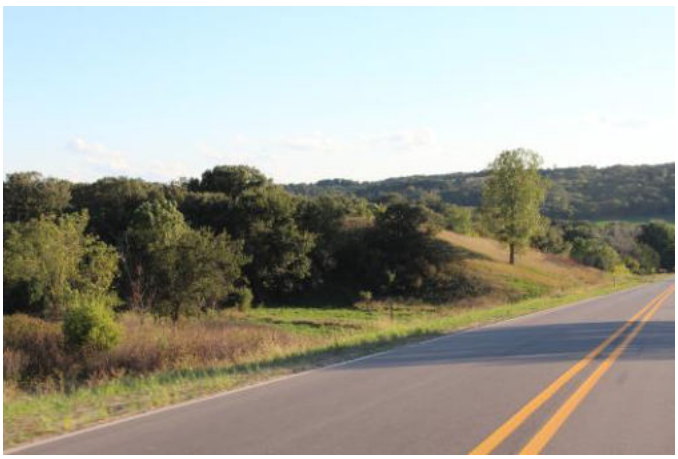
Commercial- Uses in this category consist of convenient stores; feed, seed, automobile and machinery sales; petroleum sales, etc. Commercial uses tend to be located near urban areas or in proximity to major highways for accessibility.

Industrial/Railroad Right-of-Way - Land uses of this nature may include communication plants, light manufacturing, commercial storage, industrial parks, large salvage yards, etc. These uses tend to be located near municipalities and major transportation routes for accessibility purposes.

Physical Character of Knox County

One of the most critical factors, concerning land use development in any area is the physical characteristics of the area. The physical character of Knox County has a variety of different environmentally sensitive landscapes. The county is a variety of environments including:

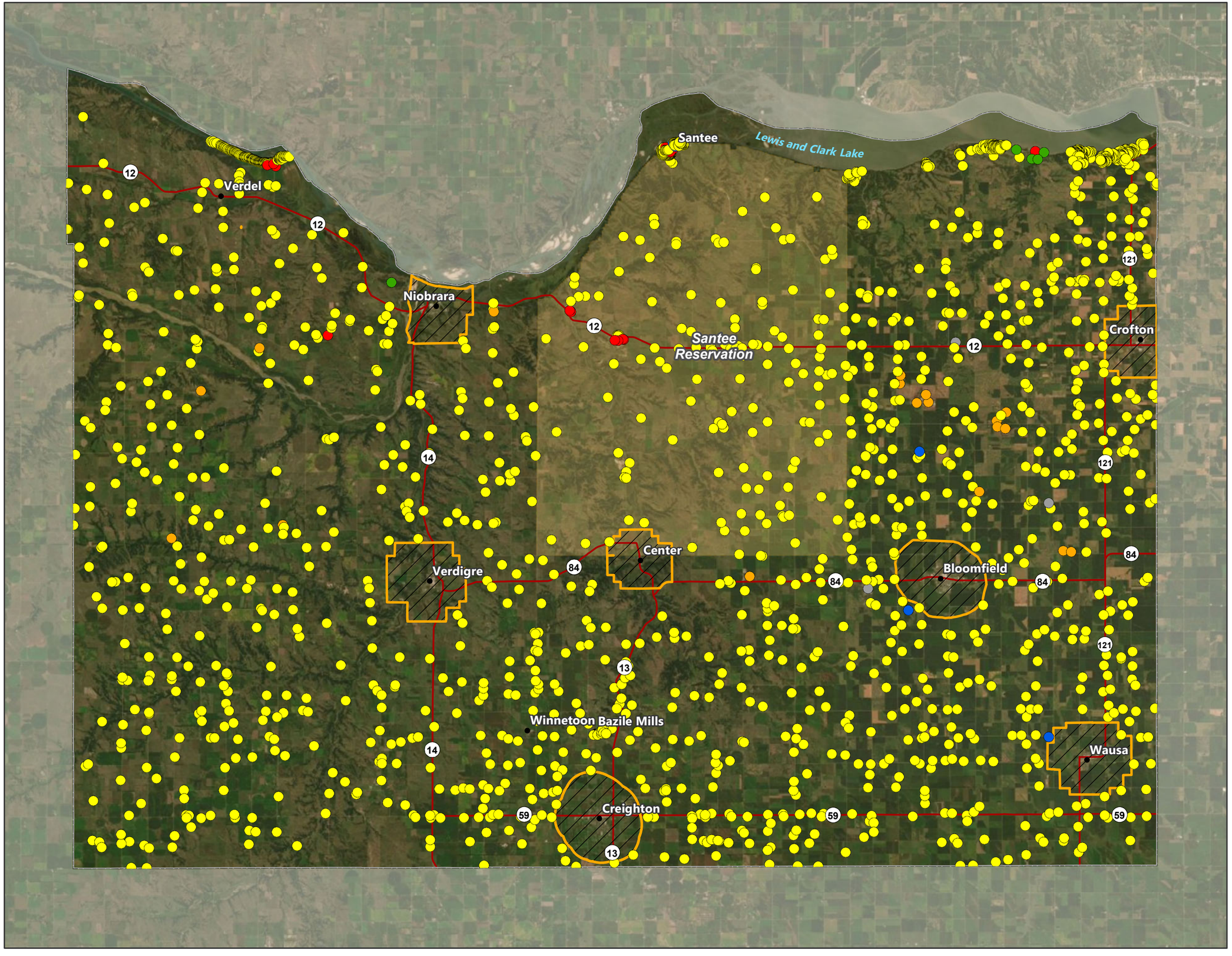
- Missouri River valley
- Niobrara River Valley
- Lewis and Clark Lake
- Bazile Creek
- Cropland
- Rolling hills



KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

EXISTING LAND USE



LEGEND

- City/Town

Existing Land Use

- Single Family Residential
- Commercial
- Public
- Recreation
- Livestock/Feedlot
- Industrial
- State Highway
- County Road
- Municipal Zoning Jurisdiction
- Santee Reservation
- County Boundary

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 08.30.2019

N

0 2.25 4.5 9 Miles

1 " = 5 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

FUTURE LAND USE

LEGEND

- City/Town
- County Road
- Santee Reservation
- County Boundary

Future Land Use

- Primary Agricultural District
- Transitional Agricultural District
- Rural Residential
- River Area Residential
- Lake Area Residential
- Commerical Corridor
- Village Area Development
- Extraterritorial Jurisdiction
- Township/Range

N

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.25.2020

0 1.25 2.5 5 Miles

1 " = 3 miles

Future Land Use Plan

The Future Land Use Plan provides the basis for the formulation of land use policy and zoning regulations. For this reason, it is imperative to formulate a plan tailored to the needs, desires and environmental limitations of the planning area. The Future Land Use Plan should promote improvements in all components of the local economy. The following common principles and land use concepts have been formed to guide future development and redevelopment activities within Knox County's planning and zoning jurisdiction.

The plan is based upon existing conditions and projected future conditions for the county. The Land Use Plan also assists the county in determining the type, direction and timing of future growth and development activities. The criteria used in this Plan reflect several elements, including:

- the current use of land within and around the county
- the desired types of growth, including location of growth
- future development activities
- physical characteristics, opportunities and constraints of future growth areas
- current population and economic trends affecting the county

Efficient allocation of land recognizes the forces of the private market and the limitations of the capital improvement budget. This Plan acknowledges these factors play an important role in the growth and development of Knox County. A Future Land Use Plan is intended to be a general guide to future land uses that balance private sector development (the critical growth element in any county) with the concerns, interests, and demands of the overall local economy.

Land Use Categories

The future land uses for Knox County are separated into 11 categories. The following list shows the land uses within this plan:

- Primary Agricultural
- Transitional Agricultural
- River Protection Corridor
- Lake Area Residential
- River Area Residential
- Rural Residential
- Village Area Development
- Commercial
- Commercial Corridor
- Industrial
- Parks and Recreation

Reservation Land

The policies found in the following pages apply county-wide, except, on areas considered Tribal lands within reservation areas of Knox County. The main reservation is the Santee Sioux Reservation as outlined on the Land Use Maps of this Chapter. Please note, any land owned and used by non-native in these areas shall follow the policies of this plan.

Primary Agriculture

General Purpose

This land use district provides for all agriculture practices. In this "agriculture first" land use district, agricultural activities should be given primary consideration where conditions prove favorable. This category is where livestock production and feeding operations are allowed and non-farm residential development are discouraged.

Compatible Uses

1. Crop production, including grazing lands
2. Livestock operations for all types of animals
3. Private grain storage
4. Commercial grain storage
5. Commercial uses related to agriculture such as: fertilizer processing and storage, grain elevators, etc.
6. Manure/fertilizer applications
7. Single acreage developments
8. Public recreational, wildlife and historical areas
9. Renewable energy equipment
10. Agri-Tourism activities such as: hunting preserves, fishing, vineyards etc.
11. Religious uses and structures
12. Educational uses and structures
13. Commercial mining

Incompatible Uses

1. Residential/Acreage developments not associated with a farming operation
2. Large commercial developments

Potential issues to consider

1. Rural Water availability and connections
2. Groundwater availability
3. Slopes
4. Topography
5. Natural amenities such as trees, ponds, and streams
6. Site drainage
7. Flooding hazards.
8. Groundwater contamination
9. Minimum lot sizes and residential densities
10. Wetlands
11. Existing and/or proposed sanitary systems
12. Wellhead protection areas
13. Proximity to conflicting uses such as new acreages near livestock confinements
14. Transportation systems (county roads, highways)

Special Policies

1. Minimum residential lot sizes should be kept at the lowest possible size accommodating both private water and sanitary sewer.
2. Residential densities within this land use category should be no more than 2 dwelling units per 1/4 section of land. However, provisions should be put into place to allow further splits under specific conditions.
3. Cluster developments should be considered and used whenever soils, topography, natural amenities warrant.
4. Separation distances should be applied to the livestock facility and rural acreages.
5. Small livestock feeding operations should be a permitted use; while larger livestock feeding operations be regulated through the conditional use process in order to help minimize environmental impacts and the health, safety and general welfare of the public.

TRANSITIONAL AGRICULTURE

General Purpose

The Transitional Agriculture represents an area in the County where agriculture is protected, but limited. The Transitional Agriculture land use is intended to provide a location where agriculture can continue to thrive but may at some point in the future be influenced by growth in the adjacent communities.

Compatible uses

1. Crop production, including grazing lands
2. Livestock operations for all types of animals
3. Agri-Tourism activities such as: hunting preserves, fishing, vineyards etc.
4. Private and commercial grain storage
5. Manure/fertilizer applications
6. Single acreage developments
7. Public recreational, wildlife and historical areas
8. Renewable energy equipment
9. Religious uses and structures
10. Educational uses and structures

Incompatible Uses

1. Large scale residential developments including mobile homes as a single-family dwelling unless located within a mobile home park
2. Livestock over 100 animal units
3. Large commercial developments

Potential issues to consider

1. Rural Water availability and connections
2. Slopes
3. Proximity to existing livestock facilities
4. Topography
5. Natural amenities such as trees, ponds, and streams
6. Site drainage
7. Flooding hazards.
8. Groundwater availability
9. Groundwater contamination
10. Wetlands
11. Existing and/or proposed sanitary system
12. Potable well locations
13. Wellhead protection areas
14. Transportation systems (county roads, highways)

Special policies

1. Residential lot sizes may vary depending upon the types of sanitary system installed and the source of potable water.
2. Residential densities within this land use category should be no more than 4 dwelling units per 1/4 section.
3. Cluster developments should be considered and used whenever soils, topography, natural amenities warrant.

River Protection Corridor

General Purpose

This land use district is shown along the Niobrara and Missouri Rivers. The River Protection Corridor has the environmental objective of protecting water supplies through a limited number of permitted uses. Preserving water quality and minimizing flood hazards are the leading priorities in considering any type of land use. Development meeting the floodplain regulations may construct in identified floodplains. However, no new construction will be allowed in the designated floodway unless a Letter of Map Amendment (LOMA) can be obtained from FEMA.

Compatible uses

1. Crop production, including grazing lands
2. Private grain storage
3. Manure/fertilizer applications
4. Single acreage developments
5. Public recreational, wildlife and historical areas
6. Tourism activities such as: parks, hunting preserves, fishing etc.
7. Religious uses and structures
8. Educational uses and structures
9. Community/Recreational Center
10. Larger park and recreation areas
11. Mining operations
12. Marinas
13. Small scale renewable energy facilities

Incompatible Uses

1. Livestock operations
2. Large commercial developments
3. Large industrial developments
4. RV Storage located in the floodplain and/or floodway
5. Mobile homes as a single-family dwelling unless located within a mobile home park

Potential issues to consider

1. Floodway
2. Floodplain and flooding hazard
3. Rural Water availability and connections
4. Proximity to existing livestock facilities
5. Wetlands
6. Depth to groundwater
7. Topography
8. Natural amenities such as trees, ponds, and streams
9. Site drainage
10. Groundwater contamination
11. Existing and/or proposed sanitary system
12. Potable well locations
13. Wellhead protection areas
14. Transportation systems (county roads, highways)

Special policies

1. Residential lot sizes may vary depending upon the types of sanitary system installed and the source of potable water.
2. Residential densities within this land use category should be no more than 2 dwelling units per 1/4 section of land. However, provisions should be put into place to allow further splits under specific conditions.
3. When a sandpit development or mining operation is proposed and the development is the proposed reclamation solution, the density should be greater.
4. Cluster developments should be considered and used whenever soils, topography, natural amenities warrant.

Lake Area Residential

General Purpose

This land use area is intended to provide for existing and future developments along the Lewis and Clark Lake. This area will require some special guidelines in the future to protect future construction and the soils of the area. These special guidelines will be discussed in detail within the Sub-area Plan.

Compatible uses

1. Crop production, including grazing lands
2. Religious uses and structures
3. Educational uses and structures
4. Community/Recreational Center
5. Residential developments

Incompatible Uses

1. Livestock operations
2. Large commercial developments
3. Mobile homes as a single-family dwelling unless located within a mobile home park

Potential issues to consider

1. Soils formations (critical in this area)
2. Floodway
3. Floodplain and flooding hazard
4. Proximity to existing livestock facilities
5. Wetlands
6. Depth to groundwater
7. Natural amenities such as trees, ponds, and streams
8. Site drainage
9. Groundwater contamination
10. Existing and/or proposed sanitary system
11. Potable well locations
12. Wellhead protection areas
13. Transportation systems (county roads, highways)

Special policies

1. Residential lot sizes may vary depending upon the types of sanitary system installed and the source of potable water.
2. Close attention should be paid to the existing soils and structural systems of new construction.
3. Cluster developments should be considered and used whenever soils, topography, natural amenities warrant.
4. New developments are encourage to contain internal water and/or sanitary sewer systems.
5. New developments are not encouraged to step down/up from the ridge to the valley.
6. New developments should be required to maintain lots an appropriate distance away from the Lewis and Clark Lake's edge.

River Area Residential

General Purpose

This land use area is intended to provide for existing and future developments along the Missouri River valley. This area will require some special guidelines in the future to protect future construction and the soils of the area. These special guidelines will be discussed in detail within the Sub-area Plan found later in this Chapter.

Compatible uses

1. Crop production, including grazing lands
2. Religious uses and structures
3. Educational uses and structures
4. Community/Recreational Center
5. Residential developments
6. Manufactured housing
7. Temporary housing such as RV's and Tiny Houses

Incompatible Uses

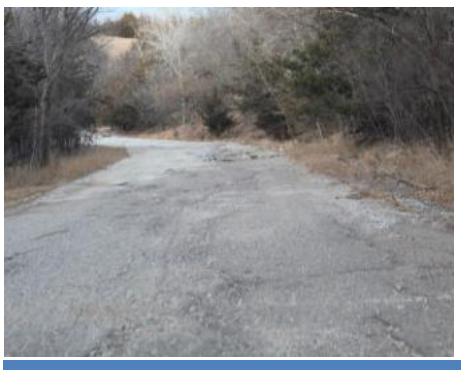
1. Livestock operations
2. Large commercial developments
3. Large permanent developments within the floodplain and floodway

Potential issues to consider

1. Soils formations (may be critical in this area)
2. Floodway
3. Floodplain and flooding hazard
4. Proximity to existing livestock facilities
5. Wetlands
6. Depth to groundwater
7. Natural amenities such as trees, ponds, and streams
8. Site drainage
9. Groundwater contamination
10. Existing and/or proposed sanitary system
11. Potable well locations
12. Wellhead protection areas
13. Transportation systems (county roads, highways)

Special policies

1. Residential lot sizes may vary depending upon the types of sanitary system installed and the source of potable water.
2. Close attention should be paid to the existing soils and structural systems of new construction.
3. Cluster developments should be considered and used whenever soils, topography, natural amenities warrant.
4. New developments are encourage to contain internal water and/or sanitary sewer systems.
5. New developments should be required to maintain lots an appropriate distance away from the Missouri River's edge.



Rural Residential

General Purpose

The Rural Residential Land Use District represents an area in the County similar to the LAR and RAR, but the denser residential development is predominately above the Missouri River and Lewis and Clark Lake; however, a portion of this district may touch the River or Lake. The primary area in Knox County falling into this district is commonly referred to as "Devil's Nest". These areas should be developed as planned developments and should incorporate clustered development concepts into the design.

Compatible uses

1. Residential developments meeting design criteria
2. Mixed-use developments incorporating:
   - Residential (This should be the dominate use)
   - Supporting commercial
   - Public amenities such as meeting halls, community centers
   - Marina
3. Agri-Tourism activities such as: vineyards etc.
4. Public recreational, wildlife and historical areas
5. Renewable energy equipment
6. Religious uses and structures
7. Educational uses and structures
8. Mobile homes within an approved mobile home park

Incompatible Uses

1. Major agricultural operations
2. Livestock operations
3. Large commercial developments
4. Large industrial developments

Potential issues to consider

1. Rural Water availability and connections
2. Slopes
3. Proximity to existing livestock facilities
4. Topography
5. Natural amenities such as trees, ponds, and streams
6. Site drainage
7. Flooding hazards.
8. Groundwater availability
9. Groundwater contamination
10. Wetlands
11. Existing and/or proposed sanitary system
12. Potable well locations
13. Wellhead protection areas
14. Transportation systems (county roads, highways)

Special policies

1. Residential lot sizes may vary depending upon the types of sanitary system installed and the source of potable water.
2. Cluster developments should be considered and used whenever soils, topography, natural amenities warrant.
3. Developments of this type should be completed as a Planned Development.

Village Area Development

General Purpose

This land use district is intended for the unincorporated communities of Knox County. The district is considered a mixed-use district in order to allow single-family residential, other residential, commercial, and even industrial uses thrive in these smaller communities. The primary areas in Knox County are Lindy, Verdel, Bazille Mills, and Winnetoon.

Compatible uses

1. Residential uses, including mobile homes
2. Commercial uses
3. Light industrial use
4. Acreages and associated accessory uses
5. Religious uses and structures
6. Educational uses and structures
7. Community/Recreational Center/Recreational facilities

Incompatible Uses

1. Livestock operations
2. Large commercial developments

Potential issues to consider

1. Rural Water availability and connections
2. Floodplain and flooding hazard
3. Slopes
4. Proximity to existing livestock facilities
5. Wetlands
6. Depth to groundwater
7. Topography
8. Natural amenities such as trees, ponds, and streams
9. Site drainage
10. Existing and/or proposed sanitary system
11. Potable well locations
12. Wellhead protection areas.
13. Transportation systems (county roads, highways)

Special policies

1. Residential lot sizes may vary depending upon the types of sanitary system installed and the source of potable water.
2. Cluster developments should be considered and required in this land use area.

Commercial Corridor Land Use

General Purpose

The Commercial Corridor is intended to be a blend of residential and commercial uses, primarily in the Lewis and Clark Lake environs.

Compatible uses

1. Agricultural uses
2. Mobile home parks
3. Uses serving the motoring public (truck stops, convenient stores, etc.)
4. Religious uses and structures
5. Educational uses and structures
6. Self-storage facilities including recreational vehicles, boats, etc.
7. Community/Recreational Center
8. Adult entertainment where appropriate
9. Secondary Educational uses and structures
10. Renewable energy
11. Single-family residential on scattered lots

Incompatible Uses

1. Livestock operations
2. Residential subdivisions
3. Billboard signs/off-premises signs

Potential issues to consider

1. Floodplain and flooding hazard
2. Groundwater availability
3. Slopes
4. Erosion controls
5. Wetlands
6. Depth to groundwater
7. Topography
8. Natural amenities such as trees, ponds, and streams
9. Site drainage
10. Existing and/or proposed sanitary system
11. Potable well locations
12. Wellhead protection areas
13. Transportation systems (county roads, highways)

Special policies

1. Minimum lot sizes based upon adequate space for vehicular movement, parking and septic and water systems.
2. Developments of 1 acre or more may be required to meet the standards of NPDES permitting.
3. Developments that create more than a 5% increase in runoff may be required to construct a detention basin to control runoff.

Wellhead Protection Areas (Overlay)

General Purpose

This land use area is identified for the protection of public water supplies. These areas are identified but will not be strictly enforced through zoning until an interlocal agreement is approved by the county and other party owning the wellhead.

These areas are considered as overlays and are in addition to the requirements and policies of the underlying area.

Typical Uses

1. Use allowed in the underlying area that are not considered a contamination hazard to the wellhead area and the water supply.

Potential Issues to Consider

1. See underlying land use category.

Buildable Lot Policies

1. See underlying land use category.

Development Policies to Consider

1. See underlying land use category.

Conservation Subdivisions

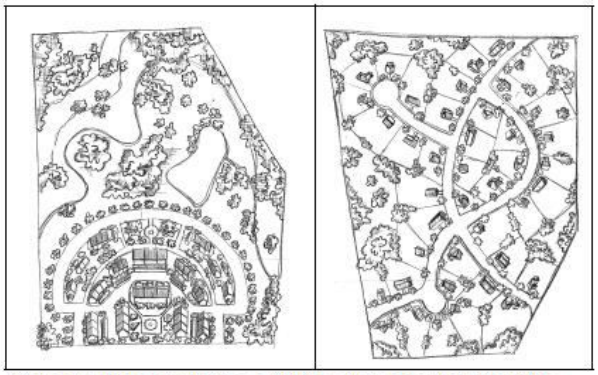
The graphic to the right represents a standard subdivision and how it can be redrawn into a conservation subdivision. The primary usage of this technique in Knox County is so a developer can maintain a specific density of building lots while protecting key environmental elements on the property. Some of these environmental elements include:

- Wetlands
- Prominent Tree Stands
- Steep slopes
- Floodplains
- Streams
- Natural prairie

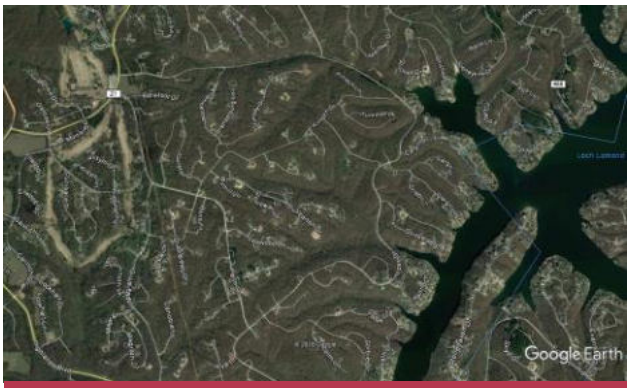
In Knox County, there are several opportunities to use Conservation Subdivisions. However, the most prominent area is along the northern edge of the county, along Lewis and Clark Lake and the Missouri River.

Key items needing to be preserved/conserved within new and existing subdivisions are the slopes, rock outcroppings, and quality trees. Many developers spend large amounts of money to replicate some of the qualities available in northern Knox County. The County should work hard to negotiate with developers to maintain a larger part of the natural amenities available. One specific tool is the use of Planned Developments. This tool allows the county to negotiate locations, setbacks, and density of certain areas in exchange of protections.

In most cases the sensitive areas are placed in some type of conservation easement. The protected areas, in a majority of cases, are placed into a common area to be shared by all the residents; this in turn increases the overall value of the lots.



Conservation subdivisions (left) feature smaller lots with a high percentage of open space. Conventional subdivisions (right) feature large lots with little common open space. A conventional subdivision is subject to all of the base zoning district standards, such as minimum lot size, front setbacks, landscaping, and adequacy of public facilities.



Aerial view of a subdivision in Bella Vista, Arkansas using these Conservation principles.

Drainageway using conservation design concepts in Fallbrook (Lincoln, NE)

FUTURE LAND USE GOALS

Land Use Goal and Objectives

Guiding future growth and development in Knox County in order to insure compatible uses locate together is essential during this planning period.

General Land Use Policies and Strategies

GENLU-1.1 Ideally, new residential development within Knox County should be focused on the communities of the county; except for those still farming in the county.

GENLU-1.2 Future land uses in the county should carefully consider the existing natural resources of the area, including soils, rivers, and groundwater.

GENLU-1.3 Any future growth and development in rural Knox County should work toward compact patterns of land uses.

GENLU-1.4 Knox County should consider limited future development to identified areas along the major highways spanning the county.

GENLU-1.5 The Knox County Land Use Plan and Zoning Regulations should be designed to expedite the review and approval process where possible.

GENLU-1.6 All land uses and structures should be carefully reviewed for compliance with the duly adopted floodplain and floodway regulations in Knox County.

Agricultural Land Use Policies and Strategies

AGLU-1.1 Knox County should continue to develop policies that enhance the "Livestock Friendly" designation.

AGLU-1.2 Knox County should encourage uses referred to as "Agri-tourism" (Wineries and orchards).

AGLU-1.3 Livestock production should be encouraged in Knox County provided environmental conditions are appropriate.

AGLU-1.4 Livestock production should be protected from the establishment of conflicting uses such as acreages.

AGLU-1.5 New livestock operations should be located in areas where their impact on neighboring land uses will be minimal.

AGLU-1.6 Knox County should allow agricultural production throughout the county; except where there may be potential conflicts with other policies of this plan.

AGLU-1.7 Livestock operations should be encouraged to utilize odor reducing technologies such as methane digestion and composting .

AGLU-1.8 Regulations should be established and implemented creating setback and buffer requirements to minimize the impacts of solid, liquid, and gas emissions from livestock facilities.

AGLU-1.9 Establish a reward program regarding the separation/buffer requirements for the use of newer livestock best practices.

AGLU-1.10 Establish adequate separation distances between livestock facilities and residential uses and vice versa.

AGLU-1.11 Knox County should minimize encroachment of non-agricultural uses into areas designated as "Prime Farmland".

AGLU-1.12 Encourage low to zero non-farm densities in prime farmland areas and other agricultural districts by providing residential lot size requirements, densities and separation distances between residential and agricultural uses.

AGLU-1.13 Protect the quality of groundwater in agricultural areas of Knox County.

AGLU-1.14 Work with livestock producers on a continual basis in evaluating protections and regulations.

River Protection Corridor Land Use Policies and Strategies

RPCLU-1.1 The River Protection Corridor should be protected due to the nature of the soils in the area and the occasional flooding occurring in the area.

RPCLU-1.2 The County should not allow the introduction of new livestock operations into the Platte River Corridor, especially in any designated floodway.

RPCLU-1.3 The establishment of chemical storage facilities including the manufacturing of chemicals should not be allowed in this area.

RPCLU-1.4 Existing uses within the River Protection Corridor having a high contaminate potential should be relocated to a more suitable location when possible.

RPCLU-1.5 The County should continue to promote the recreational potential of the area and work with existing property owners to establish specific eco-tourism opportunities.

Residential Land Use Policies and Strategies

RESLU-1.1 Large residential subdivisions should be located next to or near the communities within Knox County.

RESLU-1.2 Residential developments should be separated from more intensive uses, such as agriculture, industrial, and commercial development, by the use of setbacks, buffer zones, or impact easements.

RESLU-1.3 Encourage low to zero non-farm densities in prime farmland areas and other agricultural districts by providing residential lot size requirements and proper separation distances between residential and agricultural uses.

RESLU-1.4 Develop subdivision regulations to provide a quality living environment while avoiding inefficient and expensive public infrastructure expansions.

RESLU-1.5 New residential developments should include a subdivision agreement, which provides for the maintenance of common areas, easements, groundwater, use of plant materials and drainage.

RESLU-1.6 Establish zoning and subdivision design standards requiring buffers, and screening standards and functional usable green space, for new developments.

RESLU-1.7 All proposed rural area developments should be based on reasonable expectations and no large-scale development should be approved without:

1) The submission and approval of a layout and design concept, with provision for the staging and servicing of all phases of the development;
2) The approval of all federal and state agencies relative in any applicable health, safety and environmental controls; and
3) An adequate demonstration of the financial capacity (escrows, performance bonds, etc.) and responsibility of the applicants to complete the development and provide for operation and maintenance services.
4) Should be appropriately, if not uniquely, suited to the area or site proposed for development;
5) Should not be located in any natural hazard area, such as a floodplain (unless a sandpit development mitigating the circumstances) or area of geologic hazard, steep slope, severe drainage problems or soil limitations for building or sub-surface sewage disposal, if relevant
6) Should be furnished with adequate access – when possible a minimum of two entrances and exits.

RESLU-1.8 Examine implementation of a planned unit development (PUD)/Clustered Development concept which provides a viable alternative to conventional urban development patterns, while providing a means to encourage creative yet responsible/sensitive developments.

RESLU-1.9 Knox County should review and accommodate, wherever possible, any new or alternative development concepts or proposals, provided such concepts or proposals are consistent with and do not compromise in any way the established disposition of land uses on the Land Use Map or the goals and policies of the Plan.

RESLU-1.9 New residential construction or relocations should not be allowed along any minimum maintenance road unless the road is upgraded to county specifications and paid for by the property owner, prior to construction.

Commercial Corridor Policies and Strategies

FLU-1.1 Encourage the location of commercial and industrial uses to locate within the communities of Knox County or along the major highways.

FLU-1.2 Encourage the location and clustering of commercial and industrial uses within the rural areas of Knox County at major transportation intersections and/or along major railroad.

FLU-1.3 Utilize frontage roads within clustered commercial centers when locating along major roads/highways.

FLU-1.4 Commercial uses should be required to provide their own adequate water supply without negatively impacting

existing neighboring properties.

FLU-1.5 Industrial development not utilizing rail transport should be discouraged from locating next to a railroad right-of-way.

FLU-1.6 Heavy industrial uses with a high water and/or waste disposal requirement should be encouraged to locate or relocate only in or immediately adjacent to urban areas where all required services are available.

FLU-1.7 Commercial and industrial areas located outside a community's extraterritorial jurisdiction should have adequate services, including major utility lines, electric power substations and transmission lines, rail, sanitary sewer and water can be provided, and where appropriate, gas lines are available.

FLU-1.8 Commercial and industrial uses should be located so an adequate buffer space is provided between incompatible land uses.

FLU-1.9 The county should develop appropriate performance, design and specification standards and requirements for all existing and future industrial uses to guide their location or relocation in the county.

FLU-1.10 The county should encourage industrial development that bases its products on renewable and indigenous raw materials.

FLU-1.11 The county should recognize and encourage small-scale industries as viable alternatives to larger, conventional enterprises.

FLU-1.12 Discourage the construction of "strip" commercial developments in rural areas of the county.

Chapter 13
"The Lake Area" Sub-Area Plan

The first thing to be completed with this Chapter is to define what "The Lake Area" is and what is the characteristics of the area. "The Lake Area" basically begins on the east at the county line and continues west along the southern edge of the Lewis and Clark Lake until reaching the western edge of an area called "Devil's Nest".

This area is the most environmentally diverse in the county. It contains sandy beaches along parts of the lake; plus, tall cliffs at the lakes edge. South of the lake, the land may be flatter and changes to rolling hills. The geology is also varied throughout with sandstone, limestone, shale making up a lot of the cliff areas and, again, the sandy beaches of some areas. In addition, there is very little prime farmland located in the area.

The geological make up of this area has seen it in a state of change over the years. These changes include landslides and in some cases the lake front cliffs have fallen off into the lake. Visual examination of some homes in the area also indicate the geological base is shifting based upon expansion cracks and damage to foundations in the area.

Historic Development Trends

Historically, the lake area has been a mixture of uses since the Lewis and Clark Lake was filled in 1957 with the completion of Gavins Point Dam on the Missouri River. The area has had farming uses in parts, but historically, as with most water, the area has attracted residential development of many forms. Some of the developments in the 60 plus years have been well thought out while many have had little thought.

Photograph 13.1 View of Single-family residences across from mobile homes
Source: Google Earth

Photograph 13.2 RV park within the Sub-Area
Source: Google Earth

Historically, the area started as a summer, weekend retreat for families, a large number from the different metro areas surrounding the lake. However, over the years more and more people and families desired to make this area a year round residential spot. The mixture of residential uses, over time, has created some conflicts, since some of the part-time residents have "make shift" cabins and RV's, and even mobile homes, the new full-time residents were not accepting of these units.

There are numerous subdivisions within "Lake Area" study area; one of the most well known is Devil's Nest. Devil's Nest was originally started in the late 1960's and early to mid 1970's. The area has been platted out and included a Community Center (Event Center) overlooking Lewis and Clark Lake, homes, and a ski lift and manmade ski hills. The area has seen limited success over the years for numerous reasons, some of which will be discussed in another section of this Chapter.

Photograph 13.3 View of Devil's Nest Area
Source: Google Earth

Key Issues to Consider in the Area

The area designated as the Sub-Area has a number of issues impacting the different land uses of the area. Many of these need to be considered by both individuals and the county when different land use proposals are submitted.

Subsidence along the lakefront areas. Subsidence is the sudden shrinking or gradual downward setting of the grounds surface with little or no horizontal motion. This condition has been witnessed in a number of places within the Sub-Area. These areas are not typically ideal areas for development of residential or other uses unless special structural design is undertaken.

Plasticity is a major concern within the Sub-Area. Plasticity is tied into the subsidence. The term defined is the how vulnerable the soils are to movement, See Figure 13.5. With a few exceptions, the soils within the Sub-Area consist of soils with medium to very high movement. In reality, these

soils, unless specially engineered, may not be suitable for development of structures, especially residential units built in close proximity.

Photograph 13.4 Example of Subsidence and Plasticity in the Lake Area. Block basement wall.

Roadways/Access are another major concern for future development in this area. There is limited access to a number of the developments within the Sub-Area, especially Devil's Nest. This limitation could create issues in the future regarding snow removal, maintenance, and egress during a natural disaster such as landslides and fires.

In addition, these roads in the long-term may create barriers for emergency vehicles to access key places due to the limited access.

Due to the soils, slopes, and bedrock materials, constructing roads in this area are expensive and may need significant engineering to build them in the correct manner.

Floodplain/Flooding is a major consideration for certain portions of the Sub-Area, especially where the land has dropped to the level of the lake. These areas may be in jeopardy in the future due to the unknown weather conditions and flooding seen over the past decade. Within these areas, water could either become too high for the structures constructed or the lake/shoreline may shrink, leaving these structures farther away from the waters edge. These issues may be variable from year to year depending on the demand to release water through Gavins Point Dam.

Conflicting Uses are always an issue when an area has developed with minimal direction and planning. The conflicts arise, as mention earlier, from the mixture of year-round residents and summertime vacationers. Each group has a different goal in mind and these end states typically are in conflict around water and recreational land use.

Knox County needs to address these conflicts as part of the Future Land Use Plan whenever possible. The primary solution should be to separate the absentee landowners from the year round landowners/residents whenever possible. Another use starting to conflict is the commercial uses including convenience stores, rental stores, and RV sites.

Special polices need to address these conflicts and attempt to provide direction in the future.

Public Uses are missing within the Sub-Area. These include mostly Public Safety facilities, fire/rescue and law enforcement. The closest current facilities are located in Crofton and Niobrara. During the course of this planning period, some combined facility would be appropriate, working with interlocal agreements to support the facility with law enforcement and fire/rescue personnel/ volunteers.

Slopes are located throughout the Sub-Area. Slopes will have an impact on almost all existing and future uses within the area. In most cases, developing on slopes of 20% or greater should be greatly discouraged. However, in some locations such as Devil's Point, the slopes could work to provide walkout basements in an number of locations. Again, these slopes are also located in areas where there is high to very high plasticity and foundations/footings should be specially designed by the future homeowner in order to avoid major shifting in the materials.

Stacking of Buildings should be avoided. This is staggering two or three structures up the side of a hill in order to provide vistas of an area such as the Lake. If this is desired in the future for a new development, the developer should be required to design the finished soils in the development to prevent sliding of structures down the hill.

Stacking is a great method, but a simple landslide can wipe out multiple structures as opposed to an individual structure if the soils are not properly reengineered to support this activity. If the soils are not reengineered, then covenants need to be provided by the developer warning of the possibilities.

Utilities within the Sub-Area has rural water provided by Cedar/Knox Rural Water District. However, there are locations within the service where water cannot be adequately supplied by the District.

Most sanitary sewer in the area is basically septic systems; however, a few subdivisions have constructed centralized collection and treatment for their residents.

Lot Sizes have been an issue for a number of years. Currently, the minimum lot size required in most parts of the Sub-Area is 1/2 acre. Unfortunately, over the years, a lot of the structures built, especially, the summer dwellings, have been placed on smaller lots and have individual septic systems. These smaller lots over time, unless they already have, will fail and could cause others in close proximity to begin failing. The vast majority of the area is considered Very Limited or Somewhat Limited regarding septic systems and lagoons.

Newer developments should continue to be designed with a minimum lot size of a 1/2 acre or more. New developments should be required to develop with centralized community sanitary sewer and treatment in order to minimize future issues with the soil and conflicts with existing systems. Special designs may be required in order to provide centralized treatment due to the limitations of the soils.

Conclusions

The Sub-Area near Lewis and Clark Lake is an attractive area for development; however, development needs to be sustainable and designed to work in concert with mother nature and the soils of the area. This provides a long-term return on investment by the property owner and a long-term stable tax base for Knox County.

Recommended Policies for "The Lake Area"

The following are recommended policies that may be incorporated into the county's zoning and subdivision regulations:

1. All new residential and commercial construction should have a soils analysis completed in order to determine special design criteria.
2. Commercial development along the southern roads of the area should be located along the southern edge.
3. Mobile homes, mobile home parks, and RV parks should be located along the southern edge of "The Lake Area" and along the major transportation routes.
4. Ideally, mobile homes, mobile home parks, and RV parks should be screened from view when the roadway allows.
5. Funds need to be found for updating the major County roadways serving this Sub-Area.
6. Development along steep slopes (20% or greater) should not be allowed unless it can be demonstrated that special design criteria have been implemented in order to hold the structure and hill in place.
7. Future developments should be required to construct a centralized community sanitary collection and treatment system.
8. Whenever possible, all new residences and developments should be required to hook onto rural water.
9. The minimum lot size in the area should stay a 1/2 acre or more.
10. Development areas such as Devil's Nest should be required to eliminate dead brush and kindling, in order to minimize the risks associated with fires.
11. As new development and some redevelopment occur in the older subdivisions, it would be encouraged to allow similar uses to one and other in order to remove conflicting uses.
12. Knox County and the rural fire districts should work together to establish a combined sheriff's station and fire/rescue facility in "The Lake Area".
13. All new developments should be required to have a minimum of two means of ingress and egress to the development.

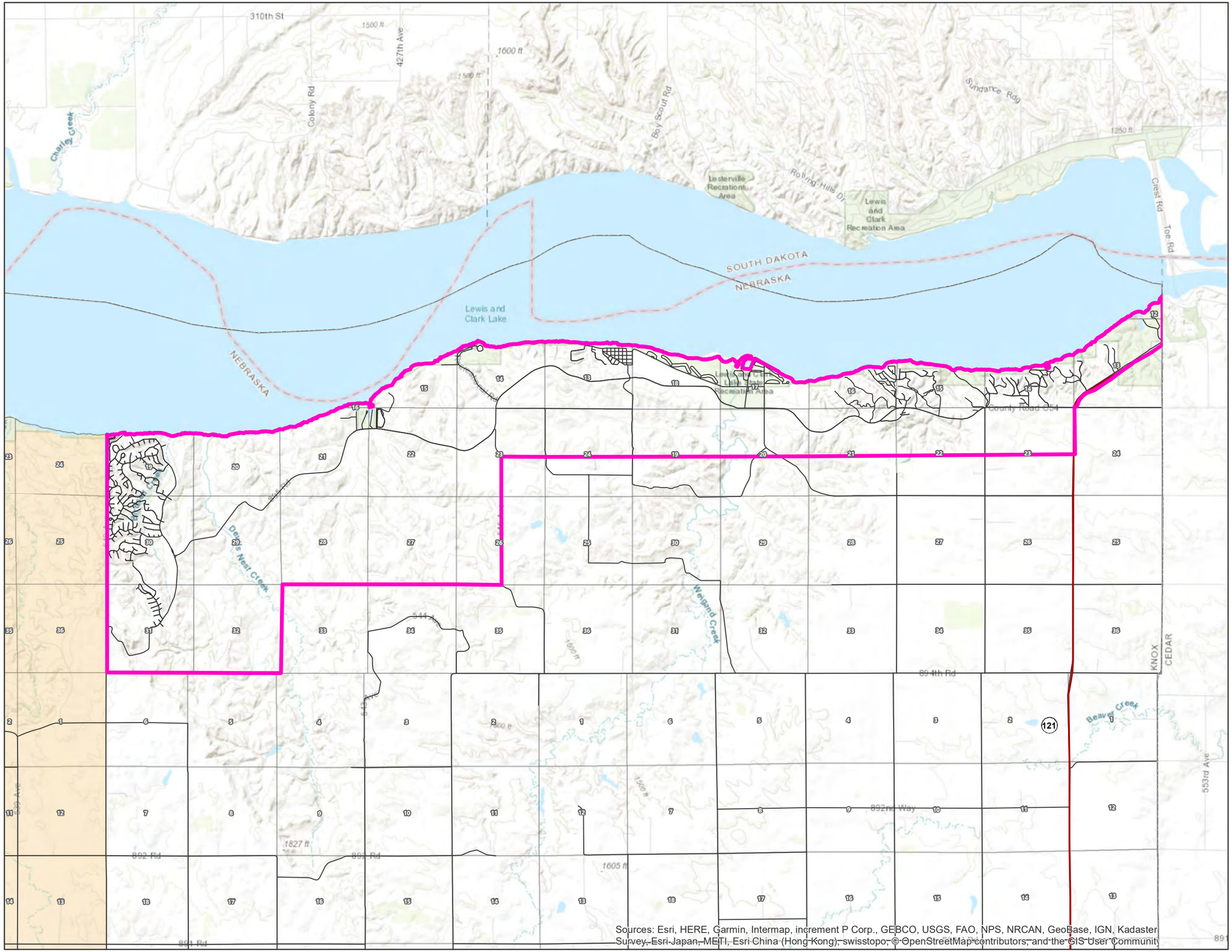
KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

BASE MAP

LEGEND

- City/Town
- State Highway
- County Road
- Township/Range/Section
- Lake Sub-Plan Area
- Santee Reservation
- County Boundary



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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 10.14.2018

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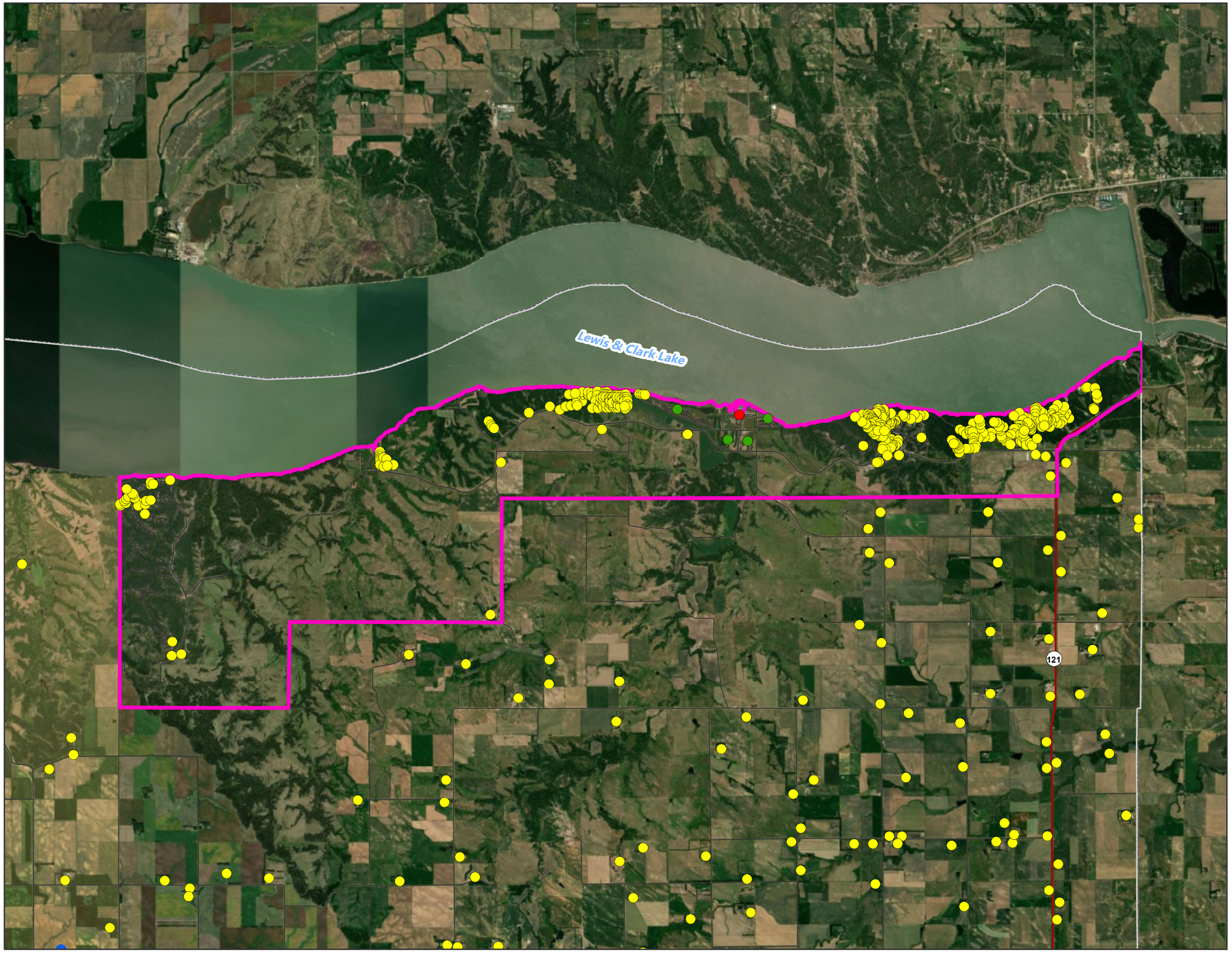
KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

EXISTING LAND USE MAP



LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- Santee Reservation
- County Boundary

Existing Land Use

- Single Family Residential
- Commercial
- Public
- Recreation
- Livestock/Feedlot
- Industrial

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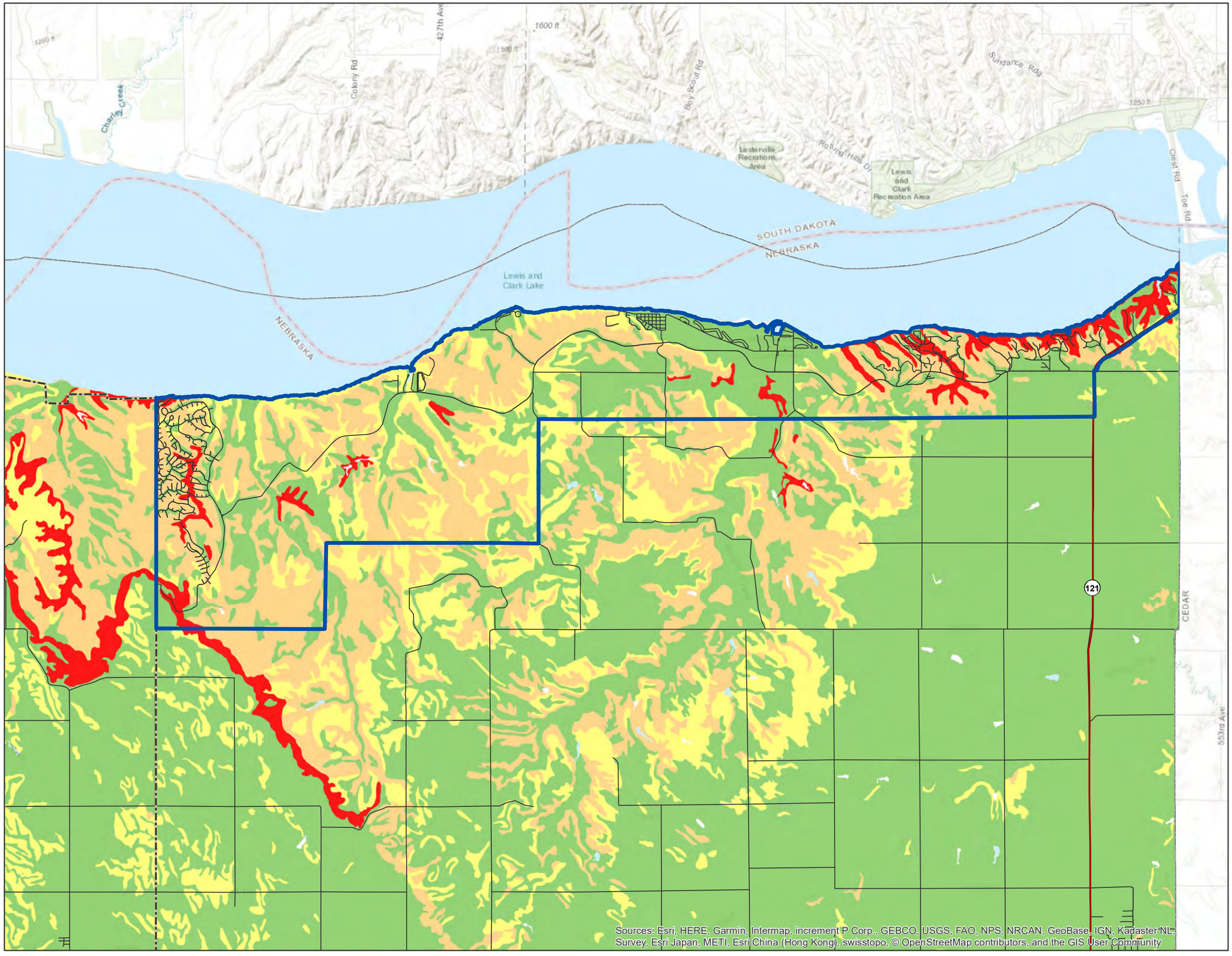
KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - SLOPE GRADIENT



LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Slope Gradient

- <1% Slopes
- 1 - 10% Slopes
- 11 - 20% Slopes
- 21 - 30% Slopes
- >30% Slopes

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1 " = 1 miles

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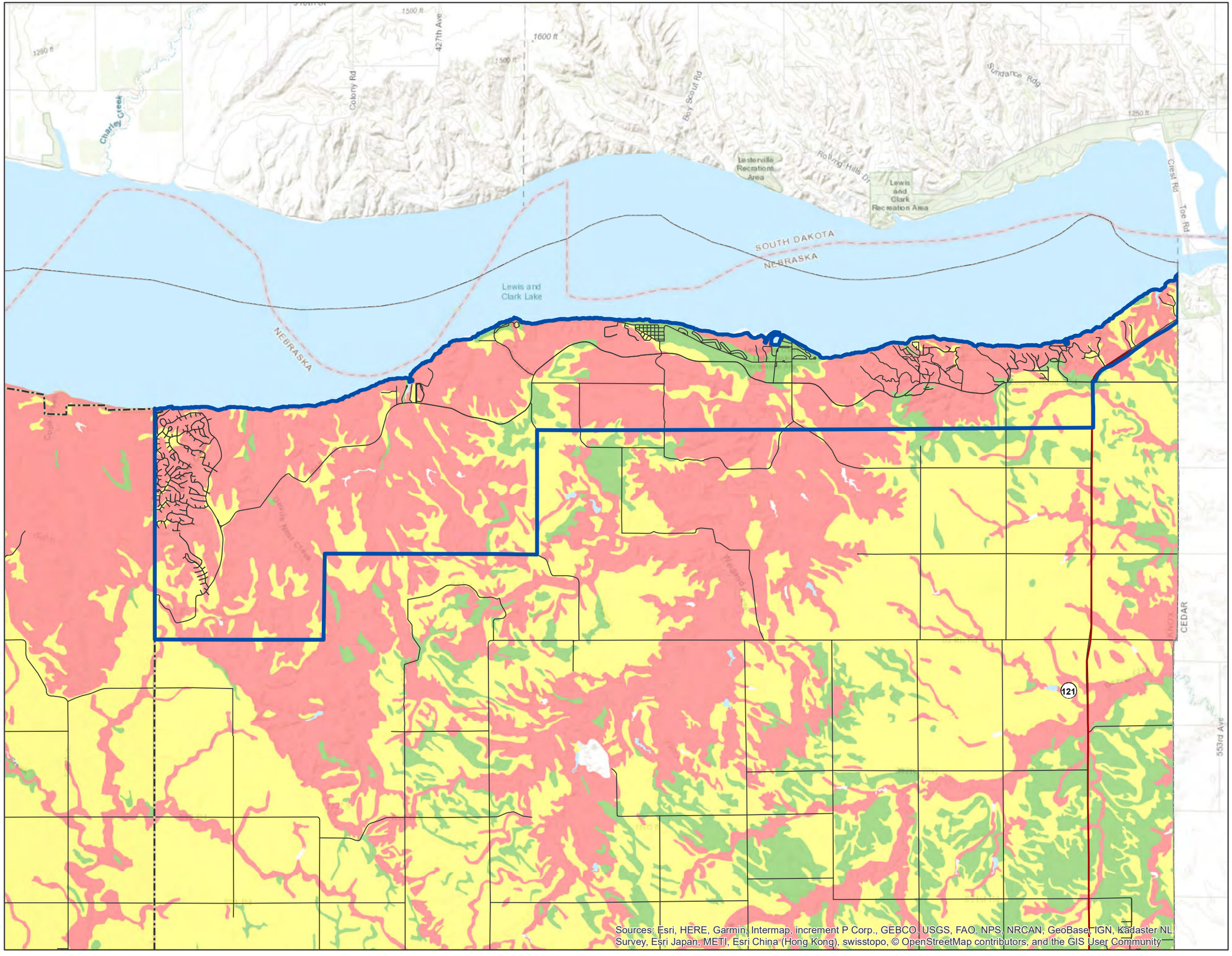
KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - DWELLINGS WITH BASEMENTS



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Dwellings with Basements

- Not Limited
- Somewhat Limited
- Very Limited

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 10.14.2018

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1 " = 1 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

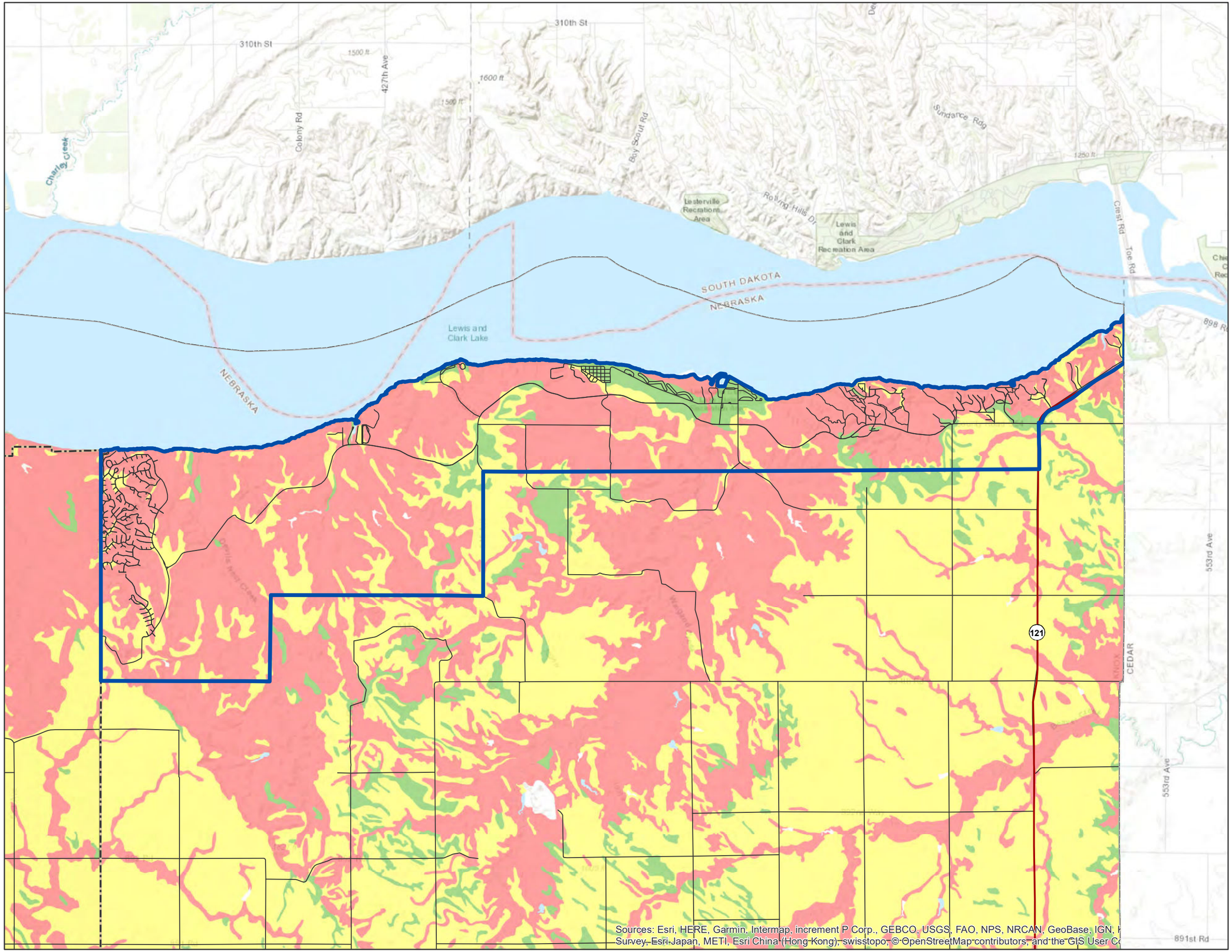
SOILS - DWELLINGS WITHOUT BASEMENTS

LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Dwellings without Basements

- Not Limited
- Somewhat Limited
- Very Limited



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DATUM: NAD 83
DATE: 10.14.2018

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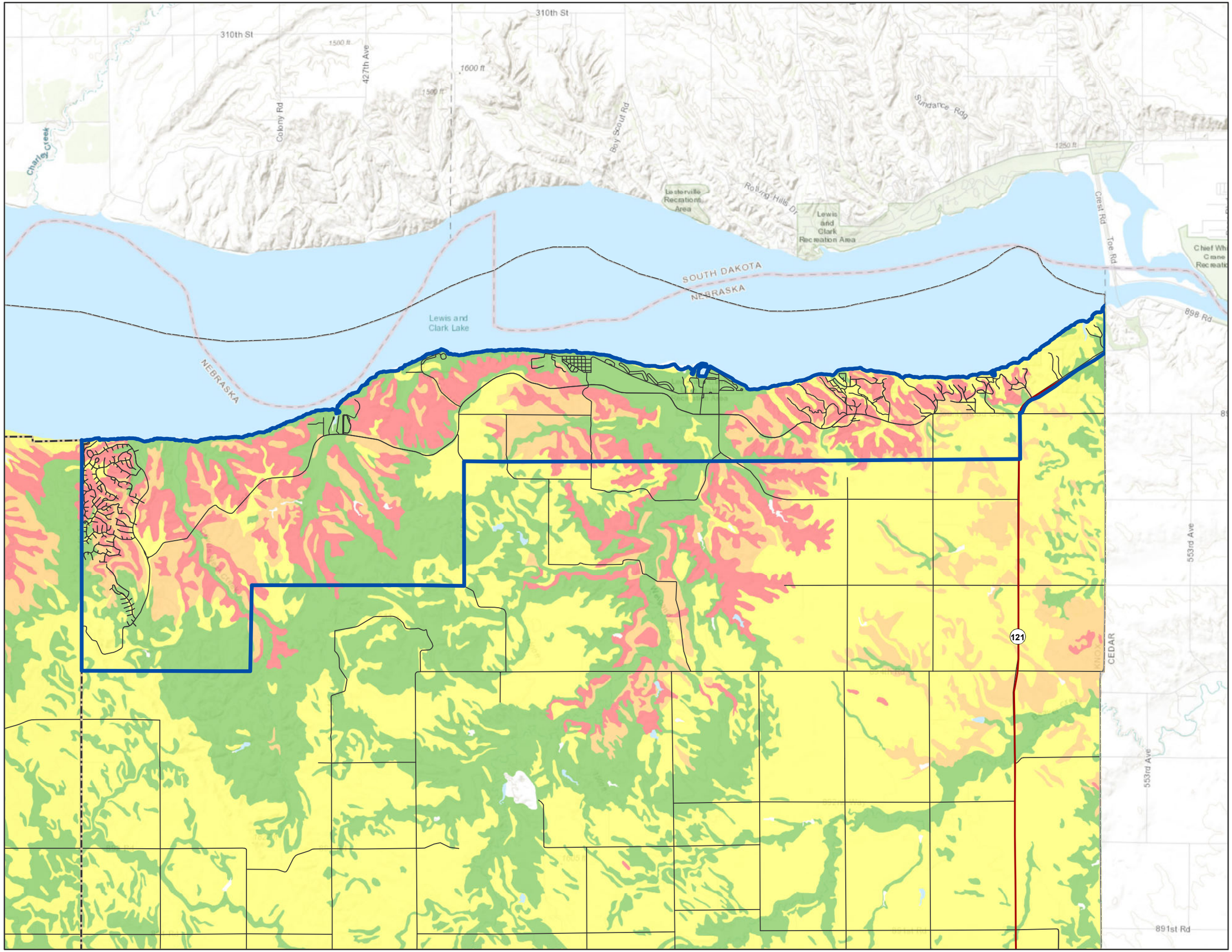
1 " = 1 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - PLASTICITY INDEX



LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- County Boundary

Soils - Plasticity Index

- Low
- Medium
- High
- Very High

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DATE: 12.09.2019

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1 " = 1 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

SOILS - SEPTIC TANK ABSORPTION FIELD CONDITIONS

LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Septic Tank Absorption Field Conditions

- Not Limited
- Somewhat Limited
- Very Limited

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 10.14.2018

0 0.5 1 2 Miles

1 " = 1 miles

N

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

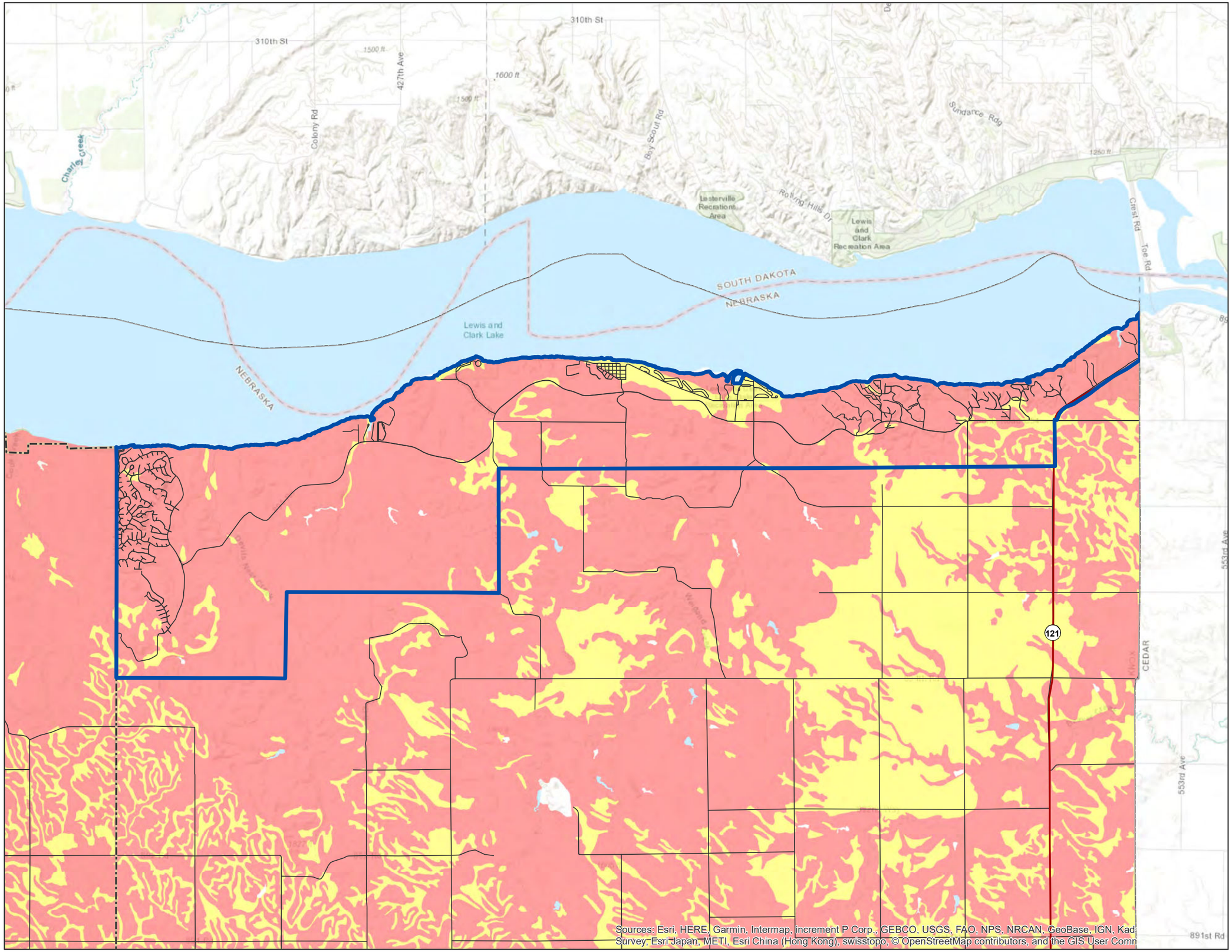
SOILS - SEWAGE LAGOON RATINGS

LEGEND

- City/Town
- Lake Sub-Plan Area
- State Highway
- County Road
- Santee Reservation
- County Boundary

Soils - Sewage Lagoon Ratings

- Not Limited
- Somewhat Limited
- Very Limited



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DATUM: NAD 83
DATE: 10.14.2018

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0 0.5 1 2 Miles

1 " = 1 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

NATIONAL WETLANDS INVENTORY MAP

LEGEND

- City/Town
- Lake Sub-Plan Area
- Wetland
- Lake
- River/Stream
- State Highway
- County Road
- Santee Reservation
- County Boundary

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1 " = 1 miles

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KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

FEMA FLOODPLAIN MAP

LEGEND

- City/Town
- Lake Sub-Plan Area
- 100-Year Floodplain
- Stream
- State Highway
- County Road
- Santee Reservation
- County Boundary

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Chapter 14 Transportation Plan

Introduction

Transportation networks tie communities together as well as providing a link to the outside world. Adequate circulation systems are essential for the safe and efficient flow of vehicles and pedestrians, and accessibility to all parts of the community. The Transportation Plan will identify existing systems and any major improvements planned for the future and those necessary to provide safe and efficient circulation of vehicles within Knox County, including major projects that ensure implementation of the Land Use Plan.

Existing Transportation System and Facilities

Residents within a county have specific transportation needs. These include rail service, bus service, air transportation, as well as vehicular transportation. All of the transportation facilities present are not available within the county and require residents to travel to the nearest location. This portion of the Comprehensive Development Plan examines those services with regard to the closest proximity for residents of Knox County.

Railroad Service

The closest rail freight service to Knox County is in Norfolk Through Nebraska Central Railroad. There is a rail line following US Highway 20, but does not have general shipping points for the public. The nearest passenger service is located in Omaha through Amtrak.

Bus Service

The nearest commercial bus service with ticketing services is available in Norfolk via Arrow Stage Lines and Omaha for Burlington Trailways and Greyhound.

Commercial Airport Service

Sioux City Gateway Airport in Sioux City, IA is the nearest commercial facility to residents in Knox County. However, arrivals and departures are limited to one major airline. Currently, the airport and commercial service connects people to Chicago and points across the U.S. through Chicago via American Airlines.

Sioux Falls Regional Airport offers flights to connecting points via Frontier, Allegiant, Delta, American and United.

Eppley Airfield in Omaha is the nearest Nebraska commercial airport offering flights via multiple airlines.

Small craft Public Airports

The Bloomfield Municipal Airport is one of two small craft airports in Knox County. Runway #14/32 is 2700 feet by 50 feet with asphalt surfacing. However, the northern 200 feet of the runway is considered displaced.

The fixed based operator (FBO) for this facility is Bloomfield Ag and Aerial Services. Elevation is listed at 1673 feet.

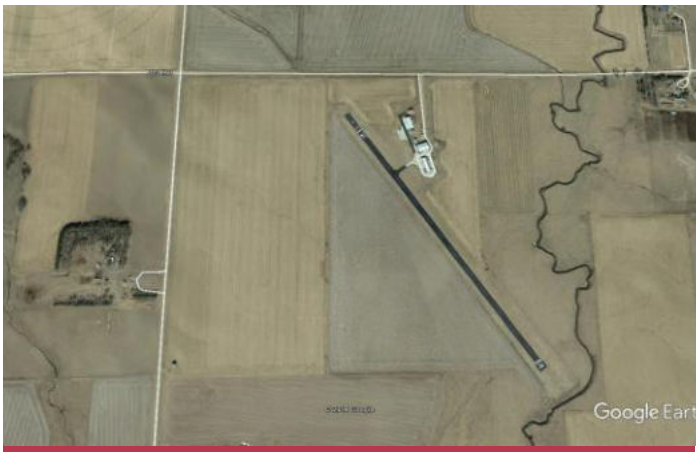

Photo 13.1

Aerial of Bloomfield Municipal Airport

The Creighton Municipal Airport is one of two small craft airports in Knox County. Runway #13/31 is 3700 feet by 60 feet with concrete surfacing. The crosswind runway, #18/36 is 2100 feet long and 200 feet wide and is turf. Elevation is listed at 1653 feet.

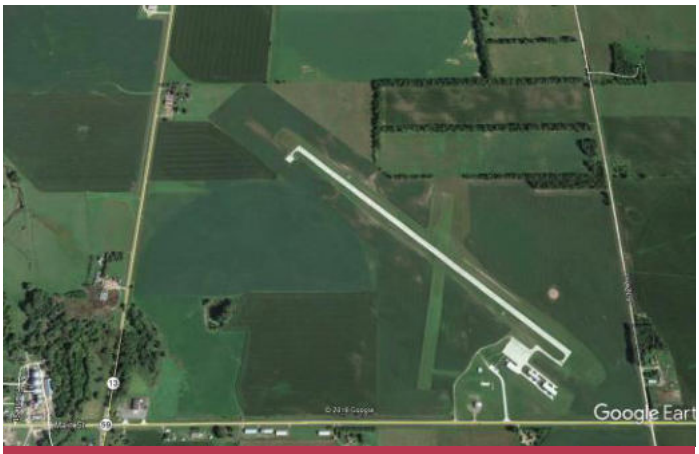

Photo 13.2

Aerial of Creighton Municipal Airport

State and Federal Highways

Knox County has nine major highways running through the county. The major north-south highways are Nebraska Highway 13, 14, and 121. Nebraska Highway 12, 59, and 84 are east and west highways. Some smaller communities are connected via state highway links referred to as 54A, 54B, 54C, and 54D.

Transportation Planning and Land Use

Land use and transportation create the pattern for future development and are extremely interdependent upon one another in order to effectively shape the community. An improved or new transportation route generates a greater level of accessibility and will likely determine how adjacent land will be utilized in the future.

In the short term, land use shapes the demand for transportation and vice versa; one key to good land use planning is to balance land use and transportation. However, new or improved roads, as well as, county and state highways may change land values, thus altering the intensity of which land is utilized.

In general, the greater the transportation needs of a particular land use, the greater its preference for a site near major transportation facilities. Commercial activities are most sensitive to accessibility since their survival often depends upon how easy a consumer can get to the business. Thus, commercial land uses are generally located near the center of their market area and along highways or at the intersection of arterial streets.

Industrial uses are also highly dependent on transportation access, but in a different way. For example, visibility is not as critical for an industry as it is for a retail store. Industrial uses often need access to more specialized transportation facilities, which is why industrial sites tend to be located near railroad lines or highways to suit individual industrial uses.

Street and Road Classification System

All of the public highways, roads, and streets in Nebraska are divided into two broad categories, and each category is divided into multiple functional classifications. The two broad categories are Rural Highways and Municipal Streets. State statute defines Rural Highways as "all public highways and roads outside the limits of any incorporated municipality," and Municipal Streets as "all public streets within the limits of any incorporated municipality." Neb. Rev. Stat. § 39-2102 (RRS 1998)

Nebraska Highway Law (Chapter 39, Article 21, Revised Reissue Statutes of Nebraska 1943) proposes the functional classification of both rural and municipal roads and streets and public

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

NATIONAL ROAD CLASSIFICATIONS

FIGURE 14.1

LEGEND

- City/Town
- County Road
- Santee Reservation
- County Boundary

National Road Classifications

- Minor Arterial
- Major Collector
- Minor Collector

Verdel
Niobrara
Santee
Crofton
Center
Verdigre
Bloomfield
Winnetoon Bazile Mills
Wausa
Creighton

N

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0 1.5 3 6 Miles

1 " = 3 miles

KNOX COUNTY, NEBRASKA

COMPREHENSIVE PLAN

STATE ROAD CLASSIFICATIONS

FIGURE 14.2

LEGEND

- City/Town
- County Road
- Santee Reservation
- County Boundary

State Road Classifications

- Major Arterial
- Other Arterial
- Collector

Santee
Verdel
Niobrara
Crofton
Center
Verdigre
Bloomfield
Winnetoon Bazile Mills
Wausa
Creighton

N

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PROJECTION: NE State Plane (Ft.)
DATUM: NAD 83
DATE: 09.23.2019

0 1.5 3 6 Miles

1 " = 3 miles

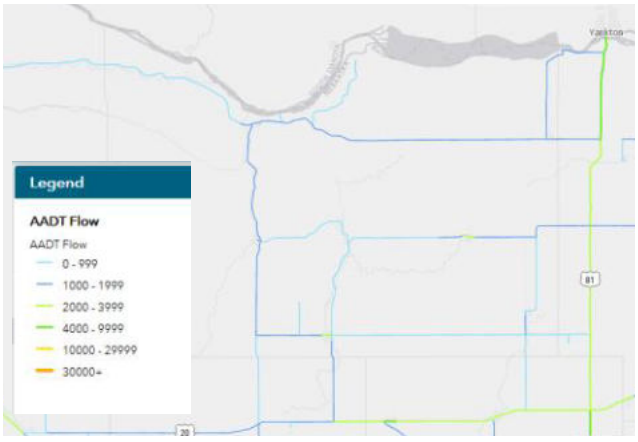
highways. Chapter 39, Article 21.03 lists rural highway classifications as:

1. Interstate: federally-designed National System of Interstate and defense highways;
2. Expressway: second in importance to Interstate. Consists of a group of highways following major traffic desires in Nebraska and ultimately should be developed to multiple divided highway standards;
3. Major Arterial: consists of the balance of routes that serve major statewide interests for highway transportation in Nebraska. Characterized by high speed, relatively long distances, travel patterns;
4. Other Arterial: consists of a group of highways of less importance as through-travel routes.
5. Collector: consists of a group of highways that pick up traffic from the local or land-service roads and transport community centers or to the arterial systems. Main school bus routes, mail routes, and farm-to-market routes;
6. Local: consists of all remaining rural roads, generally described as land-access roads providing service to adjacent land and dwellings; and
7. Bridges: structures crossing a stream three hundred feet or more in width or channels of such a stream having a combined width of three hundred feet or more.

Traffic Counts in Knox County

Traffic flow within the county on these highways varies considerably.

FIGURE 14.3:
TRAFFIC FLOW MAP



Source: Nebraska Department of Transportation

Figure 13.3 indicates the greatest traffic flows are at just outside the county along US Highway 81. However, Nebraska Highway 14 carries between 1,000 and 2,000 vehicles on average daily, as well as portion of Nebraska Highways 12 and 13. The other state highways carry less than 1,000 vehicles daily.

NE DOT Improvements

The Nebraska Department of Transportation publishes an annual list of proposed projects for the current fiscal year, for fiscal years one to five years from the present, and six years and beyond. Knox County is in the Department of Road's District 3. Between Fiscal Years 2020 and 2025, there are 10 projects budgeted for the Knox County area. These projects include:

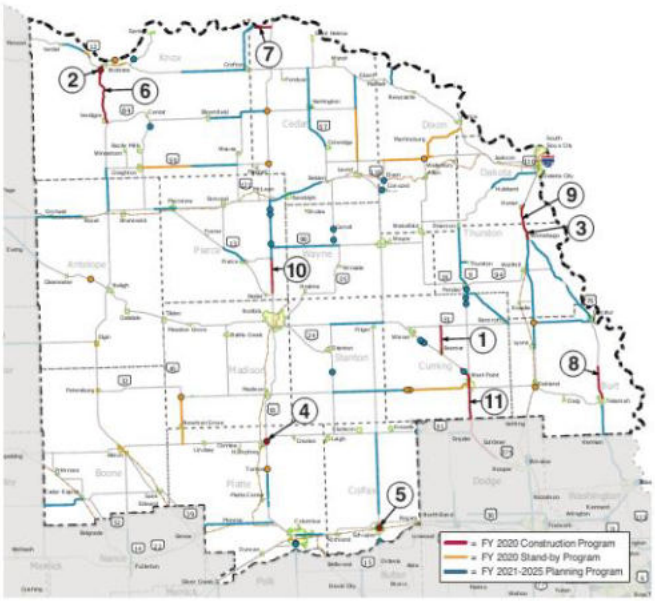
2020 projects

- Nebraska 14 Niobrara South Bridge
- Nebraska 14 Verdigre to Niobrara 11.2 miles of milling, resurfacing, and bridge work
- Nebraska 59 Creighton East 9.6 miles of resurfacing and bridge work (Standby Project)
- Nebraska S-54D Santee South Bridge
- Nebraska 12 Niobrara East and West 10.6 miles grading, Structure, Surfacing, soft shoulder

2021 to 2025 projects

- Nebraska 12 Crofton West, 12.0 miles of milling and resurfacing
- Nebraska 13 Bazile Creek Bank Stabilization
- Nebraska 59 N-121 West, 9.0 miles of milling and resurfacing
- Nebraska 84 Bloomfield to US Highway 81, 11.5 miles of milling, resurfacing, and bridge work
- Nebraska 121 Crofton North, 9.7 miles of milling, resurfacing, and bridge work

FIGURE 14.4:
NDOT SIX-YEAR HIGHWAY PROGRAM



Source: Nebraska Department of Transportation

Overall the Nebraska Department of Transportation is expecting to spend over $15,162,000 in upgrades in the Knox County over the next six years. However, this number does not include $9,699,000 in Asset Preservation Projects which based upon their negative dollar value are projects being funded through Federal Declarations from March 2019.

Transportation Policies and Strategies

TRAN-1.1 Development should be discouraged from occurring in areas where the road system is insufficient to handle any additional traffic load without upgrades being completed.

TRAN-1.2 Improve, develop, and maintain well-traveled roads with hard surfacing, when possible.

TRAN-1.3 Knox County should require new development to:

1. Limit access points on highways designated as arterials when alternative access points are feasible.
2. Minimize direct access points onto arterial rights-of-way by encouraging the utilization of common driveways.
3. New development should not be located along roads officially designated as "Minimum Maintenance"

Chapter 15 Implementation

Achieving Knox County's Future

Successful community plans have the same key ingredients: "2% inspiration and 98% perspiration." This section of the plan contains the inspiration of the many county officials and residents who have participated in the planning process. However, the ultimate success of this plan remains in the dedication offered by each and every resident.

There are numerous goals and objectives in this plan. We recommend reviewing the relevant goals during planning and budget setting sessions to determine what projects may need to be undertaken during the course of the fiscal year.

Action Agenda

The Action Agenda is a combination of the following:

- Goals and Objectives
- Land Use Policies
- Support programs for the above items

It will be critical to earmark the specific funds to be used and the individuals primarily responsible for implementing the goals and objectives in Knox County.

Support Programs for the Action Agenda

Five programs will play a vital role in the success of Knox County's plan. These programs are:

1. **Zoning Regulations**--updated land use districts can allow the county to provide direction for future growth.
2. **Subdivision Regulations**--establish criteria for dividing land into building areas, utility easements, and streets. Implementing the Transportation Plan is a primary function of subdivision regulations.
3. **Plan Maintenance**--an annual and five-year review program will allow the county flexibility in responding to growth and a continuous program of maintaining the plan's viability.
4. **Housing Study** – A Housing Study will be critical to use in direct relationship to the Comprehensive Plan due to the need for housing issues in the county. The study will help guide the county in the redevelopment and future development of housing throughout the county and all of the communities in Knox County.
5. **Strategic Plan** – A Strategic Plan will assist in identifying future economic development strategies that will tie into the overall planning effort of the county. It will be critical to work with this document and the Plan in unison.

Comprehensive Plan Maintenance

Annual Review of the Plan

A relevant, up to date plan is critical to the on-going planning success. To maintain both public and private sector confidence; evaluate the effectiveness of planning activities; and, most

importantly, make mid-plan corrections on the use of county resources, the plan must be current. The annual review should occur during the month of January.

After adoption of the comprehensive plan, opportunities should be provided to identify any changes in conditions that would impact elements or policies of the plan. At the beginning of each year a report should be prepared by the Planning Commission, which provides information and recommendations on:

- whether the plan is current in respect to population and economic changes; and
- The recommended goals, objectives, and/or policies are still valid for the County and its long-term growth.

The Planning Commission should hold a meeting on this report in order to:

1. Provide citizens or developers with an opportunity to present possible changes to the plan,
2. Identify any changes in the status of projects called for in the plan, and
3. Bring forth any issues, or identify any changes in conditions, which may impact the validity of the plan.

If the Planning Commission finds major policy issues or major changes in basic assumptions or conditions have arisen which could necessitate revisions to the Comprehensive Plan, they should recommend changes or further study of those changes. This process may lead to identification of amendments to the Comprehensive Plan and would be processed as per the procedures in the next section.

Unanticipated Opportunities

If major new, innovative development and/or redevelopment opportunities arise which impact any number of elements of the plan and which are determined to be of importance, a plan amendment may by proposed and considered separate from the Annual Review and other proposed Comprehensive Plan amendments. The Comprehensive Plan amendment process should adhere to the adoption process specified by Nebraska law and provide for the organized participation and involvement of citizens.

Methods for Evaluating Development Proposals

The interpretation of the Comprehensive Plan should be composed of a continuous and related series of analyses, with references to the goals and policies, the land use plan, and specific land use policies. Moreover, when considering specific proposed developments, interpretation of the Comprehensive Plan should include a thorough review of all sections of the Comprehensive Plan.

If a development proposal is not in conformance or consistent with the policies developed in the Comprehensive Plan, serious consideration should be given to making modifications to the proposal or the following criteria should be used to determine if a Comprehensive Plan amendment would be justified:

- the character of the adjacent area
- the zoning and uses on nearby properties
- the suitability of the property for the uses allowed under the current zoning designation
- the type and extent of positive or detrimental impact that may affect adjacent
- properties, or the county at large, if the request is approved
- the impact of the proposal on public utilities and facilities
- the length of time that the subject and adjacent properties have been utilized for their current uses
- the benefits of the proposal to the public health, safety, and welfare compared to
- the hardship imposed on the applicant if the request is not approved
- comparison between the existing land use plan and the proposed change regarding the relative conformance to the goals and policies
- consideration of County staff recommendations