CHAPTER ONE:

County Profile

Cass County is located in southeastern North Dakota (Figure 1.1) in the Red River valley and what was the lake bottom of glacial Lake Agassiz. The Red River of the North establishes Cass County's eastern border, separating it from Minnesota. The county has a total area of over 1.13 million acres with a maximum dimension of 42 miles north-south by 44 miles east-west. Fargo, located in the eastern portion of the county along the Red River is county seat and largest city with a 2000 Census population over 90,000 residents (U.S. Census Bureau 2004).

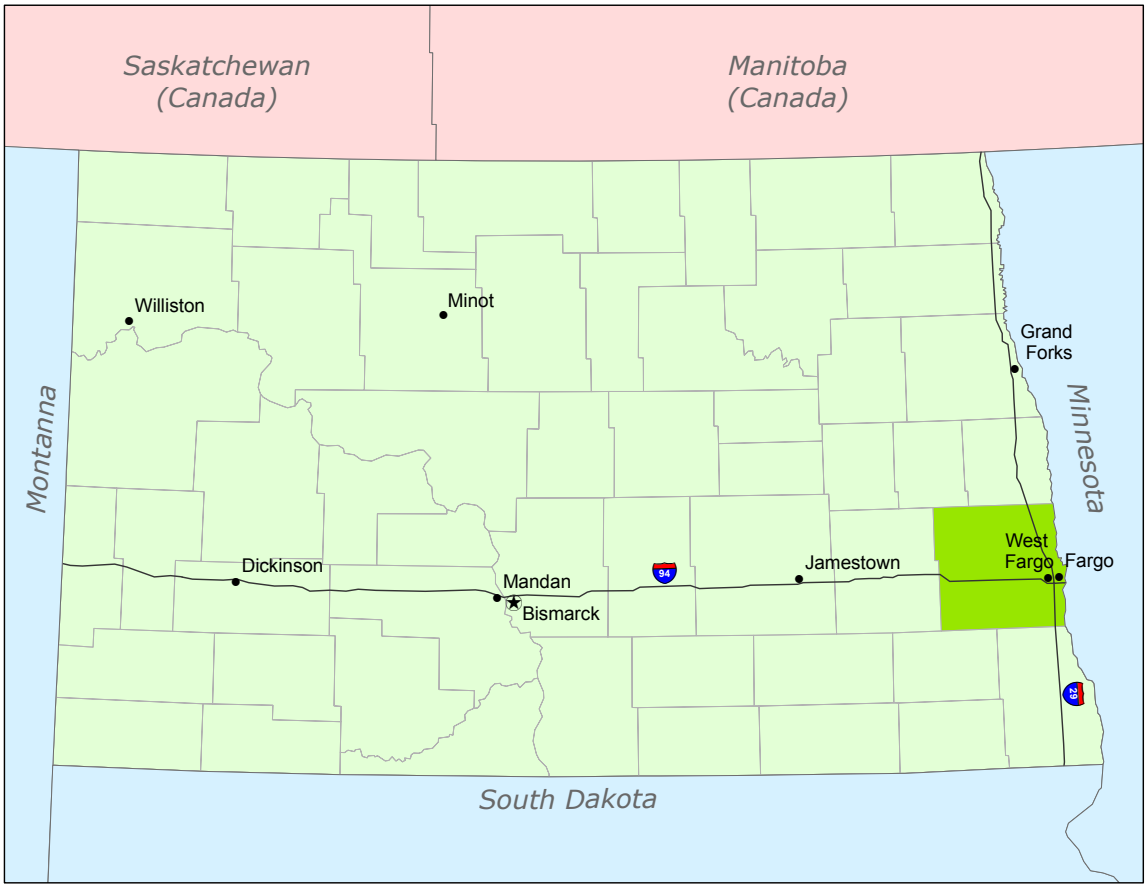

Figure 1.1. Location of Cass County and the major cities of North Dakota.

History and Background

Sisseton and Wahpeton bands of the Sioux Native Americans occupied what is now Cass County. The first European settlers migrating west across North America were fur bearers. As such, the first settler in Cass County, Peter Goodman in 1866 or 1867, was an employee of the Hudson Bay Company. The new pioneers relied heavily on the areas waterways, settling along the Red, Wild Rice, and Sheyenne rivers for sources of wood, water, resources, and transportation. (Commission of Cass County and the Cass County Planning Department 1988).

The area now known as Cass County was originally part of Pembina County which included all of northern Dakota Territory east of the Missouri River. As settlement increased in the area, Pembina County was carved into several smaller counties. Cass County, named after George W. Cass, the President of Northern Pacific Railway, was officially created in 1873, with the first County Commission meeting being held on October 27, 1873 (Commission of Cass County and the Cass County Planning Department 1988).

The expansion of the Northern Pacific Railway crossing in 1871 at what now is Fargo marked the beginning of western development into the county. This expansion brought new settlers which combined with the discovery of the fertile soils of the Red River Valley created large bonanza farming operations. These settlers performed the arduous task of sod busting, exposing the natural soils to seed various small grains; spring wheat provided the areas first cash crop and its success largely responsible for the increased number of settlers into the region (USDA 1983, 1-2). The intensive farming practices of the bonanza farms contributed to the 1930's Dust Bowls and led to soil conversation practices used to prevent the erosion of the fertile topsoil (Commission of Cass County and the Cass County Planning Department 1988).

The increased utilization of the automobile and the expansion and creation of a higher quality road network allowed residents to travel longer distance more rapidly and

reliably. Regional trade centers grew as a result, providing more products and services within relatively short distance to the rural residents (Commission of Cass County and the Cass County Planning Department 1988). As of late, the increased mobility has also allowed the residents of metro area the ability to live in the county's hinterlands and commute to the metro area for work, school, shopping, and recreation.

Climate

Cass County's continental climate contributes to an extreme of temperatures experienced over four distinct seasons. The average annual temperature for Fargo is 41.5° F with an average yearly precipitation of 21.19 inches. The typical average winter temperature is 11.1° F with an average yearly snowfall of 40.0 inches; the actual precipitation is 1.92 inches, accounting for only 9% of the annual precipitation. The typical summer averages 68.5° F and one can expect on average 12 days with a high temperature above 90° F. Summer is also the wettest season, with normal precipitation of 8.91 inches and 23 days of thunderstorms (United States 2002, 7-9).

North Dakota has a relatively short growing season compared to southern states, however long and sunny summer days make up for this briefness. The high latitude contributing to the cold winters also creates daylight lasting as long as 16 hours per day during the summer months. On average, the state experiences more cloudy than clear days, however July and August will generally experience twice as many sunny days. The combination of extended daylight hours and the clear and sunny days during the summer months makes successful agriculture operation possible despite a short growing season (Jenson no date).

Topography

The major geomorphologic feature making up the eastern three-fourths of Cass County is the Red River Valley of North. This valley is a lake plain formed by glacier melt waters of a massive glacial ice lobe which occupied the area some 10,000 to 15,000 years ago. The sediment in the glacier melt formed a flat valley ranging from 15 to 70 miles wide

and is considered some of the richest and most productive farmland in the world (Miller and Frink 1982).

The plain of Lake Agassiz is flat and nearly featureless with a northward slope of 1.5 feet per mile and a eastward slope ranging from 2 feet per mile near the Red River to 20 feet per mile farther west (USDA 1983, 3). At the bottom of the Red River Valley lies the Red River of the North, a northward flowing river beginning in southeastern North Dakota and eventually draining into Lake Winnipeg in Canada (United States 2002).

Geology

The Pleistocene Epoch, which occurred between 10,000 and 1.6 million years ago, was a period of intense cold. Throughout this period glaciers repeatedly passed across North America bringing tremendous ecological and topological changes. During this time ice sheets advanced over the area, as these glaciers retreated a portion in eastern North Dakota was blocked and formed Glacial Lake Agassiz as it melted (Commission of Cass County and the Cass County Planning Department 1988).

The eastern two-thirds of the county is the flat plain formed by the sedimentation of the Lake Agassiz. Two types of sediments are present in this area, silt and clay, which sit atop the till and associated glacial and stream deposits. Beach ridges and deltas are the principle relief features of this area; a locale containing some of the most fertile soils in the nation (Commission of Cass County and the Cass County Planning Department 1988).

The western one-third of the county to the east of the lake plain is an area descriptively referred to as the "Drift Prairie." This plains area is modified by slightly eroded glacial drift forming low and relatively rough hills and gentle rolling topography. These features, the result of the retreating ice sheets are also the location of the majority of the county's wetlands (Commission of Cass County and the Cass County Planning Department, 1988) (Figure 1.2).

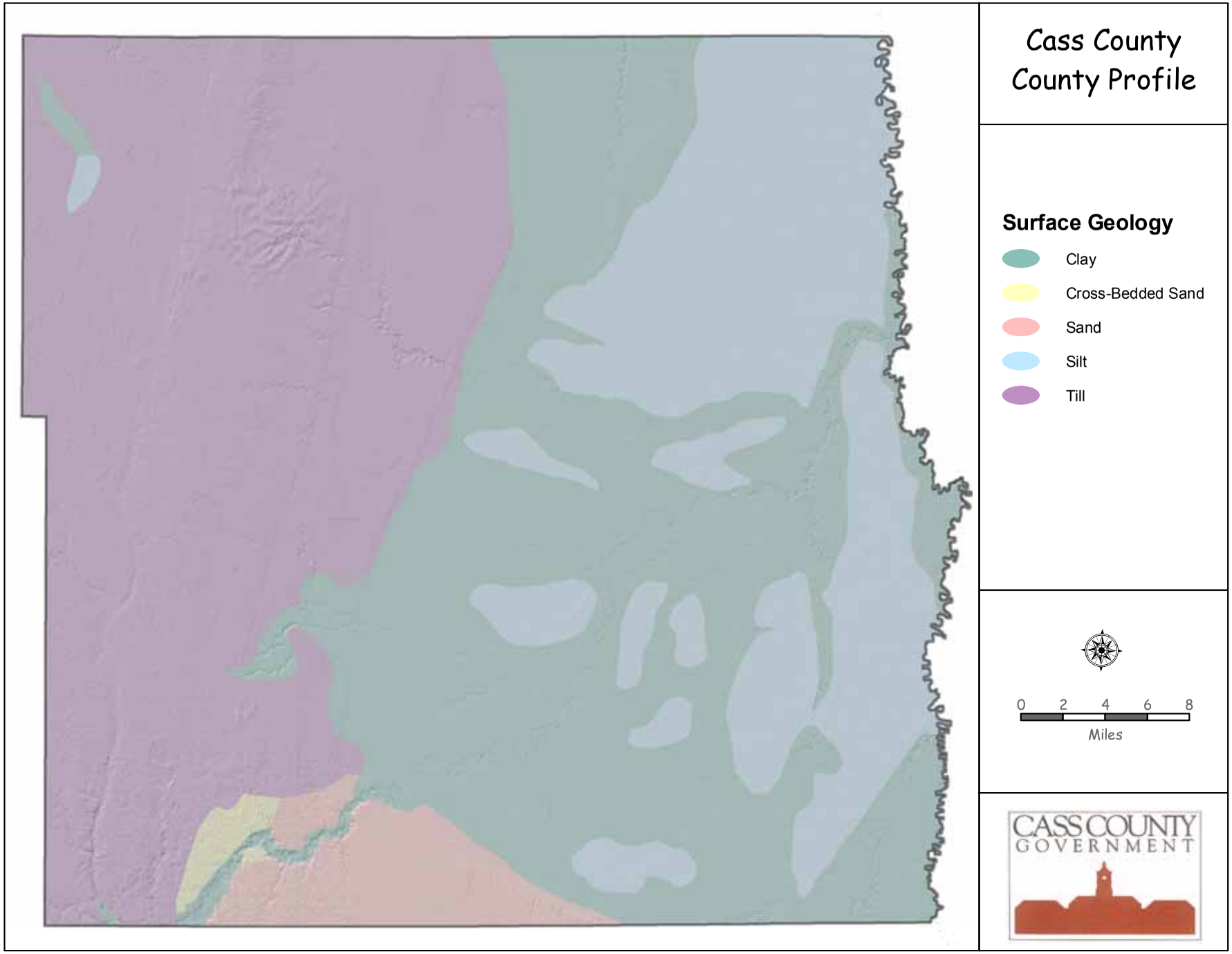

Figure 1.2. The general geology of Cass County.

Soils

The Soil Conservation Service's *Soil Survey of Cass County, North Dakota* describes the types, locations, and characteristics of the county's soils. This information is helpful when planning the logical location for development based on the intended land use. The soil survey provides the suitability, limitations, and management of the soils for specified uses; included in this information is the steepness, length, and shape of slopes, drainage, crop types and native plant species, and the types of bedrock (U.S. Department of Agriculture 1983).

The *Soil Survey of Cass County, North Dakota* breaks the soils into six categories: order, suborder, great groups, subgroup, family, and series. Cass County has 41 (Appendix A) different series (Figure 1.3), these series consisting of soils having similar horizons in their profile (Figure 1.4) which are similar in color, texture, structure, reaction, consistency, mineral and chemical composition, and arrangement (U.S. Department of Agriculture 1983).

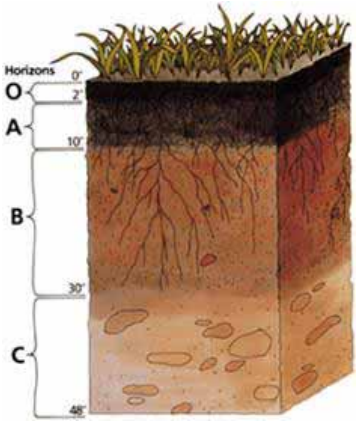

Figure 1.4. Profile of soil horizons (NRCS 2004).

While the sediment in the melt waters of Lake Agassiz produced some of the richest farmland in the world it also created underlying soils having poor construction conditions for the majority of the county. The soils high shrink-swell properties and plasticity can lead to foundation shifting, pavement failure, and bank slippage and the soils ability to expand from the absorption of water effectively degenerates its strength capability (Figure 1.5). These soils are highly susceptible to failure in locations where they are unconfined, most commonly on the slopes along rivers one will find evidence of slump, flow, creep, and earthflow. The added weight of structures, added fill or rip-rap, irrigated lawns, septic drain fields beneath the slopes, and removal of natural vegetation all compounds the natural soil stability problems (Schwert 2003).

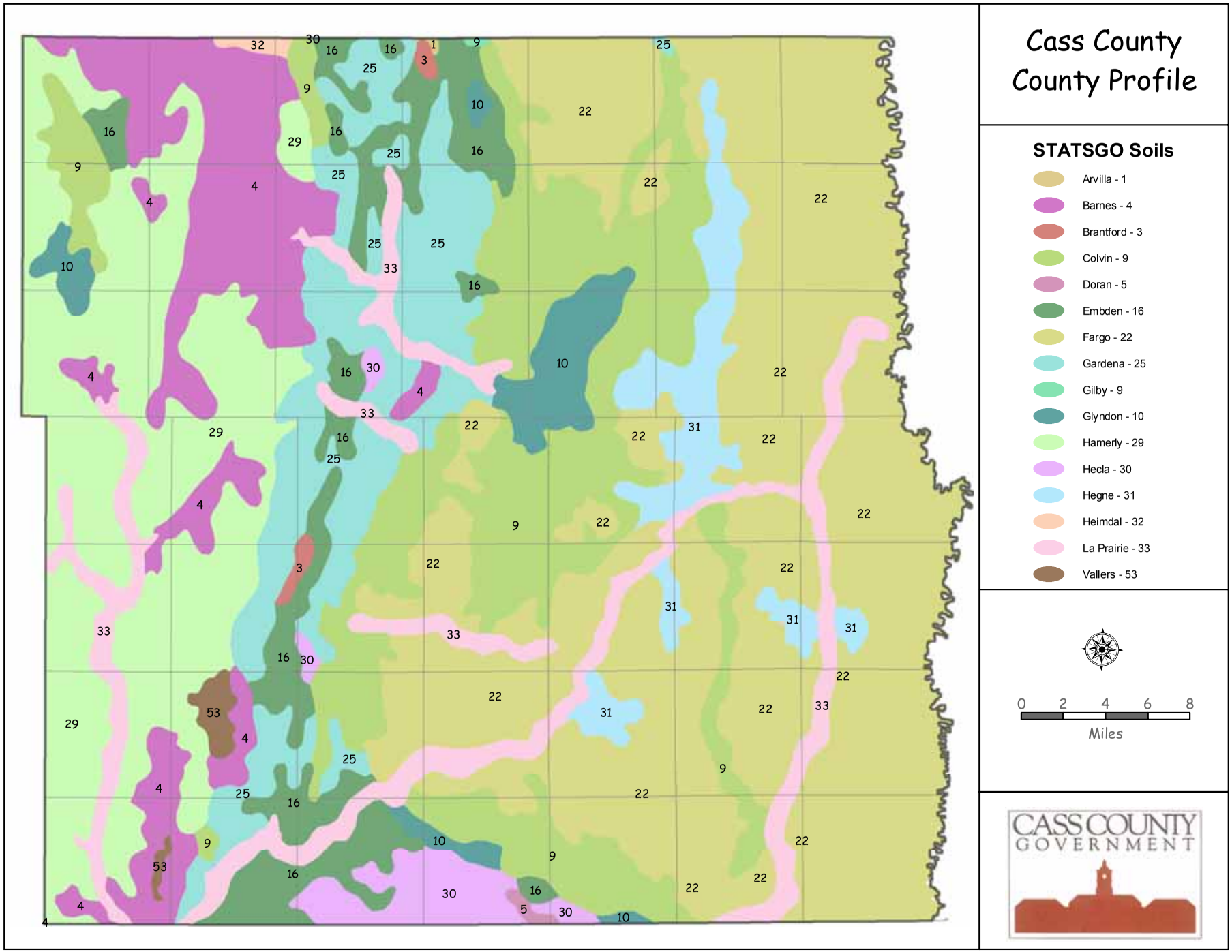

Figure 1.3. Cass County State Soil Geographic (STATSGO) soil survey.

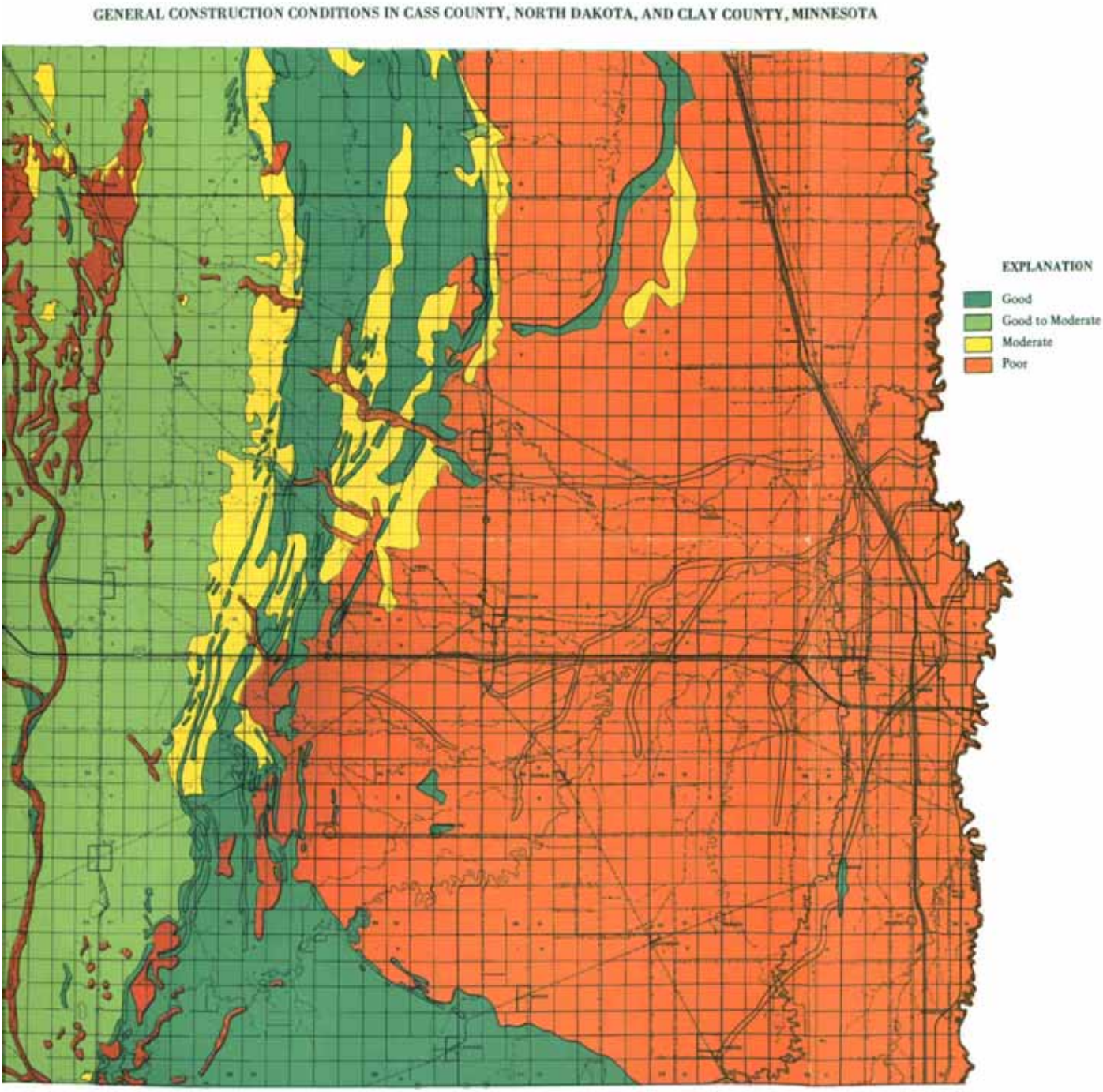

Figure 1.5. General construction conditions in Cass County (adapted from Arndt and Moran 1974).

Minerals

The majority of minerals found in Cass County are sand and gravel, small deposits of glacial boulders and brick clay also exists. Theses limited deposits of sand, gravel, and boulders are located along the beach ridges in the west central portion of the county, while the brick clay deposits are in the eastern portion. The sand and gravel are used mainly for construction of roads and highways; the limited amount of this resource results in its production being a small fraction of the county's economy. There are no known commercial quantities of gas or oil and the county has no other know deposits of minerals (Commission of Cass County and the Cass County Planning Department, 1988).

Water

Rivers

Five rivers comprise the major components of Cass County's surface drainage systems: Red River of the North, Sheyenne, Maple, Rush, and Wild Rice (Figure 1.6). These rivers play an important role in irrigation, recreation, and municipal water supply. General flow characteristics and drainage basin area figures for these rivers are presented in Table 1.1. The large variation between the mean and the maximum river flows indicates potential flooding issues are present in the county. The flat nature of the Red River valley, the minimal gradient of the rivers, and northerly flow of the Red River make the area prone to extensive flooding during the spring melt.

River	Flow (feet^3/sec)		Basin Area (miles^2)
	Mean	Max	
Red River	680	28,000	1,750
Sheyenne	201	11,000	1,295
Maple River	227	7,150	900

Table 1.1. Stream flows of Cass County's rivers (USGS 2004).

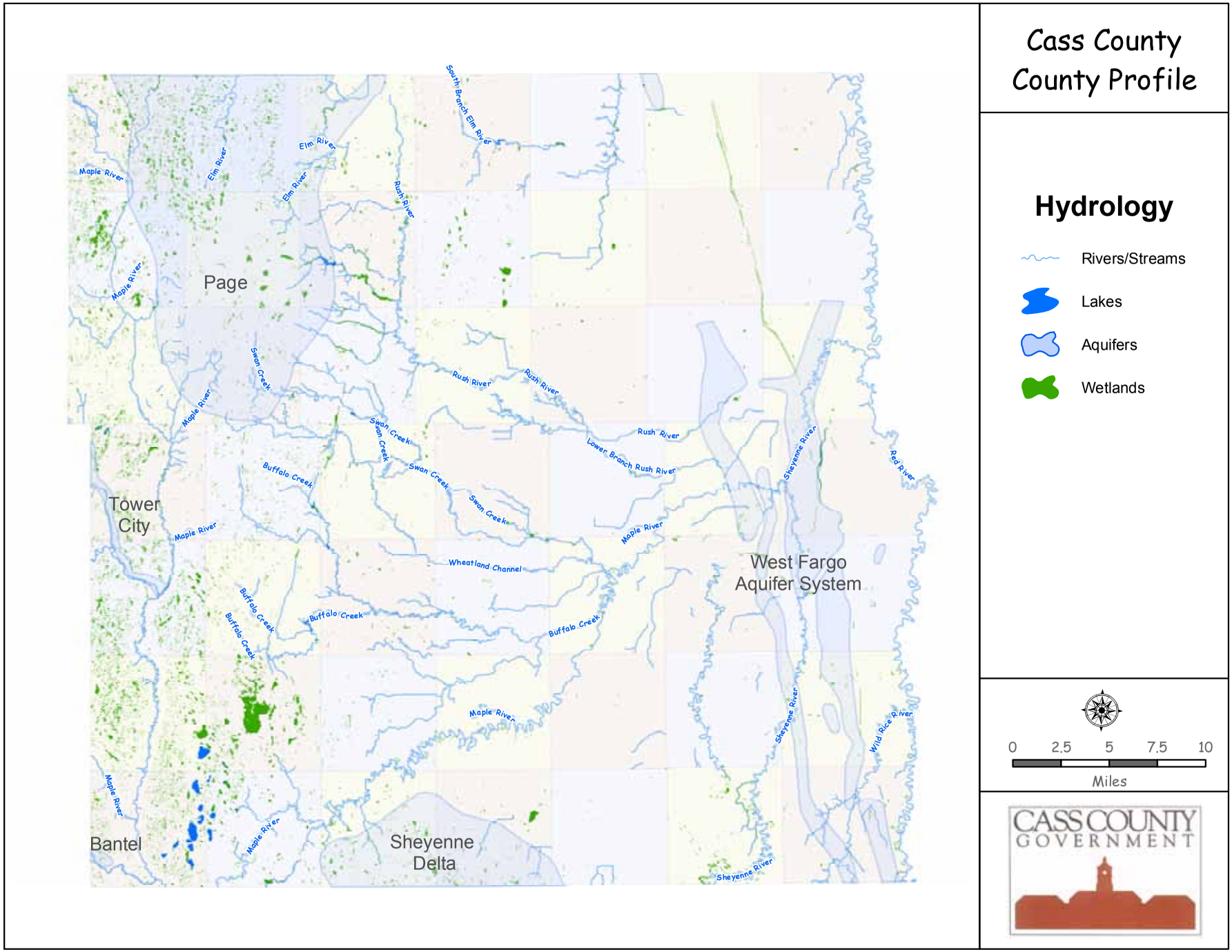

Figure 1.6. Cass County's rivers, streams, lakes, wetlands, and aquifers.

Flooding

The regional drainage of the Glacial Lake Agassiz's water some 9,000 years ago created what is now known as the Red River Valley. This valley is one of the youngest geological features of the lower 48 states, dating thousands instead of tens of million years old, and is one of the flattest regions on earth. As a result, the river is still forming its river valley; a valley that has yet to carve out a significant flood plain to hold in high waters. The lack of a significant valley makes the actual floodplain for the Red River the flat expanse of the Lake Agassiz's lake plain, allowing flood waters to cover considerable areas (Figure 1.7) (Schwert 2003).

Compounding the topographic features causing flooding is spring thawing, ice jams, and a lack of gradient as the river moves downstream. The Red Rivers northerly flow and the spring thaw in the region progressing northward along the valley results in the southern valleys snow melt merging with fresh runoff as it moves north increasing the total amount of water in the river. Furthermore, the rivers inconsistent thaw can cause ice jams as large broken pieces of ice moves north reaching impassable frozen sections of the river creating ice dams retaining the water upstream. Finally, as the river moves north its gradient also decreases, this decreasing gradient causing the river to pool upstream (Schwert 2003).

While the geological formations of the Red River Valley and its potential for flooding can not be changed and flooding on already established neighborhoods and developments can only be lessened with substantial financial investments, if it all, it is still possible to lessen the damage of floods for new developments by taking a proactive approach, "Often the most efficient approach to resolving a geological problem is to avoid the problem in the fist place" (Schwert 2003, 14). Using a proactive planning approach will not fix past mistakes, but can help to eliminate or lessen burdens created by flooding for future development. Allowing development in flood prone areas by infilling or diking not only puts these structures at risk for flooding, but also reduces natural storage area and creates bottlenecks in the flow of the river. Restricting growth in these

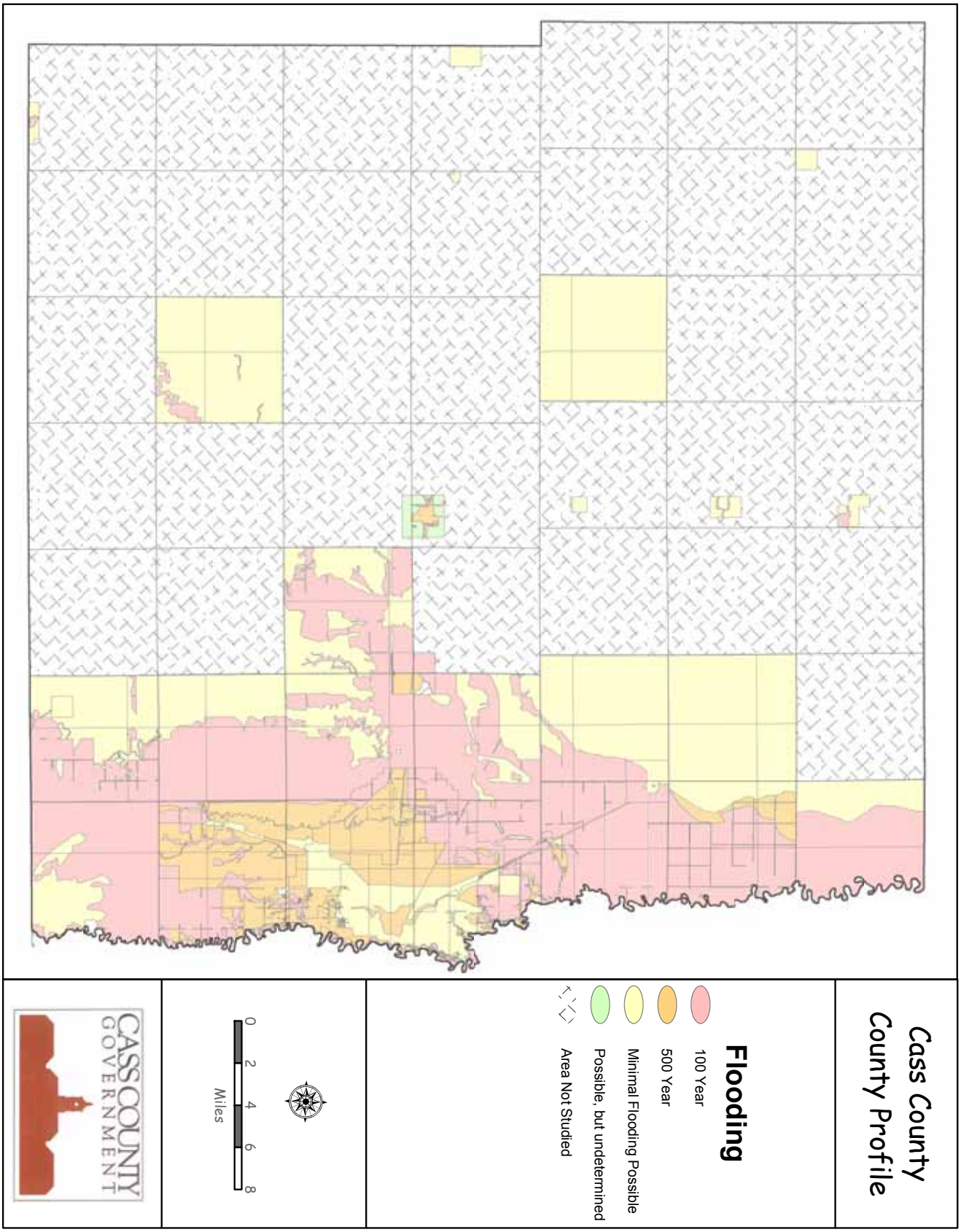

Figure 1.7. Location of Cass County's flood prone areas (FEMA Q3 Digital Data).

natural low lying areas creates a natural storage area for high waters and the lack of structures permits unobstructed flow.

The relatively infrequent flooding in the valley can tend to cause citizens to believe major flooding in the Red River Valley is a random occurrence which statistically should not have happened or expected to occur again, but with greater examination reveals the Red River Valley has many characteristics ideal for flooding (Schwert 2003). Unfortunately, the county will likely be impacted by flooding in the future, making it only a question of when, not if, flooding will occur.

Lakes, Reservoirs, and Wetlands

Cass County has 32 lakes found mostly in the west and southwest averaging 42 acres in size and 10 artificially created lakes averaging 36 acres in size. These lakes and reservoirs provide flood protection, irrigation, and recreation. The remaining sources of surface water found in the county are wetlands; which are valuable for surface and subsurface water storage, nutrient cycling, retention of sedimentation, and plant and animal habitats. The fertile soils found in wetland areas make them productive areas for farming and resulted in drainage and removal of many acres of wetlands; many of these wetlands are now protected by federal and state laws. According to the National Wetlands Inventory, Cass County has 21,036 acres of wetlands (excluding lakes and rivers); of this area 7,693 acres are permanently or semi-permanently flooded (Figure 1.6).

Aquifers

The county has several larger aquifers being utilized to varying degrees which possess limited additional development possibility. These aquifers include the West Fargo Aquifer System (WFAS), the Page Aquifer, and the Sheyenne Delta Aquifer (Figure 1.6).

The West Fargo Aquifer System is made of multiple loosely related aquifer units located in the Fargo metro area from Argusville through West Fargo down to the Wild Rice (Ripley 2000), roughly the same areas experiencing high growth during recent years. These nine aquifer units share similar characteristics and are loosely connected; meaning changes in one unit could likely be somewhat transmitted to the other units. The individual channels of the WFAS were created during different times of glacial melting traveling through the valley that predated the Red River Valley as we know it. As a result, this aquifer system is covered by glacial lake clays of the bottom of Lake Agassiz; these clays inhibiting seepage of surface water into the aquifer to recharge water levels (Ripley 2004).

Recharge of an aquifer is limited to the snowmelt and rainfall seeping through the ground down to the aquifer. In the case of the WFAS, the 60 to 90 feet of lake clays above the aquifer limits any recharge. This is a benefit in reducing contamination, but results in an aquifer with a finite amount of water (Ripley 2004). The profile of the water in the WFAS indicates the majority of the water has characteristics of cold water precipitation, rather than mixture of cold and warm water precipitation. The fact that the area only receives a small portion of precipitation in the form of snow indicates the water in the WFAS dates back to the cold water trapped during the glacial melts, meaning little apparent modern day recharge has occurred (Ripley 2000).

The declining levels in the WFAS's finite amount of water suggest little potential for new users to aquifer. The WFAS has experienced some of the largest water declines in the area; as a result, proper planning of new development will need to find other sources of water and in the future current users of the system will likely need to find alternative water sources.

The Page Aquifer is another significant aquifer which is located in the northwest portion of the county and extends into Traill and Steele counties (Ripley 2004). This aquifer was primarily used as municipal water supply for the town of Page and since 1976 15,000 acres of land have been supplied water for irrigation from the Page Aquifer (Arndt and

Moran 1974, Ripley 2004). This aquifer has received significant recharge since 1993 following the droughts of the 1980s and is considered imbalanced with recharge and managed as a sustainable resource, which may allow for some additional water to new users (Ripley 2004).

The Sheyenne Delta Aquifer is a large and substantial aquifer located in southern Cass, northern Richland, northeastern Sargent, and eastern Ransom counties. While this is a large aquifer, the majority of it is located outside the county, limiting its usefulness for Cass County (Ripley 2004).

Cass County also has smaller and less significant aquifers having lower potential and water output, with some more greatly affected by climatic extremes. Included in this group are the Tower, Bantel, and Dakota aquifers (Arndt and Moran 1974, Ripley 2000, Ripley 2004).

The Tower Aquifer located in western Cass County supplies the water needs of Tower City. This shallow aquifer is very vulnerable to climatic extremes and experienced declining water levels during the 1980s and early 1990s drought conditions. Since 1993, the aquifer has begun a period of recharge, but its small size limits its usefulness to supplying only the current water requirements of Tower City (Ripley 2004).

The Bantel Aquifers use has been limited to domestic and stock wells in southwest corner of Cass County. This aquifer is capable of recharge and should have increased levels as a result of the current wet cycle (Arndt and Moran 1974, Ripley 2004).

The Dakota Aquifer is the deepest aquifer in Cass County, with some wells in western portion of the county descending 800 feet, covering areas from the eastern to western borders of Cass County. The water in this aquifer contains high amounts saline and mineralization, deterring its use, except for limited applications for watering stock (Arndt and Moran 1974).

The data points to the fact that the use of groundwater in Cass County is limited to the current users and currently used aquifers, with only the Page Aquifer appearing to have limited potential for new users in certain geographical areas. Either the aquifers are being used at or near capacity or not being utilized because they are too small, too deep, or poor water quality; all of which will not change. The WFAS is unique in that the area it is located is expected to witness continued growth and the lack of recharge results in a finite amount of water. This will demand proper planning to protect the current resource as well as determining sources for future development. It should be noted that during the last 15 years of increased growth experienced by Fargo and West Fargo has also been during a wet cycle. The increased amount of precipitation has reduced the demands on the ground and surface water needed by the area and it should be expected these demands will only increase with the greater populations and during times of drought conditions.

Flora and Fauna

The natural environment of Cass County and the Red River valley has changed significantly since the 1880s. The region was dominated by long prairie grass and almost no natural woodlands or trees. This natural ground cover provided habitat for many animals no longer present in the area, such as bison, elk, prairie dogs, wolves, grizzly and black bears. The increased development and removal of natural vegetation has reduced the habitats and populations of many animals. The long prairie grasses and their deep roots also prevented erosion and runoff resulting in a fraction of the sedimentation currently found in the river systems. The increased sedimentation in the county's rivers has altered the riverain flora and fauna from what was found by the original settlers.

The endless "seas of grass" first welcoming settlers in the late 19th century were quickly sod busted to reveal some of the richest farmland in the world. What was once endless miles of long prairie grass are now replaced by crops, shelter belts, farmsteads, and urban development. Many of the natural prairie potholes providing habitats for many plants and animals have also been drained and filled to provide land for agricultural and

residential uses. As a result of these changes, several flora and fauna in the county are now listed as endangered, threatened, or candidate species.

Based on the current information from the U.S. Fish and Wildlife Service, there are currently three species in the Threatened or Endangered categories, protected by the Endangered Species Act of 1973, with a likelihood of occurring in Cass County. These three birds are the Bald Eagle, Whooping Crane, and Peregrine Falcon which all have their migratory range within the county. In addition to these three birds, the county also has nine other plants and animals species that were former candidates for the list and currently a concern for species management. This includes the Western Burrowing Owl (bird), Black Tern (bird), Northern Goshawk (bird), Loggerhead Shrike (bird), Ferruginous Hawk (bird), Greater Redhorse (fish),Wolf's Spike-Rush (plant), Regal Fritillary (butterfly), and Elktoe (mollusk) (US Fish and Wildlife Service 1995).

Cass County is also located within the Central Flyway, the corridor used semi-annually by waterfowl between their breeding and wintering grounds (Figure 1.6). Ten states, two provinces, and one territory make up the Central Flyway; the wetlands, river systems, lakes, and vegetation along this corridor are used as the birds move between their breeding grounds in the north and the wintering grounds in the south. The marshlands and wetlands found in Cass County created by the natural prairie potholes provide ideal habitats for these migrating birds (Figure 1.8). Waterfowl numbers have been greatly reduced since early settlement of North America from the drainage of these types of marshlands for developments (Central Flyway Waterfowl Council 1994).

Figure 1.8. Location and members of the Central Flyway (Central Flyway Waterfowl Council 1994).

Due to scarcity of wildlife habitat in Cass County, land use decisions affecting wildlife habitat must be made with great care. Management of land use is crucial to the survival and diversity of wildlife within the county and the citizens will need to determine the role of wildlife will play in the county's future and plan in accordance to these goals.