RICHLAND COUNTY LONG RANGE PLAN 2019

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USDA NRCS SIDNEY FIELD OFFICE

Contents

SECTION I INTRODUCTION

Vision

Our vision for natural resources conservation in Richland County is the realization of increased levels of stewardship on all land uses.

Mission

Our mission is to simultaneously promote environmental and economic sustainability.

Purpose

The purpose of the Richland County Long-Range Plan is to identify and prioritize resource concerns in the county then develop strategies to address them.

Partners

The entities who have assisted in the development of the Long-Range Plan are

- USDA Natural Resources Conservation Service Sidney Field Office
- USDA Farm Services Agency Richland County Committee
- Richland County Weed District
- Montana State University Extension Service
- Montana Fish Wildlife & Parks
- Richland County Conservation District
- Local landowners, farmers and ranchers

Term

The time-frame for the Long-Range Plan is five years. The plan will be reviewed annually and amended or updated as required.

SECTION II NATURAL RESOURCES INVENTORY

General Information

Richland County is in the Missouri River Country, bordering North Dakota in north eastern Montana. It has a land area of about 1,321,600 acres or 2,065 square miles. Elevation ranges from 1,800 feet on the flood plains of the Yellowstone and Missouri Rivers to about 2,900 feet on the Divide, a high ridge which separates the watersheds of the Yellowstone and Redwater Rivers. The Yellowstone River runs north and east across the southeast corner of the county and The Missouri River marks the northern border. Towns and roads are shown on Appendix A1 Richland County.

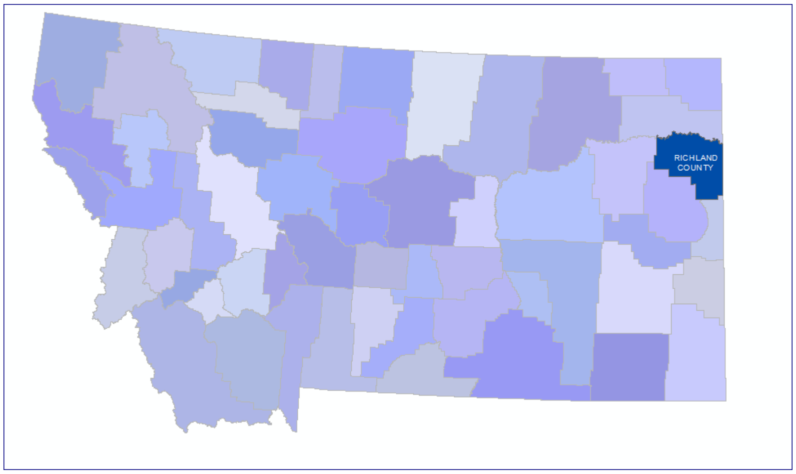

Figure 1 Location of Richland County

The growing season is 110 to 130 days; mean annual air temperature is 43.9 degrees Fahrenheit. Precipitation averages 13 to 14 inches per year on the north and east sides of the county; the west and central areas receive a yearly average of 14-15 inches. (Appendix A2)**.** Precipitation occurs mostly as rain in early spring and as the result of convective storms in May, June and July. Average snowfall is 23.7 inches, typically occurring November through April with highest snowfall in December and January; high snowfall is also common in March. Relative effective precipitation can be thought of as usable rainfall, the portion of total precipitation which becomes available for plant growth (Appendix A3).

Most of the land in the county is dedicated to agriculture. According to the United States Department of Agriculture National Agriculture Statistics Service (NASS), there were 527 farms in the county in 2017; the number of farms decreased slightly from 544 in 2012. Average farm size is 2,410 acres (NASS, 2017).

Wheat is the number one crop, by acres harvested, followed by crops grown for hay, silage and other feed for livestock. The number of acres of sugar beets harvested decreased statewide from 2016 to 2017 with Richland County acres decreasing by around 500. Even so, Richland County continued to lead the State in sugar beet production, harvesting 32.16 % of the state total. Cattle are an equally important sector of the agriculture economy; Richland County ranked 13th in the state for cattle with numbers holding steady over the last three years at around 66,000 head (NASS, 2017).

People

The total population of the county increased from 9,746 in 2010 to 11,039 in 2017. Most of the adults in the county (92.9%) have at least a high school education; nearly 20% have earned a bachelor's or higher degree. There are few residents living below the poverty level and unemployment is low, about 2.6 %. Agricultural producers in Richland County are mostly male; average age of producers is 57.8 years (US Census Bureau, 2019).

Landcover/Land Use

Land cover types in the county are approximately 34% cultivated crops and 49% lowland prairie grassland, with smaller areas of wooded draws and ravines, badlands, and wetlands or riparian areas. Lowland/Prairie grassland systems include Great Plains Sand Prairie, around 440,000 acres, and Great Plains Mixedgrass Prairie, about 218,000 acres.

Great Plains Mixedgrass Prairie covers much of the eastern two-thirds of Montana. Soils are primarily fine and medium-textured. Grasses typically comprise the greatest canopy cover, and western wheatgrass (*Pascopyrum smithii*) is usually dominant. Other species include thickspike wheatgrass (*Elymus lanceolatus*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and needle and thread (*Hesperostipa comata*). Forb diversity is typically high. In areas where sagebrush steppe borders the mixed grass prairie, common plant associations include Wyoming big sagebrush (*Artemisia tridentata ssp. Wyomingensis*)—western wheatgrass. Fire and grazing are the primary drivers of this system. Drought can also impact it, in general favoring the shortgrass component at the expense of the mid-height grasses. With intensive grazing, cool season exotics such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and field brome (*Bromus arvensis*) increase in dominance (MNHP, 2019).

The Great Plains Sand Prairie is considered a unique ecological system due to coarse textured soils with exposed caprock sandstone formations occurring across the landscape. Native plant communities are dominated by needle and thread (*Hesperostipa comata*) with little bluestem (*Schizachyrium scoparium*) and threadleaf sedge (*Carex filifolia*) on the finer textured soils. Rhizomatous warm season grasses prairie sand reed (*Calimovilfa longifolia*), sand bluestem (*Andropogon hallii*) and big bluestem (*Andropogon gerardii*) occur intermittently on coarser soils.

Wooded draws are found on steeper slopes or canyon bottoms where deep loamy soils and higher moisture levels support Rocky Mountain juniper (*Juniperous scopulorum*) and deciduous trees such as green ash (*Fraxinus pennsylvanicus*) and chokecherry (Prunus virginiana). Although they are relatively few and scattered, wooded draws are valuable habitat for many species of birds, small mammals and mule deer.

Floodplain systems are associated with perennial to intermittent or ephemeral streams along the Yellowstone and Missouri rivers and their tributaries. Floodplain systems are found on alluvial soils in highly variable landscape settings, from confined, deep cut ravines to wide, braided streambeds. The primary inputs of water to these systems include groundwater discharge, overland flow, and subsurface interflow from the adjacent upland. Flooding is the key ecosystem process, creating suitable sites for seed dispersal and seedling establishment, and controlling vegetation succession. Communities within this system range from riparian forests and shrublands to tallgrass wet meadows and gravel/sand flats.

Badlands are areas containing highly eroded, rugged and often colorful landforms with sparse vegetation. Badlands areas provide habitat for mule deer and other wildlife but support only intermittent grazing (MNHP, 2019). Refer to Appendix A4 for a landcover map of the county.

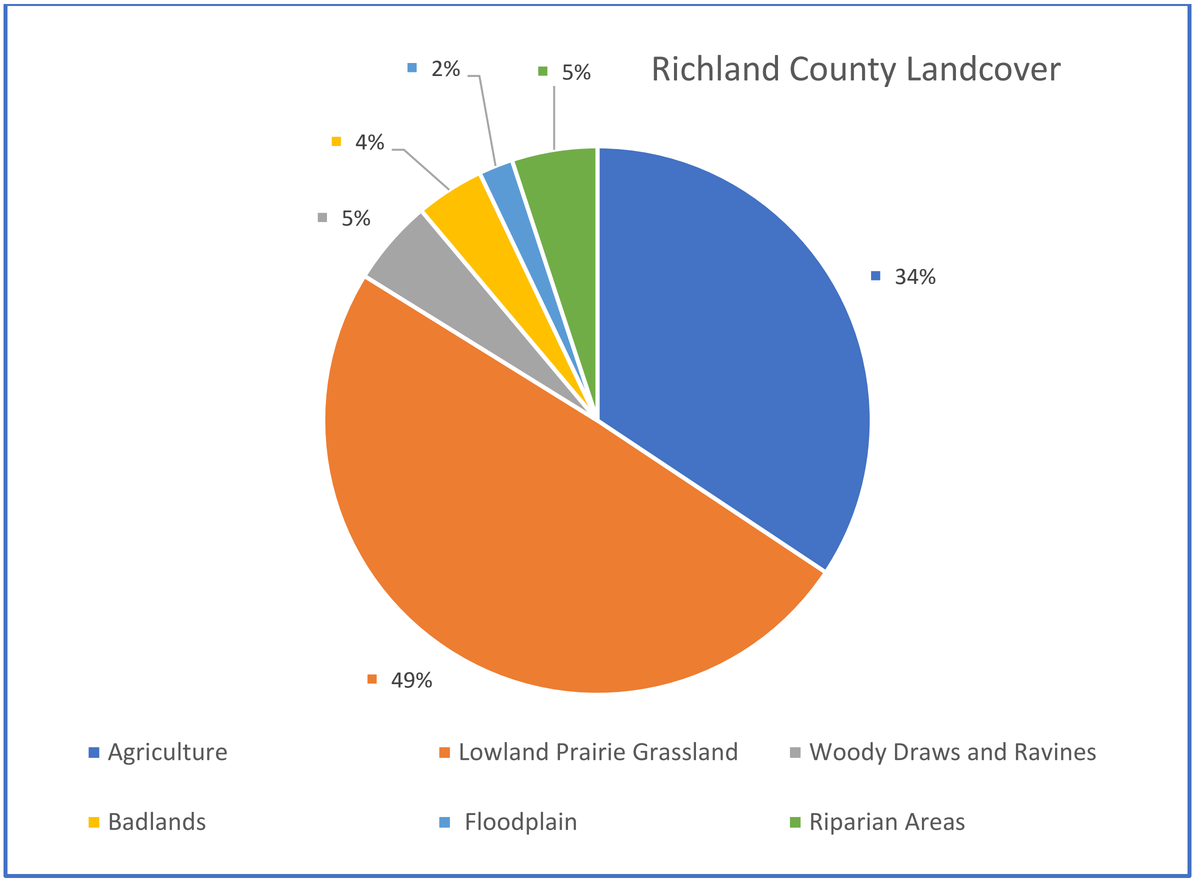

Figure 2 Distribution of Landcover Types

Land Ownership

Most of the land in Richland County, about 78%, belongs to private landowners. Acres owned and managed by state and federal entities is given in Table 1. See Appendix A5 for the locations of public land parcels.

Table 1

OWNERSHIP	ACRES	PERCENT OF COUNTY
Bureau of Land Management	52,635.46	3.98
Local Government	160.38	.12
Montana Fish, Wildlife & Parks	3,072.13	.23
Montana DNRC State Trust	88,418.27	6.69
Total Public Lands	144,286.24	11.02

Petroleum Development

Richland County sits above an interbedded sequence of black shale, siltstone and sandstone which contains the largest contiguous deposits of oil and natural gas in the U.S., known as the Bakken Formation. The Elm Coulee Oil Field was discovered in Richland County in the year 2000.

Induced hydraulic fracturing (fracking) is a relatively new extraction process where water mixed with sand and chemicals is injected into a well under high pressure to create fractures in deep subsurface rock formations. Natural gas and oil migrate through the fractures to the well where they can be recovered. Fracking and horizontal drilling make it possible to access the oil in Elm Coulee and elsewhere throughout the Bakken.

Richland County ranked number one in 2019 for oil production in the state and 103 in overall production nationally. Richland was second in the state for natural gas production. It accounts for 46% of all oil production in Montana and 16.5% of gas production statewide (ShaleXP, 2019).

Records kept by the Montana Department of Natural Resources and Conservation Board of Oil and Gas Conservation (BOGC) show that crude oil production in Richland County nearly doubled, from 5.28 million to 10.3 million barrels[1] between 2003 and 2004. Production peaked in 2006 at almost twenty-one million barrels and did not diminish below the 2004 level until 2017 (MT DNRC BOGC, 2019).

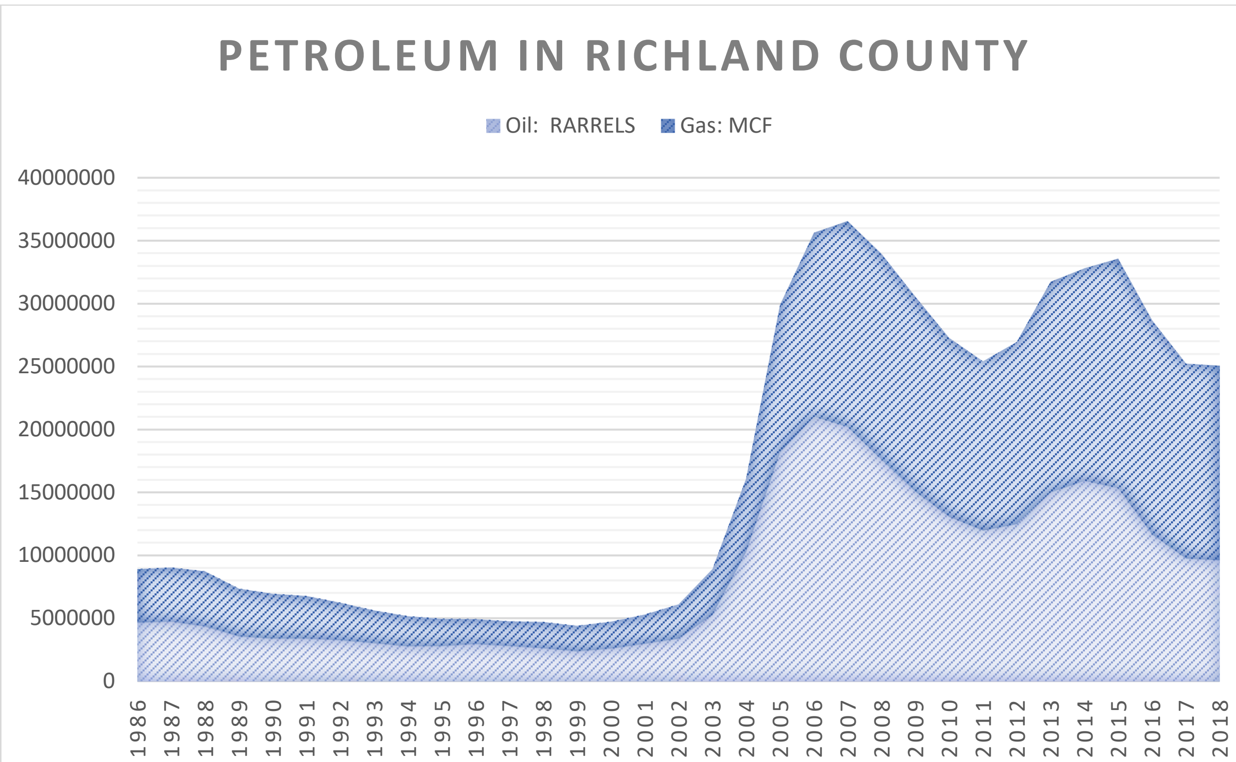

Figure 3 Oil and Gas Production in Richland County, 1986 through 2018.

During times of high production, the small rural communities in the Bakken experienced an influx of temporary residents, construction booms, housing shortages, increased pressure on existing infrastructure and other effects both beneficial and detrimental. The landscape was radically altered by well sites and roadways.

According to the BOGC, there are 87 active oil fields in Richland County. In October 2019 there were 1,100 active oil wells in the county (MT DNRC BOGC, 2019). The USGS estimates that there may be 4.4

[1] One barrel (BBL) of crude oil is equal to about 42 US gallons. MFC is an abbreviation for 'thousand cubic feet'.

to 11.4 billion barrels of undiscovered, technically recoverable oil in the Bakken Formation (USGS Energy, 2019). It is possible that Sidney and the smaller communities in Richland County could experience another oil boom in the future, with more of the same impacts to the people and the land.

LRRs and MLRAs

Land Resource Regions (LRR) are large geographic areas that are characterized by a pattern of soils, climate, water resources and land uses. Appendix A6 is a map of LRRs in the United States. Major Land Resource Areas (MLRAs) are subregions of the Land Resource Regions and comprise smaller, homogeneous areas (Appendix A7). MLRAs represent landscape-level areas with distinct physiography, geology, climate, water, soils, biological resources and land uses. These features are incorporated into the distinctions between ecological sites.

Richland County lies within parts of MLRA 53A, 54A and 58A; these are all part of the Missouri Plateau, Unglaciated section of the Great Plains Province of the Interior Plains.

MLRA 58A—Northern Rolling High Plains, Northern Part.

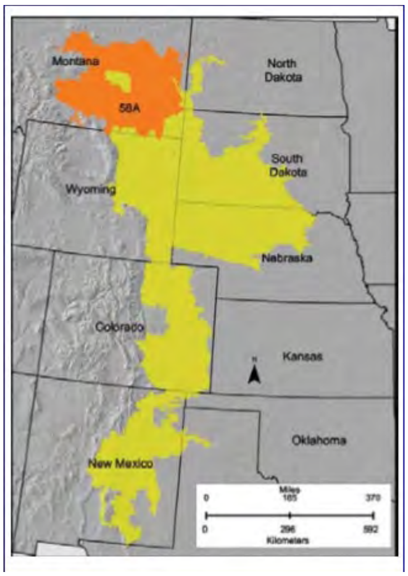

Figure 4. MLRA 58A and LRR F

MLRA 58A shown in Figure 4 in orange as part of the Western Great Plains Range and Irrigated LRR, LRR F, shown in yellow. MLRA 58A is an area of old eroded plateaus and terraces. Slopes are generally gently rolling to steep, and wide belts of steeply sloping badlands border a few of the larger river valleys. In some areas flat-topped, steep-sided buttes rise sharply above the general level of the plains.

The dominant soil orders in the MLRA are Entisols and Inceptisols. Soils typically mixed or smectitic (two parts clay to one part other) mineralogy. They are generally shallow to very deep, well drained, and clayey or loamy.

Saline seeps are a problem in areas of cropland in this MLRA. Management practices promote infiltration of precipitation into shallow aquifers. As the shallow water tables rise to the ground surface, evaporation leaves concentrations of salts behind. The level of total dissolved solids in the water from seeps commonly is more than four thousand parts per million.

MLRA 53A—Northern Dark Brown Glaciated Plains

MLRA 53A is shown in Figure 5 as a red polygon within the Northern Great Plains Spring Wheat LRR. The area is covered by glacial till. Glacial features, such as kettle holes, kames, and moraines, are common throughout the plains. Some alluvial deposits are along the Missouri River and its major tributaries. Unconsolidated sand and gravel deposits are on high and low terraces along the Missouri River and on low terraces along the other rivers in the area. The dominant soil orders in this MLRA are Inceptisols and Mollisols. These soils also

Figure 5. MLRA 53A, Within LRR E

have mixed or smectitic (two parts clay to one part other) mineralogy. They generally are very deep, very well drained and loamy or clayey.

MLRA 54—Rolling Soft Shale Plain

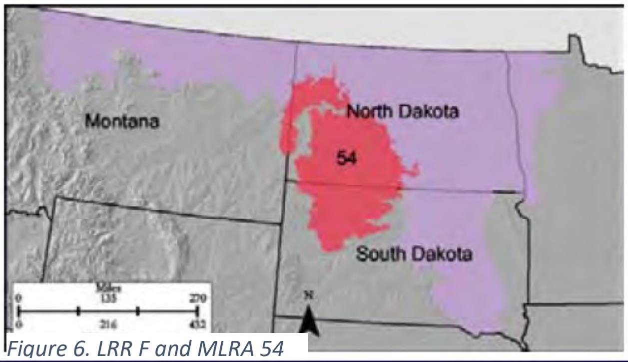

Figure 6. LRR F and MLRA 54

MLRA 54 is also part of the Northern Great Plains Spring Wheat Region. It is dominantly unglaciated, but the eastern and northern edges have been glaciated.

The area is on an old, moderately dissected, rolling plain with some local badlands, buttes, and isolated hills. Terraces are adjacent to broad flood plains along most of the major drainages underlain by soft, calcareous shales, siltstones, and sandstones of the Tertiary Fort Union Formation and the Fox Hills and Hell Creek units. The principal sources of ground water in the area are in these rocks. Impermeable Cretaceous shale underlies the aquifers. The northern and eastern parts of the area have a glacially modified topography and in places are covered by thin layers of glacial drift. Dominant Soil orders in this MLRA are Mollisols and Entisols. Soils are shallow to very deep, generally somewhat excessively drained to moderately well drained and loamy or clayey. (NRCS, 2006).

Soil Orders Definitions:

Entisols are soils that show little or no evidence of development. They occur in areas of recently deposited parent materials or in areas where erosion or deposition rates are faster than the rate of soil development, such as dunes, steep slopes, and flood plains.

Mollisols are soils that have a dark-colored surface horizon containing relatively high amounts of organic matter. These soils are quite fertile. They characteristically form under grass in regions that experience seasonal moisture deficit, such as the Great Plains.

Inceptisols are usually found in semi-arid to humid environments. They generally exhibit only moderate soil weathering and development. Inceptisols make up about 17% of the world's ice-free land surface.

Soils

The soils of greatest extent in the county are those that formed in glacial till parent material. The clay loam material containing a random distribution of rock fragments was deposited over underlying sedimentary beds during the Wisconsin Glaciation. Bowbells, Vida, Williams and Zahill soils formed in glacial till. Alluvium is the parent material in which the greatest variety of soils formed.

Soils that formed in material weathered from the unconsolidated Tongue River member of the Fort Union Formation also make up large areas of the county. These include Lambert and Shambo soils that formed in material weathered from the silty beds.

Areas of badlands were derived from exposures of the Tongue River and Lebo Members of the Fort Union Formation; these areas form the rough breaks along the Yellowstone and Missouri Rivers.

Williams-Vida soils comprise approximately 11.7% of all soils in the county. They are found in the upland glaciated plains. These soils are deep, well drained loams and clay loams underlain by clay loam glacial till. Soils are non-saline to slightly saline with moderate to moderately slow permeability and high available water capacity. These soils are of primary importance for dryland grain farming.

The second largest Soil Map Unit by acres in Richland County is the Shambo-Lambert Complex which covers 8.4% of the surface of the county. Soils in this complex were formed in the sedimentary beds of the Fort Union Formation; they occur in fans, terraces and broad swales in the southern half of the county. They are deep and well drained. Permeability is moderately slow and available water capacity is high. These soils are important for dryland farming and rangeland cattle production (USDA SCS, 1980).

Soil Associations

Soil associations are made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. A soil association is a landscape that has distinctive proportions and patterns of soils. It usually consists of one or more major soils and at least one minor soil and is named for the major soil(s). Soils in one association may occur in another, but in a different pattern. There are four soil associations in Richland County.

- **Soils on stream terraces, flood pains, and alluvial fans**: These soils are moderately well drained fine sandy loams, silt loams, silty clay loams and clays underlain by stratified fine sandy loam to silty clay alluvium. Well drained silty clay loams are underlain by silt loam or silty clay loam alluvium on alluvial fans and terraces.
- **Soils on benches, fans and terraces on uplands**: Soils are deep, well drained loams and clays loams underlain by clay loam alluvium or by sand and gravel. These soils deep, well drained loams underlain by loam and silt loam alluvium and sedimentary beds.
- **Soils on dissected sedimentary plains**: Soils are deep, steep and very steep, well drained silt loams and silty clay loams underlain by silt loam or silty clay loam and silty clay sedimentary beds. Soils in the uplands are gravelly sand loams, gravelly loamy sands and gravelly loams underlain by gravely sand or silt loam sedimentary beds on uplands. Badlands soils are severely eroded consisting mainly of outcroppings of silty, sandy and clayey sedimentary beds on broken uplands.
- **Soils on glaciated plains**: These soils were formed in glacial till; they are well drained loams and clay loams underlain by clay loam glacial till or silt loams underlain by silt loam sedimentary beds on the uplands (USDA SCS, 1980).

Prime Farmland, Farmland of Statewide Importance and Prime if Irrigated Farmland

Prime farmland is a designation assigned by U.S. Department of Agriculture for land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these land uses. Richland County has no soils designated as Prime Farmland.

Farmland of Statewide Importance are soils that have been determined to be of significance for production of food, feed, fiber, forage, and oilseed crops. These soils have an adequate and dependable water supply from precipitation or irrigation, 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, are not excessively erodible or saturated with water for a long period of time, and either do not flood frequently or are protected from flooding. They are available for farming, but could currently be cropland, pastureland, rangeland, forestland, or other land.

Nearly 40.5 % of the cultivated acres in the county are considered Farmland of Statewide Importance. There are 185,324 acres of Farmland of Statewide Importance; most of these acres, 88%, are Soil Map Unit VdC, Williams-Vida loams, described above.

Prime if Irrigated Farmland soils are those with the best combination of physical and chemical characteristics for agriculture such as the soil quality and adequate growing season necessary to produce high yields of crops suited to the region but occur in areas of limited rainfall.

Slightly less than 230,000 acres are designated Prime if Irrigated Soils in the county. The largest components of this group are Vida Clay Loam, Shambo Loam, and Williams Loam. Map Unit VdB, Vida Clay Loam and WmB, Williams Loam occur in the uplands north and west of the Yellowstone River. Shambo Loams (ShA and ShB) occur in overflow areas throughout the county. These Prime if Irrigated soils support livestock production and wildlife habitat and to a lesser extent, dryland grain farming.

Other Prime if Irrigated soils occur along the southern side of the Missouri River bottom and both sides of the Yellowstone River. Most of the soils in these bottomland areas are involved in production of alfalfa, field corn, sugar beets and other irrigated crops (Appendix A8).

Hydric Soils

Hydric soils are characterized by frequent, prolonged saturation and low oxygen content, which lead to anaerobic chemical environments where reduced iron is present. This definition includes soils that developed under anaerobic conditions in the upper part but no longer experience these conditions due to hydrologic alteration such as those hydric soils that have been artificially drained or protected such as ditches or levies.

Richland County has 11 soils that meet the criteria for hydric soils. The total amount of hydric soils is 24,559.5 acres, roughly 0.02 % of soils in the county.

Hydric Criteria Definitions:

1. All Histels except Folistels and Histosols except Folists.
2. Map unit components that, based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or show evidence that the soil meets the definition of a hydric soil. Hydric Soils Field Indicators and other information can be accessed at USDA NRCS Soils Use/Hydric Soils.
3. Map unit components that are frequently *ponded* for long or very long duration during the growing season that, based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States or show evidence that the soil meets the definition of a hydric soil.
4. Map unit components that are frequently *flooded* for long duration or very long duration during the growing season that, based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or show evidence that the soils meet the definition of a hydric soil.

Table 2 Hydric Soils

Map Unit Symbol	Map Unit Name	Landform	Acres	Hydric Criteria
BnC	Benz-Trembles Complex 0-8 % Slope	Drainage ways, flood plains	127.6	2
Ch	Cherry Havrelon and Trembles soils, occasionally flooded	Flood plains, stream terraces	1289.7	2
E4121A	Havrelon loam, 0-2% slopes, occasionally flooded	Channels, oxbows	1609.7	2, 3, 4
E4129A	Havrelon silty clay loam, 0 to 2 % slopes, occasionally flooded	Channels, oxbows	871.4	2, 3, 4
Lw	Lohler Clay, wet	Floodplains	765.2	2, 3, 4
RW	River wash	Floodplains	118.8	2, 4
Tw	Typic Haplaquents	Channels	18,809.4	2, 3
VdC	Williams-Vida loams, 2 to 8 % slopes	Moraines	1633.2	2, 3
VhC	Vida-Zahill loams, 2 to 8 % slopes	Moraines	462.1	2, 3
VhD	Zahill-Vida loams, 4 to 15 %slopes	Moraines	555.4	2, 3
WmB	Williams loam, 0 to 4 % slopes	Ground Moraines	412.7	2, 3

Water

Hydrography

The Hydrologic Unit Code (HUC) is a numbering system for watersheds developed by the U.S. Geological Survey (USGS) to provide a common coding system for state and federal agencies. Each unique HUC is attached to a specific watershed, enabling different agencies to have common terms of reference and to agree on the boundaries of the watershed. The entire country has been mapped with three levels of Hydrologic Unit Codes: 8-digit codes for large watersheds known as sub-regions, 10-digit codes for watersheds, and 12-digit codes for smaller or sub-watersheds.

Three sub-regions divide Richland County, shown as black polygons and labeled in black in Figure 7. Water flows northwest from the Divide into the Redwater River in the Redwater sub-region; the Charlie Muddy sub-region empties into the Missouri River to the north. The remainder of land in the county is in the Lower Yellowstone sub-region, which drains south and east into the Yellowstone River. Ten-digit watersheds are labeled and shown in blue; red delineates twelve-digit watersheds.

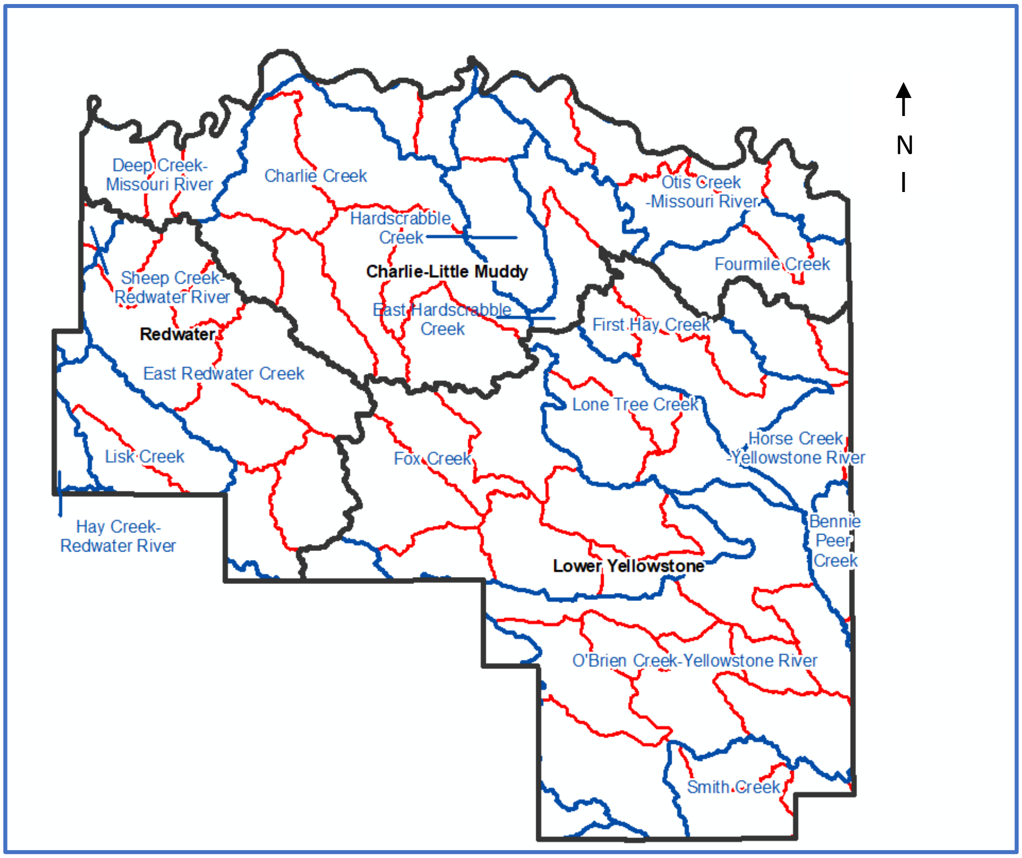

Figure 7 Richland County Hydrology

Stream Flow

Richland County has two stream gage stations operated by the United States Geologic Survey Wyoming-Montana Water Science Center in cooperation with U.S. Army Corps of Engineers and as part of the Groundwater and Streamflow Information Program network of Federal Priority Stream gages.

The Sidney Station measures output from the Lower Yellowstone River Sub-basin, a total area of 69,099 square miles. The highest recorded flow was 159,000 cubic feet per second (cfs) on June 21, 1921; the lowest flow, 5,626 cfs was recorded on May 12, 1934.

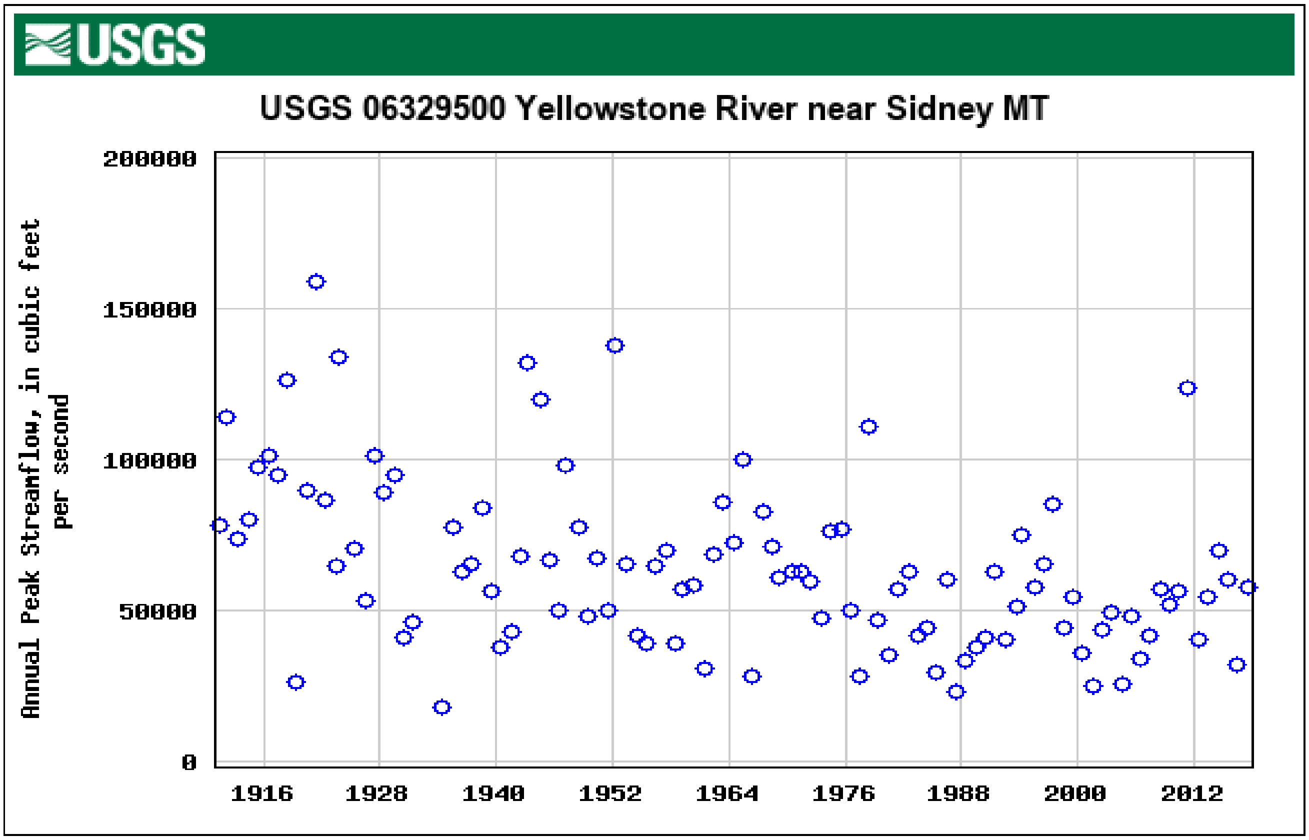

Figure 7 Annual Peak Streamflow at the Sidney Measuring Station

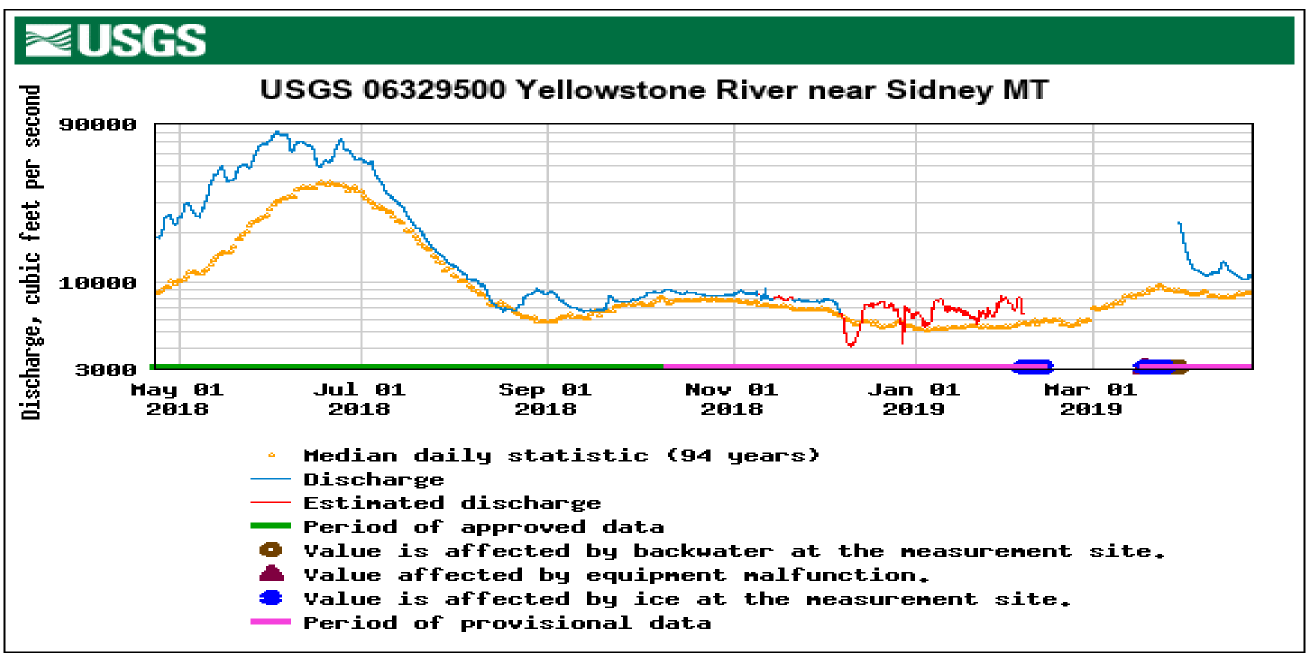

Figure 8 Discharge from May 2018 to April 2019 at the Sidney station

Culbertson, Montana is in Roosevelt County, but the Culbertson stream gage station on the Missouri River is listed for Richland County in the USGS National Water Information System Web Interface. Flow is partly regulated by Fort Peck Reservoir on the Missouri River and other reservoirs on its tributaries. Average flow from 2007 to 2018 was 9,756 cfs. The highest peak streamflow, 104,000 cfs, was recorded in June of 2011. Lowest peak stream flow of 8,620 cfs was recorded in April of 2009 (USGS, 2019).

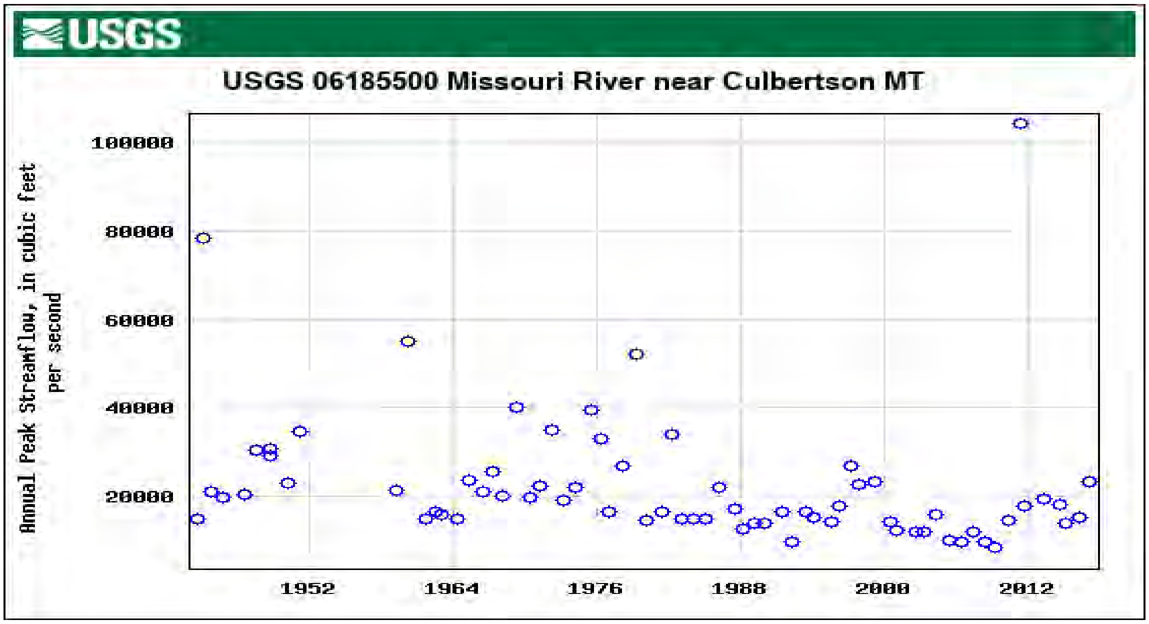

Figure 9 Annual Peak Streamflow at the Culbertson station.

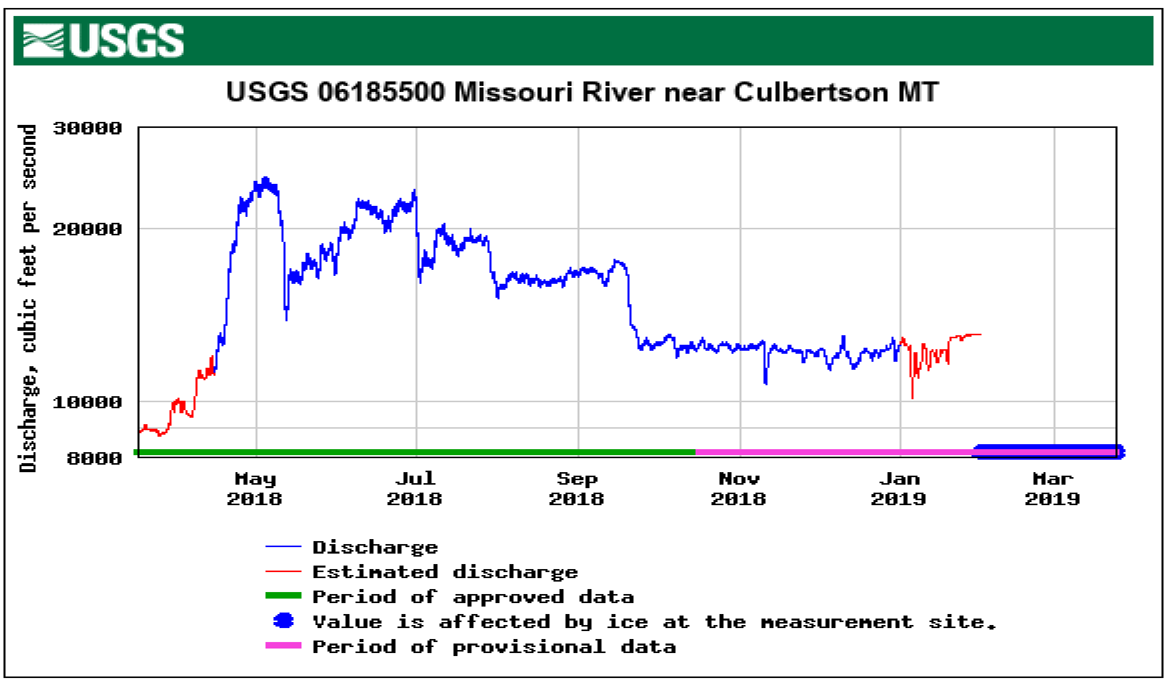

Figure 10 Discharge April 2018 to February 2019

303(d) Listed Streams

Section 303(d) of the Clean Water Act requires states, territories and authorized tribes to develop, and update every two years, lists of water that are impaired or threatened by one or more pollutants. Impaired waters are those that don't meet one or more Water Quality Standards.

A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody for the waterbody to meet water quality standards for that pollutant. Information about the Clean Water Act, impaired waters, TMDL calculations and other topics pertaining to water quality can be found on the Environmental Protection Agency's Impaired Waters and TMDLs website at: https://www.epa.gov/tmdl/overview-total-maximum-daily-loads-tmdls#1

Eighty stream reaches on fourteen streams appear on the 303-d list in Richland County. Most of the streams are listed as Water Quality Category 5: *Waters where one or more applicable beneficial uses are impaired or threatened and a TDML is required to address the factors causing the impairment or threat.*

These Category 5 streams include:

- The Missouri River and tributaries
- Tributaries of the Yellowstone River and the river itself from the Lower Yellowstone Diversion Dam to the North Dakota border
- East Redwater Creek

Aquatic life is impaired, with probable causes including nutrients from crop production, streambank alteration by livestock and human modification, total dissolved solids, lead, copper and chromium, sources unknown.

Three reaches qualify as Water Quality Category 4C: *Identified threats or impairments result from pollution categories such as dewatering or habitat modification and, thus, a TMDL is not required*.

- The Redwater River is listed for aquatic habitat impairment for alteration of stream-side or littoral vegetative covers and physical substrate habitat alterations.
- Aquatic life is impaired in Bennie Peer Creek due to alterations caused by the construction of highways and other infrastructure.
- Smith Creek is impaired by a fish passage barrier. (MT DEQ, 2019)

See Appendix A9, 303(d) Listed Streams.

Groundwater Resources

The most common groundwater source is the Tongue River member of the Fort Union Formation. Most of the wells produce water from sand and gravel contained in the alluvium and from sandstone, coal seams and clinker in the Tongue River Aquifer.

The Tongue River Aquifer lies beneath nearly 60% of Richland County; it extends west into Garfield County and as far south as Fallon County. Sandstone and coal beds compose the major water-yielding units of the formation. Wells producing as much as fifty gallons per minute (gpm) have been reported but yields of most stock and domestic wells are less than twenty gpm. Clinker, which results from baking and fusing of surrounding rock by burning coal beds generally contains many fractures and provides an excellent medium for production of large quantities of water. However, clinker occurs mostly in higher elevations and drains readily so it is commonly not saturated. Where saturated, fractured clinker may yield as much as 65 gpm (USDA SCS, 1980).

There are 4,811 water wells in Richland county. The deepest well is 1,945 feet; the oldest well was drilled in 1890. Nearly all the wells are less than 400 feet deep; more than half are less than 100 feet deep. Approximately 43 % of the wells in the county were installed for livestock water; about 135 wells are used for irrigation (MBMG, 2019).

Drinking Water

The Sidney Water Department provides water to residents and businesses in the city. Residents of the small rural communities of Savage and Crane rely on individual wells. The Lambert County Water and Sewer District has a central water distribution system. The District has two deep water wells, a 50,000 gallon on-ground steel water storage tank and a nano-filtration water treatment facility. The town of Fairview has municipal wells and a municipal water treatment center. Fairview water tests above health guidelines for six contaminants including bromodichloromethane, chloroform and radiological contaminants. Sidney water contains these and four others for a total of seven contaminants in levels above health guidelines (MT DEQ, 2019).

DryRedwater Regional Water Authority

Dry-Redwater Regional Water Authority (DRWA) was formed in 2005 to develop a regional water system to provide a reliable source of safe, high quality drinking water to small communities and rural homes in the project area. Many of these obtain water from shallow wells which often do not produce enough water and commonly test high for sodium, total dissolved solids and other contaminants. The project includes an intake and water treatment plant on Fort Peck Reservoir and extensive water pipeline systems. DRWA is locally owned by the McCone, Dawson, Garfield and Richland County Conservation Districts. The DRWA coverage area includes 11,791 square miles in McCone, Dawson, Garfield, Richland, and Prairie Counties in Montana, and McKenzie County, North Dakota west of the Yellowstone River.

The City of Sidney and Richland County partnered with DRWA to construct the first pipeline south of Sidney. The Sidney South line was active in September 2014. Also in 2014 the decision was made to fund construction of a pipeline that would include Culbertson, Lambert and Fairview (the latter two are in Richland County) serving rural users in between. DRWA is currently working on funding sources to make the Culbertson Lambert Fairview line a reality and would use the Culbertson Water Treatment Plant as an interim source. Nearly 2,000 Richland County individuals and entities have signed up for rural water through DRWA; the number of sign-ups continues to increase (DRWA, 2019).

Irrigated Lands, Water Rights, Irrigation Districts

Richland County has two organized irrigation groups, Lower Yellowstone Irrigation District (LYIP) and Sidney Water Users Irrigation District (SWUID).

The Lower Yellowstone Project was authorized by the Secretary of the Interior on May 10, 1904. The Project was designed to provide a dependable supply of irrigation water to support approximately 58,000 acres of land located on the west side of the Yellowstone River. Approximately two-thirds of the irrigated lands are in Montana with the remaining lands located in North Dakota. Construction of the project began in 1905, which included Intake Diversion Dam (also known as Yellowstone River Diversion Dam), a wood and stone diversion dam that spans the Yellowstone River approximately 70 miles upstream from the confluence of the Yellowstone and Missouri Rivers near Glendive, Montana. The

Project consists of four districts: Lower Yellowstone #1, Lower Yellowstone #2, Intake, and Savage. There are three pumping plants within the Project: one at Thomas Point on the main canal, one at Crane on the main canal, and one on Drain 27. These pumps are associated with the Intake and Savage Irrigation Districts. They provide water to uplands located above the main canal that cannot be serviced by gravity feed.

The Sidney Water Users Irrigation District stretches approximately 13 miles south to north along the eastern banks of the Yellowstone River. The SWUID is made up of five sub-districts and currently serves 4,753 acres of farmland using water pumped from the Yellowstone River and distributed through canals and laterals. The SWUID infrastructure was constructed by the Works Progress Administration in the 1930s and was officially operational by 1938. The infrastructure was owned by the Montana Department of Natural Resource Conservation (DNRC) until 1995, at which time it was transferred to the SWUID. The SWUID maintains a water right from the Yellowstone River to irrigate the acres within the District. The flow rate specified in the water right amounts to 133.22 cubic feet per second.

There are irrigation systems in the county that are not part of an irrigation district. These include irrigators that get their water from the Missouri River in the northern part of the county, irrigators on the Yellowstone River that are not in the SWUID, and irrigators using groundwater as their source.
The 1973 Water Use Act made it possible for public entities such as Conservation Districts to reserve water for future consumptive uses or to maintain a minimum flow level or quality of water (Montana DNRC, 2001). The Richland County Conservation District holds water reservations on the Yellowstone and Missouri Rivers. Some of the reserved water is available to local producers for agricultural purposes through the Conservation District.

Utilities

Electricity is supplied to different areas of Richland County by Lower Yellowstone Rural Electric Administration, Montana Dakota Utilities, McCone Electric Cooperative and McKenzie Electric Cooperative. Lower Yellowstone REA covers most of the county; McCone Electric services a small area west of Lambert; McKenzie Electric serves the far east side and Montana Dakota Utilities (MDU) provides electricity and natural gas to the town of Sidney and the rural areas in the southern part of the county.

MDU owns and operates the Lewis and Clark Station, a lignite-based electric generating station. The Station provides baseload electric service, operating twenty-four hours a day, seven days a week. Its power production capability is 50 megawatts of electricity (MDU, 2019). The Lewis and Clark Station annually consumes more than three hundred tons of lignite supplied from the nearby Savage Mine. The mine is owned and operated by Westmoreland Savage Corporation (Mitchell, 2019).

Air Quality

Montana Department of Environmental Quality maintains an air quality monitoring station in Sidney. According to DEQ there are no areas in Richland County that fail to meet air quality attainment criteria. DEQ conditions in Sidney are typically categorized as good, with visibility more than 13.4 miles; no adverse health effects are reported. (MT DEQ, 2019)

Plants and Animals

Confined Animal Feeding Operations

There are approximately a dozen animal feeding operations in the county with the capacity to hold over 300 animals. These are beef finishing lots. Two of those are capable of handling over 1,000 animals. There are several other smaller lots throughout the county used for calving, wintering, and finishing smaller herds. NRCS offered a special initiative for feedlots in the late 2000s and contracted or worked with over half of the feedlot operators. There are no dairy, poultry, or swine facilities in the county.

Montana Fish Wildlife and Parks Lands

There are several Montana Fish, Wildlife, and Parks properties in the county. Most are located along the Yellowstone River. These lands include Sidney Bridge Fishing Access Site (FAS), Diamond Willow FAS, Gartside Reservoir FAS, Snowden Bridge FAS, Culbertson Bridge FAS, Elk Island FAS and Wildlife Management Area (WMA), Fox Lake WMA and Seven Sisters WMA. Montana FWP administers the Block Management program in the county and has actively funded wildlife habitat conservation projects through their Upland Game Bird Program.

Wetlands

Riparian wetland systems occur in the bottomlands along the Missouri River and the Yellowstone River Corridor. These are mostly classified as Riparian Forested, Riparian Scrub-Shrub, Riparian Emergent and Freshwater Emergent wetlands. Creeks and coulees throughout the county support smaller areas of Riparian Emergent and Freshwater Emergent riparian systems. Ponds and reservoirs occur throughout rangeland areas of the county, the adjacent areas typically support small Freshwater or Riparian emergent systems. Figure 11 represents a portion of the Montana Natural Heritage Wetlands and Riparian Map of Richland County, illustrating the occurrence of the different types of wetlands in the southeast part of the county including the Yellowstone River corridor.

Definitions

- Freshwater Emergent wetlands are characterized by herbaceous marshes, fens, swales or wet meadows.
- Freshwater Forested and Shrub wetlands are woody wetlands, bogs or swamps.
- Freshwater and Riparian Scrub-Shrub include areas dominated by woody vegetation less than twenty feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.
- Riparian Forested and Freshwater Forested Wetlands are dominated by trees and soils are saturated or flooded for at least a portion of the growing season. (MT NHP , 2019)

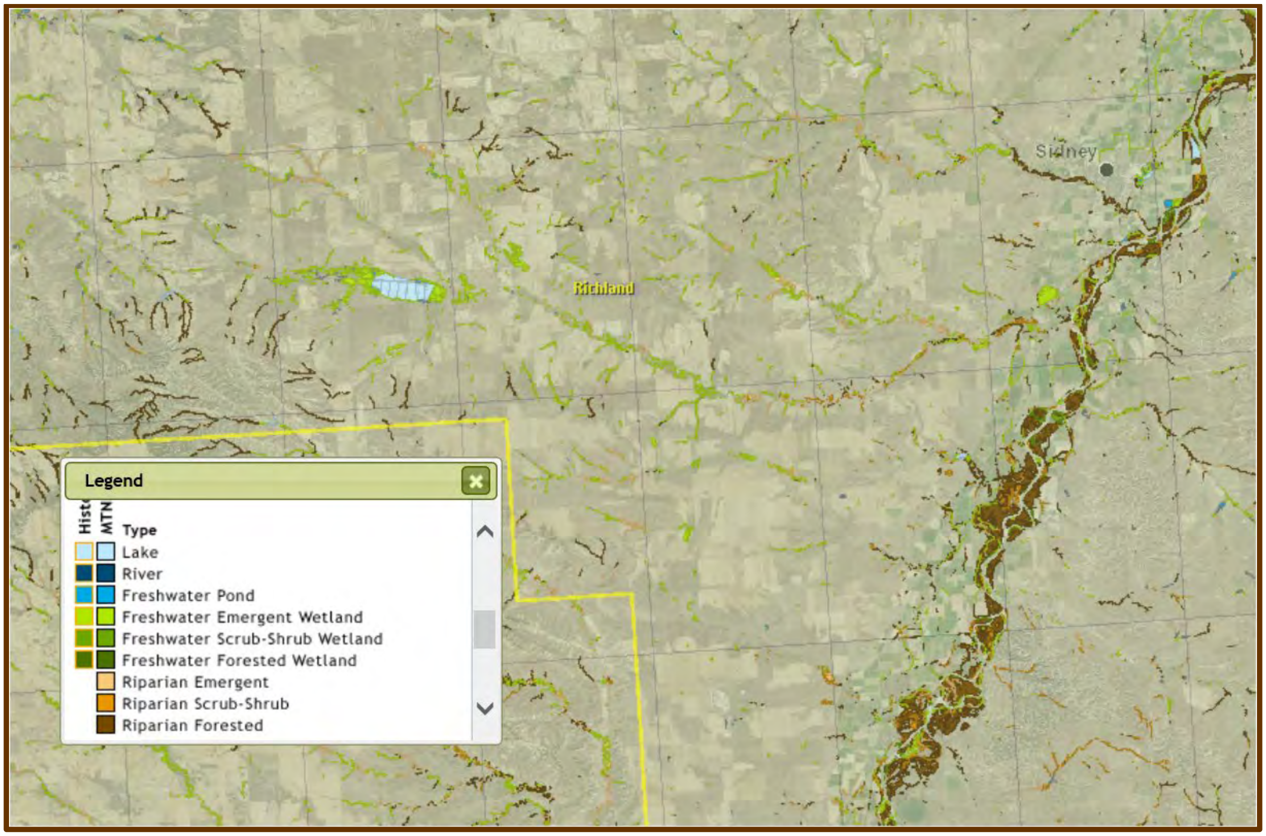

Figure 11 Wetland areas south of Sidney

MNHP provides an interactive map of wetlands and riparian areas in Montana. For more information visit http://mtnhp.org/nwi/ .

Montana Fish Wildlife and Parks State Wildlife Action Plan

Montana's Fish Wildlife and Parks State Wildlife Action Plan (SWAP) identifies community types, Focal Areas, and species in Montana with significant issues that warrant conservation attention. The SWAP lists the Yellowstone River as one of the top 13 Aquatic Focal Areas in the State (Zieglar, 2019). The area of Yellowstone River and its tributaries (Figure12) is one of 13 Tier I Aquatic Communities in the State. Tier I Communities are those with the 'greatest conservation need'. The SWAP states, "There is a clear obligation to use resources to implement conservation actions that provide direct benefit to these community types" (MT FWP, 2015).

The associated Species of Greatest Conservation Need (SGCN) are:

- Blue Sucker (*Cycleptus elongatus*)
- Northern Redbelly Dace (*Chrosomous eos*)
- Pallid Sturgeon (*Scaphirhynchus albus)*
- Shortnose Gar (*Lepisosteus platostomus)*
- Sturgeon Chub (*Macrhybopsis gelida*)
- Iowa Darter (*Etheostoma exile*)
- Paddlefish (Polyodon spathula)
- Sauger (*Sander Canadensis*)
- Sicklefin Chub (*Macrhybopsis meek*i)

The SWAP states,

"The Yellowstone River mainstem is home for many aquatic Species of Greatest Conservation Need (SGCN), native species, and a great diversity of game fish. It is an important river for spawning by the federally endangered pallid sturgeon. It also is an important river for a spawning migration of paddlefish from Lake Sakakawea. The paddlefish migration creates a high angler interest. There are several partnerships in this area including local conservation districts, state and federal agencies, and occasionally individual landowners. Most of this watershed is held in private ownership. This area is heavily used by anglers, hunters, wildlife watchers, and other river recreationists.

Coal and gas development are a current impact to this Focal Area. Dewatering, as it relates to instream flow and fish habitat, and fish passage at multiple low head diversion dams, are other issues for the Focal Area. The future threats remain the same as current impacts if they are not addressed." (MT FWP, 2015)

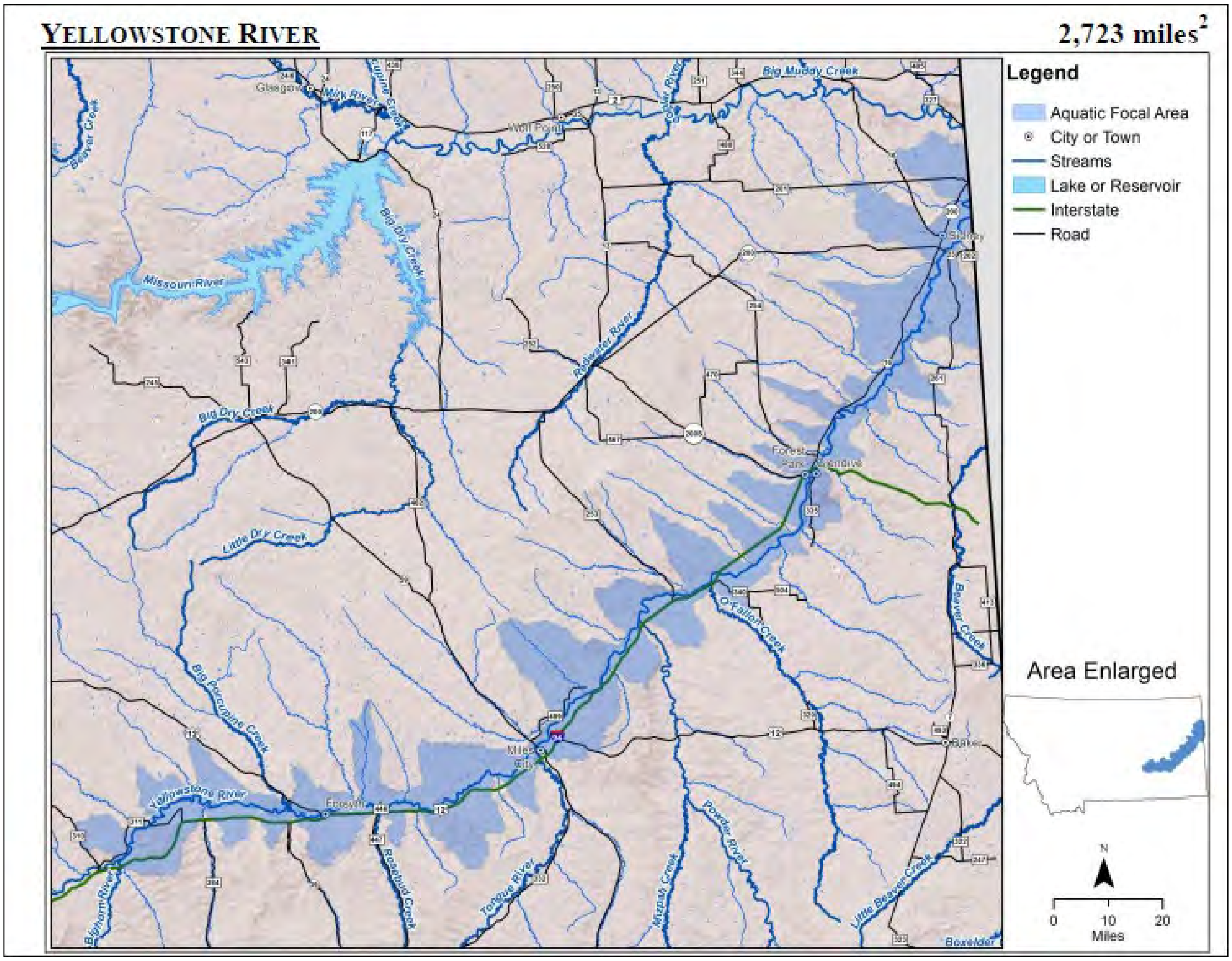

Figure 12 The Tier 1 Aquatic Community of the Yellowstone River (MT FWP, 2015)

Plant Species of Concern

Montana Natural Heritage Program Field Guide describes plant Species of Concern as, "Native taxa that are at-risk due to declining population trends, threats to their habitats, restricted distribution, and/or other factors". The plants listed in Richland County occur rarely and exhibit traits of narrow environmental specificity, allowing them to survive only in very particular niches. State Ranking is categorized as follows:

S1: At high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.

S2: At risk because of limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.

S3: Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas (MNHP, 2019).

Table 3 Plant Species of Concern, Richland County, Montana

Scientific Name	**Common Name**	**Form**	**Habitat**	**State Rank**
Almutaster pauciflorus	Alkali Marsh Aster	Perennial Forb	Mesic Grasslands	S1
Celastrus scandens	Bittersweet	Woody vine	Wetlands & Riparian Areas	S1
Dalea enneandra	Nine-anther Prairie Clover	Perennial Legume	Grassland Plains	S1
Dalea villosa	Silky prairie clover	Legume. Perennial	Sandy Sites	S2, S3
Lobelia spicata	Pale-spiked Lobelia	Perennial Forb	Wet Meadows	S2
Solidago ptarmicoides	Prairie Goldenrod	Forb	Grassland Plains	S2, S3
Viburnum lentago	Nannyberry	Shrub	Riparian forest	S2, S3
Carex gravida	Heavy Sedge	Sedge	Wetlands & Riparian Areas	S3
Elodea bifoliata	Long-sheath Waterweed	Water Weed	Wetlands & Riparian Areas	S2
Tortula acaulon	Elfin Crisp Moss	Moss,	Soil Crust	S1

Noxious Weeds

According to Richland County Weed District, the County's priority noxious weeds are leafy spurge (*Euphorbia virgata*[2]), spotted knapweed (*Centaurea stoebe*), hounds tongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), white top (*Lepidium draba*) and salt cedar (*Tamarix ramosissima*). The river corridors are heavily impacted by salt cedar and leafy spurge. Hay Creek between Sidney and Fairview is a target area for spotted knapweed control; Canada thistle occurs throughout the County. Gravel pits are known to be potential sources of seed and are monitored and treated. Oil field roads are also common sites of new infestations. The Weed District is working to establish insectaries for leafy spurge biological control agents, and there are plans to experiment with a rust on Canada thistle (Havrecamp, 2019).

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[2] Until recently the scientific name for leafy spurge was given as *Euphorbia esula*. According to Montana Natural Heritage Program (2019),"The true *Euphorbia esula* Linnaeus is restricted to certain parts of Europe where it shows little tendency to weediness. *Euphorbia virgata* retains the common name Leafy Spurge".

Invasive Species

Montana Fish Wildlife & Parks has published data documenting Eurasian watermilfoil (*Myriophyllum spicaturm*) in the Missouri River from Fort Peck Lake to the North Dakota border. As of 2018, there were no known sites of the aquatic invasive invertebrates Zebra and quagga mussels (*Dreissena polymorpha* and *Dreissena bugensis*) in the waters of Richland County. Common carp (*Cyprinus carpio*) occur in ponds and waterways in every county east of the Rocky Mountains; they are most abundant in man-made impoundments. The common carp is regarded as a pest fish because of its widespread abundance and because of its tendency to destroy vegetation and increase water turbidity by dislodging plants and rooting around in the substrate, causing a deterioration of habitat for species requiring vegetation and clean water (MT FWP, 2019).

The United States Department of Agriculture Animal and Plant Health Inspection Service lists five species of invasive terrestrial vertebrates known to be problematic in areas across the country. Of these, only the European starling (*Sturnus vulgaris Linnaeus*) is known to inhabit Richland County. The starling is a small, chunky bird about the size of a native blackbird. Its range extends over nearly all North America. In eastern Montana European starlings threaten native species by taking over habitat and are pests in crops and cattle feeding operations (USDA APHIS, 2019).

Animal Species of Concern

There are 43 animal species designated Species of Concern in Richland County. These are listed in Appendix A10. Information about Montana Animal Species of Concern is available through the Montana Heritage Program at http://mtnhp.org/animal/default.asp

United States Fish and Wildlife Service endangered, listed threatened, or species with designated critical habitat (USFWS):

Pallid Sturgeon (*Scaphirhynchus albus*) --Listed Endangered. Pallid Sturgeon are bottom dwelling, slow growing fish that feed primarily on small fish and immature aquatic insects. Adults have a flattened snout, long slender tail and are armored with lengthwise rows of bony plates instead of scales. Pallid Sturgeon can grow up to six feet long and weigh up to 80 pounds. The species is adapted to living close to the bottom of large, silty rivers; their preferred habitat has a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.

Figure 13 Pallid Sturgeon

The Pallid Sturgeon is one of the rarest fishes in North America; only about 200 adults remain in the upper Missouri River. It was federally listed as endangered in 1990 due to population decline caused by human alterations of the environment: impoundments, channelization and altered river hydrography, turbidity and temperature. The Pallid Sturgeon is currently listed as "S1" in Montana due to extremely limited or rapidly declining population numbers, range or habitat, making it highly vulnerable to global extinction or extirpation in Montana (MNHP, 2019). Any NRCS undertaking that impacts the Missouri or Yellowstone River below the ordinary high-water mark will require a consultation with USFWS and the Corp of Engineers. (Ellenburg, 2019)

Figure 14 Whooping Crane

Whooping Crane *(Grus americana)* –Listed Endangered
Whooping Cranes are the world's rarest crane and the tallest birds in North America. Adult height is about five feet, wingspan can be up to seven- and one-half feet. Average adult weight is about fifteen pounds. Once found throughout North America, the last wild flock of Whooping Cranes had been reduced to fewer than 20 birds by the 1940's due to habitat loss and hunting. Intensive conservation efforts and international cooperation between Canada and the United States rescued the species from extinction, but they remain extremely rare.

Habitat loss remains one of the biggest threats facing wild Whooping Cranes. Collisions with wind turbines and power lines are an ongoing threat. Whooping crane utilize migratory habitat in eastern Montana but do not breed in the state (Audubon, 2019).

Least Tern (*Sternula antillarum*)—Listed Endangered
Least Tern are North America's smallest tern. These little shorebirds are easily recognized by their yellow bills and legs. Although the species is widespread and common in places, the interior population been classified as threatened, endangered or as a species of concern for most states because of loss of habitat. The interior population declined by about 88% between 1966 and 2015; Interior Least Tern have been federally listed as endangered since 1985.

Figure 15 Least Tern

NRCS Montana State Biologist Pilar Ziglar states, "The interior population of the least tern is listed as endangered everywhere it occurs." (Zieglar, 2019). Least Tern often nest in colonies; nesting sites are shallow scrapes on open ground near lake shores, on sandbars or along the riverside. Unfortunately, prime nesting habitat is often used by humans for recreation or residential development. Additionally, alterations to stream flows caused by dams, reservoirs, water diversion and other changes to river systems have eliminated most historic Least Tern nesting habitat. Wide channels dotted with sandbars, which are preferred by Least Terns, have been replaced by narrow, armor-banked rivers with highly altered flows. Fluctuating water levels from reservoir releases often destroy nesting sites (MT FWP, 2019).

Figure 16 Piping Plover

Piping Plover (*Charadrius melodus*)—Listed Threatened, Designated Critical Habitat.

Piping Plover populations are also in decline due to habitat loss caused by alterations to river systems. These small shorebirds are distinguished by a single black band around their necks and noticeably short yellow-to-orange bills with black tips. Piping Plovers nest on shorelines and islands of alkali lakes in North Dakota and Montana and on sandbar islands and reservoirs shorelines along the Missouri River. Dam construction, water diversion and water withdrawals change river flow and drastically reduce the amount of available nesting habitat. Human activity has increased predation which decreases nest success and chick survival. (MT NHP, 2019).

USFWS provides maps of piping plover critical habiat throughout its range. Montana is included in the Mountain Prairie region, there are four range maps for the piping plover in Montana. These can be viewed at https://www.fws.gov/mountain-prairie/es/pipingPlover.php

Northern Long-Eared Bat (*Myotis septentrionalis*)—Listed threatened.

In Montana this species in known to occupy specific habitat within a limited range along the Missouri and Yellowstone river drainages near the North Dakota border, as shown in Figure 17 from the MNHP Northern Myotis Field Guide. These small, light brown bats are most often found hibernating in abandoned mines in the river breaks in Richland County. In the summer they roost in riparian forested areas dominated by cottonwood trees. They emerge to feed at dusk using echolocation to hunt moths, flies, leaf hoppers and beetles.

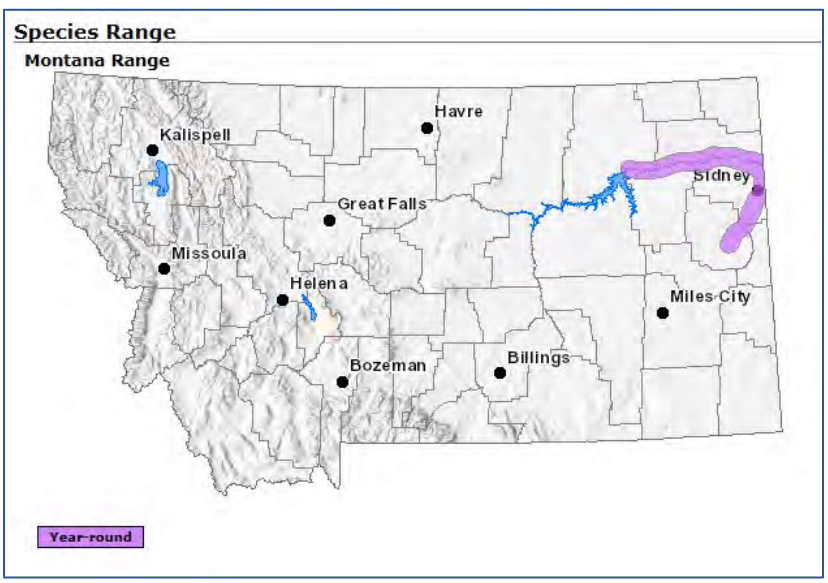


Figure 17 Northern Myotis Range in Montana

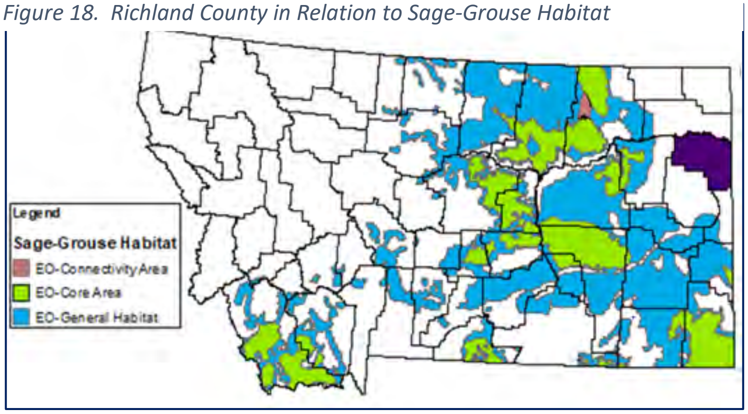
Long-Eared Bat populations in other areas of the country have suffered tremendous losses due to white nose syndrome. Regional extinction has occurred in some locations. White-nose syndrome is caused by a fungus, *Pseudogymnoascus destructans.* It attacks the bare skin of bats while they're hibernating. As it grows it causes changes in bats' behavior, causing them to become active during hibernation, using up the stored fat that they need to survive the winter. White-nose syndrome continues to spread rapidly across the United States and Canada, mostly through bat-to-bat contact. According to the White-Nose Syndrome Response Team, there were no reported occurrences of the disease in long-eared bats in Montana as of August 2019 (WNS Response Team, 2019).

Other causes of population decline are due to extensive logging or tree thinning, human disturbance during hibernation and mortality from collisions with wind turbines. The species was officially listed as Threatened on April 2, 2015 under the Endangered Species Act (MT NHP, 2019).

Greater Sage-Grouse

Montana, along with several other western states, has been the focus of multiple recent petitions to list the greater sage-grouse (*Centrocercus urophasianus*) under the federal Endangered Species Act. The primary concerns for sage-grouse are loss and fragmentation of their habitat. In Montana habitat loss due to conversion of sagebrush steppe to cropland and energy development is thought to be the biggest threat to greater sage-grouse.

Figure 18. Richland County in Relation to Sage-Grouse Habitat



On September 22, 2015 the U.S. Fish and Wildlife Service determined that the greater sage-grouse did not warrant listing protections under the Endangered Species Act. It was decided that the primary threats to populations had been ameliorated by conservation efforts implemented by Federal, State, and private land owners (USFWS, 2015).

Core area is defined as the area that contains the species of concern, having, exemplary natural plant and animal communities, or exceptional native diversity. Core areas delineate essential habitat that would not be able to absorb significant levels of disturbance without substantial impact to the species of concern. Sage-grouse core areas provide habitat for 75 % of all known breeding sage-grouse in Montana and represent landscapes of greatest biological importance to the long-term persistence of the species. Figure 18 shows Richland County (purple) in the context of greater sage-grouse habitat throughout Montana. There are no core areas or areas considered to be general habitat for the species in Richland County.

Grassland Birds

Several species of grassland birds are Montana species of concern in Richland County. Vickery et al. explain the recent decline of grassland birds and probable causes of their decline in *Grassland Birds: An Overview of Threats and Recommended Management Strategies*.

"During the past quarter century, grassland birds have experienced steeper, more consistent, and more widespread population declines than any other avian guild in North America. While some grassland species are Neotropical migrants, most are short-distance migrants that winter primarily in the southern U.S. and northern Mexico. The winter ecology of most grassland birds is poorly known; winter survivorship could be a critically important factor in the long-term declines that some species have experienced.

Shortgrass prairies evolved under intense grazing by prairie dogs and bison. Consequently the shortgrass prairie bird fauna evolved to select a variety of different site characteristics, created within landscapes receiving grazing pressure ranging from light to severe. Unfortunately, current range management practices strive to graze rangelands uniformly. These practices remove or inhibit heterogeneous grazing impacts across landscapes, and do not favor the specific habitat requirements of many species.

For example, Mountain Plovers require heavily grazed sites for breeding, but Lark Buntings prefer denser vegetation. Thus, moderate grazing everywhere is unlikely to result in suitable habitat for either species. In many locales, insufficient grazing has led to the invasion of grasslands by shrubs and forbs. Rather than opposing grazing as a management tool in all grasslands, conservation groups should encourage grazing that imitates natural conditions as closely as possible." (Vickery, 2000)

Table 4 Grassland Birds Species of Concern, Richland County Montana

 Baird's Sparrow (*Centronyx bairdii*)	Prefers to nest in native prairie; requires a relatively complex plant structure including areas of light to no grazing. Feeds on seeds, insects and spiders. Migrates from winter habitat in Mexico to the grasslands of the northern plains in Montana, North Dakota and Canada. Loss of native prairie habitat due to agricultural conversion and loss of winter habitat due to overgrazing are thought to be causes of population decline (MNHP, 2019).
 McCown's Longspur *(Rhynchophanes mccownii)*	Prefers semi-arid shortgrass steppe, open with sparse vegetation. Migrates in large flocks between breeding ground in the Canadian Prairie Provinces and northwestern Great Plains and wintering grounds in the southwestern US and northern Mexico. Decreasing range-wide abundance can be attributed to conversion of short-grass prairie to agriculture and urban development (MNHP, 2019).

 Chestnut-collared Longspur *(Calcareous ornatus)*	Prefers open, sparse vegetation in native pastures with short-to-medium grasses that have been recently disturbed (grazed, mowed or burned). Summer diet includes insects, especially grasshoppers, caterpillars and spiders, and seeds. In the winter it eats seeds from grain, sunflowers and grasses. Winter habitat is the grasslands of the southwestern U.S. and north-central Mexico. Breeding grounds are grasslands in Montana and North Dakota and southern Canada. Conversion of native prairie to agriculture and urban development has eliminated the Chestnut-collared Longspur from much of its historical breeding range (MNHP, 2019).
 Sprague's Pipit *(Anthus spragueii)*	Do not nest in cropland and are uncommon or absent in non-native grasslands. They tolerate some grazing of this habitat but do not nest where it is overgrazed. Prefer scattered shrubs and relatively little bare ground. Summer diet is mostly insects and other arthropods, with some seeds. Little is known about the winter ecology and diet of Sprague's Pipit. Breeds in the north-central United States in Minnesota, Montana, North Dakota and South Dakota as well as south-central Canada. Wintering occurs in the southern US. Conversion from prairie to cropland and pasture along with excessive grazing are identified as the cause of this species' decline (MNHP, 2019).
 Long-billed Curlew *(Numenius americanus)*	Breeds in areas with sparse, short grasses, including shortgrass and mixed-grass prairies and agricultural fields. Outside of the breeding season it is found in wetlands, tidal estuaries, mudflats and beaches. Degradation or loss of grassland breeding habitat to agricultural and residential development is the greatest threat to the Long-billed Curlew. Additionally, other human disturbances such as off-road vehicle travel and agricultural practices such as chaining or dragging to remove sagebrush can destroy nests if done in the spring (MNHP, 2019).

SECTION III CONSERVATION ACTIVITY ANALYSIS

NRCS Conservation Practices Data

Partner conservation efforts: The NRCS and Conservation District work with several partners in the area. These include Montana Fish Wildlife & Parks, Montana State University (MSU) Extension, USDA Agricultural Research Service, MSU Eastern Ag Research Center, Richland County Weed District, Richland County, Montana Salinity Control Association, Sidney Water Users, Lower Yellowstone Irrigation District and Montana Bureau of Mines and Geology.

Changes Over the Last Five to Ten Years Because Of Conservation Activities

The largest changes to the county due to conservation activities have been in water quantity conservation. Program opportunities have allowed us to install over forty sprinkler irrigation systems in the valley over the last ten years, significantly reducing runoff and deep percolation.

Rangeland improvement projects are the priority resource concern for the local work group. We have made steady progress with range improvement and adoption of prescribed grazing on rangeland.

Cover cropping has increased over the past five years in the county; implementation has been facilitated through the EQIP and CSP programs.

USDA Farm Bill Programs

Conservation Reserve Program

The Conservation Reserve Program (CRP) is a land conservation program administered by the Farm Service Agency (FSA). In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

Although Richland County only ranks thirty-second for size of the fifty-six counties in Montana, it is number eight in acres enrolled in CRP. Figure 24 illustrates changes in the number of acres enrolled in CRP in Richland County from 1998 to 2014 (EWG Farm Subsidy Database, 2019).

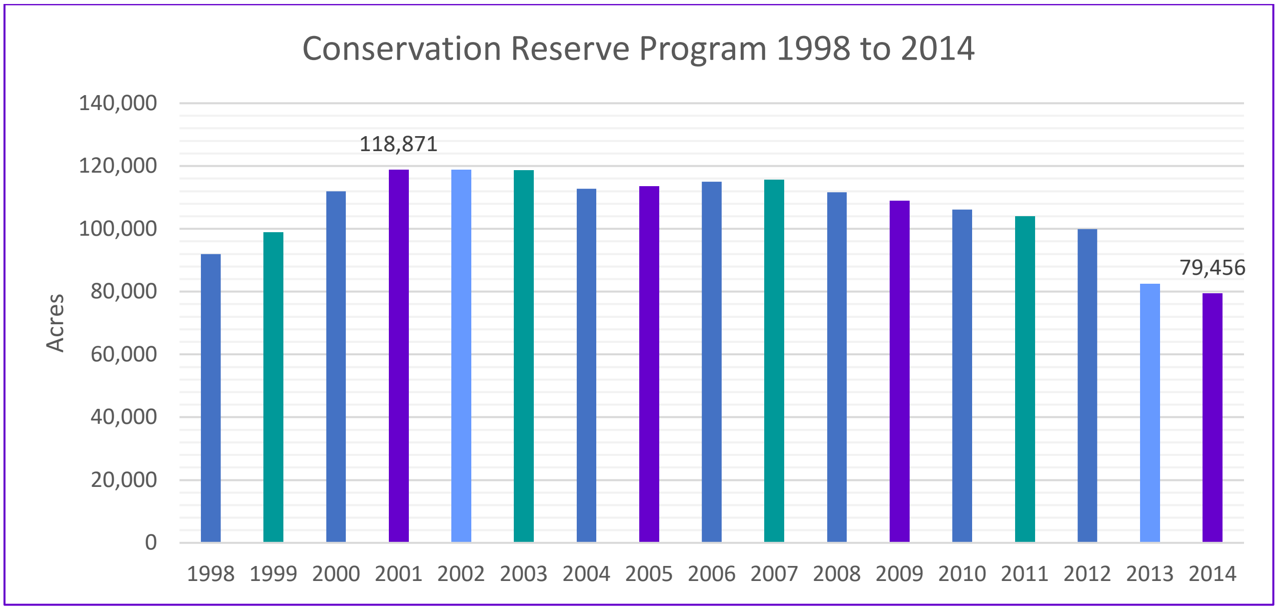


Figure 19 Conservation Reserve Program Acres Enrolled from 1998 to 2014, Richland County, Montana

In addition to the conversion of cropland and land rental aspects of the program, a number of landowners also applied conservation practices to land enrolled in CRP.

Table 5 CRP Practices

CRP Practices 2008 to 2018	
Activity	Acres
Conservation Cover	9,320.43
Access Control	1,766.64
Integrated Pest Management	1,755.35
Upland Wildlife Habitat Management	1,315.08
Forage and Biomass Planting	944.03
Range Planting	246.60
Restoration of Rare or Declining Natural Communities	89.63
Tree/Shrub Establishment	14.75
Total	15,452.51

Agricultural Water Enhancement Program (AWEP)

Twenty-six participants applied resource conservation practices through AWEP in fiscal years 2011 through 2018 to improve irrigation systems efficiency.

Conservation Technical Assistance (CTA)

Conservation Technical Assistance (CTA) is the help provided by NRCS, employees of other entities or agencies under the technical supervision of NRCS, to clients to address opportunities, concerns, and problems related to the use of natural resources. The CTA Program provides land users with proven conservation technology and the delivery system needed to achieve the benefits of a healthy and productive landscape. In Richland County from 2008 to 2018, Conservation Technical Assistance was provided for over 214,000 acres.

Table 6 Most Common CTA Practices

CTA 2008 to 2018	
Practice	Acres
Fence	30,750.52
Livestock Pipeline	37,077.74
Prescribed Grazing	43,599.74
Residue and Tillage Management, No-Till	14,816.52
Watering Facility	41,664.65

Conservation Stewardship Program (CSP)

CSP is a program to help producers to enhance or advance their existing conservation plan and improve their business operation. Participants maintain their current level of stewardship for resource concerns met at the time of application and apply activities to meet or exceed at least one additional resource concern on each land use in their operation.

Table 7 CSP Activities Prior to 2012

Practice or Enhancement	**Acres**
Use drift reducing strategies to reduce pesticide drift	29,383.74
Rotation of supplement and feeding areas	28,904.22
Biological suppression & other non-chemical: brush, weeds & invasive species	28,445.27
Apply nutrients no more than 30 days prior to planned planting date	18,232.81
Apply enhanced efficiency fertilizer products	15,256.07
Grazing management to improve wildlife habitat	12,136.64
Apply phosphorus fertilizer below soil surface	11,906.97
Continuous No Till	11,906.97
Wildlife Friendly Fencing	11,081.05
Managing Calving to Coincide with Forage Availability	9,782.74
Split nitrogen applications 50% after crop/pasture emergence/green up	8,930.23
Use of Cover Crop Mixes	8,930.23
Harvest hay in a manner that allows wildlife to flush and escape	6,806.09
Retrofit watering facility for wildlife escape & enhanced access for bats & bird species	4,168.95

Retrofit watering facility for wildlife escape	2,353.90
Regional weather networks for irrigation scheduling	436.48
Irrigation pumping plant evaluation	109.12
Remote monitoring and notification of irrigation pumping plant operation	109.12
Decrease irrigation water quantity or conversion to non-irrigated crop production	96.05
Renovation of a windbreak or shelter belt, or hedgerow for wildlife habitat	91.79
Total CSP Acres	**209,068.44**

Conservation Stewardship Program (CStwP)

CStwP is the current iteration of the Conservation Stewardship Program. Practices and enhancements have become more numerous and more specific.

Table 8 CStwP Practices and Enhancements

CStwP Enhancements 2012-2018 By Acres	Acres
Herbaceous Weed Control (Plant Pest Pressures) For Desired Plant Communities/Habitats	105
Cover Crop to Suppress Excessive Weed Pressures and Break Pest Cycles	122
Improve the Plant Diversity / Structure of Non-Cropped Areas for Wildlife Food and Habitat	125
Grazing Management That Protects Sensitive Areas-Surface Water from Nutrients	131
Complete Pumping Plant Evaluation for All Pumps on A Farm.	137
Cover Crop to Reduce Water Erosion	186
Advanced IWM--Weather Is Monitored, Recorded and Used in Decision Making	264
Grazing Management That Protects Sensitive Areas from Gully Erosion	278
Reduced Tillage to Increase Plant-Available Moisture: Irrigation Water	348
Harvest of Crops Using Measures That Allow Desired Species to Flush or Escape	377
Improving Nutrient Uptake Efficiency and Reducing Risks to Air Quality - Emissions of GHGs	407
Reduce Risks of Nutrient Losses to Surface Water by Utilizing Precision Ag Technologies	447
Regional Weather Networks for Irrigation Scheduling	620
Herbaceous Weed Control for Desired Plant Communities/Habitats	807
Grazing Management for Improving Quantity and Quality of Cover and Shelter for Wildlife	1,291
Retrofit Watering Facility for Wildlife Escape/Access for Bats and Bird Species	1,609
Split Nitrogen Applications 50% After Crop/Pasture Emergence/Green Up	2,362
No-Till System to Increase Soil Health and Soil Organic Matter Content	2,694
Reduce Risk of Pesticides in Surface Water by Utilizing Precision Application Techniques	3,201
Improving Nutrient Uptake Efficiency and Reducing Risk of Nutrient Losses to Surface Water	3,299
Biological Suppression/Non-Chemical Techniques: Brush, Weeds and Invasive Species	3,528
Maintaining Quantity and Quality of Forage for Animal Health and Productivity	3,604
Improving Nutrient Uptake Efficiency and Reducing Risk of Nutrient Losses to Groundwater	4,160
Precision Application Technology to Apply Nutrients	5,222
Apply Controlled Release Nitrogen Fertilizer	5,681
Continuous No-Till with High Residue	9,038
Apply Enhanced Efficiency Fertilizer Products	10,406
Continuous No Till	10,406
Harvest Hay in A Manner That Allows Wildlife to Flush and Escape	14,649

Use Drift Reducing Strategies to Reduce Pesticide Drift	29,175
Monitoring Nutritional Status of Livestock Using the Nutbal Pro System	31,968
Range Grazing Bundle #1	33,353
Managing Livestock Access to Water Bodies/Courses	40,853
Grazing Management to Improve Wildlife Habitat	43,761
Monitor Key Grazing Areas to Improve Grazing Management	43,761
Rotation of Supplement and Feeding Areas	70,353

Table 9 CStwP Activities Measured in Units Other Than Acres

CStwP Other Enhancements & Practices 2012-2018	Amount	Measure
Irrigation pumping plant evaluation	206.67	Each
Incorporating ""wildlife friendly"" fencing for connectivity of wildlife food resources	2,173.57	Feet
Pumping plant powered by renewable energy	377.61	TDH
Retrofit watering facility for wildlife escape	16,257.05	Acres
Structures for Wildlife	185.28	Acres
Wildlife Friendly Fencing	4,210.52	Feet

Wildlife Habitat Incentives Program (WHIP)

The Wildlife Habitat Incentive Program (WHIP) was a voluntary program for landowners who wanted to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land. It has been folded into EQIP. One conservation plan was implemented under WHIP in Richland County in 2010 and 2011 to enhance wildlife habitat conservation on 38.7 acres.

Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program (EQIP) is a voluntary conservation program that promotes agricultural production and environmental quality as compatible goals. Through EQIP, agricultural producers receive financial and technical assistance to implement structural and management conservation practices that optimize environmental benefits on working agricultural land. From Fiscal Year 2008 through Fiscal Year 2018, Richland County wrote and administered one hundred ten EQIP contracts with seventy-nine participants. The most commonly contracted practices are shown in Table 10.

Table 10 Most Common EQIP Practices

Practice	Count	Applied Amount	Measure
Irrigation Water Management	82	4376.88	Acres
Pumping Plant	64	15,784.38	TDH
Watering Facility	45	41,664.65	Acres
Residue and Tillage Management, Mulch Till	59	21,960.28	Acres
Irrigation System, Sprinkler	38	4376.88	Acres
Fence	37	30,750.52	Feet
Pasture and Hay Planting	24	3719.58	Acres
Nutrient Management	19	2801.18	Acres
Water Well	19	9412.22	Acres
Prescribed Grazing	18	43599.74	Acres
Cover Crop	14	810	Acres
Structure for Water Control	13	399	Each
Range Planting	11	3065.43	Acres
Herbaceous Weed Control	10	5813.43	Acres

Partnerships

Since 2011 Richland County Conservation District, in partnership with Richland County and the NRCS, has implemented conservation practices to address resource concerns on over fifty-six thousand acres. The District offers cost share to landowners for conservation practices which cover, on average, about a third of the total cost of each project. These practices have included:

- 25 Livestock wells and solar systems
- 18 Livestock water pipelines
- 5 Cross fences
- 8 Forage and biomass plantings, converting cropland to grass
- 9 Tree/Shrub plantings

Additionally, the Lower Yellowstone and Sidney Water Users Irrigation Districts partnered with the Conservation District and the Sidney Field Office to upgrade or repair ten irrigation systems.

The Conservation District holds annual conservation tree sales and offers education by hosting the Outdoor Classroom for Richland County middle school students and other workshops and trainings.

MSU Extension is working with the Conservation District, the NRCS and a private landowner to investigate the feasibility of winter grazing dryland corn, cover crops and warm season grasses as an alternative to the traditional model of winter feeding. Rather than harvesting crops, hauling and storing the feed, then hauling it out to the cattle, the forage is left in the field and offered to cattle in small temporary paddocks. The project involves use of temporary fence which was paid for in part by a 223 Grant.

The District plans to host a field day in late Fall 2019 to demonstrate the success of the model to local cattlemen.

SECTION IV OPPORTUNITIES AND DESIRED OUTCOMES

Since the beginning of the formation of Local Work Groups, the locally led process has identified resource concerns in both widely spread and targeted areas in the county. In general, the widespread issues are located on rangeland and dryland cropland while the targeted areas are usually irrigation related. Recently, there has been an increase in interest in new targeted areas (Appendix B1).

Widespread Ongoing Concerns

Degraded Plant Condition, Rangeland (Rangeland Health and Livestock Production)

Lack of grazing management is the underlying reason for this concern. There is a lot of potential for increased management on range and tame pastureland in the county.

Inadequate livestock water is the lead factor contributing to uneven grazing distribution where some areas within the grazing unit tend to be over-utilized while others are only lightly grazed or ungrazed. This causes a shift in the plant community in the over-used areas where high-quality forage grasses are being replaced by unpalatable forbs such as curly-cup gumweed and fringed sage wort, invasive annuals and other undesirable species.

Native species creeping juniper and little bluestem have been observed to be increasing in some areas. Introduced grasses such as crested wheatgrass and smooth brome are known to invade rangeland, displacing native species and lowering overall forage quality. They create numerous troubles in addition to degradation of the plant community. Increased fire hazard, increased soil erosion, diminished wildlife habitat, increased sediment loading and other negative impacts to the environment follow these invaders.

A realistic desired outcome for this resource concern would be to provide the tools increase management on 10 more ranches over the next 5 years.

Noxious weeds

Leafy spurge and Canada thistle have been identified as the primary targets for action. Noxious weeds have several common characteristics that provide exceptional competitive advantages over native plants in the ecosystem. Canada thistle and leafy spurge both produce incredible numbers of seeds. They have extensive root systems that allow for storage of carbohydrate reserves and increased access to soil water and nutrients. The roots support vegetative reproductive structures. Both species are drought resistant, resilient and prolifically reproductive. They have almost no native natural enemies in North America.

The Fox Creek area in north Central Richland County has been considered as a priority area for noxious weed control efforts. Canada thistle and leafy spurge occur in large patches and smaller scattered infestations to such an extent that rangeland production, plant community health and structure, wildlife habitat and livestock are all significantly impacted by their domination of the range sites. If no action is taken, entire watersheds will be infested to the level that they no longer support native plants and animals and will no longer be fit to use for livestock grazing.

A desired future outcome would be control of noxious weeds on 5,000 acres in the next 5 years.

Irrigation Efficiency

Irrigation water management, improved irrigation infrastructure, increased irrigation systems efficiency, and the need for engineering assistance with plans and designs were all called for in the LWG meeting. Much of the infrastructure belonging to the Irrigation Districts fall short of meeting the needs of users. Leaking delivery systems are causing saturated soils and saline seeps in certain areas. There is great potential to improve and upgrade on-farm irrigation systems as well.

A desired future outcome for irrigated systems would be to attain eighty to 90% application efficiency on 5,000 acres over the next five years.

Soil Erosion

Sheet and rill erosion on rangeland can occur as a result of grazing pressure and from native plants being displaced by invasive species and noxious weeds. The Local Working Group identified soil erosion and soil health as important resource issues in Richland County. The benefits of cover crops were discussed as an alternative to treat the resource concern on active cropland. Planting marginal cropland back to perennial forage species is an alternative to treat the resource concern in certain areas.

A desired future outcome for soil erosion would be a 50% reduction in soil loss on 1,000 acres.

Streambank erosion has always been a concern along the Yellowstone and Missouri Rivers. On the Missouri, changes are made to the flow regime for flood control and endangered species conservation. When flow is high, streambanks are saturated. When flows are dropped, the riverbank collapses. As a secondary concern, changes in flow make it difficult or even impossible to irrigate crops due to access issues at pump sites.

The Yellowstone river also continues to meander in the valley causing streambank erosion concerns for landowners. Attempts to control streambank erosion often worsen the problem or cause impacts to neighboring landowners.

A future desired condition would be to work with the U.S. Army Corp of Engineers and U.S. Fish & Wildlife Service to reduce stream bank erosion while providing flows for agriculture producers and endangered species.

New concerns

Insufficient Water

Fox Hills Aquifer

Declining flows from Fox Hills artesian wells have been occurring over the last two decades. The Richland County Conservation District started working with MBMG and Montana DNRC in 2015 to complete an inventory of wells drawing from the Fox Hills-Hell Creek aquifer. Many of these wells were over one thousand feet deep, were installed using two-inch metal casing and are or were free-flowing. Free flowing wells extract more water than recharge can replace, which adversely impacts other wells nearby. Water level monitoring has documented a decline of one to four feet per year over the past twenty years in Richland County. The lowering of water levels has caused a decline or loss of production in wells throughout the area.

MBMG is planning an investigation in the spring of 2020 to determine the extent of the resource concern. The Sidney Field Office is working to create a plan with water-conserving alternatives such as capping unused wells, retrofitting wells to provide the ability to shut off flow when water is not needed (winterizing), and installing control structures to restrict flow to match irrigation system requirements. The plan will propose to retrofit, cap or repair between thirty and fifty wells over several years.

If no action is taken, the flowing wells will continue to produce more water than is needed for agriculture, resulting in a waste of a valuable and potentially non-renewable resource. The aquifer water levels will continue to drop, risk of the negative effects described above will increase, more wells will experience decreased productivity, and some will dry up altogether.

The future desired outcome would be to develop a program to assist well owners to cap, valve, or winterize free flowing wells so they do not reduce flows in other wells.

West Crane Aquifer

According to the MBMG, "The Lower Yellowstone Buried Valley (LYBV) aquifer forms an important water resource in eastern Montana. The LYBV aquifer contains sand and gravel deposited by glacial meltwater streams. These deposits form a complex aquifer system with some areas capable of supporting high-yield irrigation wells. The aquifer provides the municipal water supply to the city of Sidney. It also underlies the irrigated farmland in the Yellowstone River valley near Sidney and dryland farmland and pastures. In the upland setting, the aquifer is referred to as the West Crane Aquifer. The greatest interest in irrigation development is in the West Crane Aquifer. (Appendix B2). The aquifer underlies land traditionally used to grow dryland crops until its discovery in 2007. Since then, new irrigation wells have caused concern about the aquifer's capability to support groundwater development." (MBMG GWIP, 2019)

There has not yet been a determination whether the current rate of production exceeds the recharge capabilities of the West Crane Aquifer. If agriculture is using the water faster than rain and snowmelt can replace it, at some point the level of the aquifer will drop. Negative effects of aquifer depletion include:

- Lowering of the water table, making the water inaccessible to existing wells.
- Increased costs as water must be pumped farther to reach the surface. In some cases, using the well may become cost prohibitive.
- Reduced surface water supplies. When groundwater is depleted, the lakes, streams and rivers connected to groundwater can be diminished.
- Riparian areas could be negatively impacted as the water level drops; cottonwood trees and other plants may not be able to access water.
- Land subsidence occurs when there is a loss of support below the land surface. This is most often caused by human activities, mainly from the overuse of groundwater.

MBMB is investigating how much groundwater can be sustainably developed for irritation from the West Crane aquifer without significantly affecting ground and surface water resources. Work included installation of nineteen test wells for monitoring in 2017. Dataloggers were installed in the wells and in several private wells. As of October 2019 MBMG had not yet released any water level data pertaining to the irrigation development potential of the aquifer (MBMG GWIP, 2019).

A future desired outcome would be the formation of a groundwater monitoring system, providing a means for producers to track groundwater levels and regulate withdrawals in order to conserve water.

SECTION V PRIORITIZATION

This is the Sidney Field Office NRCS Long-Range Plan and represents a dynamic resource conservation strategy. Long Range Planning is an essential part of doing business. Readers of this plan need to realize that the NRCS workload changes with each Farm Bill and that NRCS has responsibilities such as Natural Resource Inventory (NRI), conservation compliance, emergency programs, et cetera, which take time away from fulfilling this plan. The resource concerns below are listed in priority order with the knowledge that the Plan will change over time as resource concerns in target areas are addressed, as new resource concerns are identified, and as other factors continue to influence conservation in Richland County.

The Richland County Local Working Group met on April 11, 2019 to discuss and prioritize natural resource concerns. Considering the results of the meeting, requests for assistance with resource conservation in the county, and trends in resource use and agriculture, the Field Office has isolated the following resource concerns as priorities for focused conservation.

The number one ranked resource concern was livestock production limitations. Tied for second, third, and fourth priorities were soil quality, soil erosion, and degraded plant condition. The fifth ranked resource concern was water quantity. Appendix B1.

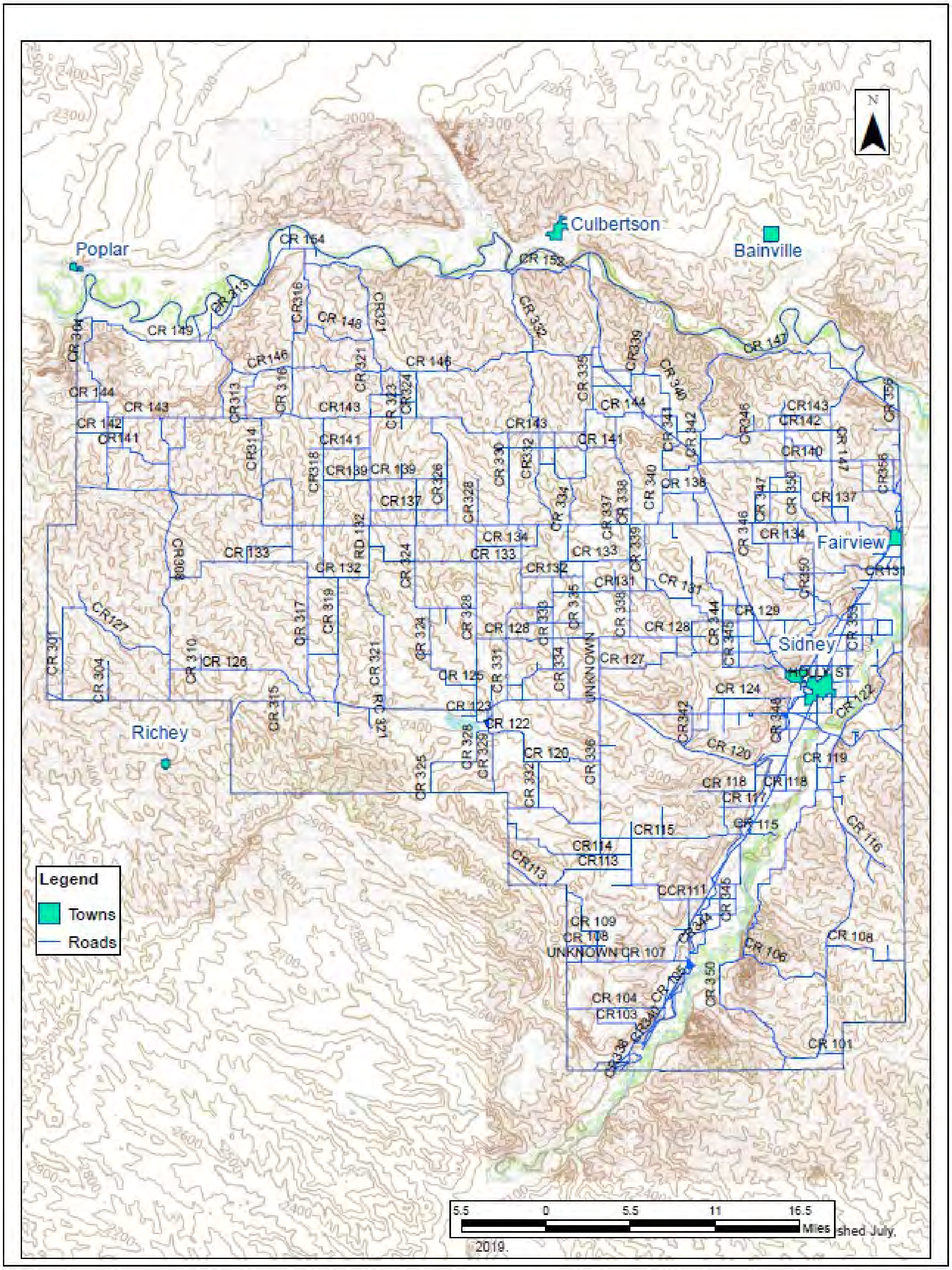
Livestock production limitations: This is a comprehensive lack of adequate forage, adequate stock water, noxious weed control, healthy plant communities, and erosion control. This is a county wide concern as shown on maps that were marked at the local work group meeting. See Appendix B1.

Soil quality, soil erosion, and degraded plant condition all tie back to the livestock production concern on rangeland but were separated out because they occur on other land uses as well. Degraded plant condition is where the Local Work Group put the noxious weed concern which has been near the top of the priority list for years. Again, these were countywide concerns with noxious weeds being one that could be narrowed down to a certain area.

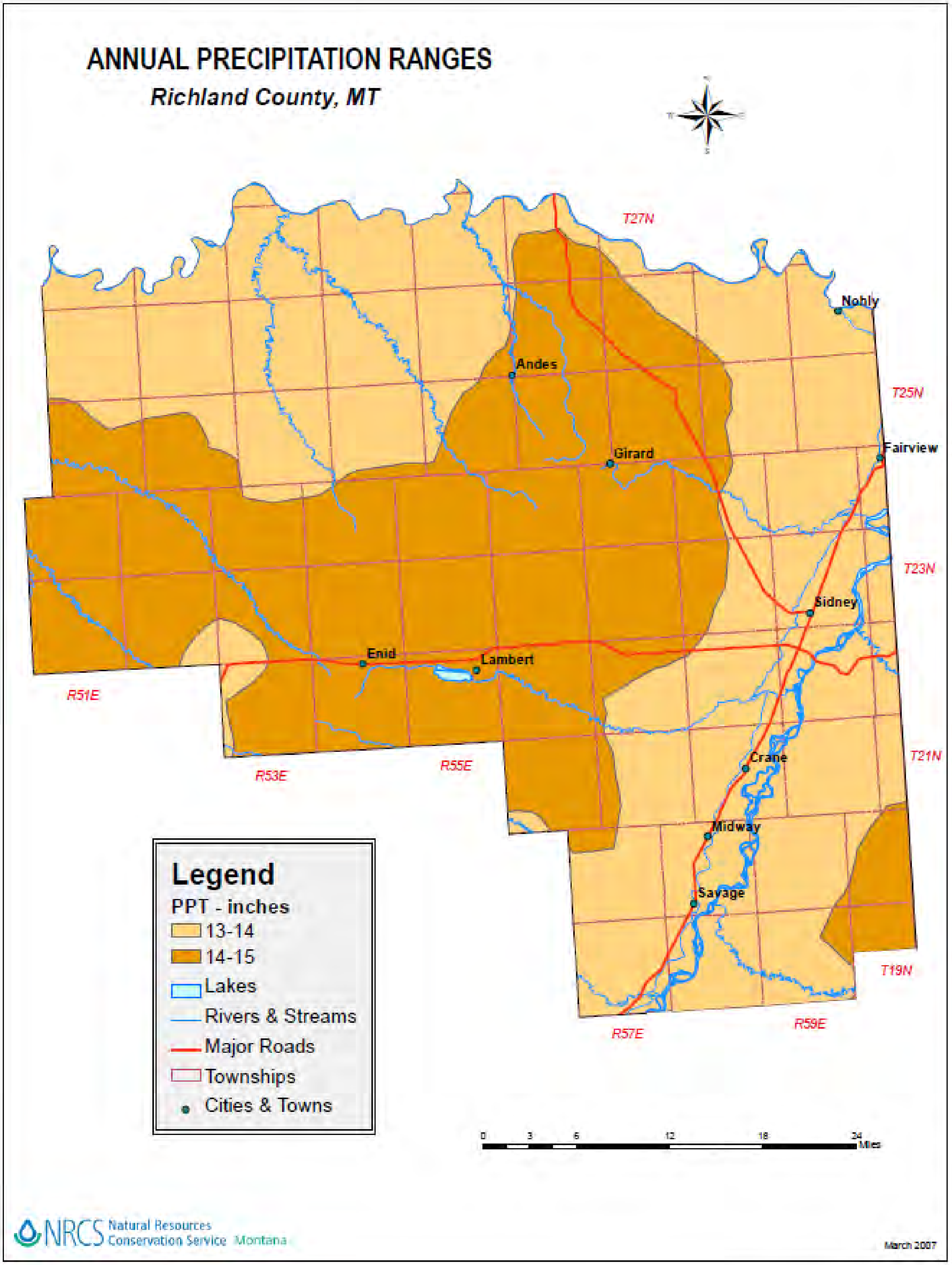
The fifth concern was **water quantity**. This ties back to irrigation delivery and application systems and the many opportunities in the valley to improve both. It also applies to conserving flows in the Fox Hills wells and West Crane Aquifer. These are targeted concerns and show potential for Targeted Implementation Plans.

APPENDIX A

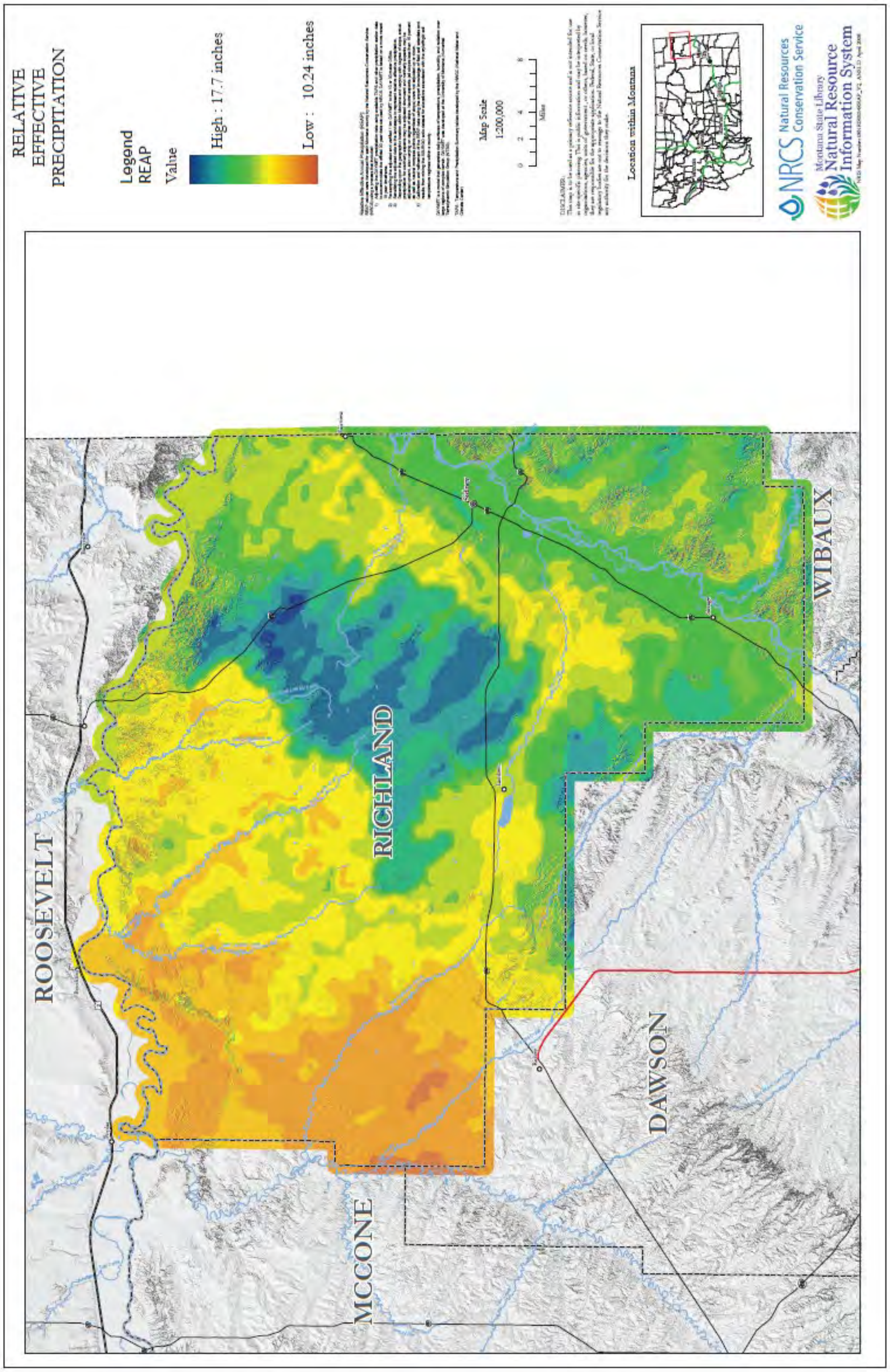
A1 Richland County



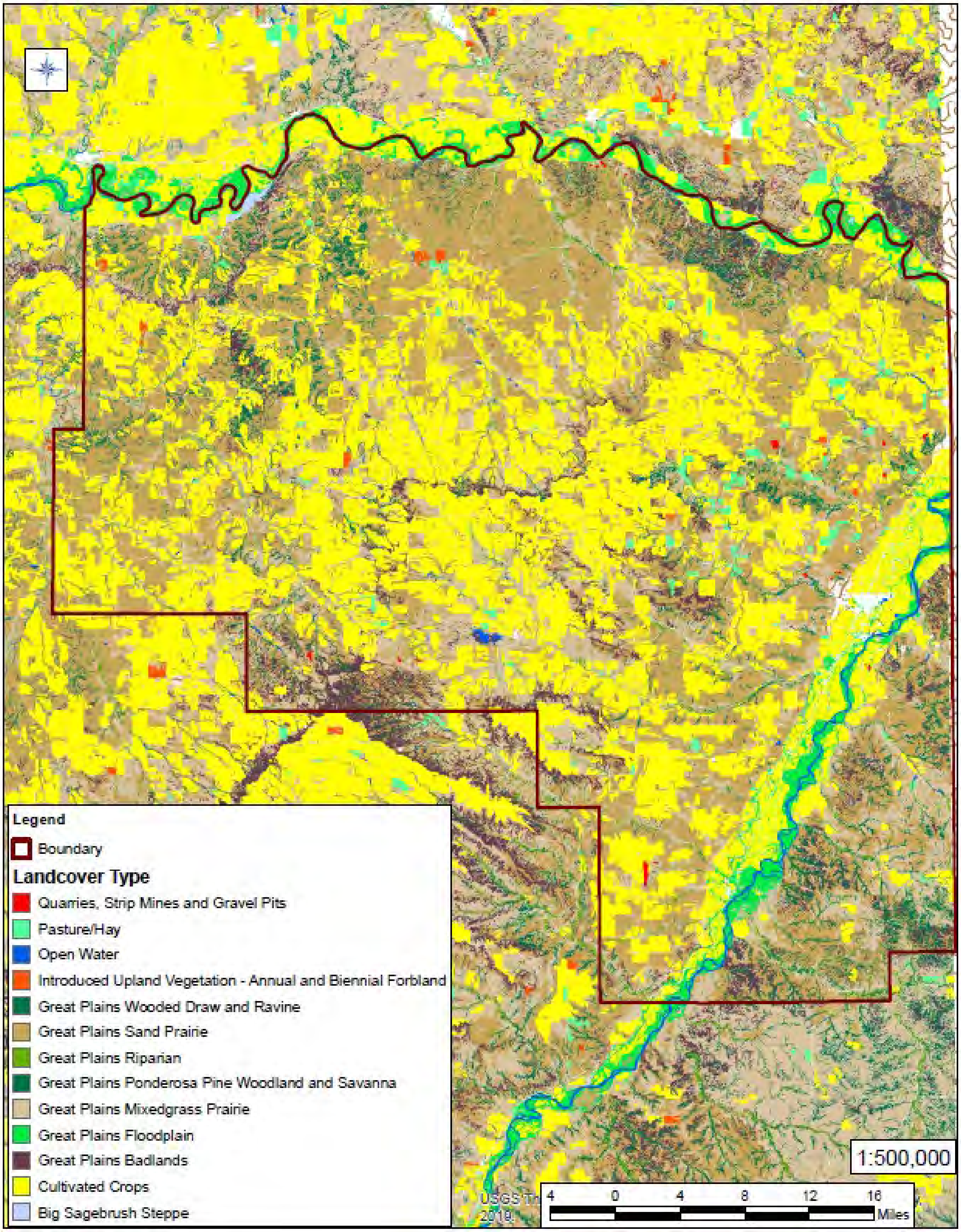
A2 Precipitation Ranges



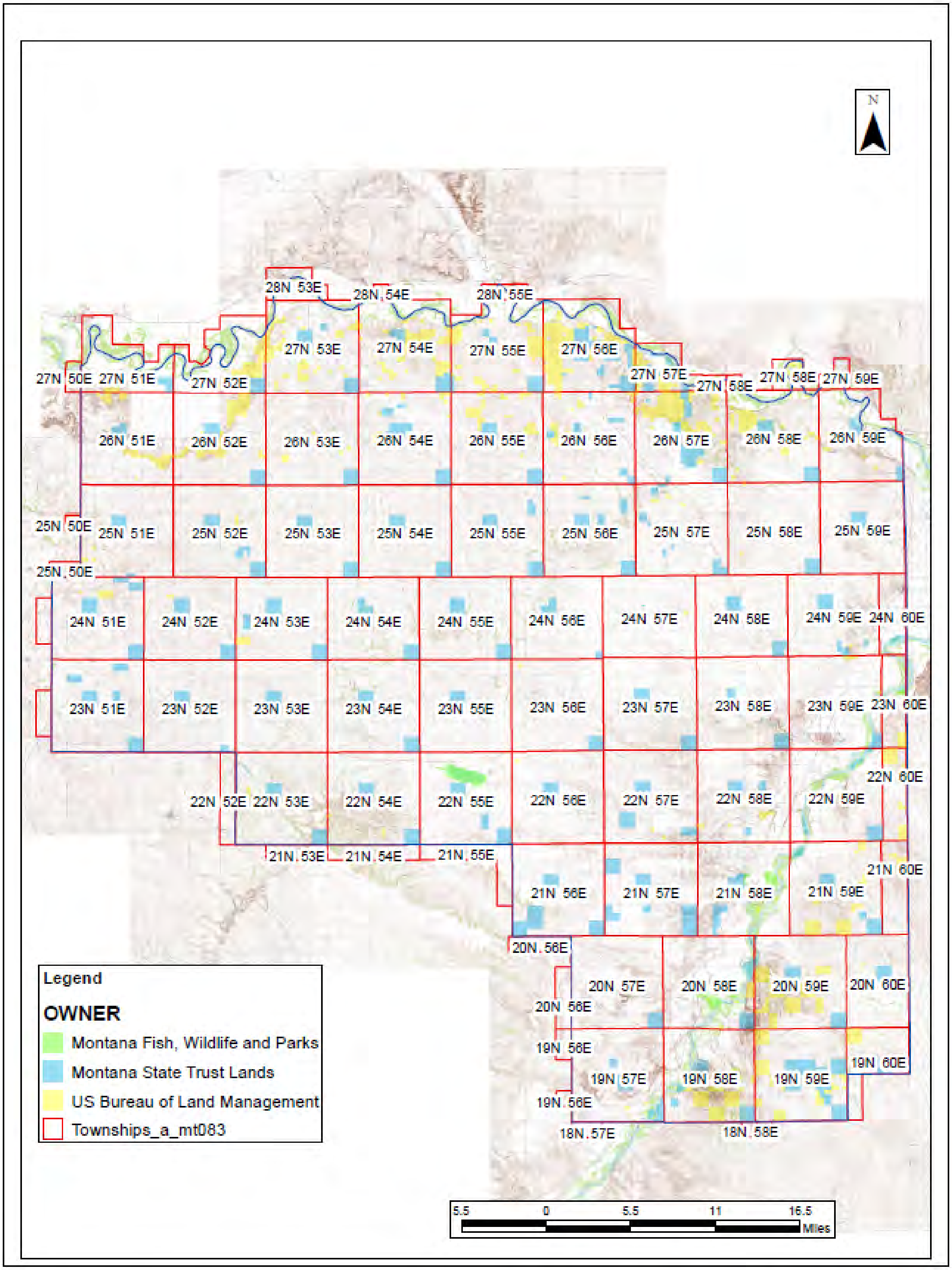
A3 Relative Annual Effective Precipitation



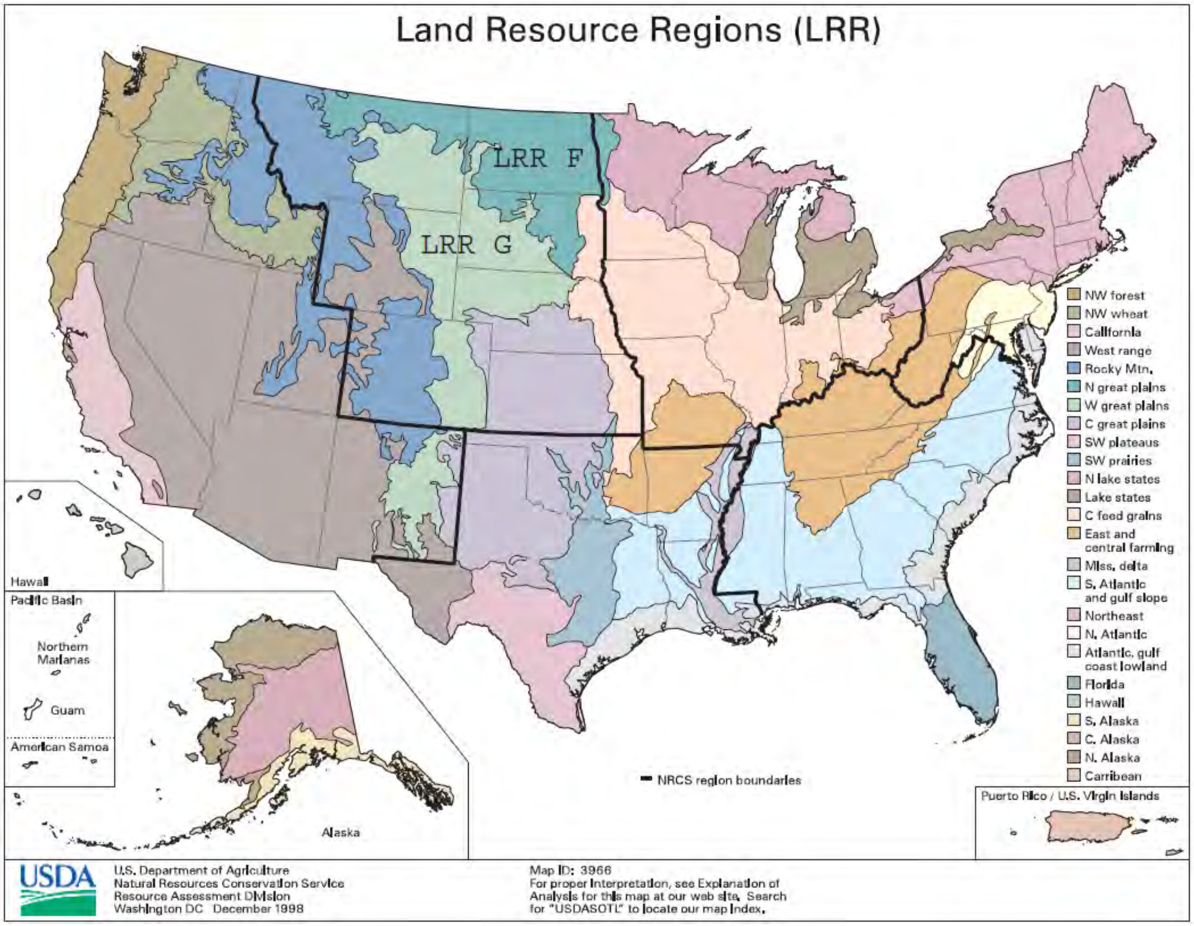
A4 Landcover



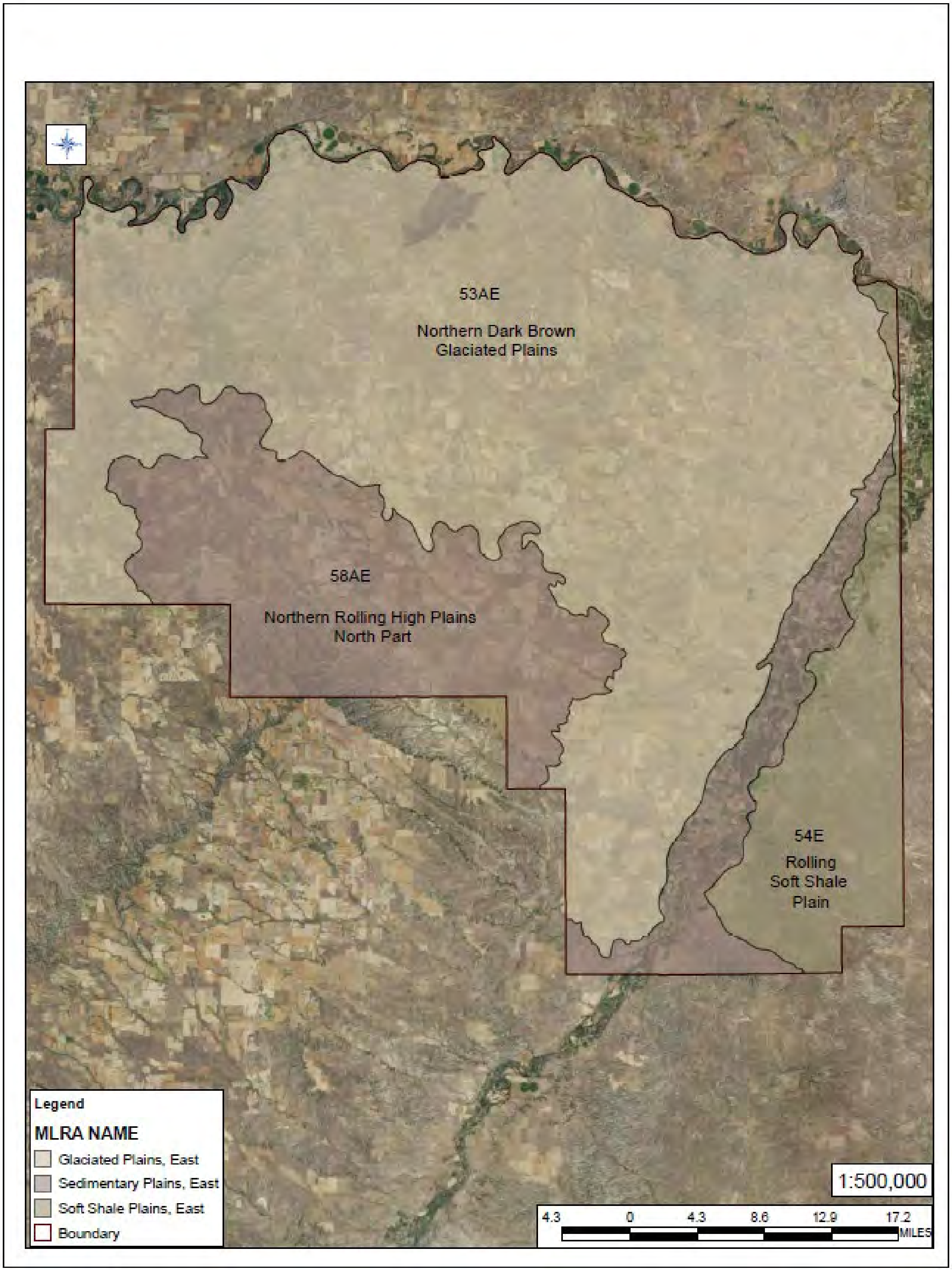
A5 Land Ownership



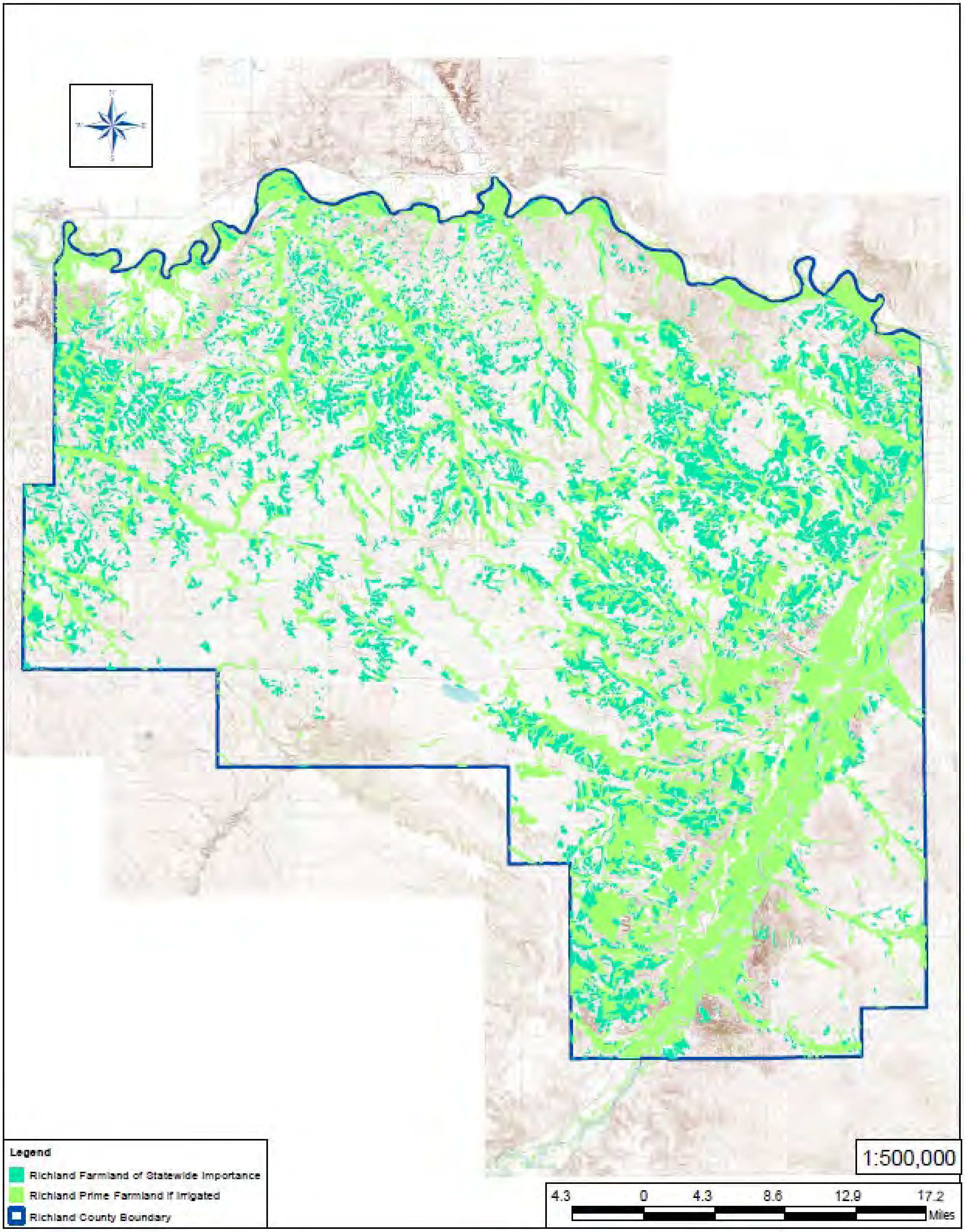
A6 Land Resource Regions



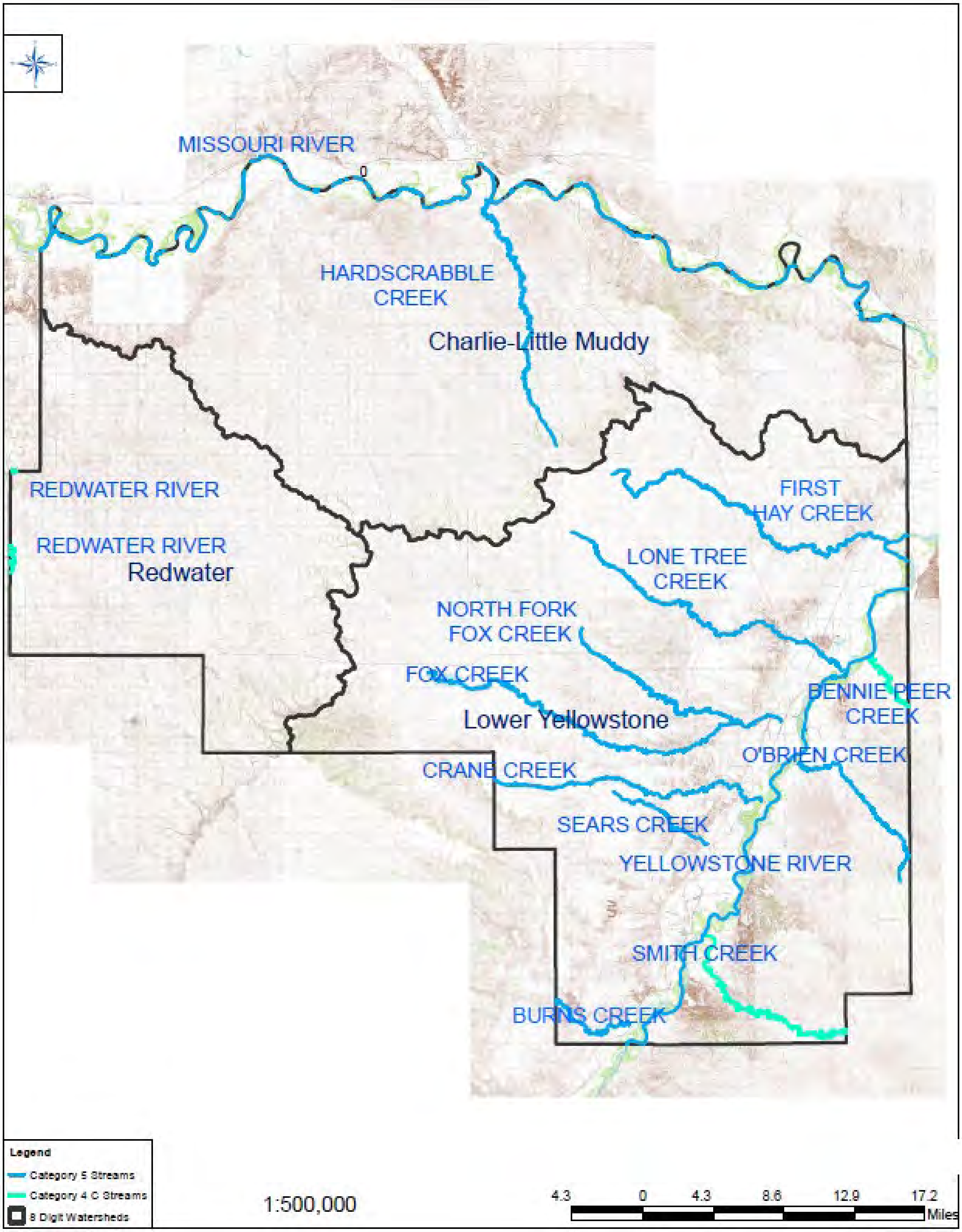
A7 MLRAs


53AE
Northern Dark Brown
Glaciated Plains
58AE
Northern Rolling High Plains
North Part
54E
Rolling
Soft Shale
Plain
Legend
MLRA NAME
Glaciated Plains, East
Sedimentary Plains, East
Soft Shale Plains, East
Boundary
1:500,000
4.3
0
4.3
8.6
12.9
17.2
MILES

A8 Farmland of Statewide Importance and Prime Farmland if Irrigated



A9 303(d) Listed Streams

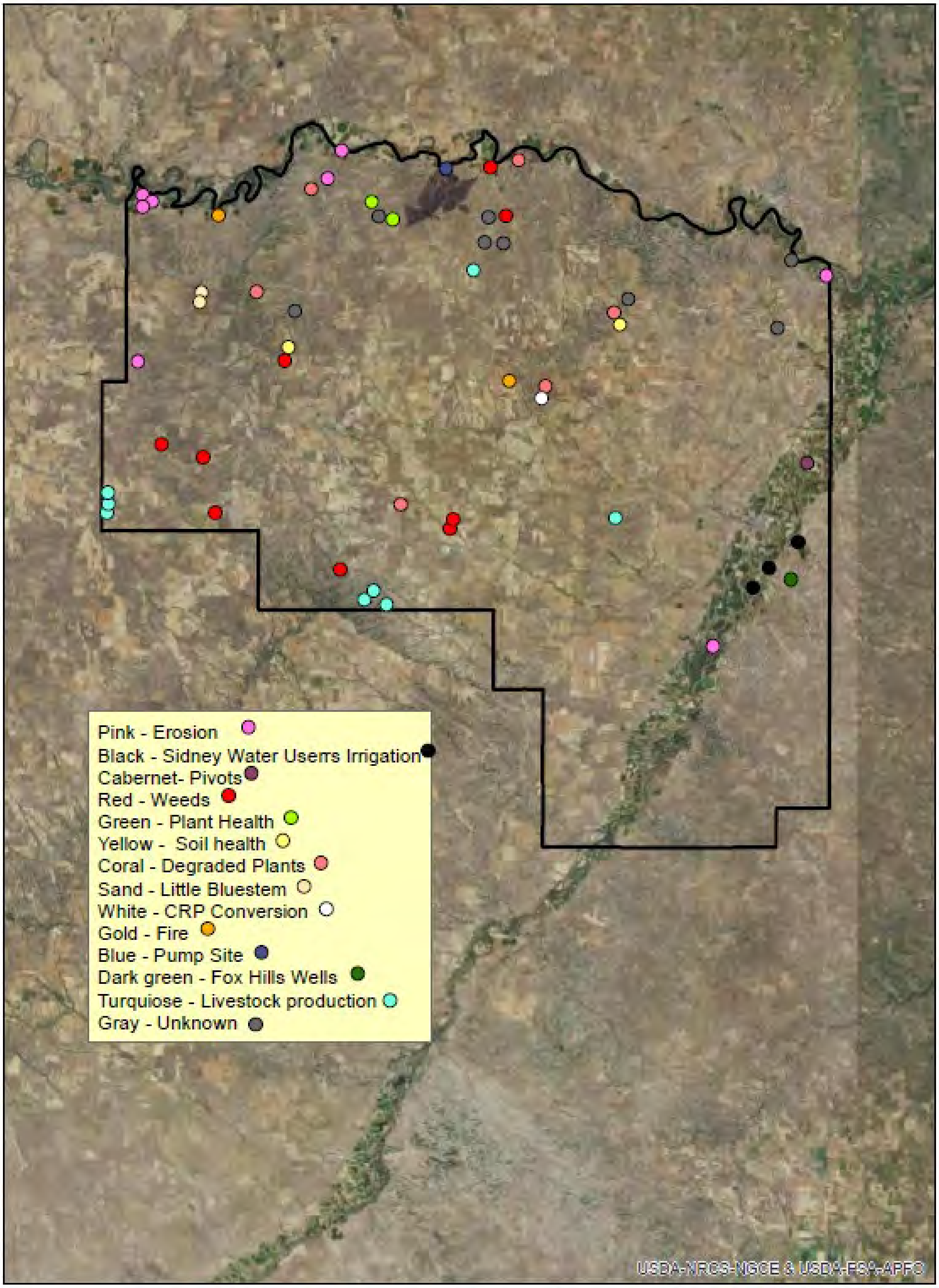


A10 Animal Species of Concern

Scientific Name	Common Name	Family	State Rank	Habitat
Corynorhinus townsendii	Townsend's Big-eared Bat	Bats	S3	Caves in forested habitats
Cynomys ludovicianus	Black-tailed Prairie Dog	Squirrels	S3	Grasslands
Euderma maculatum	Spotted Bat	Bats	S3	Cliffs with rock crevices
Lasiurus borealis	Eastern Red Bat	Bats	S3	Riparian forest
Lasiurus cinereus	Hoary Bat	Bats	S3	Riparian & forest
Myotis lucifugus	Little Brown Myotis	Bats	S3	Generalist
Myotis septentrionalis	Northern Myotis	Bats	S2	Riparian & mixed forest
Anthus spragueii	Sprague's Pipit	Pipits	S3B	Grasslands
Aquila chrysaetos	Golden Eagle	Hawks / Kites / Eagles	S3	Grasslands
Ardea herodias	Great Blue Heron	Bitterns, Egrets, Herons	S3	Riparian forest
Calcarius ornatus	Chestnut-collared Longspur	Longspurs, Snow Buntings	S2B	Grasslands
Catharus fuscescens	Veery	Thrushes	S3B	Riparian forest
Centronyx bairdii	Baird's Sparrow	New World Sparrows	S3B	Grasslands
Charadrius melodus	Piping Plover	Plovers	S2B	Lakes & river shorelines
Coccyzus americanus	Yellow-billed Cuckoo	Cuckoos	S3B	Prairie riparian forest
Coccyzus erythropthalmus	Black-billed Cuckoo	Cuckoos	S3B	Riparian forest
Dolichonyx oryzivorus	Bobolink	Blackbirds	S3B	Moist grasslands
Grus americana	Whooping Crane	Cranes	S1M	Wetlands
Lanius ludovicianus	Loggerhead Shrike	Shrikes	S3B	Shrubland
Melanerpes erythrocephalus	Red-headed Woodpecker	Woodpeckers	S3B	Riparian forest
Numenius americanus	Long-billed Curlew	Sandpipers	S3B	Grasslands
Oreoscoptes montanus	Sage Thrasher	Thrashers, Mockingbirds, Catbirds	S3B	Sagebrush
Spizella breweri	Brewer's Sparrow	New World Sparrows	S3B	Sagebrush
Sternula antillarum	Least Tern	Gulls / Terns	S1B	Large prairie rivers
Apalone spinifera	Spiny Softshell	Softshell Turtles	S3	Prairie rivers & larger streams
Chelydra serpentina	Snapping Turtle	Snapping Turtles	S3	Prairie rivers & streams
Heterodon nasicus	Plains Hog-nosed Snake	Colubrid Snakes	S2	Friable soils
Phrynosoma hernandesi	Greater Short-horned Lizard	Sagebush / Spiny Lizards	S3	Sandy / gravelly soils
Chrosomus eos	Northern Redbelly Dace	Minnows	S3	Small prairie rivers
Cycleptus elongatus	Blue Sucker	Suckers	S2S3	Large prairie rivers
Etheostoma exile	Iowa Darter	Perches	S3	Small prairie rivers
Lepisosteus platostomus	Shortnose Gar	Gars	S1	Large prairie rivers
Macrhybopsis gelida	Sturgeon Chub	Minnows	S2S3	Large prairie rivers
Macrhybopsis meeki	Sicklefin Chub	Minnows	S1	Large prairie rivers
Margariscus nachtriebi	Northern Pearl Dace	Minnows	S2	Small prairie streams
Polyodon spathula	Paddlefish	Paddlefishes	S2	Large prairie rivers
Sander canadensis	Sauger	Perches	S2	Large prairie rivers
Scaphirhynchus albus	Pallid Sturgeon	Sturgeons	S1	Large prairie rivers
Polygonia progne	Gray Comma	Brush-footed Butterflies	S2	Deciduous& riparian woodland
Stylurus intricatus	Brimstone Clubtail	Clubtail Dragonflies	S1	Large prairie rivers
Homoeoneuria alleni	A Sand-dwelling Mayfly	Oligoneurid Mayflies	S2	Large prairie rivers
Lachlania saskatchewanensis	A Sand-dwelling Mayfly	Oligoneurid Mayflies	S1	Large prairie rivers
Macdunnoa nipawinia	A Sand-dwelling Mayfly	Heptageniid Mayflies	S2	Large prairie rivers

APPENDIX B

B1 Local Working Group Map of Priority Resource Concerns and Target Areas



B2 Locations of West Crane Aquifer Wells

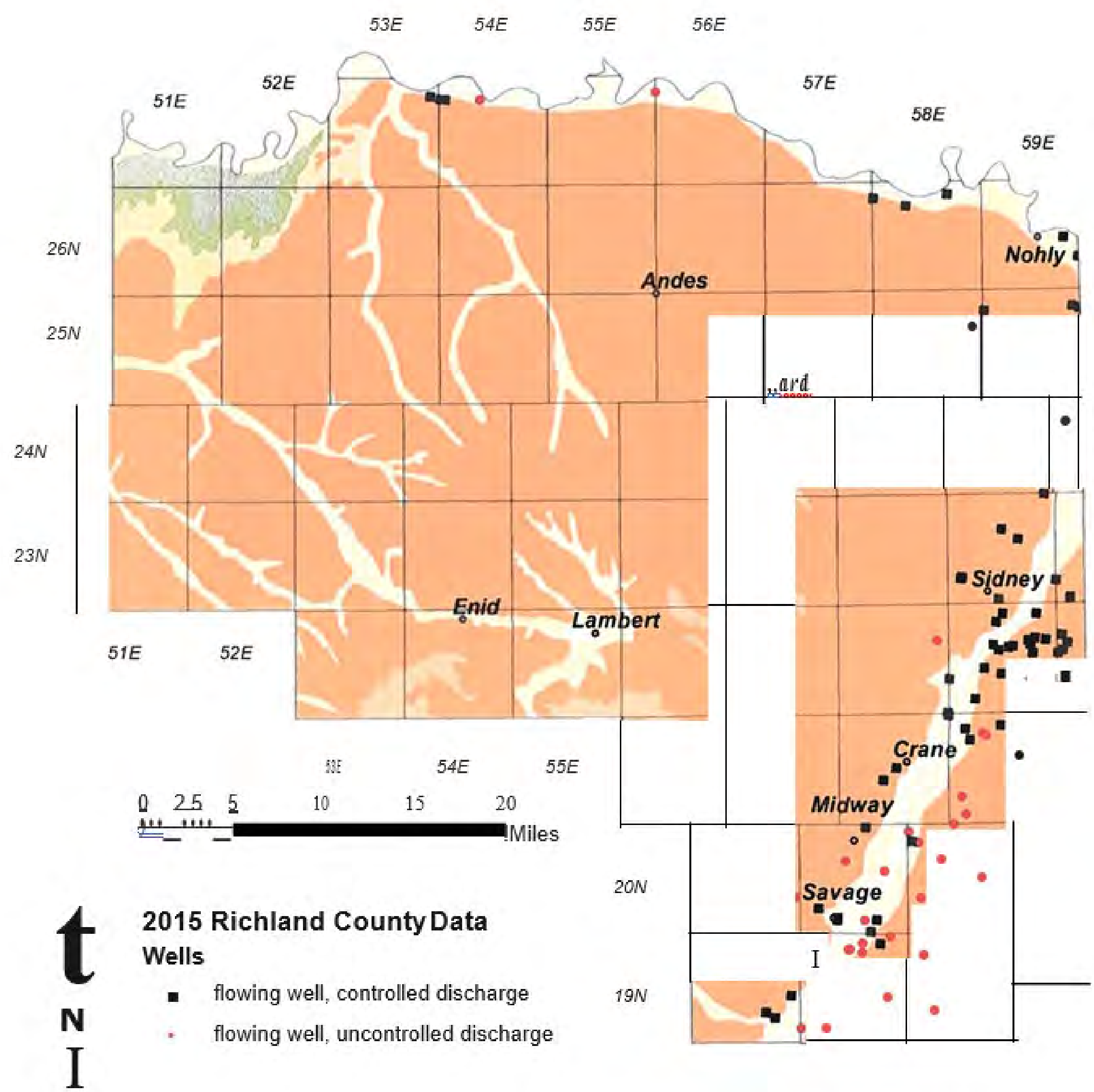


Figure 6: Locations of wells identified as needing remediation for uncontrolled flow. Some of the wells shown as controlled flow need modification to winterize the wellhead to prevent freezing.

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