2009
State Water Management Plan

North Dakota State Water Commission

2009 State Water Management Plan

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A MESSAGE FROM THE STATE ENGINEER

I am pleased to present the 2009 State Water Management Plan to the citizens of North Dakota. This new plan comes at a time of rapid pace changes across the state. Expansion of energy development and changes in agri-business are creating many business opportunities and new jobs that will help secure the state's prosperity. However, these changes are creating unprecedented demands on our most precious natural resource – water.

North Dakota will be challenged in the future with population shifts, increased oil and gas production, expansion of the alternative fuels industry, new value added agricultural processing, and increased agricultural production. All of which will have a significant impact on our surface and ground water resources. The 2009 State Water Management Plan identifies needs that exist across North Dakota and the infrastructure investments that will be required in the next biennium and the next decade. Investments must be made today to provide quality water supplies as well as relief from flood damages in the future.

While this plan is not a strict blue print it does provide important guidance for decision making at all levels. Our goal is to provide the maximum amount of benefit from North Dakota's water resources to meet today's needs while protecting the resource for future generations.

Now, at the beginning of the 21st Century, we must make wise choices that will create the best possible quality of life for our children and future generations.

Dale L Frink

Dale L. Frink, P.E.
North Dakota State Engineer

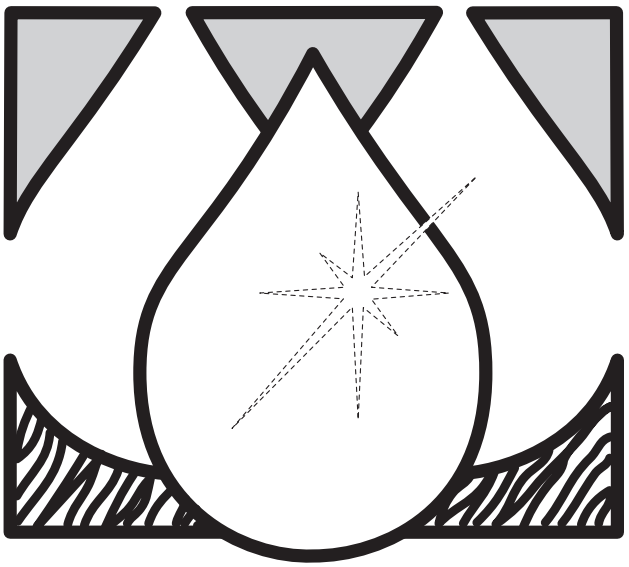
INTRODUCTION

Water is, without question, North Dakota's most precious natural resource. Water is not only critical for life but is required in every human enterprise. North Dakota water law established the foundation for the wise management and development of this precious resource. The State Legislature has given this very important responsibility to the State Water Commission (SWC or Commission). It is the responsibility of the Commission to develop, protect, and conserve the state's water resources for the benefit of current and future generations of North Dakotans. Part of this responsibility involves facing water resource management challenges with thoughtful insight, determination, and persistence; yet always being mindful of the necessity of the sound stewardship of our most treasured resource. . . water!

Authority and Background

The Commission is required by virtue of the North Dakota Century Code, Section 61-01-26 and Section 61-02-14 to develop and maintain a comprehensive water plan for the sound management of North Dakota's water resources.

Over the years, numerous state water management plans have been developed by the Commission to identify statewide water resource management and development project needs and funding required for implementation. The most recent comprehensive plan was completed in 1999.



Since 1999, the State Water Management Plan has been updated with supplements every biennium with Water Development Reports published prior to the Legislative Assemblies. The reports serve to assist the Legislature in the decision-making process in appropriating funds for water management and development. This new document will also serve to provide useful information to the 61st Legislative Assembly.

Water planning and management is a dynamic process and maintaining flexibility in the process is essential. Water resource managers and decision-makers must be able to respond and modify projects and programs when circumstances and situations change. It is important that the plan is not considered a map or blueprint that can only be followed step by step. Rather it is a reference tool, to be used as a guide in water resource management and development. The plan must be flexible and must respond to changing needs and challenges such as natural disasters, emergency repairs, funding, or permitting obstacles.

Purpose

The purpose of the 2009 State Water Management Plan is to: 1) provide information regarding current and projected water use; 2) iden-

tify areas where water is generally available for new beneficial uses; 3) identify goals and objectives for water resource management and development; 4) identify potential water resource management and development projects and programs; 5) provide current information regarding North Dakota's revenue sources for water resource management and development; 6) serve as a formal request for funding from the Resources Trust Fund; and 7) broadly identify water resource management and development opportunities and challenges, and provide recommendations to address them.

One of the most important components of this plan is identifying where water may be available for new development and use. The State Engineer appropriates water for beneficial use in North Dakota. Some aquifers and streams in North Dakota are on the brink of becoming fully appropriated; meaning that much of the state's available water resources have already been permitted for municipal, agricultural, industrial, and recreational purposes. This report will provide general information and assist development interests in identifying potential water sources when locating facilities. It will assist development interests in the very early planning stages of project development. Thus avoiding unnecessary expense and delay in project implementation. Developers should determine early in the planning process that a reliable, quality water source is available close to their proposed project facility. In areas of short supply, the Commission should be contacted early in the planning stages of project development to obtain more detailed information regarding the availability of water in a specific area.

Plan Methodology

The 2009 State Water Management Plan addresses a myriad of water-related management issues and provides a long-term vision for the future of water development in our state. The compilation of information and interests necessary to accurately inventory and plan for future water needs requires a cooperative effort between state, federal, and local interests, and the input and expertise of water stakeholders.

This plan documents contemporary water project needs across North Dakota and is a guide for water development in future biennium. However, it is important to note, that planning for water development is a dynamic process – one that is subject to a variety of influences. As such, a water plan must remain flexible to adjust for unexpected changes, yet provide a clear overall picture of what citizens want the state's future to look like.

Partnerships

Numerous local, state, federal, and non-governmental entities often collaborate through partnerships with the Commission in efforts to resolve the state's water resource management and development problems and issues. The Commission is committed to pursuing partnerships that will use and protect water resources for North Dakota citizens, not only for today, but also for future generations.

As has been the case in the past, many challenges will face the state in the future and North Dakotans must work together to overcome obstacles that will prevent us from realizing benefits from North Dakota's water resources for its citizens. This plan is a tool that will assist us in achieving our goals.

GOALS AND OBJECTIVES

The purpose of the following goals and objectives is to more clearly define where North Dakota's long-term water management and development efforts will be directed in the future. By pursuing and implementing these goals and objectives, North Dakota will meet many of the currently unmet water management and development needs across the state.

GOAL:
To regulate the use of water resources for the future welfare and prosperity of the people of North Dakota.

OBJECTIVES:

- Encourage the most efficient use of water by all users.
- Appropriate water resources with consideration of its availability and impacts to exiting permit holders.
- Maintain comprehensive water rights records to ensure that appropriations are based on the best available information.

GOAL:
To develop water resources for the future welfare and prosperity of the people of North Dakota.

OBJECTIVES:

- Implement the Dakota Water Resources Act of 2000 to meet water supply needs of people throughout North Dakota.
- Complete the Northwest Area Water Supply, the Southwest Pipeline, the Red River Valley Water Supply, and other water distribution systems.
- Support the development of structural flood control projects in communities, where appropriate.
- Support the development of ring dikes for farmstead protection.
- Support irrigation development to encourage growth and diversification in the agricultural industry.
- Develop systems to provide sufficient quantities of Missouri River water to meet North Dakota's future demands, and secure water rights to protect those uses.
- Develop small dams where appropriate to retain water for use in times of scarcity.
- Support development of riparian buffer zones where applicable.
- Assist communities and rural water associations in funding and developing water supplies.

GOAL:
To manage water resources for the future welfare and prosperity of the people of North Dakota.

OBJECTIVES:

- Recognize long-term sustainable use of available water resources.
- Encourage best land management practices.
- Coordinate with and assist other state agencies in the protection of water quality.
- Assist the ND Department of Health (Department of Health) in monitoring water quality and wellhead protection.
- Support increased monitoring of water quality to detect pollution sources.
- Encourage and implement a balance of structural and non-structural techniques for reducing flood damages.
- Ensure all cloud seeding projects are conducted in a scientifically sound and environmentally safe manner.
- Develop/refine watershed models and techniques.
- Encourage and assist with the development of a comprehensive state drought mitigation plan.
- Maintain channel flow capacity of rivers and streams.
- Coordinate bank stabilization efforts on public lands.
- Coordinate with federal, state, and local entities to reduce high sediment loads on the Missouri River and other river systems.
- Encourage the recognition of downstream environmental and economic effects of flooding through more comprehensive floodplain management planning.

• Encourage the cosideration of water quality in floodplain management and emergency planning.

• Assist communities with technical evaluations of potential floodplain development.

• Improve coordination and communication between state agencies and local entities to improve management of rural flood control issues.

• Coordinate the development of new Digital Flood Insurance Rate Maps (DFIRMS).

GOAL:
To educate the public regarding the nature and occurrence of North Dakota's water resources.

OBJECTIVES:

• Continue support of the Water Education for Teachers (WET) program.

• Continue public information/education regarding our atmosphere and how it works, and the capabilities and limitations of cloud seeding.

• Encourage floodplain management efforts in counties and communities.

• Provide incentives through voluntary education programs to encourage private landowners to maintain or enhance environmental quality.

• Enhance public information/education programs on floodplain management.

• Improve training opportunities for floodplain managers.

• Encourage the implementation of land treatment methods to help control runoff during spring snowmelts.

• Encourage communities and counties to enroll in the National Flood Insurance Program.

• Encourage public knowledge concerning the location of floodways.

• Encourage reuse, reclamation, and conservation of water.

• Continue public information/education programs on irrigation opportunities.

• Encourage research, best management practices, and high-tech agricultural practices for more efficient application of agricultural chemicals and fertilizers.

• Improve public information/education efforts regarding sovereign lands of the State of North Dakota.

• Improve public information/education efforts on tile drainage.

GOAL:
To collect, manage, and distribute information to facilitate improved management of North Dakota's water resources.

OBJECTIVES:

• Evaluate quality and quantity of surface and ground water resources and provide public inventories of water availability.

• Continue and improve the statewide observation well network used to gather water level and water quality data.

• Ensure that adequate records are kept of all cloud seeding operations.

• Continue and improve the statewide growing season precipitation reporting network.

• Continue the dissemination of project weather radar and precipitation data via the Internet.

• Continue to implement the Commission's Web-based Map Service.

• Continue to provide and improve the Commission's Web-based Water Resources Information Management Systems.

• Maintain and improve the existing precipitation monitoring network to aid in flood forecasting.

• Maintain or enlarge the existing stream gauge system, particularly in areas subject to overland flooding and around smaller streams in cooperation with the U.S. Geological Survey.

• Support research to determine how, when, and at what rates water can be applied to various soil types and crops to arrive at long-term cost-effective, efficient use of water.

GOAL:
To conduct research into the processes affecting the hydrologic cycle to improve the management of North Dakota's water resources.

OBJECTIVES:

• Conduct studies of the nature and occurrence of water to optimize its conservation and development throughout the state.

• Evaluate the impacts of cloud seeding on precipitation patterns and the environment.

• Define hail climatology for North Dakota.

• Conduct basic storm research in cooperation with universities and federal agencies.

NORTH DAKOTA WATER RESOURCES

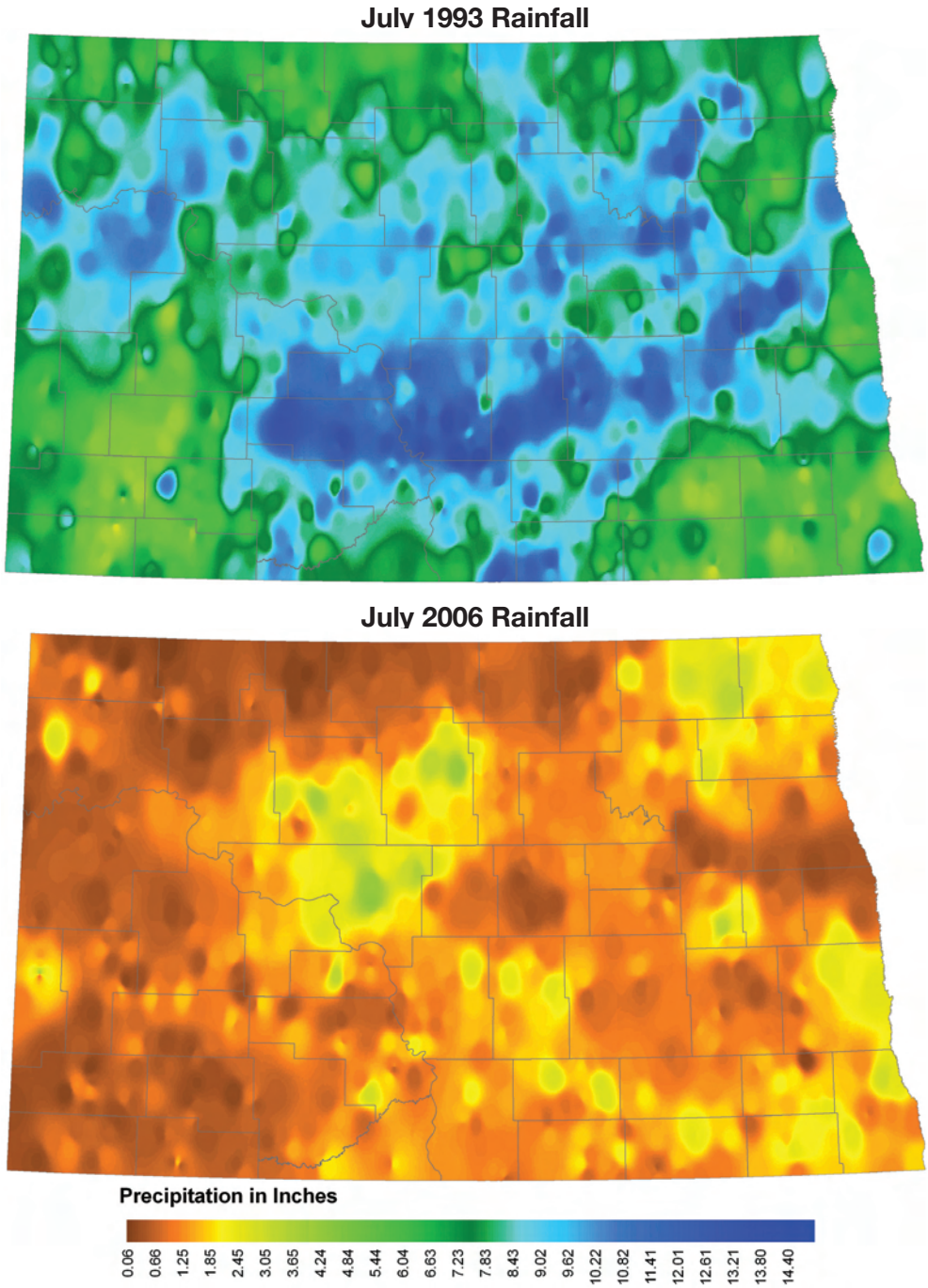
Like most western states, North Dakota faces a variety of water quantity and quality issues. And, the ability to provide an adequate quantity of high quality water for all beneficial uses is vital in securing the economic, social, and environmental future of North Dakota.

The following section outlines the state's water resources and climatic conditions affecting them, and it addresses surface and ground water quality issues, and present and future water use trends.

Climate

Since settlement days, North Dakota has seen extreme weather patterns such as during the "Dirty Thirties" and more recently the extended wet cycle that led to the rise of Devils Lake and the disastrous Red River Valley flood of 1997. Over the last decade, western North Dakota has experienced a prolonged drought, while at the same time the eastern side of the state has seen severe flooding.

North Dakota is located in a region of central North America



North Dakota experiences extremes in precipitation, as shown in these precipitation maps for July of 1993 and July of 2006. (Courtesy NDARB Cooperative Observer Network)

that bridges the divide between "too wet" and "too dry." The 100th Meridian line of longitude roughly splits the state in half. East of this line, there is generally more precipitation in the form of snow and rain, than there is the uptake of water by plants and evaporation.

West of the 100th Meridian, water loss exceeds precipitation. Recent fluctuations in climate have shown that this artificial boundary between wet and dry shifts slightly east or west depending upon larger climatic patterns.

North Dakota's extreme climate is largely driven by air masses from three areas: the Rocky Mountains, where the mountains block much of the Pacific moisture; the polar region, which bring much of our cold weather; and the Gulf of Mexico, which brings much of our precipitation.

In North Dakota, based upon 1971-2000 data, precipitation annual totals vary greatly across the state, with the western portion of the state experiencing an average of 14 inches per year, and the eastern portion seeing as much as 21 inches per year.

Drought

Drought has often been a defining aspect of climate in North Dakota since settlement days, from the many problems caused by the drought in the 1930s, through several shorter dry cycles experienced as recently as 2008. Drought can cause crops to fail, stress municipal water supplies, impact recreation, and make life generally miserable for anyone who makes their living directly or indirectly from the land.

Drought certainly is not new to the region, with the most severe dry periods recorded in the 1930s, and more recently, the 1980s. Studies of isolated lake beds in several places in North Dakota show that extreme fluctuations in the pattern of excessive precipitation and drought are normal.

Studies found that in the case of lakes, a variation between wet cycles and dry cycles have existed for thousands of years. Lakebed records indicate that since the continental glaciers receded, droughts and wet cycles lasting more than 100 years have occurred.

In an "average" year, there is often sufficient precipitation for the various uses that rely upon it. However, historical and paleoclimatological records indicate that there will be periods of time of significant moisture shortage.

Flooding

While droughts are common in the northern Great Plains it is also true that this region experiences wet cycles. Climatologists believe that parts of North Dakota are currently in a wet cycle that began in 1980, which has led to flooding in the Red River Valley and the Devils Lake basin. It is useful to note that although we are believed to be in a long-term wet cycle on the eastern half of the state, mini-droughts can be experienced within that cycle. This has been the case in recent years, with drought afflicting western, and increasingly, eastern North Dakota.

Flooding in the Red River Valley in 1997 was the most severe in recorded history when parts of the Red River Valley experienced a record-breaking 12 feet of snow, followed by a severe ice storm in the spring, and rapid spring melt. These factors, along with ice jams in several key areas, led to the catastrophic flooding that most visibly impacted the city of Grand Forks. It is worth noting that partial records indicate a flood more severe than the 1997 event occurred prior to European settlement.

With regard to the Devils Lake basin, in 1992, many in the state were concerned that the fishery was in imminent danger of dying off due to high salinity related to low lake levels caused by the late 1980s drought. In 1993, all of that changed, and with significant rainfall and snow runoff, the lake began to rise. The rise of Devils Lake has been relentless, with little respite since it began.

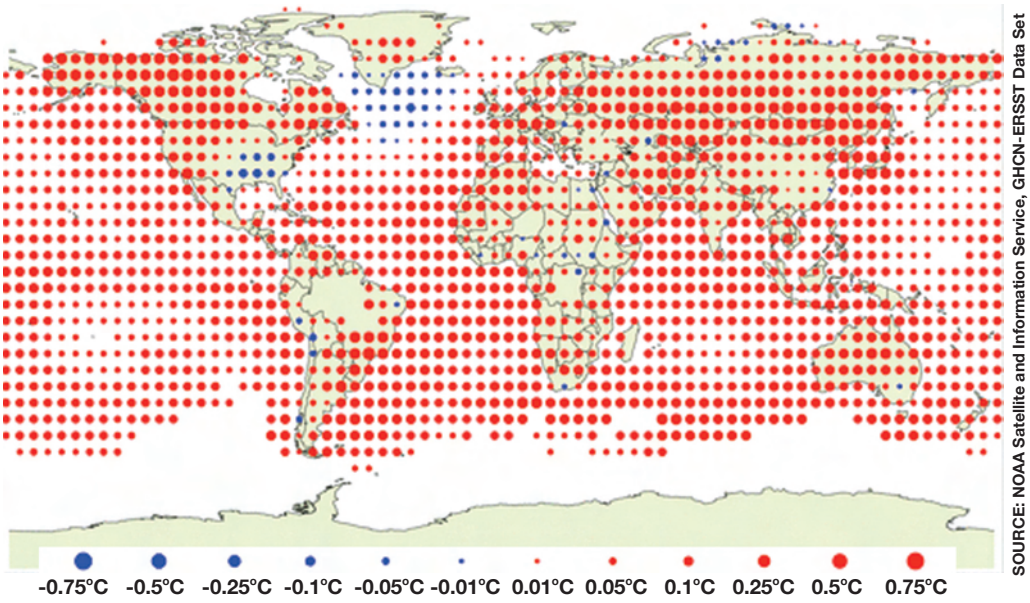
Ironically, while Devils Lake continued to rise in the first half of the last decade, significant areas of the state have been dealing with severe drought.

Climate Trends

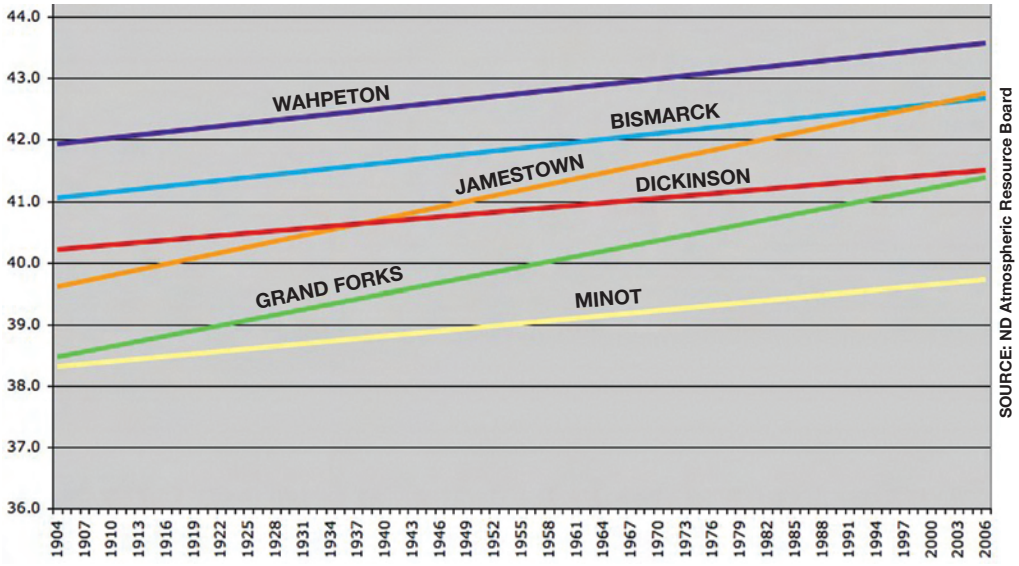
Several studies of lake sediment in North Dakota have demonstrated that the state is subject to long-term climatic variation, alternating between extended wet and dry cycles. Evidence has shown that the state does not really have a "normal" climate. In recent years, portions of North Dakota have been experiencing severe drought, which has led to programs such as the Commission's Drought Disaster Livestock Water Supply Project Assistance Program.

In recent years, climate change and global warming have gained greater attention. While the root causes of climate change, be they natural or human-induced, are still very much under debate, recent data does indicate that global temperatures have increased slightly.

If warming trends continue, it is uncertain what effects North Dakota will experience. Climatological data inferred from lake core samples that provide a picture of climate in the region since the termination of the last ice age indicate that when global temperatures are warmer, North Dakota's climate may not react in a predictable manner.



Annual Global Temperature Trends, 1904-2006
in Degrees Celsius Per Decade

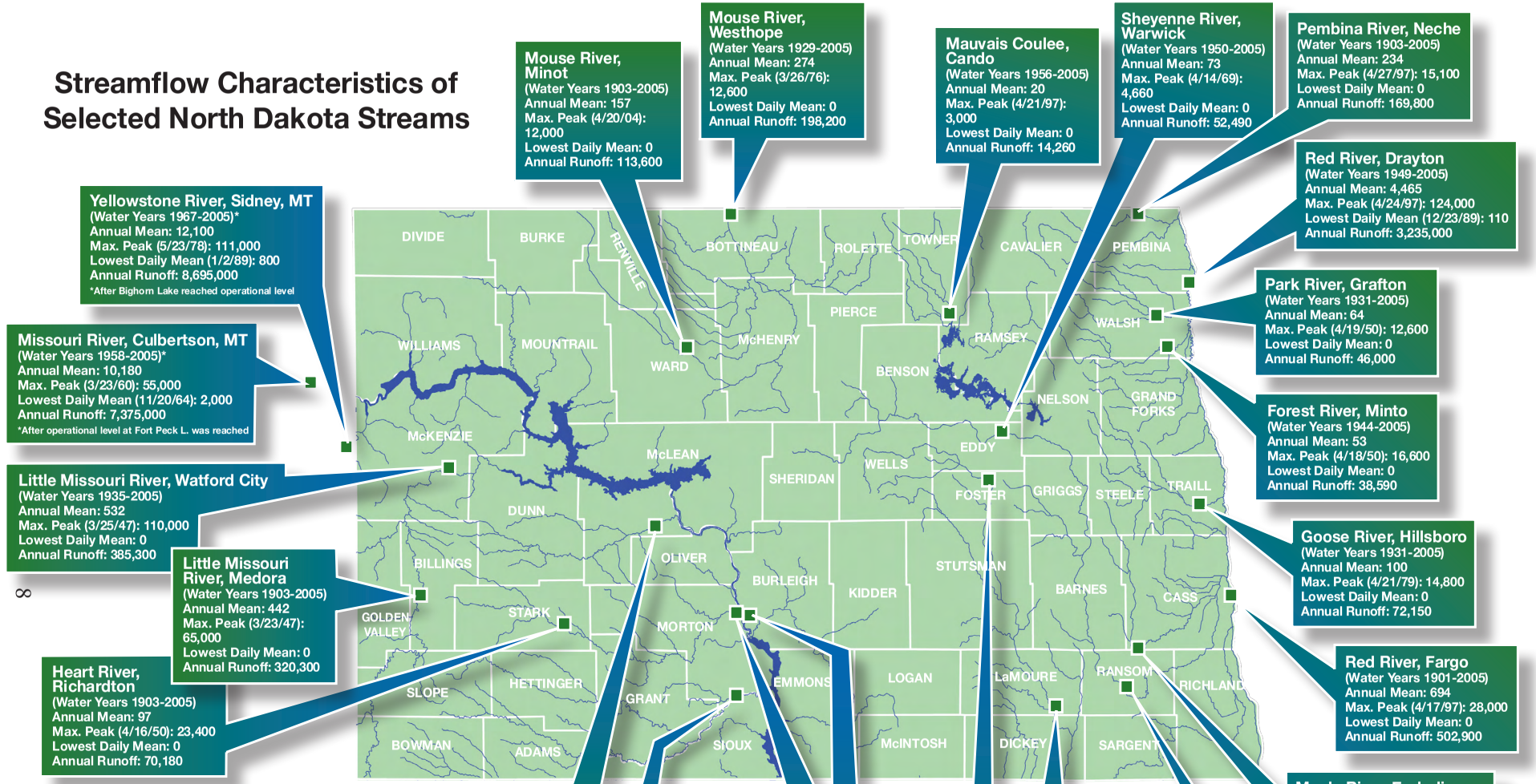


Average Annual Temperature Trends, 1904-2006,
for Six Long-Term Climate Observation Sites in ND
in Degrees Fahrenheit

Surface Water Resources

North Dakota is separated into two major drainage basins by a continental divide running from the northwest to the southeast corners of the state. The northeastern portion of the state falls generally within the Hudson Bay drainage, while the southwestern part is

Streamflow Characteristics of Selected North Dakota Streams



Yellowstone River, Sidney, MT
(Water Years 1967-2005)*
Annual Mean: 12,100
Max. Peak (5/23/78): 111,000
Lowest Daily Mean (1/2/89): 800
Annual Runoff: 8,695,000
*After Bighorn Lake reached operational level

Missouri River, Culbertson, MT
(Water Years 1958-2005)*
Annual Mean: 10,180
Max. Peak (3/23/60): 55,000
Lowest Daily Mean (11/20/64): 2,000
Annual Runoff: 7,375,000
*After operational level at Fort Peck L. was reached

Little Missouri River, Watford City
(Water Years 1935-2005)
Annual Mean: 532
Max. Peak (3/25/47): 110,000
Lowest Daily Mean: 0
Annual Runoff: 385,300

Little Missouri River, Medora
(Water Years 1903-2005)
Annual Mean: 442
Max. Peak (3/23/47): 65,000
Lowest Daily Mean: 0
Annual Runoff: 320,300

Heart River, Richardton
(Water Years 1903-2005)
Annual Mean: 97
Max. Peak (4/16/50): 23,400
Lowest Daily Mean: 0
Annual Runoff: 70,180

Mouse River, Minot
(Water Years 1903-2005)
Annual Mean: 157
Max. Peak (4/20/04): 12,000
Lowest Daily Mean: 0
Annual Runoff: 113,600

Mouse River, Westhope
(Water Years 1929-2005)
Annual Mean: 274
Max. Peak (3/26/76): 12,600
Lowest Daily Mean: 0
Annual Runoff: 198,200

Mauvais Coulee, Cando
(Water Years 1956-2005)
Annual Mean: 20
Max. Peak (4/21/97): 3,000
Lowest Daily Mean: 0
Annual Runoff: 14,260

Sheyenne River, Warwick
(Water Years 1950-2005)
Annual Mean: 73
Max. Peak (4/14/69): 4,660
Lowest Daily Mean: 0
Annual Runoff: 52,490

Pembina River, Neche
(Water Years 1903-2005)
Annual Mean: 234
Max. Peak (4/27/97): 15,100
Lowest Daily Mean: 0
Annual Runoff: 169,800

Red River, Drayton
(Water Years 1949-2005)
Annual Mean: 4,465
Max. Peak (4/24/97): 124,000
Lowest Daily Mean (12/23/89): 110
Annual Runoff: 3,235,000

Park River, Grafton
(Water Years 1931-2005)
Annual Mean: 64
Max. Peak (4/19/50): 12,600
Lowest Daily Mean: 0
Annual Runoff: 46,000

Forest River, Minto
(Water Years 1944-2005)
Annual Mean: 53
Max. Peak (4/18/50): 16,600
Lowest Daily Mean: 0
Annual Runoff: 38,590

Goose River, Hillsboro
(Water Years 1931-2005)
Annual Mean: 100
Max. Peak (4/21/79): 14,800
Lowest Daily Mean: 0
Annual Runoff: 72,150

Red River, Fargo
(Water Years 1901-2005)
Annual Mean: 694
Max. Peak (4/17/97): 28,000
Lowest Daily Mean: 0
Annual Runoff: 502,900

Maple River, Enderlin
(Water Years 1956-2005)
Annual Mean: 57
Max. Peak (6/30/75): 7,610
Lowest Daily Mean (12/7/63): 0.1
Annual Runoff: 41,600

Sheyenne River, Lisbon
(Water Years 1957-2005)
Annual Mean: 222
Max. Peak (4/23/97): 5,670
Lowest Daily Mean: 0
Annual Runoff: 161,100

James River, LaMoure
(Water Years 1950-2005)
Annual Mean: 163
Max. Peak (4/14/69): 6,800
Lowest Daily Mean: 0
Annual Runoff: 118,200

James River, Grace City
(Water Years 1968-2005)
Annual Mean: 56
Max. Peak (4/3/97): 4,000
Lowest Daily Mean: 0
Annual Runoff: 40,560

Knife River, Hazen
(Water Years 1929-2005)
Annual Mean: 164
Max. Peak (6/24/66): 35,300
Lowest Daily Mean: 0
Annual Runoff: 119,100

Heart River, Mandan
(Water Years 1924-2005)
Annual Mean: 260
Max. Peak (4/19/50): 30,500
Lowest Daily Mean: 0
Annual Runoff: 188,400

Cannonball River, Breien
(Water Years 1934-2005)
Annual Mean: 238
Max. Peak (4/19/50): 94,800
Lowest Daily Mean: 0
Annual Runoff: 172,700

Missouri River, Bismarck
(Water Years 1954-2005)*
Annual Mean: 22,540
Max. Peak (7/13/75): 68,900
Lowest Daily Mean (3/25/55): 4,000
Annual Runoff: 16,330,000
*Since completion of Garrison Dam

Source: U.S. Geological Survey, Water Data Report, ND-05-1

Note: Annual Mean, Max. Peak Flow, and Lowest Daily Mean are reported in cubic feet per second. Annual Runoff is reported in acre-feet.

Definitions:
Annual Mean - The arithmetic mean for the individual daily mean discharges for the reported water years.
Max. Peak Flow - The maximum instantaneous peak discharge that occurred during the reported water years.
Lowest Daily Mean - The minimum daily mean discharge for the reported water years.
Annual Runoff - The total quantity of water in runoff for a drainage area for the year.
Acre-Feet - The quantity of water required to cover one acre to a depth of one foot.
Cubic Feet Per Second - The rate of discharge representing a volume of one cubic foot passing a given point in one second.

NORTH DAKOTA STATE WATER COMMISSION

drained by the Missouri River to the Gulf of Mexico.

For planning purposes, there are five major watersheds in North Dakota: the Missouri River basin, James River basin, Souris River basin, Red River basin, and Devils Lake basin.

The Missouri River drainage system includes the major sub-basins of the Missouri and James Rivers. The tributaries on the south and west sides of the Missouri River typically occupy small but sharply defined valleys. This area is well drained with few natural lakes. The topography is characterized by rolling, hilly plains; with numerous flat-topped, steep-sided buttes. The most prominent are located in the Badlands along the Little Missouri River. Areas east of the Missouri River include glaciated areas that are characterized by many small lakes and wetlands.

The James River, which is a major tributary of the Missouri River, begins in the drift prairie of central North Dakota, but does not join the Missouri until it reaches Yankton, South Dakota. The James system is poorly to moderately drained, with a large number of wetlands.

The Hudson Bay drainage includes the Souris and Red River systems, and the Devils Lake basin.

The Souris River originates in Saskatchewan and then loops

Water Resource Facts Summary

TOPIC	VALUE
State Surface Area (Sq. Miles)	70,700
Total Miles of Rivers and Streams[1]	59,607
Total Miles of Rivers and Streams by Stream Class[2]	
Class I, IA, and II Streams	5,973
Class III Streams	48,634
Total Miles of Rivers and Streams by Basin	
Red River (including Devils Lake)	11,991
Souris River	3,670
Upper Missouri (Lake Sakakawea)	13,877
Lower Missouri (Lake Oahe)	22,277
James River	2,792
Border Miles of Shared Rivers and Streams[3]	430
Total Number of Lakes and Reservoirs[4]	247
Number of Natural Lakes	109
Number of Manmade Reservoirs	138
Total Acres of Lakes and Reservoirs	761,772
Acres of Natural Lakes	218,616
Acres of Manmade Reservoirs[5]	543,156
Volumes of Major Waterbodies (million acre-feet)	
Devils Lake[6]	2.8
Lake Sakakawea[7]	23.8
Lake Oahe[7]	23.1
Lake Tschida[7]	0.44
Jamestown Reservoir[7]	0.38
Lake Ashtabula[7]	0.2
Acres of Wetlands[8]	2,500,000

1 Total miles are based on rivers and streams entered into the Assessment Database (ADB) and reach indexed to the 1:100,000 scale National Hydrography Dataset.

2 Stream classes are defined in the Standards of Quality for Waters of the State (North Dakota Department of Health, 2006). In general, Classes I, IA, and II streams are perennial, while Class III streams are intermittent or ephemeral.

3 Includes the Bois de Sioux River and the Red River of the North.

4 Number includes only the lakes and reservoirs which are publicly owned and are in the ADB.

5 Estimates based on surface acreage at full pool elevation.

6 Volume at elevation 1,446 feet above mean sea level (including Stump Lake).

7 Maximum pool volume.

8 Estimate provided by Dahl, T.E., Wetlands - Losses in the United States: 1780s to 1980s, Washington, D.D., U.S. Fish and Wildlife Service Report to Congress, 1990.

through North Dakota before it reenters Canada west of the Turtle Mountains. The topography is varied within the basin, with hilly terrain in the southwest, a flat glacial Souris Lake plain in the east, and forested hills of the Turtle Mountains in the northeast.

The Red River winds northward almost 400 miles, forming the border between North Dakota and Minnesota. From the international boundary with Canada, the Red flows another 155 river miles to Lake Winnipeg in Manitoba. The valley through which the river flows is the former bed of glacial Lake Agassiz. The ancient lakebed is extremely flat, and is home to some of the most productive farmland in the world.

The Devils Lake basin is currently a non-contributing sub-basin of the Red River basin. The drainage system is formed by chains of waterways and connecting lakes; many of which ultimately terminate in Devils Lake itself.

Flow in all North Dakota streams and rivers is seasonably variable. Runoff is greatest in early spring as a result of snowmelt water and spring rainfall. Many smaller streams experience little or no flow for extended periods during summer months. Although, dramatic flow variations in river discharges can be caused by changes in weather patterns, isolated storm events, evaporation rates, and snow pack conditions.

According to information in North Dakota's Assessment Database (ADB), provided by the Department of Health to the U.S. Environmental Protection Agency, there are 138 man-made reservoirs and 109 natural lakes.

Reservoirs comprise about 71 percent of North Dakota's total lake/reservoir surface acres, accounting for a surface area of 543,156 acres. Of these, 480,731 acres, or 62 percent of the state's entire lake and reservoir acres are contained within the two mainstem Missouri River reservoirs (Lake Sakakawea and Lake Oahe). The remaining 136 reservoirs share 62,425 acres, with an average surface area of 459 acres.

The 109 natural lakes in North Dakota cover 218,616 acres, with approximately 132,246 acres, or 60 percent attributed to Devils Lake (and Stump Lake combined) at an elevation of 1,446 feet above mean sea level. The remaining 108 lakes average 800 acres, with half being smaller than 250 acres.

There are an estimated 59,607 miles of rivers and streams in the state. These estimates are based on rivers and streams entered into the ADB and reach indexed to the 1:100,000 scale National Hydrography Dataset (NHD).

Total miles of rivers and streams by major basin are provided in the Water Resources Facts Summary on the preceeding page.

Ground Water Resources

Ground water underlies the land surface throughout the state. Ground water generally occurs in two major types of rock – unconsolidated deposits and bedrock. Unconsolidated deposits are loose beds of gravel, sand, silt, or clay of glacial origin. Bedrock consists primarily of shale and sandstone.

Aquifers of glacial origin are generally more productive to wells than aquifers found in the underlying bedrock. Bedrock aquifers underlie the entire state and tend to be more continuous and widespread than aquifers in the unconsolidated deposits.

It is estimated that 60 million acre-feet of water are stored in the major unconsolidated aquifers in the state. The amount of water available in the major bedrock aquifers is estimated to be approximately 435 million acre-feet.

Atmospheric Water Resources

Mean annual precipitation ranges from a maximum of just over 21 inches in the southeast corner of the state to just under 14 inches in the extreme northwest corner. This distribution results in generally adequate moisture for dry land farming in the east, but less reliable supplies in the semi-arid west.

Precipitation is largely dependent upon an adequate supply of airborne moisture, both visible (clouds) and invisible (water vapor). The primary atmospheric water source for North Dakota is the warm, humid air originating from the Gulf of Mexico. While westerly flow from the Pacific Ocean does initially move atmospheric moisture towards the state, the repeated lifting and cooling of the air as it passes over the mountains causes much of the moisture to precipitate from the air before it reaches the plains. Moisture from the Gulf of Mexico faces no such impediments.

The capacity of the atmosphere to hold moisture is largely governed by its temperature. Warm summertime air can hold enough moisture to allow a thunderstorm to generate several inches of rainfall in a few minutes, whereas cold arctic air from the Canadian prairies can scarcely support any precipitation. As such, the warm season accounts for more than three-quarters of the state's total annual precipitation.

Depending on the season, the total water contained in the atmosphere above North Dakota ranges from about 350,000 acre-feet in the winter, to 5.5 million acre-feet in the summer. A vast majority of the water passes through the state, borne by winds aloft. On any given day, nature converts a small fraction of the available water to clouds and/or precipitation.

Water Quality

In North Dakota, water quality is primarily the responsibility of the Department of Health. The SWC and other natural resource agencies work cooperatively with the Department of Health to maintain, monitor, and plan for adequate supplies of high quality water.

Since the 1980s, North Dakota has been mirroring a national trend towards quantifying and improving water quality in natural systems throughout the state. A large portion of the early work focused on gathering information to determine the conditions of the waterbodies. In the last two decades, an increasing amount of work has been done to address non-point source water pollution.

Surface Water

The Health Department currently recognizes 247 lakes and reservoirs for water quality assessment purposes. Only 198 are included in the state's water quality standards as classified lakes, and therefore are assigned designated beneficial uses.

Under the federal Clean Water Act (CWA), states are required to report on water quality, and develop a list of those waters needing total maximum daily loads (TMDLs) due to their being water quality-limited, and submit an assessment report every two years. This list has become known as the "TMDL list" or "Section 303(d) list."

When a waterbody is water quality limited, the state is required to determine its beneficial uses, and the reduction in pollutant loading necessary for that waterbody to meet water quality standards. The process is called TMDL.

When a state prepares its list of water quality-limited waterbodies, it is required to prioritize waterbodies for TMDL development and to identify those waterbodies that will be targeted for TMDL development within two years.

The 2008 TMDL list for North Dakota identified 225 waterbodies (32 lakes and 193 rivers and streams) and targeted 80 waterbody/pollutant combinations for TMDL completion by 2010. Eighty of those waterbodies are targeted for completion in the next four years.

The Health Department expects to complete TMDLs for all listed waters by 2010.

Waterbodies are categorized from 1, where all designated uses are met, to 5, where a pollutant impairs a waterbody and a TMDL is required. Eighty-four percent of waterbodies assessed fully support the beneficial use designated as aquatic life. The remaining 16 percent of waterbodies assessed for this report were assessed as

not supporting aquatic life.

Non-point source pollution was the primary cause of aquatic life use impairment.

A total of 100 lakes and reservoirs were assessed for this report, with the state's remaining lakes and reservoirs making up only 5.5 percent of total acreage. Ninety-seven percent were assessed as fully supporting aquatic life use. Of this total, 37 percent were considered threatened, while three lakes did not support aquatic life.

The primary sources of pollutants affecting aquatic life use in the state were cropland erosion and runoff; animal feeding operations and poor grazing management; and point source discharges, such as urban runoff, hydrologic modifications (e.g., upstream impoundments, low-head dams, channelization, flow regulation and diversion, riparian vegetation removal, and wetland drainage).

Recreation use was assessed on 6,617 miles of waterbodies in the state, and was classified as supporting, fully supporting but threatened, and not supporting on 23, 52, and 25 percent of those miles, respectively. The presence of fecal coliform was mainly responsible for a waterbody not supporting recreation.

Drinking water supply use is classified for 5,560 miles of rivers and streams in the state. Of the 1,738 miles assessed for this report, only 5 percent were threatened for drinking water supply use, primarily through taste and odor problems.

A total of 4,095 miles of rivers and streams were classified as being capable of supporting fishing for consumption. Of the state's waterbodies designated for fish consumption, only the Red River had sufficient methylmercury in fish tissue to be assessed as not supporting fish consumption use. Sources of methylmercury in fish remain largely unknown. While there are many potential sources of methylmercury (both anthropogenic and natural), to date there have been no specific causes or sources identified for the mercury present in North Dakota fish.

Four reservoirs (Garrison/ Sakakawea, Oahe, Bisbee, and Mt. Carmel) are currently used either directly or indirectly as municipal drinking water supplies, while three others (Patterson Lake, Homme Dam, and Renwick Dam) serve as back-up water supplies in the event the primary water supplies should fail. Homme Dam, Mt. Carmel Dam, and Lake Sakakawea were assessed as fully supporting drinking water supply use. Drinking water supply use was not assessed for the remaining lakes and reservoirs.

Ground Water

In North Dakota, 45 percent of the state's total population relies on ground water to supply its drinking water needs. Ground water is also a significant supply for agriculture and industry.

Water quality in the state's aquifers varies greatly and is marginal for drinking purposes in many areas. Unconsolidated aquifers generally have water that is less mineralized than water in deeper bedrock aquifers, which are typically more saline.

North Dakota has not identified widespread ground water contamination, although some naturally occurring compounds, such as arsenic, may make the quality of ground water undesirable in a small number of aquifers. Those areas where human-related ground water contamination has occurred have usually been associated with petroleum storage facilities, agricultural storage facilities, feedlots, poorly designed wells, abandoned wells, wastewater treatment lagoons, landfills, septic systems, and the underground injection of waste.

Assessment and protection of ground water continues through ambient ground water quality monitoring activities, the implementation of wellhead protection projects, the Comprehensive Ground Water Protection Program, and the development of a State Management Plan for Pesticides.

North Dakota has 249 communities with municipal systems relying on ground water as a wa-

ter supply. In 2008, ten of those communities exceeded primary water quality standards, and 177 exceeded secondary water quality standards.

Water Permitting

North Dakota follows the prior appropriation doctrine for water rights. Prior appropriation can be simplified into the phrase, "first in time, first in right." What this means is that the first entity to use water (senior appropriator) acquires the right to its use over later water entities (junior appropriators).

2008 Water Use Permits

	Conditionally Approved	Held in Abeyance	Perfected	Total
Commercial	4	0	8	12
Domestic	2	0	11	13
Fish And Wildlife	89	0	217	306
Flood Control	7	0	45	52
Industrial	113	10	203	326
Irrigation	432	52	1,759	2,243
Multiple Uses	9	0	18	27
Municipal	26	1	259	286
Power Generation	0	0	10	10
Recreation	13	0	155	168
Rural Water	17	2	85	104
Stock	11	0	70	81
TOTAL	723	65	2,840	3,628

North Dakota Water Permit Definitions

Application in Processing: The water permit application is either in administrative or hydrological review. Administrative review deals with the nonhydrologic aspects of processing a water permit application. Hydrologic review deals with the evaluation of the water permit application in accordance with North Dakota Century Code 61-04-06.

Conditionally Approved Water Permit: The permit application has fulfilled all the administrative, legal, and hydrological requirements and is approved to begin applying water to beneficial use.

Perfected Water Permit: This is a "Conditionally Approved" permit which has been inspected by Water Commission staff and a determination made that water is being applied to beneficial use in accordance with the conditions prescribed in the conditional water permit.

Held in Abeyance: This status is used when only a portion of the requested water withdrawal is conditionally approved by the State Engineer. The unapproved portion of the water permit request is held in abeyance pending the acquisition of additional hydrologic data that will be used to provide a basis for future action by the State Engineer.

Withheld, Deferred: The permit application has fulfilled all the administrative criteria. However, the entire requested water withdrawal amount requires additional hydrologic analysis, and in many instances, the acquisition of additional hydrologic data before action can be taken.

Void: A water permit application was filed with the State Engineer, however, the applicant did not complete the application process.

(continued)

North Dakota Water Permit Definitions (continued)

Denied: The permit application has fulfilled all the administrative criteria. However, the hydrological analysis indicates the water permit application cannot be approved in accordance with North Dakota Century Code 61-04-06.

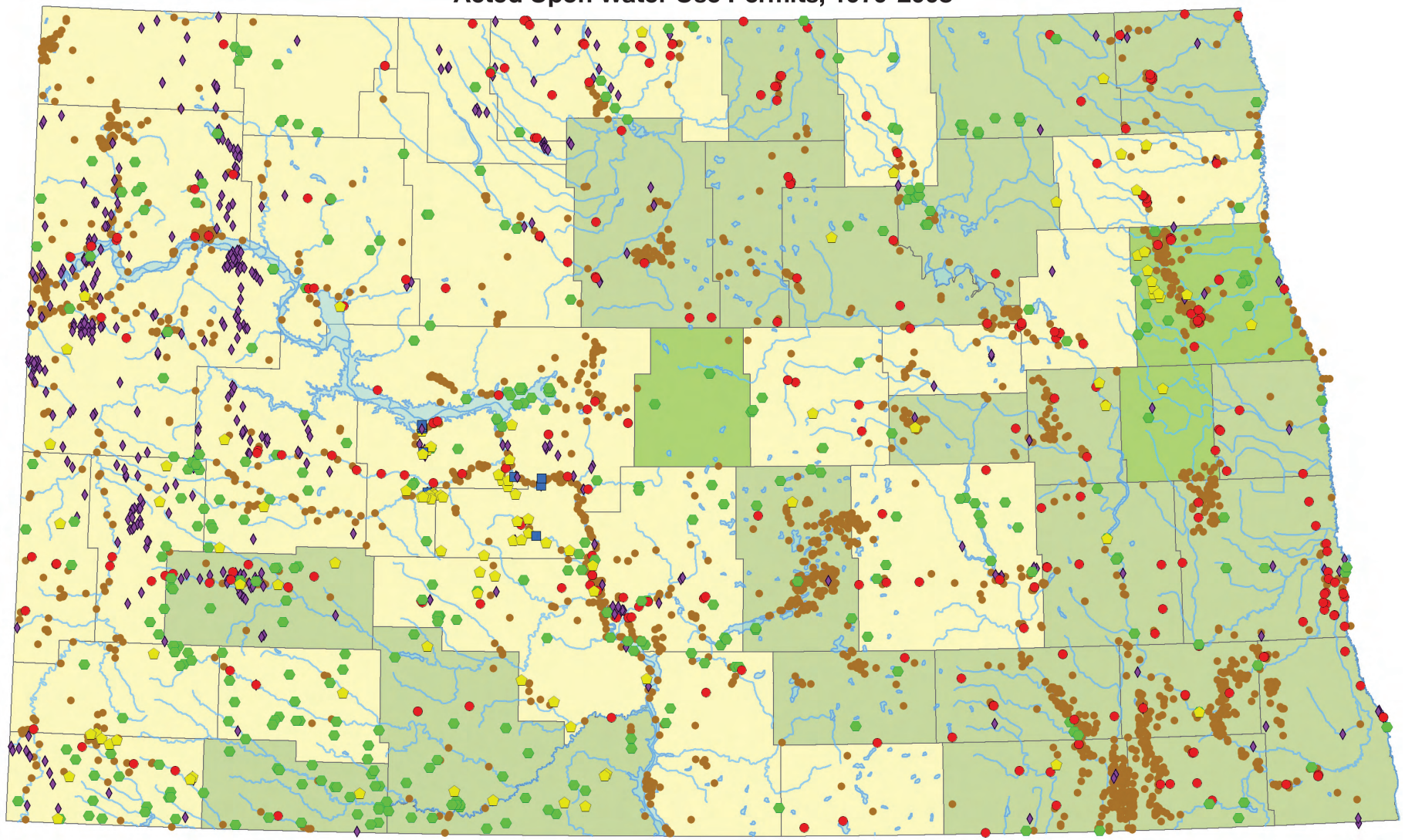
Canceled: If a conditional or perfected water permit holder fails to apply water to beneficial use, as cited by the water permit beneficial use date or fails to apply water to beneficial use for three successive years, unless the failure or cessation of use has been due to the unavailability of water, a justifiable inability to complete the works, or other good and sufficient cause, the State Engineer may cancel the water permit and declare the water permit or right forfeited.

When there are multiple water permit applications for water from the same source, and that source is insufficient to supply all the applications received by the State Engineer within a 90-day time period, the following order is used to determine priority, from first to last: domestic; municipal; livestock; irrigation; industrial; and fish, wildlife, and recreation.

In the future, the demand for water will continue to grow, presenting significant challenges for Commission staff. This is because a more comprehensive analysis is required to determine whether or not a proposed water permit is feasible, given variables such as amount of water requested, timing of the withdrawal, and characteristics of the waterbody. The complexity of natural systems often results in permit processing durations of over a year.

In 2008, there were a total of 3,628 water use permits in North Dakota. Irrigation represents the largest proportion (62 percent), followed distantly by industrial (9 percent), fish and wildlife (8 percent), municipal (8 percent), recreation (5 percent), rural water (3 percent), stock (2 percent), and flood control (1 percent), with the remainder all comprising less than 1 percent each.

Acted Upon Water Use Permits, 1970-2008



Depicted are all of the water permits granted between 1970 and 2008. Obvious trends are the high concentrations of irrigation permits in southeastern North Dakota and in Grand Forks County, and a high concentration of recreation, wildlife, and fishery permits in southwestern North Dakota. Commercial/industrial use has a large number of permits in west-central North Dakota. County colors are reflective of the average amount of time it took for granted permits to be processed, from start to completion.

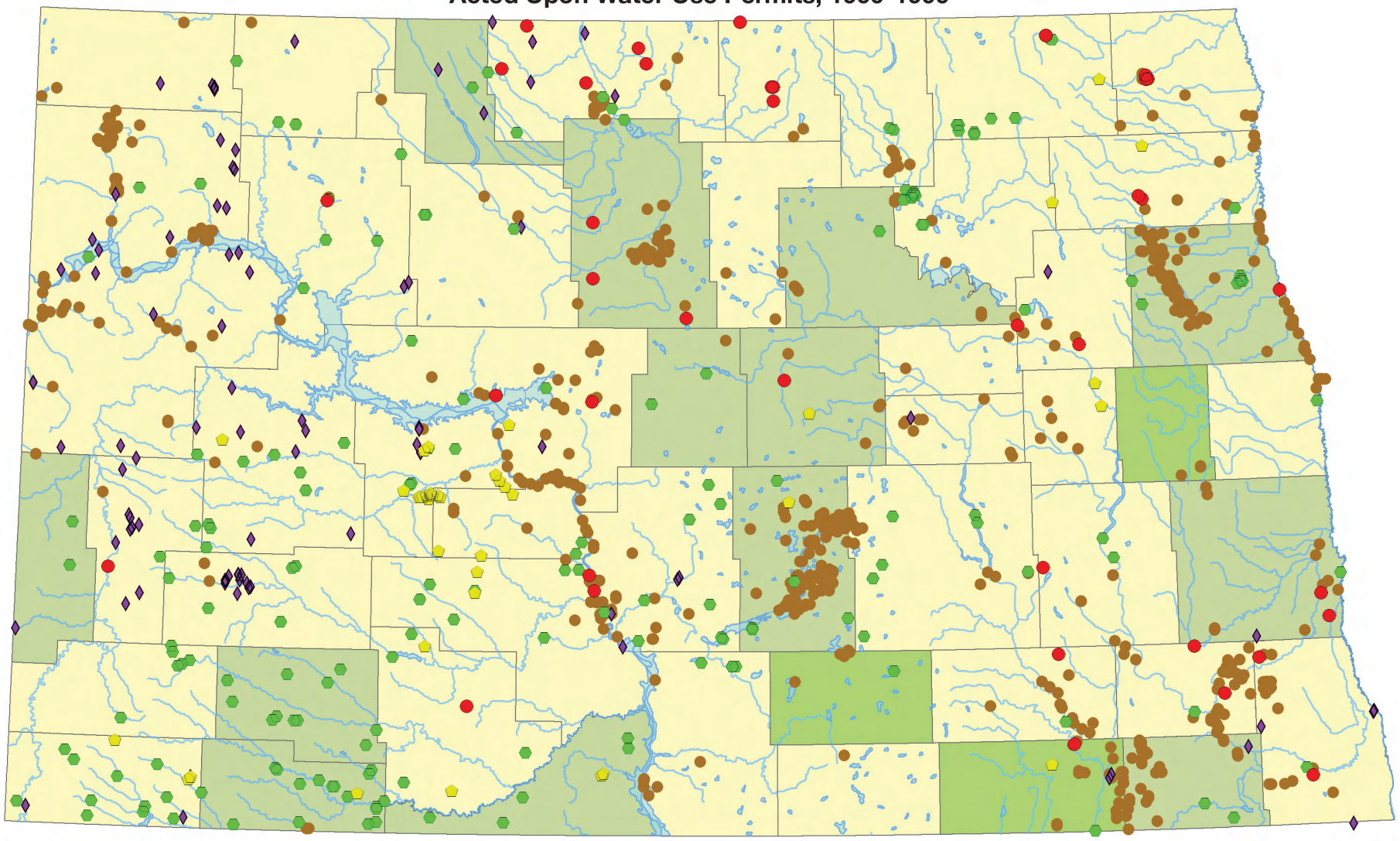
Type of Water Use Permit

- Power Generation
- Flood Control, Multiple Use, Stock
- Domestic, Rural Water, Municipal
- Recreation, Fish and Wildlife
- Commercial, Industrial
- Irrigation

Review Period

- 0 - 1 Year
- 1 - 3 Years
- 3 - 5 Years

Acted Upon Water Use Permits, 1990-1999



Depicted are all of the water permits granted between 1990 and 1999. Obvious trends are the high concentrations of irrigation permits along the Missouri River, in southeastern North Dakota, Grand Forks, and Kidder counties, and a high concentration of recreation, wildlife, and fishery permits in southwestern North Dakota. Commercial/industrial use had a large number of permits in western North Dakota. County colors are reflective of the average amount of time it took for granted permits to be processed, from start to completion.

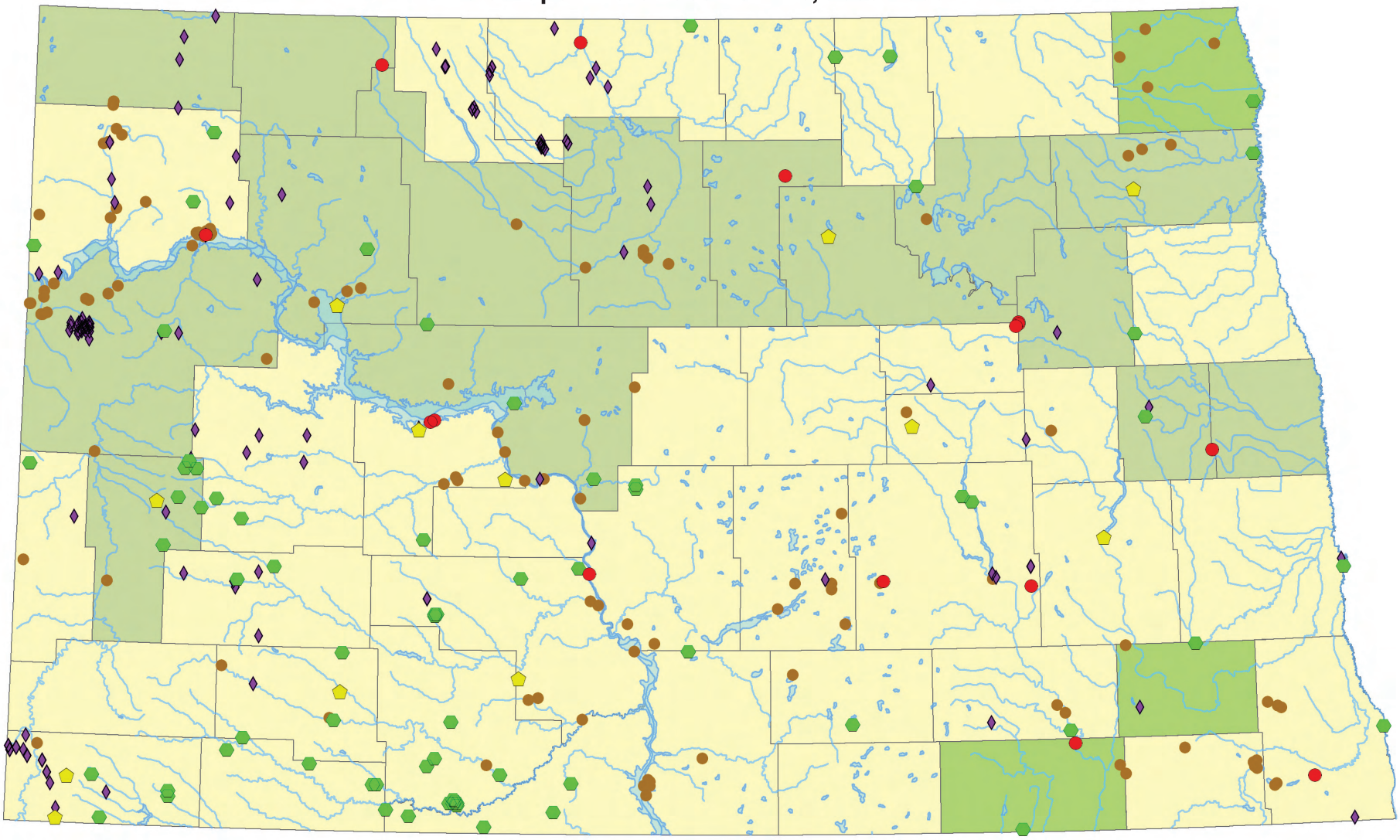
Type of Water Use Permit

- Flood Control, Multiple Use, Stock
- Domestic, Rural Water, Municipal
- Recreation, Fish and Wildlife
- Commercial, Industrial
- Irrigation

Review Period

- 0 - 1 Year
- 1 - 2 Years
- 2 - 3.5 Years

Acted Upon Water Use Permits, 2000-2008



Depicted are all of the water permits granted between 2000 and 2008. Of note, are the concentration of fish, wildlife, and fishery permits in southwestern North Dakota, the concentration of commercial/industrial permits in McKenzie, Bowman, and Renville counties, and irrigation development in Williams and McKenzie counties. County colors are reflective of the average amount of time it has taken for yet to be approved permits to be processed.

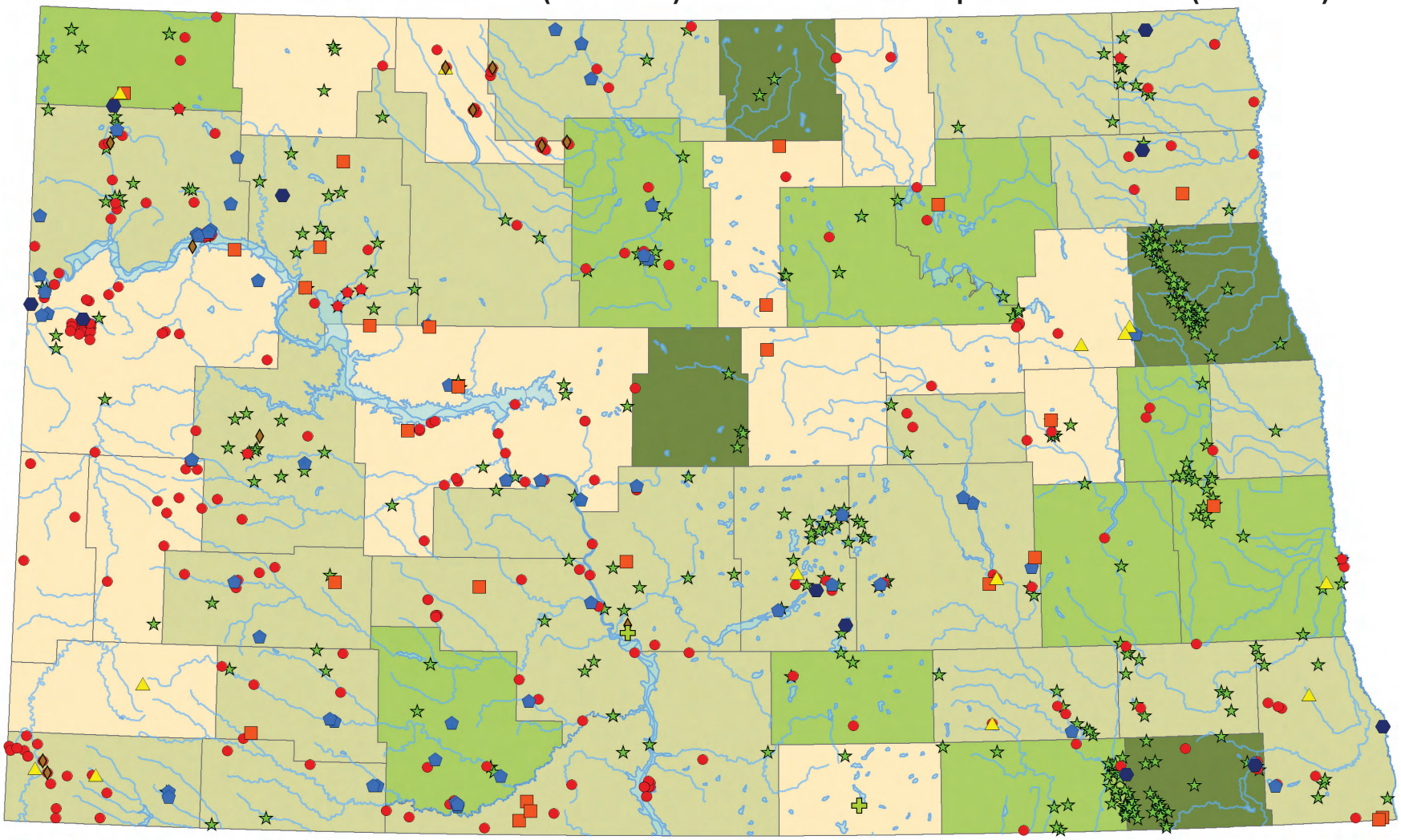
Type of Water Use Permit

- Flood Control, Multiple Use, Stock
- Municipal, Rural Water
- Fish and Wildlife, Recreation
- Commercial, Industrial
- Irrigation

Review Period

- 0-1 Year
- 1-2 Years
- 2-2.5 Years

Status of Water Permits Under Review (1970-2008) and Status of Acted Upon Water Permits (2000-2008)



Depicted are two separate data sets. The first is the locations of all water permit applications currently being reviewed, along with the average duration of the application review process, by county (Legend A). The second data set is the status of all permits acted upon between 2000 and 2008 (Legend B). This map shows where the greatest amount of interest in the state lies in terms of future appropriations of water, and as a result, the greatest pressure on available resources. This is particularly the case in Grand Forks, Dickey, Sargent, and Kidder counties.

A) Status of Water Permits Under Review, 1970-2008

- 0 - 1 Year
- 1 - 5 Years
- 5 - 10 Years
- 10 - 16 Years
- Applications Currently Being Reviewed

B) Status of Acted Upon Water Permits, 2000-2008

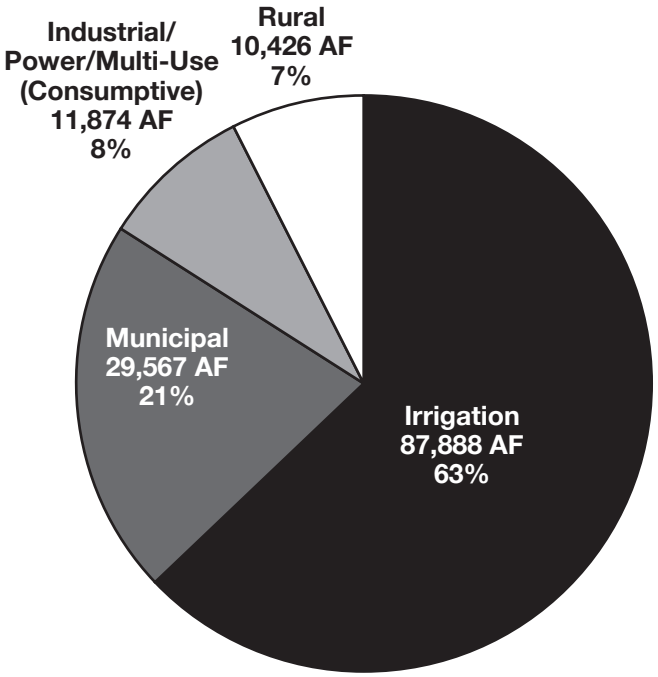
- Withheld, Deferred
- Cancelled
- Held in Abeyance
- Denied
- Void
- Perfected
- Conditionally Approved

Current Water Use

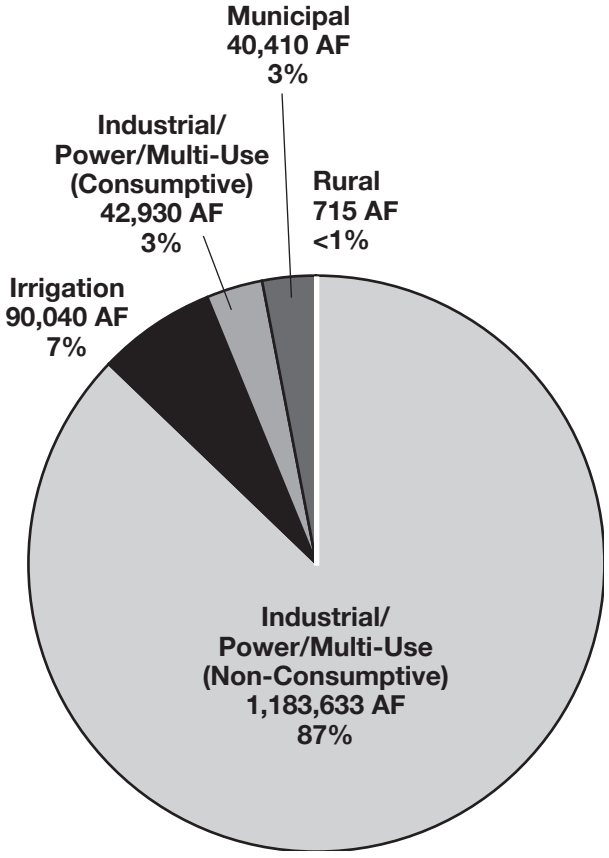
Water in North Dakota is used in a variety of ways. While the traditional uses of "mining, irrigating, and manufacturing" found in the North Dakota Constitution in Article XI, Section 3 still remain prevalent, new diverse uses and needs are continually being created.

With regard to some of the minor changes between 2007 water use and the 1997-2007 average, Garrison releases were slightly down. Conversely, irrigation uses increased, and were likely due to the continuing dry cycle, with permitted water withdrawals supplementing moisture not received as precipitation. Consumptive water use for industry and power generation were likely greater than the ten year average as a result of increased industrial development. Municipal use was also above average in 2007, and was likely a result of increased lawn watering because of dryer conditions. The continuing trend of rural populations moving to urban centers is another possible reason for increased municipal use. Rural water use decreased, however, which may in part have to do with decreasing populations in rural areas.

In a more specific comparison of recent 2007 water use with the 1997-2007 average, 2007 water use for irrigation increased by 41,171 acre-feet (23 percent), consumptive use of industrial, power, and multiple uses increased by 6,044 acre-feet (11 percent), non-consumptive use of industrial, power and multiple uses decreased by 52,480 acre-feet (4 percent), municipal



1997-2007 Ground Water Average Use (in Acre-Feet) TOTAL: 139,755 AF



1997-2007 Surface Water Average Use (in Acre-Feet) TOTAL: 1,357,728 AF

use increased by 1,593 acre-feet (2.3 percent), and rural water use decreased by 578 acre-feet (5 percent).

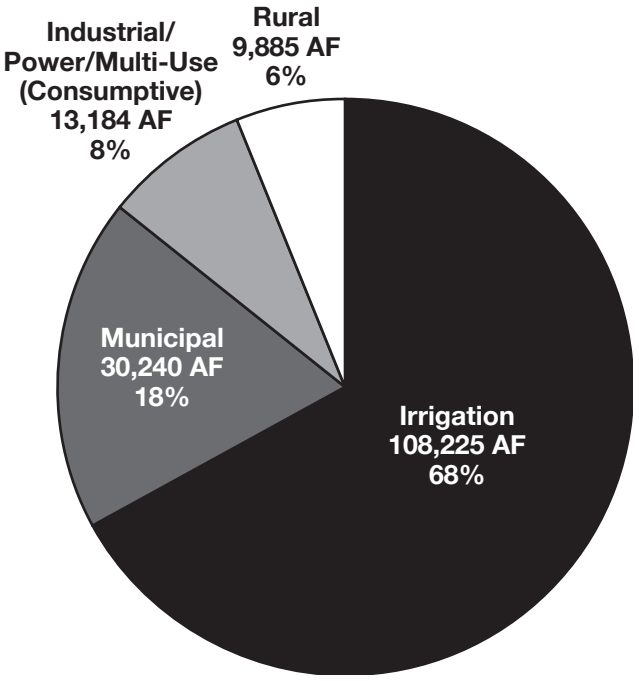
In 2007, the vast majority (89 percent) of reported total water use was drawn from surface water, with the remaining (11 percent) of water use being ground water in origin. Ground water use was 161,534 acre-feet, surface water use was 1,331,701 acre-feet, and total water use for 2007 was 1,493,235 acre-feet. Total water use in 2007 was nearly the same as the 1997-2007 average, which totaled 1,497,483 acre-feet.

Ground Water Use

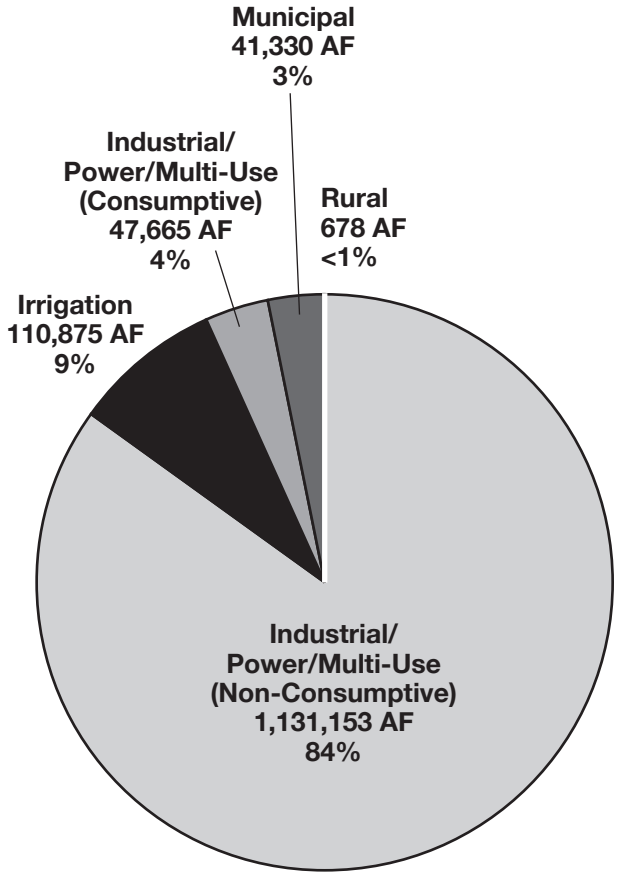
Ground water use is accounted for primarily by irrigation and municipal, rural, and industrial uses. It serves as the primary domestic water source for areas not served by Missouri River water. Ground water is virtually the sole source of water used for domestic purposes by rural residents and residents of small communities with no public distribution system. In 2007, irrigation accounted for over 68 percent of ground water use, with municipal (18 percent), industrial/power/multi-consumptive (8 percent), and rural water (6 percent) following consecutively.

Surface Water Use

Industrial/power/multi-non-consumptive use, which is mainly power generation through Garrison Dam and coal fired power plants, accounted for 84 percent of surface water use. Nearly 100 percent of the water used for thermoelectric and coal gasification purposes is obtained from Lake Sakakawea and the Missouri River. The remainder of surface water supplies are utilized by irrigation (9 percent), industrial/power/multi-consumptive (4 percent), municipal (3 percent), and rural water (<1 percent).



2007 Ground Water Use
(in Acre-Feet)
TOTAL: 161,534 AF



2007 Surface Water Use
(in Acre-Feet)
TOTAL: 1,331,701 AF

Water Conservation and Recycling

Because North Dakota periodically experiences drought conditions, water conservation, and to a lesser extent, recycling, are strategies that communities throughout the state utilize to reduce water usage when availability is limited. Cities throughout the state have modernized their water and sewer lines to prevent in-system losses that benefit no one, and in fact increase costs. One example of water conservation is the city of Fargo, which has enacted requirements that residents limit lawn watering to every other day during the summer months, reducing water use by about 2.5 million gallons annually.

There is additional capacity for water conservation in North Dakota. Work conducted in support of the Environmental Impact Statement for the Red River Valley Water Supply Project found that if additional water conservation measures were enacted, a reduction in approximately 1.4 billion gallons (4,300 ac-ft) of water could be accomplished in that project area.

Groundwater injection or infiltration are strategies that have been considered in the state in order to "bank" surface water when it is readily available as shallow groundwater. Studies conducted by the Commission in the 1980s have shown that the technology is feasible, although somewhat expensive. Currently there is only one such project in North Dakota, in the northeastern part of the state.

Future Water Needs

North Dakota's future water needs and trends will be influenced by a number of factors. Most importantly, we can expect future trends to be driven primarily by population patterns, and current and expected economic development opportunities. However, it is difficult to predict all of the factors that may lead to the next population shift in our state, or to identify where the next industrial boom might occur, and what it might involve. To address some of these future uncertainties, an important element of this planning process will be to recommend more detailed analysis of future water availability for all types of users in North Dakota, in the context of a broad spectrum of future water use scenarios. The purpose of this section of the current planning effort is to define some of the influencing factors and to discuss anticipated water use scenarios for various uses.

General Population Trends

North Dakota's changing population distribution has, and will continue to have dramatic implications for the appropriation of water. Since 1960, North Dakota's ten largest urban centers have seen varying degrees of population change - from booming West Fargo, where a 546 percent increase in population has occurred, to Jamestown, where a 2 percent decline has been the trend. Census estimates in 1987 revealed for the first time that more North Dakotans lived in urban centers than rural areas, and estimates since that time point to a continuation of that trend.

From a county historical perspective, the U.S. Census estimates that only nine counties have increased in population since 1960. And of those nine counties, increasing population trends can be attributed to either population shifts from rural to large urban centers, (Burleigh,

Population Trends:
North Dakota's Ten Largest Cities

RANK	CITY	1960 CENSUS	2006 ESTIMATE	CHANGE	% CHANGE 1960-2006
1	Fargo	46,662	90,056	43,394	93%
2	Bismarck	27,670	58,333	30,663	111%
3	Grand Forks	34,451	50,372	15,921	46%
4	Minot	30,604	34,745	4,141	14%
5	West Fargo	3,328	21,508	18,180	546%
6	Mandan	10,525	17,449	6,924	66%
7	Dickinson	9,971	15,636	5,665	57%
8	Jamestown	15,163	14,813	-350	-2%
9	Williston	11,866	12,303	437	4%
10	Wahpeton	5,876	7,907	2,031	35%

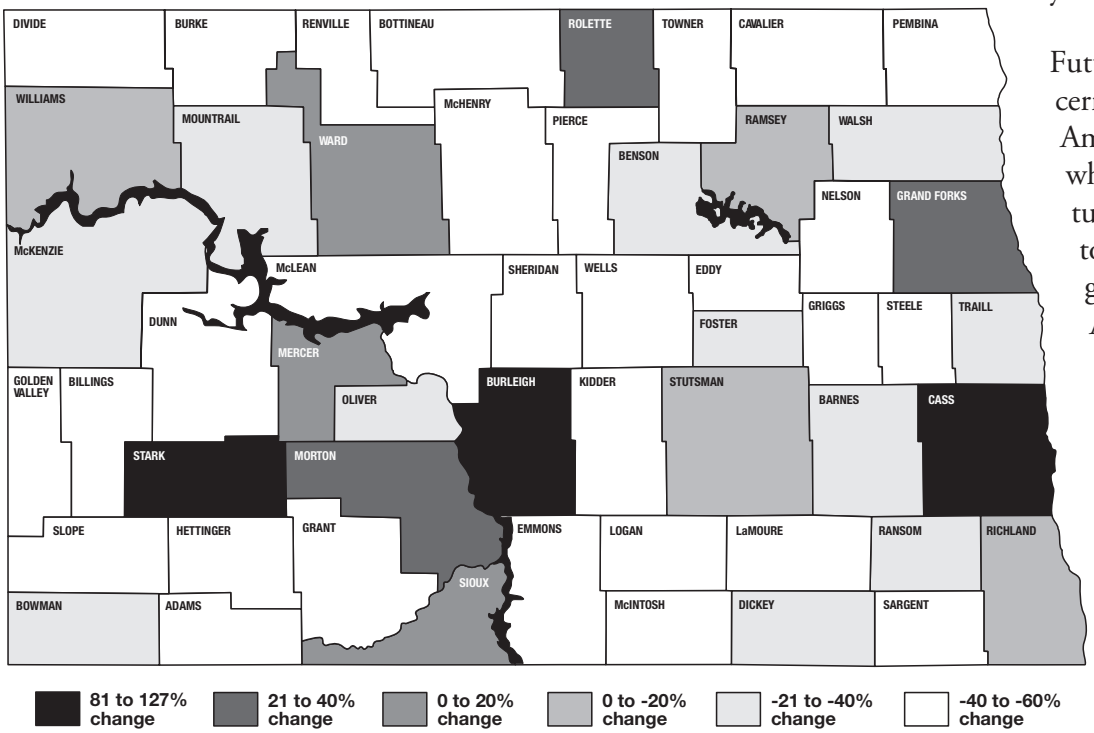
Cass, Grand Forks, Morton, Stark, and Ward Counties), energy development (Mercer County), or the presence of reservations (Rolette and Sioux Counties).

In looking ahead, and based on data from the U.S. Census Bureau, North Dakota's population will likely increase by about 1.5 percent from 642,207 in the year 2000 to 651,291 in the year 2020. The eastern-most 13 Red River Valley counties will experience a population increase of about 4 percent (primarily in Cass and Grand Forks Counties), while the remaining 40 counties in central and western North Dakota will experience a population decline of about 4 percent.

The North Dakota State Data Center estimates that only seven counties; Burleigh, Cass, Grand Forks, Morton, Benson, Rolette, and Sioux (four urban and three primarily reservation counties, respectively) will increase in population from 2000 to 2020. All of the other 46 remaining counties are expected to lose population during that same time period. It is possible that current and expected energy development, particularly in western oil-producing counties, could slow or even reverse population loss trends in certain areas, but to what degree remains unknown. If that trend materializes, urban areas along the Missouri River, and those served by the Southwest Pipeline Project, and ultimately the Northwest Area Water Supply, will be positively situated to meet future water needs as they arise.

Another emerging population issue that will have implications for future water supply project development involves the growth of bedroom communities surrounding North Dakota's larger urban centers. A prime example is West Fargo, which only a half-century ago contained less than a couple thousand people. Today, West Fargo is estimated to be North Dakota's fifth largest community, with about 21,500 people, and recent annual growth rates of over 10 percent. Though West Fargo has seen exceptional growth, there are many other smaller communities around Fargo, West Fargo, Bismarck, and Grand Forks that are also seeing an influx in people that are willing to make the daily commute into larger cities. Along with this growth, communities are faced with questions about how to provide and pay for supporting infrastructure, including new and enhanced water supply systems.

Percent Change in Population by County, North Dakota, 1960 to 2007



Future water supply concerns also exist on Native American reservations where existing infrastructure will not be adequate to meet the needs of growing populations. According to estimates by the North Dakota State Data Center, Native American reservation populations grew by 14 percent, from 20,042 in 1990, to 22,892 in 2000. Projections indicate that reservation populations are

likely to reach 27,691 by 2015, or an increase of 44 percent from 2000. Of the growing populations on reservations, 41 percent were under the age of 20 during the 2000 census.

As urban areas continue to grow, particularly in the eastern section of the state, water supplies must be carefully planned for and managed. The Red River accounts for only 6 percent of the annual flow of surface water in the state, while the 13 eastern Red River Valley counties currently contain about 42 percent of the state's total population. Even more revealing is the fact that the narrow strip of North Dakota that lies between Interstate 29 and the Red River contains 25 percent of the state's total population. Efforts to address looming water supply issues in the Red River Valley are well underway through the planning of the Red River Valley Water Supply Project, which will be addressed in greater detail later in the Plan.

Water Use Estimates

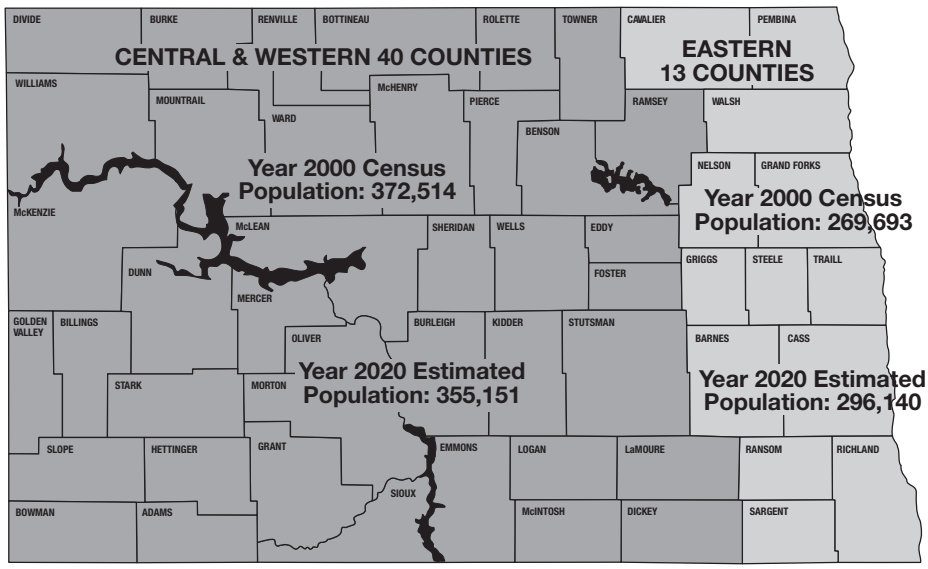
For future estimates, the year 2020 was used for all water use projections, since this was the most futuristic population projection available for North Dakota from the U.S. Census Bureau. In addition to using population data for making predictions of human consumption of water, the year 2020 was used in making estimates for irrigation, industrial, and thermoelectric water use needs. Mining and aquaculture account for relatively small amounts of water use in North Dakota, so they were grouped within the industrial use category. Livestock water use is not monitored by the SWC, but a general description of current and future trends will be provided in later sections using U.S. Department of Agriculture statistics. Domestic water use is also not monitored by the SWC, but was estimated using U.S. Census Bureau population data.

Numerous studies have been undertaken to evaluate future water needs in North Dakota. The most recent study was completed by the Bureau of Reclamation (BOR) for the Red River Valley Water Supply Project. The BOR study evaluated the water needs for 13 counties within the Red River Valley portion of North Dakota (and the communities of Breckenridge, Moorhead, and East Grand Forks in Minnesota).

The BOR report estimated that by the year 2050 there would be an annual water use demand of 68,168 acre-feet for municipal purposes, and 23,890 acre-feet for industrial purposes. The actual municipal water use for all 13 counties peaked in 1991 at 33,000 acre-feet. Based on census data for 2020, the population for the 13 counties in the BOR study would see a 4 percent increase, or 27,000 people, while the central and western 40 counties would experience a 4 percent decrease, or 17,000 people.

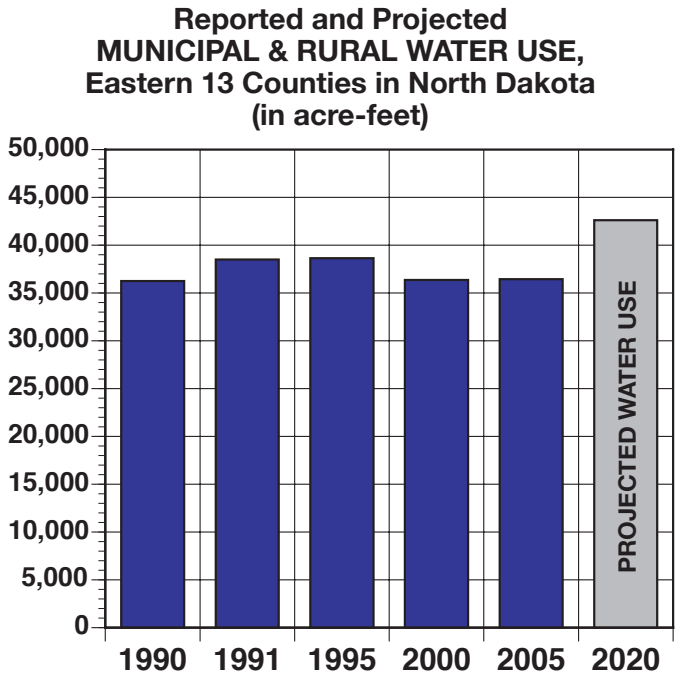
The following water use estimates use the BOR's population segmentation of North Dakota as shown in the map below. The eastern 13 counties were grouped as one water use and population entity, and the remaining 40 central and western counties were grouped as the other water use and population entity.

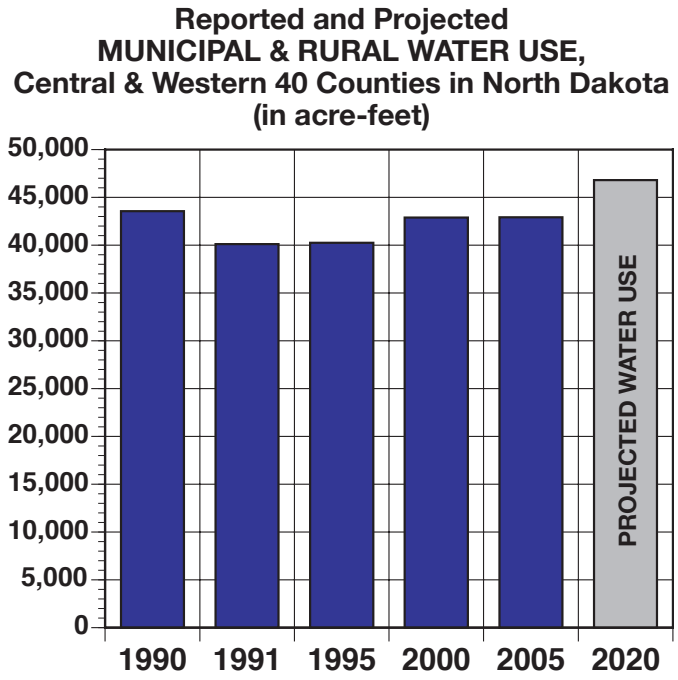
Bureau of Reclamation's Population Segmentation of North Dakota Counties

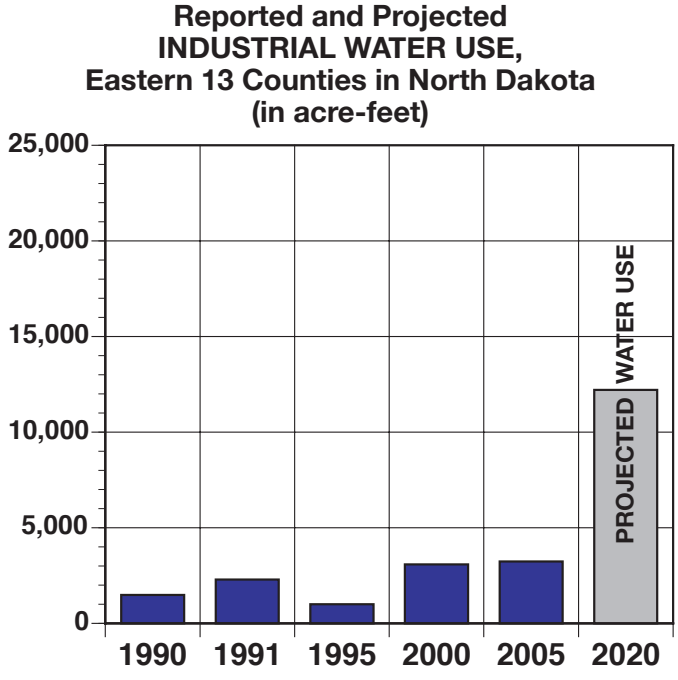


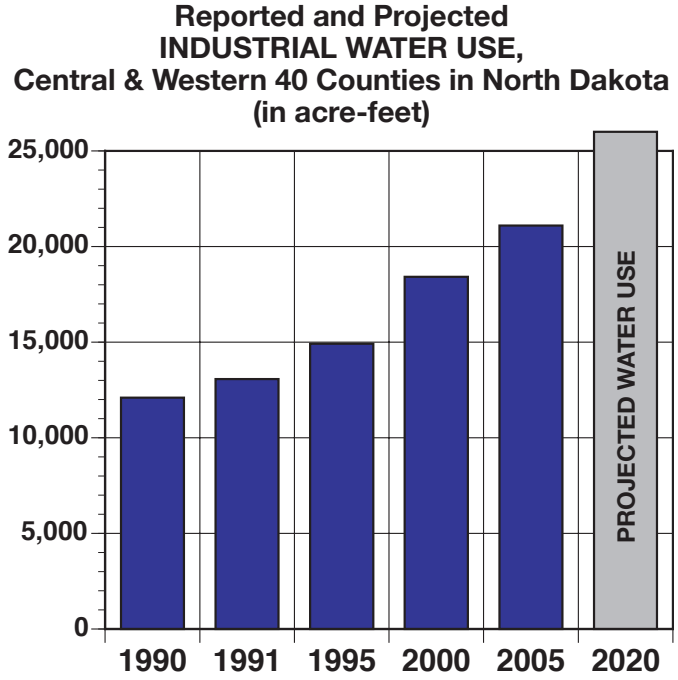
Public and Domestic Water Use

When historic water use trends for the eastern 13 counties are examined, it is evident that municipal water use for the last 15 years has been fairly constant, between 30,000 to 33,000 acre-feet. Rural water use has increased slightly, from 5,000 acre-feet to 6,500 acre-feet. One of the contributing factors to this trend is that small towns are moving their use to rural water systems to meet new EPA water quality requirements. Using population data, along with historic water use, projections were estimated based on an 8 percent multiplier for human use. This results in an estimated municipal









and rural use of 42,600 acre-feet per year (38 MG/Day) by the year 2020 for the 13 Red River Valley counties.

When historic water use trends for the central and western 40 counties are examined, it is evident that municipal water use for the last 15 years has been fairly constant, ranging from 36,000 to 40,400 acre-feet. Rural water use increased by 1,200 acre-feet from 1990 to 1995, and then stabilized at around 4,600 acre-feet. Using population data, along with historic water use, projections were estimated based on a 4 percent multiplier for human use. This results in an estimated municipal and rural use of 46,800 acre-feet per year (41.8 MG/Day) by the year 2020 for these 40 counties.

Industrial Water Use

Industrial water use in the eastern 13 counties more than doubled in the last 15 years, from 1,500 acre-feet in 1990, to 3,200 acre-feet in 2005. Industrial water use for the 13 counties in eastern North Dakota is estimated to be approximately 12,200 acre-feet per year (10.9 MG/Day) by the year 2020.

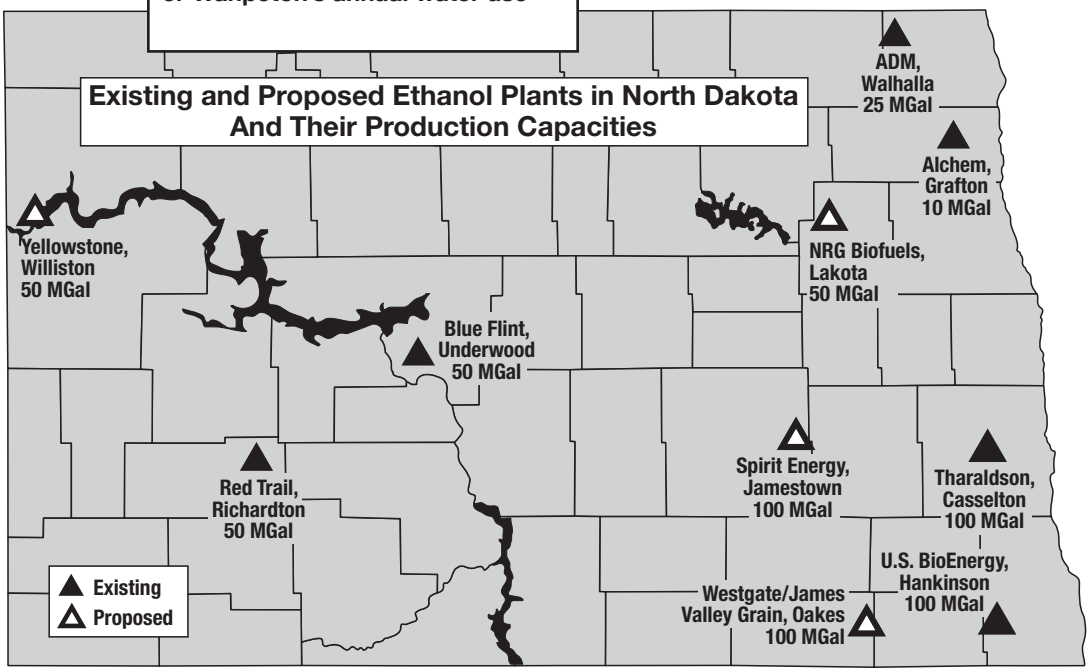
Industrial water use in the central and western 40 counties nearly doubled in the last 15 years, increasing from 12,000 acre-feet in 1990, to 22,000 acre-feet in 2005. Industrial water use for the 40 counties in the central and western counties of North Dakota is estimated to be approximately 26,000 acre-feet per year (23.2 MG/Day) by the year 2020.

Potential changes within the agricultural processing industry that will have the greatest impact on future water development and appropriation include commodity prices, changes in the Conservation Reserve Program (CRP), and the push for increased ethanol production. Closely related will be potential impacts to future irrigation water use, which is addressed in a separate section.

In terms of ethanol development, it should be noted that in 2007, two industrial permits for 6,200 acre-feet were issued for ethanol plants in southeast North Dakota, which have yet to put water to beneficial use. It is anticipated that by 2020 there will be two more ethanol plants needing a total of 2,800 acre-feet of water per year in the Red River Valley. In western North Dakota, two ethanol plants were built and began putting water to beneficial use during 2007. Each plant has a water permit for nearly 750 acre-feet. It is anticipated that by 2020 there will be two more new ethanol plants, needing a total of 3,400 acre-feet of water per year.

Water Needed For ETHANOL PRODUCTION

- **3 to 6 gals. of water are needed to produce 1 gal. of ethanol**
- **100 Mgal plant requires 900 to 1,850 AF of water**
- **That's equal to 8 to 16, 135-acre center pivot irrigation systems (based on 10-in. annual application)**
- **Water use for an average 100 Mgal plant is equal to Devils Lake or Wahpeton's annual water use**



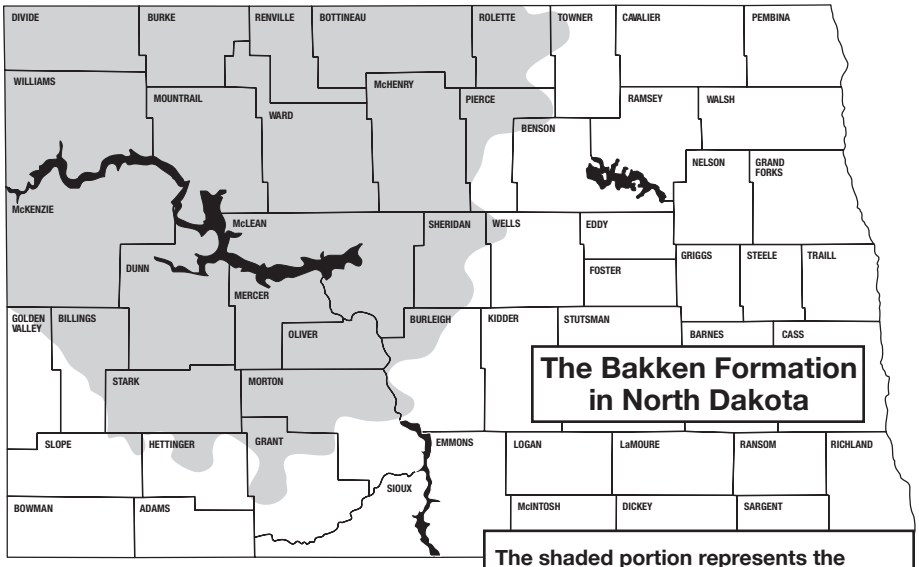
Another important industrial water use that will have an influence on future appropriation is oil well development. According to the North Dakota Department of Mineral Resources' (DMR), Division of Oil and Gas, 15 non-Bakken drilling rigs are expected to drill 10 wells each per year (for a total of 150 new non-Bakken wells annually) for the next several years. Rigs drilling in non-Bakken formations use up to 0.3 acre-feet (100,000 gallons) per well. Therefore, non-Bakken drilling could require as much as 45 acre-feet (15 million gallons) of new water per year.

Bakken wells, however, use a great deal more water as part of the drilling process, requiring just over 3 acre-feet (1 million gallons) of fresh water to drill a single well. According to the DMR, they estimate about 800 new Bakken wells will be drilled from June 2008 to June 2009; 4,600 new wells (2,300 per year) from June 2009 to June 2011; and then 11,200 new wells (1,400 per year) through 2019. If this estimate is accurate, new Bakken wells could require as much as 50,936 acre-feet (16.6 billion gallons) of fresh water through 2019.

Electric Power Water Use

There are currently ten water permits issued for thermoelectric power in North Dakota. The SWC requires reporting of both consumptive water use and non-consumptive water use for this purpose. Consumptive water use for thermoelectric power refers mostly to water that is not returned to its original source because of evaporative losses as part of the power plants' cooling processes. Non-consumptive use for this purpose means power plants are piping water through facilities for cooling purposes or using it to spin turbines, and then all of the water is returned to the original source. According to SWC records, consumptive use ranged from 28,682 acre-feet in 1997, to 38,580 in 2006. Non-consumptive use averages approximately 1,000,000 acre-feet annually.

The SWC estimates a 2020 future water use need of 56,000 acre-feet (50 MG/Day) of consumptive use, and 1,100,000 acre-feet (982 MG/Day) of non-consumptive use for thermoelectric power.

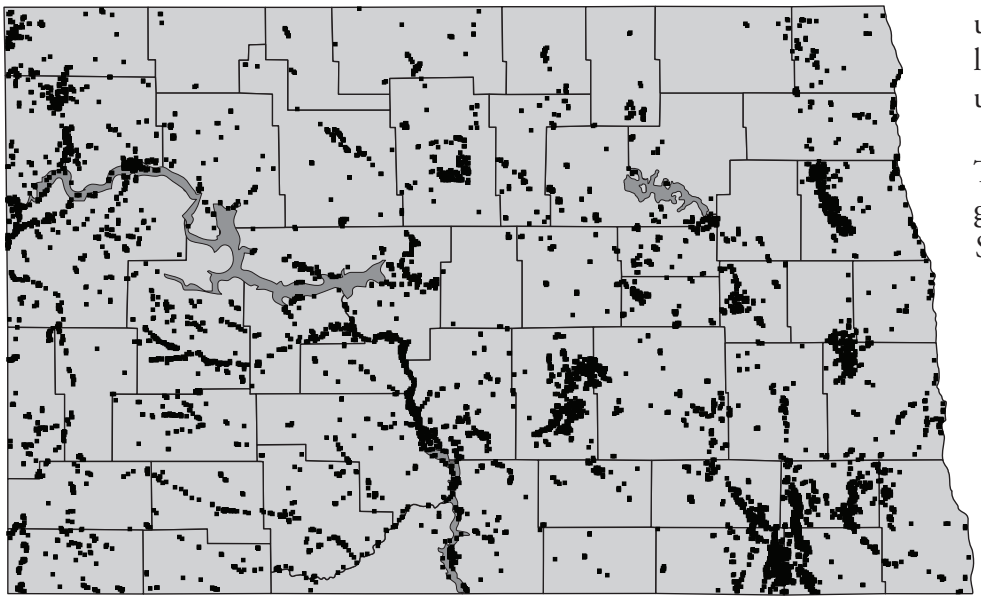


The shaded portion represents the maximum extent of rocks belonging to the Bakken Formation in North Dakota. It is estimated that current drilling technology could lead to the recovery of 2.1 billion barrels (1 percent) of the oil in North Dakota's portion of the formation.

Agricultural Water Use

As mentioned previously, economic factors and development opportunities will greatly influence future water use and availability. And in North Dakota, there is no greater economic driving force than agriculture, with one-quarter of the state's economic base derived from agriculture. In 2006, North Dakota farmers and ranchers produced more than $4 billion in farm commodities, once again making it the state's leading industry. And as of 2007, almost 90 percent of the state's land was dedicated to agriculture, either through cropland or grazing.

Nationally, North Dakota farmers are number one in producing 16 different commodity categories, including spring wheat, durum wheat, barley, flaxseed, canola, dry edible beans, pinto beans, oil sunflowers, all sunflowers, non-oil sunflowers, navy beans, all dry edible beans, lentils, honey, oats, and all wheat. The state also ranks in the top ten for the production of sug-



Irrigation Sites in North Dakota

arbeets, potatoes, alfalfa, soybeans, and hay.

The nature of farming, as it relates to farm size, has been changing, with the size of farms increasing since 1880, and the number of farms decreasing since the Dust Bowl era. However, both of those trends seem to be leveling off over the course of the last decade, with only small changes to the average farm size, and the number of farms across the state.

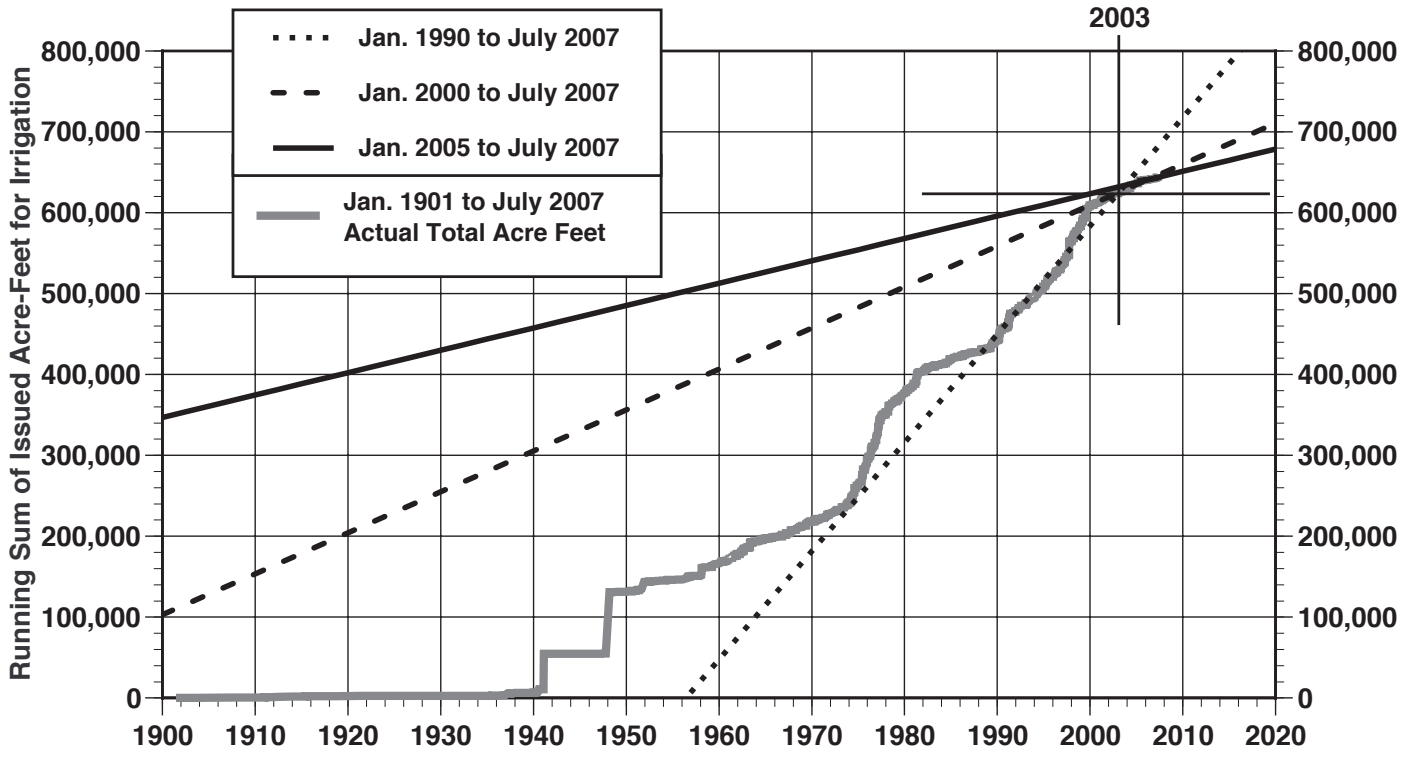
Regarding water use for irrigation, there is a great deal of variability in use across the state each year. One of the sources for this variability is the geographic distribution of irrigation sites within the state. The map above shows the locations of all irrigation sites in North Dakota. The sites represent both ground water and surface water irrigation sources. Sites located on the Missouri River, or west of the Missouri River are primarily surface water sources. Sites located in eastern and central North Dakota are primarily ground water sources.

A principal aspect of surface water irrigation is the availability of water. During drought conditions, many permits simply do not have enough surface water to irrigate crops adequately. These conditions result in water use reports showing very little water use during a drought, thus producing an inverse relationship between drought and water use. Also, surface water flood irrigation is based on a constant application rate of 12 inches per year, since there is no instrumentation measuring flow rates. An additional geographic aspect of irrigation is that much of North Dakota's irrigation is concentrated within certain regions of the state. Because of these localized concentrations, localized climatic events can have dramatic effects on irrigation water use. But, correlations between annual irrigation water use and climate data can be misleading if state-wide climate data is used.

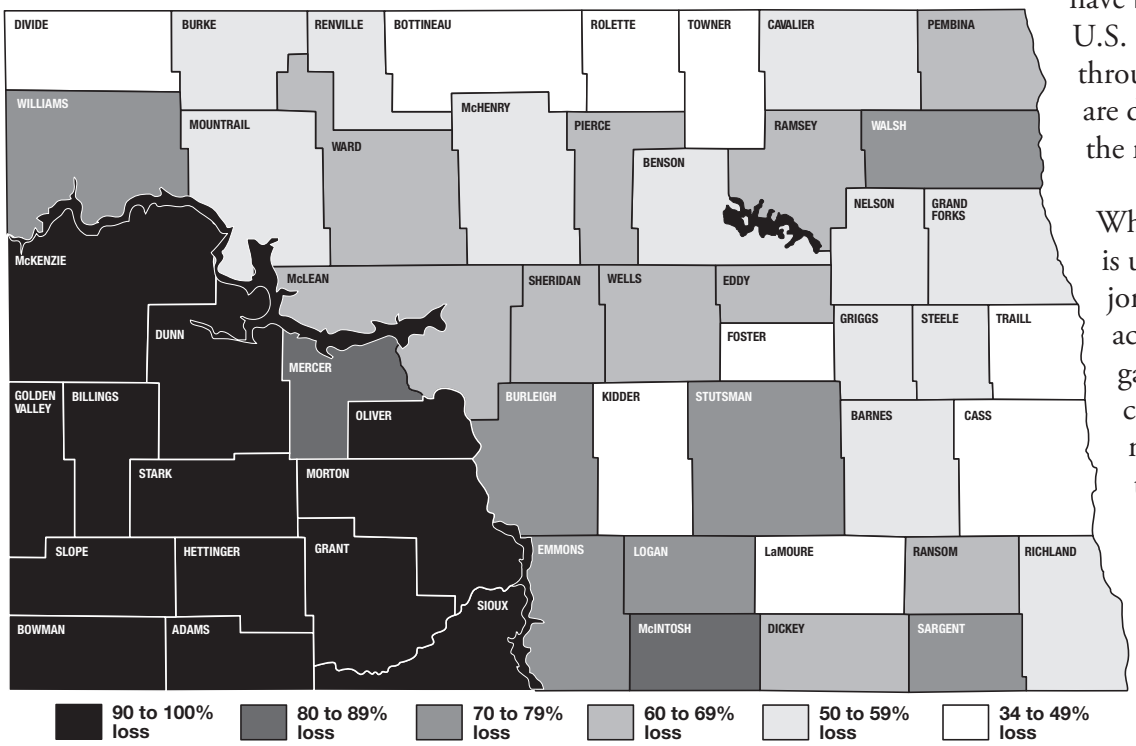
Through an analysis of more regionalized climatic factors, the SWC estimates that there will be approximately 55,000 acre-feet of water needed for irrigation development by the year 2020. Previous work at the SWC has shown an approximate 70 percent utilization rate between granted acre-feet of water and consumed acre-feet of water. Based on these numbers, it is estimated that there will be a demand for an additional 35,300 acre-feet of water (34 MG/Day). This results in a total of 264,394 acre-feet of water per year (236 MG/Day) for irrigation water use by 2020.

However, an important unknown is that higher commodity prices in concert with expiring CRP contracts will mean more acres entering into production, and possibly, additional irrigated acres. Ten-year projections in a year 2008 report to the U.S. Congress by the Food and Agricultural Policy Research Institute suggested that record oil prices and new bioenergy mandates (such as the U.S. Energy Independence and Security Act of 2007) will continue to support historically high commodity prices. In some instances, higher commodity prices, and thus the ability to receive higher rental rates, have forced producers to choose between honoring existing CRP contracts, entering into new ones, or foregoing the conservation program all together for more attrac-

Issued Acre-Feet for Irrigation in North Dakota
Past and Projected



Projected Percentage Loss of CRP Acres in North Dakota
2007 - 2012



tive rental rates. Future scenarios for CRP enrollment have been estimated by the U.S. Farm Service Agency through 2012. The results are depicted by county in the map shown at left.

What is known, is that it is unlikely that the majority of former CRP acres will become irrigated acres, simply because they were only marginal for farming to begin with. However, the additional acres put into production, along with higher commodity prices, will mean increased farm

incomes for a number of growers, which in turn may enable them to develop irrigation on more favorable tracts of land.

With regard to livestock, the SWC does not monitor livestock water consumption, however, there is extensive livestock-related data available from the U.S. Department of Agriculture, including their associated water needs. Using this data, the SWC made an estimate of livestock water use for North Dakota. It is estimated that approximately 29,340 acre-feet of water is used for livestock each year (26.2 MG/Day).

According to the North Dakota Department of Agriculture, a common trend over the course of the last several decades in the production of beef cattle, dairy cows, and hogs is a migration toward larger operations, but less of them. Estimates from the USDA National Agricultural Statistics Service indicate in the last decade: the number of beef cattle operations has declined by 15 percent to 10,500; the number of dairy cow operations has declined by 70 percent to 400; and hog operations have also declined over that same time period by 60 percent to around 400 operations. According to the North Dakota Department of Agriculture, this trend is expected to continue, meaning the actual number of livestock will remain largely the same. However, they will be dispersed in fewer locations among larger operations.

The implications of these trends in the livestock industry with regard to future water use are that total water use will remain largely the same, but it will become concentrated in fewer locations. In some cases, the resource will be able to handle the additional demand, in others cases, it will not. For that reason, owners of large livestock operations should make water availability a priority when choosing the location of future operations.

Fish, Wildlife, and Recreation

Water use for fish, wildlife, and recreation are generally part of larger multi-purpose projects, such as dams and reservoirs. Although independent uses for these purposes do exist in North Dakota, they are generally small and account for less than 1 percent of total water use. For that reason, no future water use projections were developed for this current planning effort.

It is, however, important to note that demand for fish and wildlife could increase in the future through the introduction of minimum instream flow permits. This would mean that a permit could authorize the maintenance of a minimum water flow in a river or stream to protect crucial habitat. In the past, multi-agency task forces have been formed to study the necessity and viability of establishing minimum flows, but no changes have been made to state water law. Currently, the State Engineer does not have the authority to issue permits for minimum instream flows. Thus, any changes to this regulatory authority would require modifications to current state statutes.

Though legal authority to grant minimum instream flows does not exist, flows in certain rivers are sometimes managed to maintain flow levels of senior or proprietary water users when project works, such as dams or diversions are present. For example, along the Souris and James Rivers, the state must maintain water levels adequate to satisfy senior water permits for several national wildlife refuges. Other stream flow management occurs along the Little Missouri River; where under the authority of the Little Missouri Scenic River Act issued by the State Legislature, the river must maintain a free-flowing natural condition; allowing no dams on the mainstem of the river. The protection of various species that have been, or will be protected by the federal Endangered Species Act could also result in mandates to maintain minimum stream flows in rivers, or elevations in lakes and reservoirs – particularly along the Missouri River system.

Dams provide opportunities for recreation in areas all across the state, and in many instances, provide fish and wildlife benefits. However, the state's aging dam infrastructure has prompted water managers to make decisions regarding the future of a number of dams in North Dakota. In some instances, repairs are economically

justifiable. But in other instances, removal is a more favorable option. More recently, the state has tried to implement fish passage elements into dam repairs and modifications whenever possible. This is done to improve habitat and to reduce drowning hazards associated with low head dams. This trend is likely to continue in the future.

Water Availability

Shifting population concentrations, and increasing numbers of industrial and agricultural developments across the state have resulted in a situation where North Dakota's ground and surface water resources are becoming more fully appropriated. Thus, the presence or absence of water has become one of the primary factors in locating industrial plants, or any other developments requiring large amounts of water. The following section provides an overview of the availability of North Dakota's surface and ground water resources – including a color-coded map of potential future ground water development areas.

Surface Water Resources

North Dakota is a land of extreme climate. This fact is reflected in its water resources, where surface water supplies are linked to the region's highly variable precipitation patterns. During wet years, and throughout much of the 1990s, North Dakota experienced a wet cycle that had rivers flow bank full, and lakes rising to record levels. As was experienced during the 1930s and even more recently, droughts have caused rivers to go dry, and lake beds to become salt flats.

In North Dakota, the Missouri River contains approximately 96 percent of the state's surface water, and Lake Sakakawea and Lake Oahe account for approximately 97 percent of all available water storage. However, the greatest concentration of population in the state is situated in the Red River Valley, where surface water resources have been historically limited during periodic droughts. The reliable availability of surface water is an issue that is currently confronting the state, and will likely drive water management in the future.

Bedrock Aquifers

The bedrock aquifers occur throughout most of North Dakota. The most important bedrock aquifers are, 1) the Lower Cretaceous Dakota Sandstone aquifer, 2) the Upper Cretaceous Fox Hills Sandstone and Hell Creek aquifers, and, 3) the Tertiary sand/lignite aquifers within the Fort Union Formation, Golden Valley Formation, and White River Group.

The Lower Cretaceous Dakota Sandstone aquifer underlies most of North Dakota with depths ranging from about 200 feet below land surface in the eastern part of the state, to up to about 6,000 feet below land surface in the western part of the state. Individual well yields of up to about 1,000 gallons per minute are possible from properly completed wells in the Dakota aquifer. Due to the relatively high salinity, particularly in the central and western part of the state, ground water from the Dakota aquifer generally is not suitable for most uses.

The Upper Cretaceous Fox Hills Sandstone and Hell Creek aquifers underlie the central and western parts of North Dakota. The aquifers are exposed at land surface and increase in depth to about 2,000 feet in the west-central part of the state. Individual well yields of up to about 200 gallons per minute are possible from properly completed wells in the Fox Hills aquifer. Water from the Fox Hills and Hell Creek aquifers is commonly characterized by relatively high salinities, but is a common source for domestic and livestock use and limited municipal and rural use. The relatively high salinity renders most Fox Hills and Hell Creek waters unsuitable for irrigation use.

The Fox Hills aquifer provides an important free-flowing source of ground water for ranchers in low-lying areas in the western part of the state (Yellowstone, Little Missouri, Missouri River valleys). However, because of declining water levels in the Fox Hills aquifer, it is the policy of the State Engineer to direct large-scale ground water diversions to other groundwater sources, if feasible, to reduce the rate of water-level decline, and

to extend the period of free-flowing conditions.

The Tertiary sand and Lignite aquifers within the Fort Union and Golden Valley Formations, and the White River Group, underlie the western part of North Dakota. Individual well yields of up to about 50 gallons per minute are possible from properly completed wells in the Tertiary sand and Lignite aquifers, but yields of 5 to 10 gallons per minute are more common. These aquifers are an important source of water for domestic and livestock use in western North Dakota. Like the Fox Hills and Hell Creek aquifers, ground water in the Tertiary sand and Lignite aquifers is commonly characterized by relatively high salinities that pose restrictions for irrigation use.

Glacial Drift Aquifers

About two-thirds of the state of North Dakota is covered by glacial drift. Major aquifers in the glacial drift are comprised of water deposited sand and gravel.

The major glacial drift sand and gravel aquifers are divided into surficial and buried aquifers. Surficial aquifers receive recharge from direct infiltration of precipitation and snowmelt. Buried aquifers generally are confined by less permeable, clay-rich glacial drift (till and/or lake sediments), and as a result, recharge is significantly less than recharge associated with surficial aquifers.

Individual well yields in glacial drift aquifers are highly variable, ranging from a few gallons per minute in thin, narrow, fine-grained parts of the aquifers, to a few thousand gallons per minute in thick, extensive, coarse-grained parts of the aquifer. Water quality in the glacial drift aquifers is also highly variable, ranging from about 100 to 20,000 milligrams per liter dissolved solids concentrations. In comparison with sedimentary bedrock aquifers, the glacial drift aquifers commonly provide larger individual well yields and better water quality (lower salinity).

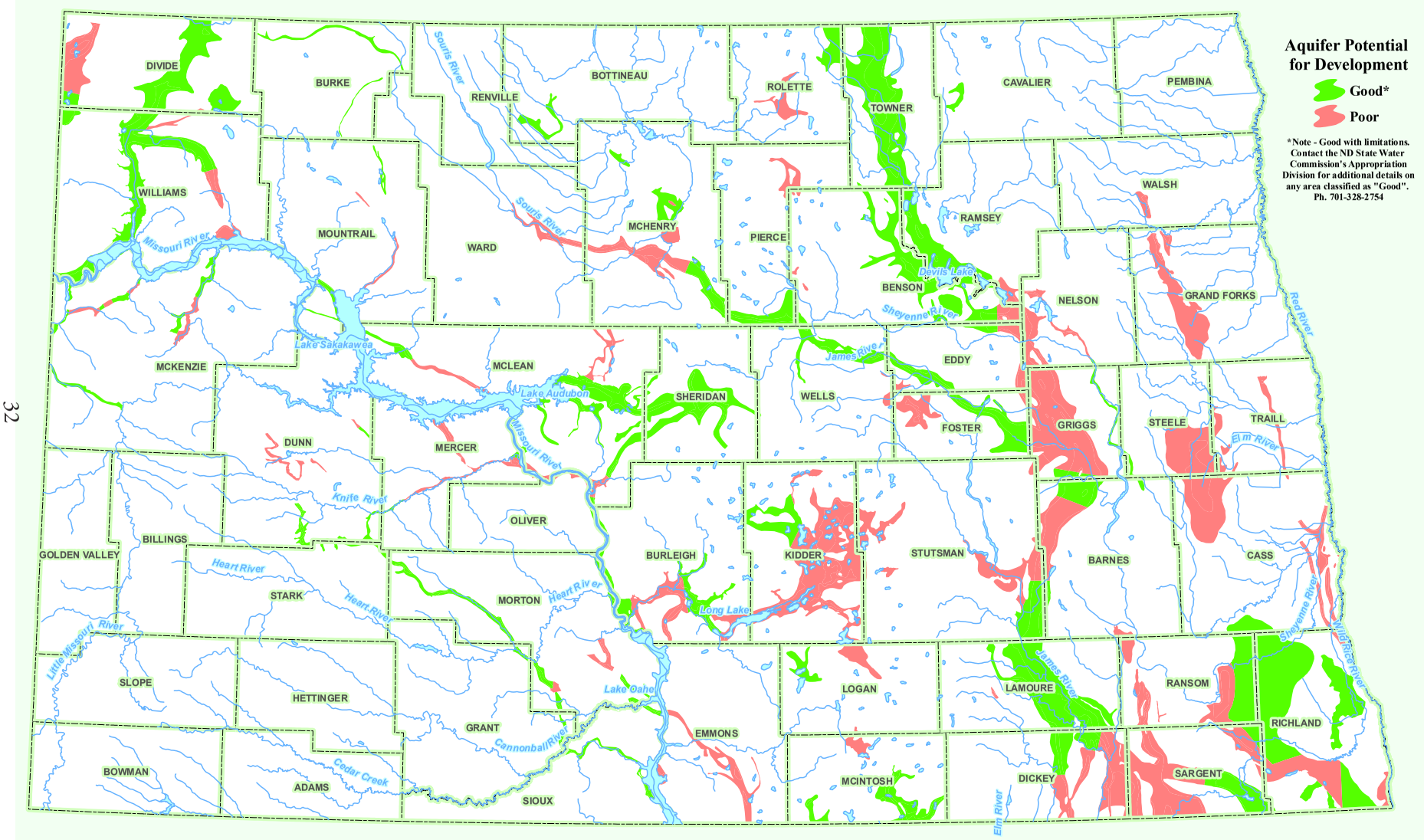
Ground Water Resources

The major glacial drift aquifers in North Dakota are outlined in the Ground Water Availability map on the following page. In addition, the map shows areas in these aquifers where the potential for additional ground water development is good (areas shown in green) or poor (areas shown in red). This map was developed to provide a preliminary basis for considering sites for developing relatively large-scale ground water supplies. The areas in the glacial drift aquifers where the potential for ground water development is poor are characterized by existing large-scale ground water development. These areas are at, or near, full appropriation.

The areas in the glacial drift aquifers where the potential for additional large-scale ground water development is good are generally characterized by little to moderate or no existing ground water development. It is important to understand that in the areas where the potential for additional ground water development is good there may exist complex aquifer geometries and /or poor water quality characteristics that could restrict sustained large-scale ground water withdrawals for a particular use. For example, several areas of the state likely could yield large quantities of ground water where the water quality is unsuitable for irrigating the heavy textured overlying soils. The water quality may be acceptable for other uses. Given the above, this map should be used only as a preliminary guide to identify potentially suitable ground water supplies. Individuals interested in developing a relatively large-scale ground water supply should contact hydrologists in the Water Appropriation Division of the SWC to further identify sites that may meet their specific needs.

Hydrologic data to assess the potential for developing a ground water supply in the form of descriptive geologic logs from test holes, water levels, and water quality analyses can be accessed on the Commission website at www.swc.nd.gov, by clicking on the “Map and Data Resources” link. In addition, scanned versions of reports in the form of County Ground-Water Studies, Water Resource Investigations, and City Ground-Water Studies can be accessed on the same website by clicking the “Reports and Publications” link.

Ground Water Availability in North Dakota
Glacial Drift Aquifers



NORTH DAKOTA STATE WATER COMMISSION, AUGUST 2008

VISION FOR THE 21ST CENTURY

Present and future generations of North Dakotans will enjoy an adequate supply of good quality water for people, agriculture, industry, and fish and wildlife; Missouri River water will be put to beneficial use through its distribution across the state to meet ever-increasing water supply and quality needs; and successful management and development of North Dakota's water resources will ensure health, safety, and prosperity, and balance the needs of generations to come.

North Dakota's water management vision for the 21st century provides direction for water management and development across the state. It builds on successes of the past, and more importantly, it calls on water managers, decision makers, and members of the general public alike, to seize future opportunities. However, in order to achieve this vision, the state must address several critical water management and development issues, including developing Missouri River water, developing adequate water supplies for eastern North Dakota, financing future water development, and balancing public trust obligations.

Priority Project Updates

Since the completion of the 1999 State Water Management Plan, the State of North Dakota, through the Commission, has seen tremendous progress made in water development in all parts of the state. What is also important to recognize is that many of the state's large-scale water projects progressed despite the many obstacles that often face projects today. The following summary provides an update of progress that has been made, and milestones that have been met on several of the state's priority water development efforts over the course of the last five bienniums.

Grand Forks Flood Control

Since the devastating flood of 1997, the city of Grand Forks has worked in cooperation with the federal government and the State of North Dakota to develop one of the largest flood control projects the state has ever seen. As a result of that cooperation, the Grand Forks flood control project has been completed, and it is recognized as a permanent flood protection feature by the Federal Emergency Management Agency.

The Grand Forks flood control project consists of levees and a floodwall set back from the Red River. In addition, stabilization of an existing dam, removal of a former railroad bridge, interior flood control features, numerous road and railroad closures, extension and expansion of an existing diversion channel, and construction of a new diversion channel with associated structural features, are all part of the project.

Wahpeton Flood Control

Like Grand Forks, the city of Wahpeton was hit hard by the flood of 1997, and as a result, sought a permanent flood protection project that would better protect the community from a 1997-type event. The Wahpeton flood control project consists of a permanent levee system to protect the city, and a flood easement to keep breakout flows from being blocked in the future.

Phase I construction has been completed, which includes interior pumping stations, detention ponds, and other interior flood control features. Phase II plans and specifications for a portion of the in-town levees was also completed, and construction began in 2008. Phase III plans and specifications, which are for the second of three in-town levee reaches, have been initiated. Both Phase II and Phase III levee construction efforts must be completed in concert with levee

constructions on the Breckenridge, Minnesota side of the Red River to avoid project induced impacts.

Maple River Dam

Construction on Maple River Dam began in the fall of 2004, and it was deemed operational only two years later in the fall of 2006. All aspects of construction were officially completed in 2007.

Maple River Dam is located in southeast North Dakota, approximately eight miles north of Enderlin. This dry dam is a 70-foot high earthen embankment, capable of temporarily retaining up to 60,000 acre-feet of floodwater. Maple River Dam is designed to provide flood protection along the Maple, Sheyenne, and Red Rivers, and it was the fourth phase completed as part of the Sheyenne River flood control project. The other completed phases are the West Fargo Sheyenne River Diversion, the Horace to West Fargo Sheyenne River Diversion, and the five-foot flood pool raise at Baldhill Dam.

Southwest Pipeline (SWPP)

Since the development of the 1999 State Water Management Plan, a tremendous amount of progress has been made on the Southwest Pipeline Project. From 1999 to 2009, the number of rural water users will have increased from just under 1,600 to about 3,700. And, the number of cities and other bulk water users will go from 25 to 53 during that same time period. In addition, by the end of the 2007-2009 biennium, it is estimated that the total population served by the SWPP will be about 35,000.

The SWPP also recently contributed to North Dakota's energy development efforts by providing water to Red Trail Energy, an ethanol plant located in Richardton. And because of the high quality water provided by the SWPP, Red Trail was able to amend its contract to reduce their maximum annual usage from 315 million gallons per year, to 252 million gallons per year. With Red Trail's need for that much water, they have become the second largest water user on the SWPP, behind only the city of Dickinson. In comparison, Dickinson currently uses just over 600 million gallons of Missouri River water per year.

Northwest Area Water Supply (NAWS)

In the spring of 2002, construction began on the long-awaited Northwest Area Water Supply project. Since that time, construction on the 45 miles of pipeline between Minot and Lake Sakakawea has been completed. In August 2008, construction was also completed on 24 miles of pipeline, four pump stations, and two storage reservoirs that provide water service to Berthold, Minot's South Hill region, and North Prairie Rural Water District, with an interim supply from Minot's water treatment plant. In fall 2008, the Kenmare-Upper Souris contract was awarded for completion of 53 miles of pipeline and a pump station to address arsenic issues in Kenmare, and provide additional water supply to the Upper Souris Water Users rural water system.

Additional project components that will be constructed along the main transmission line include an intake at Lake Sakakawea, some level of treatment facility at Max, a control structure at the basin divide, and a three million gallon raw water storage reservoir. However, these future facilities along the main transmission line will require completion of the EIS and federal funding.

The EIS was pursued due to the 2002 lawsuit filed by the Province of Manitoba, which argued that NAWS could increase the risk of transferring non-native biota between the Missouri River and Hudson Bay drainage basins, and the project should have additional environmental review. As a result, project construction has been delayed on features between Minot and Lake Sakakawea that affect treatment decisions, however the federal court has allowed construction on the northern tier to proceed.

When completed, NAWS will provide up to 26 million gallons of Missouri River water per day to at least 63,000 citizens in North Dakota. With additional rural development, NAWS could serve as many as 81,000.

Red River Valley Water Supply (RRVWS)

The Commission has worked in cooperation with the Garrison Diversion Conservancy District, and the U.S. BOR toward the completion of an EIS for the Red River Valley Water Supply Project. The purpose of the EIS, which was completed in December 2007, is to evaluate alternatives to meet the long-term water needs of the Red River Valley in North Dakota, and the cities of East Grand Forks, Moorhead, and Breckenridge in Minnesota.

As part of the Final EIS, the BOR, and the State of North Dakota, identified the Garrison Diversion Unit Import to the Sheyenne River Alternative as the preferred alternative. As the State of North Dakota and the federal government pursue the development of the preferred alternative, the SWC will continue to provide technical and financial assistance toward project completion.

Municipal, Rural and Industrial (MR&I) Water Supply Program

Because of North Dakota's Municipal, Rural and Industrial Water Supply Program, regional and rural water systems have continued to expand throughout the state. As a result of this added assistance, there are now 32 regional water systems in North Dakota providing quality drinking water. Over 160,000 residents are served by regional water systems, including 312 cities, and over 90,000 rural residents. Currently, all or part of 47 of North Dakota's 53 counties are served by regional water systems, and most have plans to expand to cover additional areas.

Just since 1999, MR&I projects have been completed for several water supply systems across the state, including: All Seasons Water Users District, Glenfield, LaMoure, Langdon Rural Water, McKenzie County Rural Water, Minot (NAWS), North Valley Water District, Park River, Ramsey County Rural Water, Ransom Sargent Rural Water, Rugby (NAWS), South Central Regional Water District, Stutsman Rural Water District, Tri-County Water District, Underwood, Walsh Rural Water District, Williams Rural Water, and Williston.

Several water supply systems also have projects under construction, including: All Seasons Water Users District, Berthold (NAWS), Devils Lake, Minot (NAWS), North Central Rural Water Consortium, Parshall, South Central Regional Water District, Southwest Pipeline Project, Traill Rural Water District, Tri-County Rural Water, and Wimbledon.

In addition, studies were completed to develop improved water supplies at Carrington, McLean Sheridan Rural Water, Mountrail Rural Water, North Central Rural Water Consortium, South Central Regional Water District, Southeast Water District, Traill Rural Water District, and Williams Rural Water.

Devils Lake Flood Control

Since the early 1990s, flooding in the Devils Lake region has persisted, with an unpredictable future ahead. In response, the state of North Dakota and the SWC have determined that there is no single solution to the flooding problems in that region. Rather, a three-pronged approach, including infrastructure protection, upper-basin water management, and an outlet to the Sheyenne River, together, are the only means of providing some relief.

A great deal of progress has been made on all three fronts. In recent years, the state has provided assistance to the Devils Lake Joint Water Resource Board to help with the implementation of an irrigation test project that is aimed at utilizing upper basin waters for value-added agriculture, while helping to reduce inflow into Devils Lake. At the same time, the Commission has continued to fund the Extended Storage Acreage Program to store floodwater in the upper portions of the basin.

In addition, the Commission completed an outlet to the Sheyenne River in the summer of 2005. Outlet operation has been limited due to low flows and poor water quality in the Sheyenne River.

In infrastructure protection ef-

forts, the levee protecting the city of Devils Lake has provided adequate protection for the community thus far. But, because the threat of increasing lake levels still exists, the city has been working with the U.S. Army Corps of Engineers to identify potential flood protection alternatives, should the lake continue to rise. Because of the tremendous costs that would be involved in any type of levee raise and extension, Devils Lake will likely be looking to the state for cost-share assistance.

In other infrastructure protection efforts, certain Devils Lake area roads are currently acting as dikes, though they were not originally designed for that purpose. As such, a number of solutions are being proposed to minimize future risks.

Devils Lake Water Supply

As Devils Lake continued its infamous rise, it covered six miles of the city of Devils Lake's water supply line with up to 40 feet of water. To make matters worse, the city was also facing new federal Safe Drinking Water Act regulations for arsenic that came into effect in January 2006. With arsenic levels at over three times the allowable concentration under the new regulations, the city was only given an exemption through January 2009. And, because of Devils Lake's population, the Department of Health was not able to grant an exemption beyond that timeframe.

In response, the city of Devils Lake has been working in cooperation with the SWC and the federal government to develop a new water supply.

With regard to project progress, the city's new waterline portion of the project has been completed, and water is expected to be flowing from a new wellfield by spring 2009. Construction on the new water treatment plant is expected to begin during the summer of 2009, with operation starting a year later.

General Water Management

Though larger, higher profile projects get most of the attention across the state, the Water Commission is also constantly cooperating with local sponsors to complete smaller water development efforts. General water management projects include rural flood control projects, snagging and clearing, channel improvements, recreational projects, planning efforts, and special studies. Just since the completion of the 1999 State Water Management Plan, dozens of these projects have been completed each year. And through cooperative efforts with water resource districts and other local entities, the Water Commission will continue to strive to develop relationships and agreements to pursue the development of smaller projects that have big impacts to the communities and regions they benefit.

State Water Development Program

This section will briefly describe the inventory process used by the SWC Planning and Education Division to identify future water project and program funding needs. A discussion will also be provided of current water development activities, as well as project needs for the 2009-2011 biennium and beyond.

The Inventory Process

As part of the SWC's water planning efforts, the Planning and Education Division once again solicited project and program information from potential project sponsors. The results provide the SWC with an updated inventory of water projects and programs that are expected to come forward for SWC cost-share in the upcoming 2009-2011 biennium and beyond. As in the past, the product of this effort becomes the foundation that supports the State Water Commission's budget request to the Governor and Legislature.

To obtain updated and new project and program information from sponsors, the Planning and Education Division sent project information forms to county water boards, joint boards, and communities. The managers of major water projects, including the Municipal, Rural, and Industrial Program; Northwest Area Water Supply Project; and Southwest Pipeline Project, were also surveyed. Infor-

mation requested on the forms included general project descriptions, location, permit information, and identification of potential obstacles, among other basic aspects of the projects.

More importantly, sponsors were asked to assign the most realistic start dates possible to projects they expected to present to the SWC for cost-share consideration - particularly during the 2009-2011 and later bienniums. As part of that effort, project sponsors needed to take into consideration when a funding commitment from the SWC will be needed, and to identify when state dollars will be necessary for projects or programs to proceed.

As the project information forms were received by the SWC, each project is reviewed to determine if the proposed timeframes for project advancement are reasonable and justified by supporting information. After project reviews were completed, the information was transferred into the Planning and Education Division's water project database. This provides the SWC with updated project information for older projects and an accounting of new projects that have developed since the last inventory process, during the 2005-2007 biennium. The result of this inventory process is a comprehensive list of water projects throughout North Dakota that could come forward for new or additional cost-share in future bienniums. As stated earlier, this is an invaluable tool for budget planning purposes both for the SWC and the Legislature.

In addition to water project information, water managers were also asked to provide information on major water use changes that might be expected within their respective jurisdictions. And, all entities were asked to provide information regarding issues concerning regulations, policies, or legislation that they would like to see the SWC or SE address during future Legislative Assemblies.

Project Inventories

The following tables will provide an inventory of completed and currently active projects in the 2007-2009 biennium, and future water development needs that were provided by project sponsors for the 2009-2011 biennium.

Completed Projects, 2007-2009 Biennium

The table below lists the projects, programs, and studies that were completed by June 30, 2007, or midway through the 2007-2009 biennium.

Completed Projects 2007-2009

Willow Creek Watershed Engineering Services
Epping Dam Review & Investigation
Sheyenne River Snagging & Clearing, SE Cass
Casselton Township Imp. District Drain #64
Crown Butte Dam Inlet
Antelope Creek Retention Sites Phase II
Gessner Drain Improvement
Cass County Drain #9 Drop Structure
Cass County Drain #13 Reconstruction, Phase V
Cass County Drain #14 Reconstruction
Cass County Drain #40 Reconstruction
Cass County Drain #45 Extension Construction
Grand Forks County Drain #27A Outlet Improvement
Pembina County Drain #16 Reconstruction
Richland County Drain #62 Reconstruction
Richland County Drain #65 Reconstruction
Sargent County Drain #11 Improvement
Traill/Roseville Drain #19 Legal Extension
Grand Forks WRD Farmstead Ring Dike Program
City of Garrison, Water Line Intake Boring Project
Mountrail County Irrigation Project Feasibility Study
Mount Carmel Dam Incident Consultant
Mount Carmel Dam Incident
Mount Carmel Dam Engineering Services
ND Water Resource Institute Fellowship
Wild Rice Mainstream Retention Sites Study
City of Hazen Topographic Mapping
Goose River Snagging & Clearing, Steele and Nelson
Sussex Dam Engineering Feasibility Study
ND Natural Resources Trust
Wild Rice River Snagging & Clearing, Richland County
SE Cass, Normanna Township Drain Construction
Walsh County Assessment Drain #4B Construction
Elm River Snagging & Clearing - Steele County WRD
Elm River Snagging & Clearing - Trail County WRD
Harwood Township Drain Construction, SE Cass
Pembina County Drain #72 Construction
Cass County Drain #66 Construction
Digital Aerial Survey Hydraulic Analysis and Mapping
Sweetbriar Creek Dam Engineering Agreement
ND Water Education Foundation Tours
ND Ag. Weather Network, NDSU

Currently Active Projects, 2007-2009 Biennium

The projects and project categories listed in the adjacent table represent water development efforts that are being pursued in the current biennium. Several individual projects are listed in the table. However, a number of others fall under project categories, such as irrigation development or general water management, and therefore, are not individually identified in the table.

This table also represents the total 2007-2009 SWC project budget, and what the SWC had approved for project funding halfway through the biennium. As the table suggests, the SWC had approved 71 percent of the project budget by June 30, 2007.

Currently Active Projects 2007-2009

PROJECT OR CATEGORY	BUDGET	SWC/SE APPROVED
GRAND FORKS FLOOD CONTROL	$2,384,557	$2,384,557
WAHPETON FLOOD CONTROL	2,492,560	1,337,957
FARGO SOUTHSIDE FLOOD CONTROL	16,650,000	2,584,750
MR&I WATER SUPPLY	24,038,796	24,038,796
IRRIGATION DEVELOPMENT	2,497,982	613,182
GENERAL WATER MANAGEMENT	14,640,445	10,727,894
MISSOURI RIVER MANAGEMENT	100,000	90,000
BALDHILL DAM FLOOD CONTROL	358,811	358,811
RENWICK DAM REHABILITATION	1,148,520	1,148,520
MAPLE RIVER DRY DAM	611,235	611,235
RED RIVER VALLEY WATER SUPPLY	12,090,000	1,800,000
DEVILS LAKE BASIN DEVELOPMENT	135,550	135,550
DEVILS LAKE DIKE	1,624,202	1,624,202
DEVILS LAKE OUTLET	2,465,477	2,465,477
DEVILS LAKE WATER SUPPLY	4,553,000	4,553,000
DEVILS LAKE OUTLET OPERATIONS	2,000,000	2,000,000
NELSON COUNTY FLOOD RELIEF	203,008	203,008
WEATHER MODIFICATION	600,000	525,000
SOUTHWEST PIPELINE PROJECT	13,409,130	13,409,130
NORTHWEST AREA WATER SUPPLY	8,019,857	8,019,857
TOTALS	$110,023,130	$78,630,926

Water Development Funding Needs, 2009-2011 Biennium

This table contains projects that could move forward and request SWC cost-share in the 2009-2011 biennium. This accounting of projects simply represents a non-prioritized list of needs as submitted by water managers. It does not guarantee, in any way, that all of the projects listed will receive funding.

The list is organized into seven categories based on SWC cost-share policies, including: flood control, rural flood control, snagging and clearing, irrigation, studies and planning, multi-purpose, and water supply projects. The total financial need to implement all of the projects in the 2009-2011 inventory is at least $563 million. The state's share of that total is about $137 million, based on current cost-share requirements. The federal government and local project sponsors would be responsible to make up the balance.

It should be recognized that the 2009-2011 totals do not account for projects that may not seek funding in the current 2007-2009 biennium and will carry over to the next biennium. As a result, the actual need for the upcoming biennium has the potential to be greater than portrayed here. In contrast, it should also be noted

that water development projects can be delayed as a result of local or federal funding problems, permits, or environmental issues, which can substantially influence the actual need for any given biennium.

Water Development Funding Needs, Beyond 2009-2011

The potential funding need from the state that was reported by project sponsors beyond the 2009-2011 biennium, through 2017, exceeds $333 million in total project costs. At least $260 million of that total can be attributed to water supply projects, including the Red River Valley Water Supply Project. Projects included in this timeframe were either identified by project sponsors to move ahead beyond June 30, 2011, or they were placed into a later timeframe by SWC staff based on their knowledge of the project.

Water Development Funding Needs 2009-2011

RURAL FLOOD CONTROL

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Cass	Red	Cass County Drain #10	$0	$700,000	$1,300,000	$2,000,000
Cass	Red	Cass County Drain #13	$0	$700,000	$1,300,000	$2,000,000
Cass	Red	Cass County Drain #14	$0	$700,000	$1,300,000	$2,000,000
Cass	Red	Cass County Drain #15	$0	$175,000	$325,000	$500,000
Cass	Red	Cass County Drain #40	$0	$350,000	$650,000	$1,000,000
Cass	Red	Cass County Drain #53	$0	$630,000	$1,170,000	$1,800,000
Cass	Red	Lynchburg/Buffalo Channel Imp.	$0	$1,575,000	$2,925,000	$4,500,000
Cavalier	Red	Cypress Creek Drain #2	$0	$45,787	$85,033	$130,820
Grand Forks	Red	Cole Creek Channelization	$0	$133,000	$247,000	$380,000
Pembina	Red	Auger Coulee	$0	$245,000	$455,000	$700,000
Pembina	Red	Kippen Coulee	$0	$105,000	$195,000	$300,000
Pembina	Red	Pembina County Drain #42 Reconstruction	$0	$71,000	$133,092	$204,092
Pembina	Red	Pembina County Drain #66 New Outlet	$0	$87,500	$162,500	$250,000
Pembina	Red	Pembina County Drain #69	$0	$26,250	$48,750	$75,000
Pembina	Red	Pembina County Drain #73	$0	$122,500	$227,500	$350,000
Pembina	Red	Pembina County Drain #75	$0	$70,000	$130,000	$200,000
Richland	Red	Drain #14 Reconstruction	$0	$175,000	$325,000	$500,000
Richland	Red	Drain #3 Reconstruction	$0	$350,000	$650,000	$1,000,000
Walsh	Red	Channel 3 Lower Forest River	$0	$94,500	$175,500	$270,000
Walsh	Red	Silberger Drain	$0	$210,000	$390,000	$600,000
Walsh	Red	Walsh County Drain #25	$0	$87,500	$162,500	$250,000
Walsh	Red	Walsh County Drain #67A	$0	$350,000	$650,000	$1,000,000
Walsh	Red	Walsh County Drain #70	$0	$140,000	$260,000	$400,000
Walsh	Red	Walsh County Drain #71	$0	$105,000	$195,000	$300,000
Walsh	Red	Walsh County Drain #72	$0	$61,250	$113,750	$175,000
Walsh	Red	Walsh County Drain #73 - Goulet Drain	$0	$61,250	$113,750	$175,000
		Rural Flood Control Total	$0	$7,370,537	$13,689,375	$21,059,912

FLOOD CONTROL

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Cass	Red	Fargo Southside Flood Control	$11,000,000	$30,000,000	$30,000,000	$71,000,00
Cass	Red	Farmstead Ring Dikes	$0	$2,000,000	$3,000,000	$5,000,000
Cass	Red	Swan Creek Diversion Phase II	$0	$1,000,000	$1,000,000	$2,000,000
Cass	Red	Upper Maple River Dam	$0	$2,500,000	$2,500,000	$5,000,000
Cass	Red	Wild Rice R. Floodwater Retention	$0	$20,000,000	$20,000,000	$40,000,000
Griggs	Red	Uland Dam Repair	$0	$75,000	$75,000	$150,000
Nelson	Devils Lake	Michigan Spillway	$0	$440,000	$560,000	$1,000,000
Pembina	Red	Pembina R. Setback Dike System	$0	$350,000	$650,000	$1,000,000
Richland	Red	Wahpeton Flood Control	$1,633,150	$503,950	$503,950	$2,641,050
Sargent	Red	Brummard-Lubke Dam Repair	$0	$100,000	$100,000	$200,000
Statewide	Devils Lake	Devils Lake Oultet Operation	$0	$2,000,000	$0	$2,000,000
Walsh	Red	Grafton Flood Control	$2,681,000	$446,850	$446,850	$3,574,700
Williams	Missouri	Sand Creek Drainage	$0	$450,500	$450,500	$901,000
		Flood Control Total	$15,314,150	$59,866,300	$59,286,300	$134,466,750

MULTI-PURPOSE

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Benson	Red	Bouret Dam Repair	$0	$78,000	$42,000	$120,000
Burleigh	Missouri	Missouri River - Prison Farm Bank Stabilization	$2,970,000	$0	$990,000	$3,960,000
Burleigh	Missouri	Missouri River Protection and Imp. Act of 2000 Projects	$500,000	$0	$167,000	$667,000
Eddy	Red	Warwick Dam Rehabilitation	$33,333	$33,333	$33,334	$100,000
Nelson	Red	McVille Dam Repair	$0	$50,000	$50,000	$100,000
Nelson	Red	Tolna Dam Repair	$0	$30,000	$30,000	$60,000
Pembina	Red	Cart Creek Improvements	$0	$137,500	$118,750	$256,250
Pembina	Red	Drayton Dam Upst. Channel Landslide Remediation	$440,000	$680,000	$120,000	$1,240,000
Multi-County	Missouri/ Souris	ND Cloud Modification	$0	$700,000	$1,421,212	$2,121,212
Walsh	Red	Bylin Dam Repair	$0	$1,300,000	$700,000	$2,000,000
Walsh	Red	Matejcek Dam Repair	$0	$1,300,000	$700,000	$2,000,000
		Multi-purpose Total	$3,943,333	$4,308,833	$4,372,296	$12,624,462

IRRIGATION

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Multi-county	Devils Lake	Devils Lake Basin Water Utilization Pilot Project	$1,100,000	$1,100,000	$800,000	$3,000,000
Statewide	Statewide	Irrigation Development	$0	$2,000,000	$3,000,000	$5,000,000
		Irrigation Total	$1,100,000	$3,100,000	$3,800,000	$8,000,000

STUDIES AND PLANNING

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Cass	Red	Absaraka Dam Reconstruction	$0	$50,000	$50,000	$100,000
Cass	Red	Embden Dam Reconstruction	$0	$50,000	$50,000	$100,000
Cass	Red	Garsteig Dam Reconstruction	$0	$50,000	$50,000	$100,000
		Studies & Planning Total	$0	$150,000	$150,000	$300,000

SNAGGING AND CLEARING

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Cass	Red	Sheyenne River Snagging and Clearing	$0	$100,000	$300,000	$400,000
Cass	Red	Wild Rice River Snagging and Clearing	$0	$50,000	$150,000	$200,000
Grand Forks	Red	Turtle River Snagging and Clearing	$0	$93,750	$281,250	$375,000
Nelson	Red	Sheyenne River Snagging and Clearing	$0	$8,000	$24,000	$32,000
Richland	Red	Antelope Creek Snagging and Clearing	$0	$50,000	$150,000	$200,000
Richland	Red	Sheyenne River Snagging and Clearing	$0	$37,500	$112,500	$150,000
Richland	Red	Wild Rice River Snagging and Clearing	$0	$50,000	$150,000	$200,000
Walsh	Red	North Branch Park River Snagging and Clearing	$0	$125,000	$375,000	$500,000
		Snagging and Clearing Total	$0	$514,250	$1,542,750	$2,057,000

WATER SUPPLY

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Barnes	Red	Valley City Water Treatment Plant Improvements	$3,081,870	$0	$2,521,530	$5,603,400
Burke, Divide	Souris	BDW Phase II Expansion	$2,439,500	$0	$1,045,500	$3,485,000
Burke, Divide	Souris	BDW Phase III Expansion	$722,400	$0	$309,600	$1,032,000
Cass	Red	City of Davenport Water Supply Expansion	$198,900	$0	$107,100	$306,000
Cass	Red	Fargo Ground Storage Reservoir #1	$0	$0	$8,741,500	$8,741,500
Cass	Red	Fargo Ground Storage Reservoir #2	$0	$0	$378,974	$378,974
Cass	Red	Fargo Transmission Pipeline	$0	$0	$21,159,300	$21,159,300
Cass	Red	Fargo Water Towers	$0	$0	$3,523,660	$3,523,660
Cass	Red	Fargo Water Treatment Plant Expansion	$0	$0	$154,915	$154,915
Divide	Souris	Crosby Water Treatment Plant	$875,283	$0	$1,625,525	$2,500,808
Emmons	Missouri	South Central Rural Water - Emmons County	$23,520,000	$0	$10,080,000	$33,600,000
Grand Forks	Red	Grand Forks Water Distribution Pipeline Improvements	$0	$0	$2,902,500	$2,902,500
Grand Forks	Red	Grand Forks Water Distribution Storage Improvements	$0	$0	$886,000	$886,000

WATER SUPPLY (continued)

County	Watershed	Project Name	Federal 2009-2011	State 2009-2011	Local 2009-2011	Total Cost
Grand Forks	Red	Grand Forks Water Treatment Facility and Residuals Mgmt	$0	$0	$6,086,000	$6,086,000
McHenry	Souris	City of Granville Water Storage Tank Replacement	$75,000	$0	$75,000	$150,000
McKenzie	Missouri	McKenzie County Rural Water: System II	$3,468,500	$0	$1,156,500	$4,625,000
McKenzie	Missouri	McKenzie County Rural Water: System IV	$3,669,000	$0	$1,224,000	$4,893,000
McLean	Missouri	City of Garrison Water Storage Improvements	$2,665,000	$0	$1,435,000	$4,100,000
McLean		City of Max	$50,000	$0	$50,000	$100,000
McLean		North Central Rural Water Consortium	$14,280,000	$0	$6,120,000	$20,400,000
McLean	Missouri	Washburn Regional Water Supply	$3,719,000	$0	$2,931,000	$6,650,000
Morton	Missouri	Mandan South End Reservoir Project	$0	$0	$9,600,000	$9,600,000
Morton	Missouri	Mandan Water Treatment Plant Optimization	$0	$0	$4,511,900	$4,511,900
Mountrail	Missouri	Mountrail Rural Water Expansion	$6,020,000	$0	$2,580,000	$8,600,000
Multi-county	Red	Dakota Rural Water System Improvements	$883,500	$0	$883,500	$1,767,000
Multi-county	Missouri/ Souris	Northwest Area Water Supply	$30,000,000	$16,000,000	$11,000,000	$57,000,000
Multi-county	Missouri/ Red	Red River Valley Water Supply Project	$30,000,000	$30,000,000	$30,000,000	$90,000,000
Multi-county	Missouri	Southwest Pipeline Project	$16,000,000	$16,000,000	$0	$32,000,000
Pembina	Red	Drayton Dam Section 206 Improvement	$400,000	$0	$0	$400,000
Pembina	Red	Drayton Water Treatment Plant Clearwell Imp.	$488,000	$0	$262,000	$750,000
Richland	Red	SEWUD Regional Water Service - East/North	$0	$0	$1,100,000	$1,100,000
Traill	Red	City of Hillsboro Water Tower	$735,150	$0	$395,850	$1,131,000
Traill	Red	Traill Rural Water - Regional Water Supply Project	$13,329,253	$0	$5,712,822	$19,042,075
Walsh	Red	Grafton Intake Improvements (Park River)	$20,000	$0	$11,000	$31,000
Walsh	Red	Grafton Intake Improvements (Red River)	$50,000	$0	$25,000	$75,000
Walsh	Red	Grafton Water Treatment Plant Improvements	$2,949,400	$0	$2,142,600	$5,092,000
Walsh	Red	Park River Water Tower	$693,875	$0	$373,625	$1,067,500
Williams	Missouri	New Williston Pressure Tank and 11th St. Reservoir	$4,200,000	$0	$0	$4,200,000
Williams	Missouri	R & T Water Supply Expansion	$10,503,500	$0	$4,501,500	$15,005,000
Williams	Missouri	Williams Rural Water District Expansion	$2,029,000	$0	$676,000	$2,705,000
		Water Supply Total	$177,066,131	$62,000,000	$146,289,401	$385,355,532
		ALL PROJECTS TOTAL	$197,423,614	$137,309,920	$229,130,122	$563,863,656

Water Project Funding

North Dakota funds a majority of its water projects through the SWC. Funding that is funneled through the SWC for water development has come from several sources, including: the state's General Fund; the Dakota Water Resources Act, the Municipal, Rural, and Industrial (MR&I) Water Supply Program; the Resources Trust Fund; and the Water Development Trust Fund. In addition to these sources, the SWC is also authorized to issue revenue bonds for water projects, and the SWC has shared control of the Drinking Water State Revolving Loan Fund. There are also other federal funding sources that will be briefly discussed.

General Fund

The executive budget includes $11.1 million general fund dollars for agency operations. This is significant for statewide water development efforts because it frees-up other trust fund revenue for projects.

Municipal, Rural, and Industrial Water Supply Program

A major source of grant funding for water supply development in North Dakota is the MR&I Water Supply Program. The program's funding was authorized by Congress though the 1986 Garrison Diversion Unit Reformulation Act. Federal funding channels through the BOR, to the state's federal fiscal agent, Garrison Diversion Conservancy District. The program is jointly administered by the Garrison Diversion Conservancy District, and the Commission. The federal agency of Rural Development provides funding through the United States Department of Agriculture for a majority of loans to cover the local share of MR&I projects.

The 1986 Garrison Reformulation Act authorized a federal MR&I grant program of $200 million. All of that funding has been expended. Additional federal funding authorization for the MR&I program resulted from the passage of the Dakota Water Resources Act of 2000. The Act provides resources for general MR&I projects, the Northwest Area Water Supply Project, the Southwest Pipeline Project, and a project to address water supply issues in the Red River Valley. An additional $600 million, indexed for inflation, was authorized; which includes a $200 million grant for state MR&I, a $200 million grant for North Dakota Tribal MR&I, and a $200 million loan for a Red River Valley Water Supply Project.

Annual MR&I funding is dependent upon U.S. Congressional appropriation, and thus, varying annual appropriations result in project delays. As of September 2008, $228 million in federal funds had been approved for North Dakota's MR&I program with $30 million for Federal Fiscal Years 2007 and 2008.

Resources Trust Fund

Section 57-51.1-07.1 (2) of North Dakota Century Code requires that every legislative bill appropriating monies from the Resources Trust Fund (RTF), pursuant to subsection one, must be accompanied by a Commission report. This report, the 2009 State Water Management Plan, satisfies that requirement for requesting funding from the RTF for the 2009-2011 biennium.

The RTF is funded with 20 percent of the revenues from the oil extraction tax. A percentage of the RTF has been designated by constitutional measure to be used for water-related projects and energy conservation. The SWC budgets money for cost-share based on a forecast of oil extraction tax revenue for the biennium, which is provided by the Office of Management and Budget.

Revenues into the RTF for the 2007-2009 biennium are expected to total $87.6 million. Future revenues from the oil extraction tax are highly dependent on world oil prices and production, which make it very difficult to predict future funding levels. The Executive budget includes authority based on the November 2008 forecast of $94.7 million for the 2009-2011 biennium from oil extraction. However, the Executive budget also contains an alternate oil price

forecast for oil extraction revenue that could be as low as $20 million if a $40 price per barrel is used through the entire 2009-2011 biennium.

Additional new revenue into the RTF will come from SWPP reimbursements, State Water Commission water supply program loan repayments (which amount to $1 million per biennium through year 2017), interest, and oil royalties. Therefore, based on the November 2008 projections, RTF revenue available for water development during the 2009-2011 biennium could be $98.2 million.

Water Development Trust Fund

Senate Bill 2188 (1999) set up a Water Development Trust Fund as a primary means of repaying the bonds it authorized. House Bill 1475 allocated 45 percent of the funds received by the state from the 1998 tobacco settlement into the Water Development Trust Fund.

Revenues into the Water Development Trust Fund for the 2007-2009 biennium are expected to total about $26.3 million. The Office of Management and Budget estimates revenues of $19.7 million for the 2009-2011 biennium.

The recent passage of Measure 3 by North Dakota voters will redirect a portion of the tobacco settlement, known as the strategic contribution fund, toward a statewide tobacco prevention program. The strategic contribution fund portion of the settlement is North Dakota's compensation for work done by the state's Attorney General in finalizing the national tobacco settlement agreement. It is this increase in the settlement amount that will be used for the tobacco prevention program. The passage of Measure 3 will not change the 45 percent allocation of tobacco settlement funds into the Water Development Trust Fund. However, it will decrease tobacco settlement receipts destined for the Water Development Trust Fund by $12.4 million per biennium.

Payments into the fund are scheduled through 2025 at a level based on inflation and tobacco consumption.

Bonding

The SWC has bonding authority (NDCC 61-02-46) to issue revenue bonds of up to $2 million per project. The Legislature must authorize revenue bond authority beyond $2 million per project. In 1991, the Legislature authorized full revenue bond authority for the Northwest Area Water Supply Project, in 1997 it authorized $15 million of revenue bonds for the Southwest Pipeline, and in 2001 it raised the Southwest Pipeline authority to $25 million. As of June 30, 2008 the Commission has outstanding bonds totaling $18.7 for the Southwest Pipeline project. There are no outstanding bonds for the NAWS project.

In 1999, the SWC was authorized to issue up to $84.8 million in appropriation bonds under provisions of Senate Bill 2188. The Legislature's intent was to partially fund flood control projects at Grand Forks, Devils Lake, Wahpeton, and Grafton, and to continue funding for the Southwest Pipeline. In March 2000, the SWC issued bonds generating $27.5 million, thus reducing available bonding authority to $57.3 million. Recognizing the need for water development projects in addition to those identified in SB 2188, the 2003 Legislature allowed authority for the unissued $57.3 million to expire, but then authorized $60 million of bonding authority for statewide water development projects. In June 2005, the Commission did issue bonds generating $60 million. As of June 30, 2008, the Commission has outstanding bonds totaling $87.7 million for other statewide water projects.

Because the tobacco settlement dollars were not projected to remain uniform each year, the SWC set up a repayment schedule to correspond with the projected tobacco receipts. Although the repayment amounts are based on the projected receipts, the scheduled repayments must be made regardless of the actual receipts. Payments for existing water development bonds will be $16.9 million for the 2009-2011 biennium, however funds must be available to make the August 1, 2011 pay-

ment. This payment occurs the second month of the new biennium prior to the receipt of any of that biennium's tobacco settlement dollars. That repayment will be $8.4 million.

Drinking Water State Revolving Loan Fund

An additional source of funding for water supply development projects is the Drinking Water State Revolving Loan Fund (DWSRLF). Funding is distributed in the form of a loan program through the Environmental Protection Agency and administered by the Department of Health. The DWSRLF provides below market-rate interest loans of 3 percent to public water systems for capital improvements aimed at increasing public health protection and compliance under the federal Safe Drinking Water Act.

The SWC's involvement with the DWSRLF is two-fold. First, the Department of Health must administer and disburse funds with the approval of the SWC. Second, the Department of Health must establish assistance priorities and expend grant funds pursuant to the priority list for the drinking water treatment revolving loan fund, after consulting with and obtaining the SWC's approval.

The process of prioritizing new or modified projects is completed on an annual basis. Each year, the Department of Health provides an Intended Use Plan, which contains a comprehensive project priority list and a fundable project list. The 2008 comprehensive project priority list includes 91 projects with a cumulative total project funding need of $326.7 million. The fundable list of 18 projects includes $36.4 million in loans from the total federal grants of $100 million for fiscal years 1997 through 2008. Available funding for the DWSRLF program for 2009 is anticipated to be approximately $8 million.

Other Federal Funding

With regard to other federal funding, the U.S. Army Corps of Engineers provides significant assistance to North Dakota for flood control projects. The Environmental Protection Agency, U.S. Bureau of Reclamation, U.S. Geological Survey, and the Natural Resources Conservation Service also contribute to the state's water development efforts in many different ways, including studies, project design, and project construction.

Funding Priorities, 2009-2011 Biennium

This section discusses the state's priority water development efforts and funding for the 2009-2011 biennium. It includes one course of action for water development in North Dakota that is subject to change during the 61st Legislative Assembly and the biennium.

Water Development Priorities & Descriptions

North Dakota's prioritized water development funding needs are grouped into several main categories in the following table. Each of those projects and categories is explained hereafter.

Cloud Modification

State funding in the amount of $700,000 is budgeted for operational cloud seeding costs with counties participating in the North Dakota Cloud Modification Project. The Atmospheric

2009-2011 Water Development Priorities

PRIORITY PROJECTS	2009-2011 (MILLIONS)
Cloud Modification	0.7
Devils Lake Outlet	2.0
Fargo Southside Flood Control	20.0
General Water Management	11.3
Irrigation	1.0
MR&I	10.0
Northwest Area Water Supply	12.0
Northwest Oil Impact MR&I	5.0
Red River Valley Water Supply	30.0
Southwest Pipeline Project	12.0
EXPENDITURE TOTAL	104.0

Resources Board currently cost-shares approximately 35 percent of operational costs, with participating counties paying the remaining 65 percent. This funding level will allow the program to continue its current level of capability for the 2009-2011 biennium.

Devils Lake
Having completed the Devils Lake outlet in the summer of 2005, it is now necessary for the state to provide funding for the operation and maintenance of the project. It is estimated that these costs will total approximately $2 million per biennium.

The state outlet is currently sized for 100 cfs, but could be expanded to 300 cfs in the future with additional work if necessary. The outlet consists of: two pumping plants, one on the Round Lake portion of Devils Lake, and the second near Josephine, North Dakota; approximately 4 miles of pipeline; and 10 miles of open channel.

Fargo Southside Flood Control
After narrowly escaping extensive damages during the 1997 flood, the City of Fargo and Cass County have been working toward the development of a flood control project that would protect south Fargo and areas south of the city that have experienced significant flooding in the past.

The alternative that the City of Fargo has selected, known as the Wild Rice River Levee Alternative, includes a continuous series of levees and/or floodwalls that provide protection from the Red River, Wild Rice River, and to a lesser extent, the Sheyenne River. Channel improvements will also be implemented along the Red River to improve hydraulic efficiency from the confluence of the Wild Rice and Red Rivers north to where Rose Coulee enters the Red. The project will also include internal drain improvements with levees to allow high water breakout flows from the Wild Rice to pass through the protected area in a controlled manner. And, to reduce or eliminate stage increases upstream of Rose Coulee, internal storage will be included in the protected area. In addition, a Wild Rice River mini-diversion, which will be similar to the Sheyenne River diversion, will divert Wild Rice River flows to the south and east to protect rural housing developments along the Wild Rice between Interstate 29 and Highway 81. And finally, a high capacity pump station and closure structure will be constructed on Rose Coulee west of Highway 81.

The total cost of the project is estimated at $161 million, with a requested state contribution of $75 million. The Commission has budgeted $20 million toward the project for the 2009-2011 biennium.

General Water Management
General water management projects include rural flood control, snagging and clearing, channel improvements, recreational projects, dam repairs, planning efforts, and special studies. Funding for dam repairs is quickly becoming a priority in North Dakota and across the nation, with dams that were constructed during the 1960s approaching their design life, and those that were constructed in the 1930s being well beyond their design life, and in many cases, in serious disrepair.

It is estimated that 15 of the most needed dam repairs in North Dakota could total about $19.5 million. The $11.3 million that is budgeted for general water management projects will be used to fund a portion of the state's general projects that are ready to proceed during the 2009-2011 biennium, including some dam repairs. Costs associated with the North Dakota Water Coalition's Missouri River Management project category are also included in this budgeted amount.

MR&I
Because of North Dakota's MR&I water supply program, regional and rural water supply systems have continued to be developed or expand across the state. The $10 million that is budgeted could be used toward a number of MR&I projects across North Dakota. However, until the amount of federal funding available for MR&I projects is more clearly known, state commitments for the advancement of these projects may vary in response.

Northwest Area Water Supply
The Northwest Area Water Supply (NAWS) project is a regional

water supply project that will eventually supply much of northwestern North Dakota with Missouri River water. The 45-mile main transmission line between Minot and Lake Sakakawea has been completed, and NAWS is now providing water service to Berthold, Minot's South Hill region, and North Prairie Rural Water District with an interim supply from Minot's water treatment plant.

State funding of $12 million for the NAWS project will go toward: resolution of the 2002 lawsuit following release of the Record of Decision; the initiation of design work on a biota treatment plant and intake; the remaining contracts to move water from Lake Sakakawea to Minot; and completion of the High Service Pump Station, the Kenmare-Upper Souris pipeline, and the Mohall-All Seasons pipeline.

Northwest North Dakota Oil Impact MR&I

As the oil industry continues to grow in the northwest portion of North Dakota, so does the need for water development projects to support that growth. The drilling alone will require a tremendous amount of water resources, as 1 to 1.5 million gallons of water are required to drill a single Bakken Formation well, and 50,000 to 100,000 gallons of water are needed to drill non-oil shale wells. In total, North Dakota's Oil and Gas Division is estimating that as many as 13,250 new oil wells could be drilled by 2019. And, in addition to the wells themselves, water supply systems in that region will need to provide water to the thousands of workers and their families living in those areas. As such, $5 million has been set aside to assist water supply systems with their support of the oil industry in northwest North Dakota.

Red River Valley Water Supply

With most of the Red River Valley's population relying on the Red River and its tributaries as their sole source of water, the impacts of a prolonged drought would be devastating to that region. And, as the population and economy of the Red River Valley continue to grow, the need for a more reliable source of quality water has become more important than ever before.

The Final EIS has been completed, and the BOR and the State of North Dakota have identified the Garrison Diversion Unit to Sheyenne River alternative as the preferred alternative. This alternative would supplement existing water supplies to meet future water needs with a combination of Red River, other North Dakota in-basin sources, and imported Missouri River water. The primary feature of this alternative will be a 125-mile, 66-inch (122 cfs) pipeline from the McClusky Canal to Lake Ashtabula.

As this project moves closer to fruition, North Dakota will need to support the Red River Valley Water Supply Project with state funding through the SWC of approximately $30 million during the 2009-2011 biennium to advance this critical water development effort when it is ready to proceed.

Southwest Pipeline Project

The Southwest Pipeline Project is a regional water supply system that draws water from Lake Sakakawea and serves 35,000 people in southwest North Dakota, including 28 communities, and 3,100 rural hookups – with plans to expand.

The $12 million budgeted for the Southwest Pipeline Project will be used to complete the main transmission line from Hazen to Stanton, a reservoir at the Zap water treatment plant, and telemetry for the water treatment plant and reservoir. Development of a rural water distribution system in the Zap service area is also a possibility – depending on the availability of funding.

Irrigation

As ethanol plants continue to be developed across the state, the need for increased corn production, supported by irrigation development, will also grow. The $1 million budgeted for irrigation will provide the necessary funding assistance to advance irrigation efforts in areas of need across North Dakota.

SPECIAL TOPICS

North Dakota has a variety of special issues or topics that have a significant impact on water management and development. The special topics are wide ranging in scope, affecting all aspects of water management and development, from education to project implementation. The special topics are highlighted to demonstrate their individual significance and are presented in alphabetical order.

Aquatic Nuisance Species

Aquatic nuisance species (ANS) are simply defined as "non-native aquatic species that for some reason humans find undesirable to be introduced into an aquatic environment." In recent years, ANS are a topic that has gained increasing attention.

ANS first became relevant to North Dakota water issues when the Garrison Diversion project was ultimately blocked by, among other factors, Canada's concern over the threat of transference of ANS. In the years since, the Devils Lake Outlet, Northwest Area Water Supply Project, and now the Red River Valley Water Supply Project, have all had to contend with ANS as a major issue.

ANS are a concern because they can impact an aquatic system in a number of ways: through competition with native species; through the creation of byproducts that are environmentally undesirable; through changes to the aquatic environment that are undesirable to humans, or other aquatic organisms that they value; and through the potential for negative economic impacts to structures such as water intakes through higher maintenance costs.

In addition to major water projects, there are other areas where ANS have recently had an impact. Dead Colt Reservoir, in Ransom County, is a popular fishing spot where a plant called Eurasian watermilfoil was found in 2005. Milfoil is an ANS that clogs waterways, and negatively affects sport fisheries and boating.

In an effort to eradicate milfoil, the North Dakota Game and Fish Department and Ransom County reduced the reservoir's water level to freeze out the shallow-water rooted plant, and apply a herbicide. These efforts had some effect, but milfoil was later found near Valley City, and also below Baldhill Dam, necessitating another year of water level control and herbicide application.

Currently, North Dakota is relatively ANS free. But, in adjoining jurisdictions, ANS are becoming an increasing problem, and are starting to have real economic impacts. With continued high probability of movement of ANS, it is likely that in coming years North Dakota will have to grapple with numerous ANS threatening to invade from all directions.

In a recent study from the University of Notre Dame, the impact of an ANS, zebra mussels, on the Great Lakes region was $27 million annually for raw water use by municipalities, power plants, and industry. In 2008, zebra mussels were present in the Missouri River in southeastern South Dakota. If zebra mussels were to successfully establish in North Dakota, industries such as power plants, and municipal water supplies along the Missouri River corridor could see maintenance costs dramatically increase.

The effect of ANS can be seen in the state's major water diversion projects, where both the NAWS and RRVWS will include multi-million dollar water treatment plants, and the Devils Lake outlet is continuing International Joint

Commission mandated studies that sample water in the lake to verify the lack of ANS.

These three needed projects alone will result in tens of millions in ANS-related costs to North Dakota and the federal government.

Water management organizations throughout the state are finding that ANS are requiring an increasing amount of their time and resources. Education and prevention, through cooperation with the state and federal entities involved in ANS control, such as the North Dakota Game and Fish Department and the U.S. Geological Survey, is the key to addressing this problem in North Dakota.

Apportionment

Apportionment, which is defined as "the act of dividing and distributing in shares according to a plan" is an issue that North Dakota will likely face in coming years in regards to the state's waters. In this context, apportionment deals with the allocation and distribution of waters that travel across state and national boundaries. In North Dakota's case, this applies primarily to the Missouri, Red, Souris, James, and Pembina Rivers.

Water apportionment is an issue that has a long legal history in other parts of the U.S., beginning in 1907 with a U.S. Supreme Court case between the states of Kansas and Colorado over allocation of the Arkansas River. Numerous cases since then have ended up in the Supreme Court, with many of the questions raised regarding an equitable distribution of the benefits from interstate rivers and groundwater.

Factors considered by the U.S. Supreme Court in cases over the past century included: whether the states involved used the prior appropriation doctrine; climactic and physical conditions of the river and its basin; the consumptive use of water throughout the river; the character and rate of return flows; the extent of already established uses; available water from storage; the effect of wasteful water use downstream; and damages to current users if water use limitations are changed.

In North Dakota, there are two apportionment agreements in effect. One is between the U.S. and Canadian governments over the Souris River, which governs the distribution of water from the river which originates in Saskatchewan, runs through North Dakota, and ends in Manitoba.

The second apportionment agreement is the Yellowstone River Compact between the states of Montana, North Dakota, and Wyoming. The agreement, adopted in 1950, governs the distribution of water from the Yellowstone River, which has its headwaters in Wyoming, flows a great distance through Montana, and has a short length in North Dakota.

The other major inter-jurisdictional rivers in the state however, do not have an apportionment agreement in place. The Red River, which is shared with South Dakota, Minnesota, North Dakota, and the Province of Manitoba, currently does not have an apportionment agreement in place. However, Minnesota is interested in seeing minimum instream flows for biological integrity, and Manitoba is concerned about the need for equitable sharing of the flows of the Red River in the case of a prolonged drought.

In the case of the Missouri River, the operations of the river's six mainstem dams are managed by the U.S. Army Corps of Engineers (Corps). The Corps utilizes a plan, called the Missouri River Master Water Control Manual. Though the Master Manual is technically not an apportionment agreement, it does dictate water releases along the mainstem system. The Master Manual was developed shortly after the completion of the dams in 1960, and has been periodically revised, most recently in 2004.

Another apportionment-related law affecting the Missouri River in North Dakota is the O'Mahoney-Milliken Amendment, part of the 1945 Pick-Sloan Act. Under the amendment, beneficial consumptive uses on the Missouri River have priority over navigation in terms of operation of the main stem reservoirs.

Cloud Modification

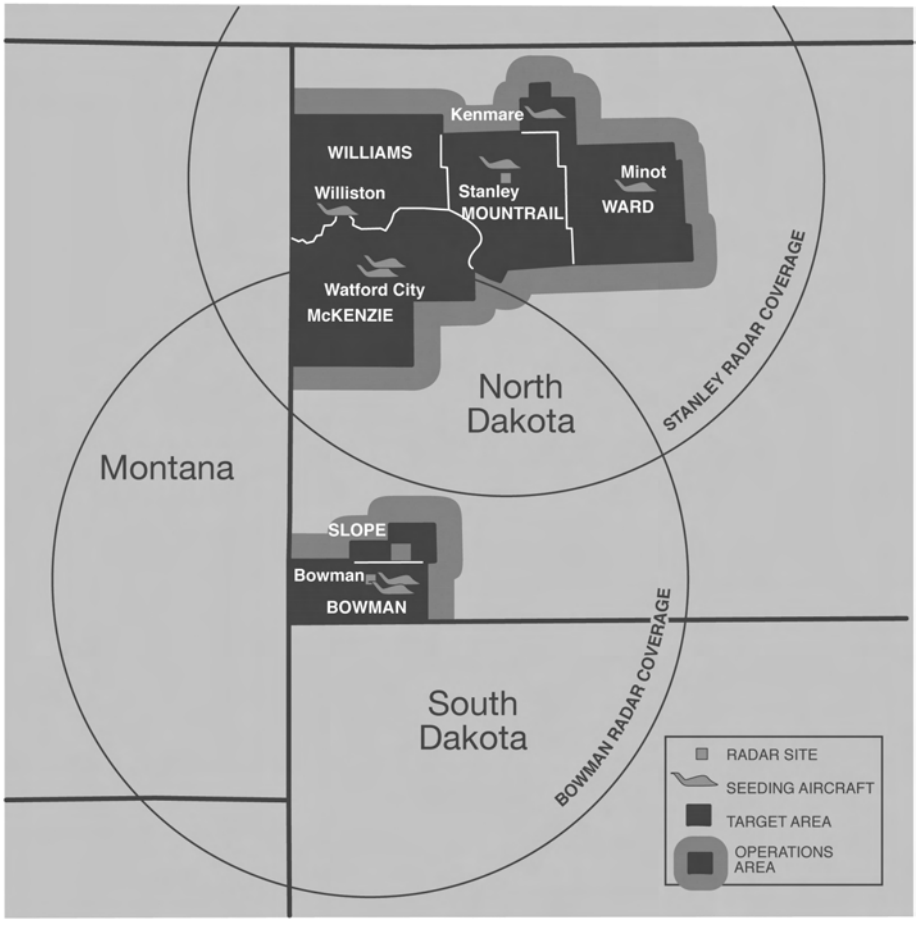
The first cloud seeding in North Dakota dates back to Bowman County in 1951. Later, in 1975, the Atmospheric Resource Board, a division of the SWC, was created by the North Dakota Legislature.

At present, the North Dakota Cloud Modification Project (NDCMP) covers nearly 10,500 square miles of western North Dakota. Those counties involved include Bowman, McKenzie, Mountrail, part of Slope, Ward, and Williams. Most of the counties have participated in the program for nearly 50 years.

Cloud seeding operations are conducted during suitable atmospheric conditions from the months of June through August each summer. Program goals are the enhancement of growing season rainfall, and reduction of hail damage to crops and pastures.

Independent evaluations indicate the NDCMP has reduced crop-hail damage by 45 percent and increased rainfall by approximately 10 percent, increasing wheat yields by nearly six percent. The economic impact is substantial at more than $24 million annually, which translates to a 37 to 1 benefit-to-cost ratio.

ND Cloud Modification Project



Hygroscopic Seeding Research

Cloud seeding in North Dakota, and nearly all of the dozens of programs in the western U.S. employs silver iodide as their primary seeding agent. Silver iodide has been proven to increase ice production in clouds through years of research in the atmosphere, while posing no negative effects to the environment.

Recent research has indicated that another technique, called hygroscopic seeding may have beneficial effects in our state. Rather than producing ice in clouds, hygroscopic seeding attempts to increase the sizes of cloud droplets, enabling precipitation to form via collision and coalescence of those droplets with others in the cloud. Seeding trials in South Africa, Mexico, and Texas have demonstrated significant rainfall increases from clouds under suitable conditions.

The Atmospheric Resource Board has been pursuing research in this area since 2003. Initial work focused on measurements of atmospheric particulates, which provide the "seeds" for cloud droplet formation. More recently, efforts have centered around experimental seeding trials in conjunction with the University of North Dakota's John D. Odegaard School for Aerospace Sciences. UND's specialized weather radar, which can determine the types of precipitation (liquid or ice) particles in clouds, is one advanced tool tasked

to study the effects of hygroscopic seeding.

The ultimate goal is to determine the effects of hygroscopic seeding in North Dakota and the potential for its use in the NDCMP.

Federal Research Program

The Atmospheric Resource Board continues to pursue an authorized, federal program for weather modification research and development. Through the North American Interstate Weather Modification Council (NAIWMC), the Board is working in cooperation with ten other western states (Arizona, California, Colorado, Idaho, Kansas, Nevada, Oklahoma, Texas, Utah and Wyoming) involved in weather modification operations or research.

Bills have been introduced in both the Senate and House that would establish a federal board to oversee the program and provide research grants through a peer-reviewed proposal process. This effort has the additional support of the Western States Water Council (the water policy arm of the Western Governor's Association), the Family Farm Alliance, and a number of state and local organizations.

Doppler Weather Radar

Weather radars have been operated during the summer months in support of the NDCMP since the early 1970s. In 1997, the Atmospheric Resource Board acquired radars surplused by the National Weather Service after installation of the NEXRAD Doppler radar network. The radars have been operated each season in Bowman and Stanley, North Dakota since that time.

Prior to June 2009, the Board plans to upgrade the radars with Doppler technology. In addition to providing the capability to measure atmospheric winds, the upgrades will allow earlier detection of precipitation, improve severe weather detection, and expand data sharing capabilities. The enhanced, real-time radar data will continue to be available to the public through the board's website at www.swc.nd.gov/arb.

Expanded Climate Monitoring

The Board has maintained a volunteer, growing-season rain and hail reporting network since 1977. Presently, nearly 800 North Dakotans donate their time to observe and record these data from April through September each year, producing one of the highest-density networks in the U.S. The reports provide valuable information for a number of users and can be accessed directly through the Board's website.

In 2006, observers were given the option of reporting their observations on the Internet. Today, about one in eight observers reports online, with those numbers expected to increase in the coming years. Data reported online are made available to users more quickly than those reported through paper forms, which must be entered by Board staff in Bismarck.

Recently, the Board has partnered with the North Dakota State Climatologist and the National Weather Service to further expand climate monitoring in the state through a national network dubbed CoCoRaHS, the Community Collaborative Rain Hail and Snow Network. In addition to summertime reporting, CoCoRaHS observers will also monitor snowfall, providing year-round observation of precipitation in the state. The addition of winter-season reporting will improve our knowledge of North Dakota's climate and provide data that prove valuable in the prediction of spring flooding. Data can be accessed at www.cocorahs.org.

Snowpack Augmentation

A water use and allocation agreement was reached in 2007 among the seven states in the Colorado River basin. As part of the larger plan, the lower basin states of Arizona, California, and Nevada agreed to provide state funds to enhance upper-basin cloud seeding programs in Colorado, Utah, and Wyoming to increase snowpack and enhance runoff into the Colorado River for downstream use. Long-term evaluations of

cloud seeding to increase snowpack indicate increases on the order of 10 percent.

Should this concept prove successful, there may be opportunities to apply the cloud seeding model to other large river basins. The most likely to draw the interest of North Dakota would be a program in the upper Missouri River basin. No doubt, increased runoff into the Missouri River and its tributaries would be a boon to the states relying on the river for water supply, power generation, irrigation, and recreation.

Dam Safety Program

The National Dam Safety Program was initiated in 1978 through the U.S. Army Corps of Engineers after the failure of Toccoa Falls Bible College Dam in Georgia. The North Dakota Dam Safety Program, administered by the SWC, was initiated to continue the national program of inspecting dams and assessing their safety at the local level.

The SWC Dam Safety Program inspects 109 high and medium hazard dams on a rotational basis, so that every dam on the list is fully inspected at least once every ten years.

High hazard dams are inspected at least once every four years. In addition, each spring, 128 dams are given a partial inspection to check on the status of the dams after the spring runoff season.

Other dams in North Dakota are inspected on an as needed basis, such as when a dam is built, rehabilitated, or when the public has a concern about a dam.

Because many of North Dakota's dams were constructed over half a century ago, a large percentage of them are nearing, or have surpassed their estimated life expectancy. As such, there is a growing need to repair an ever-increasing number of dams in all parts of the state.

The aging of North Dakota's dam infrastructure has also brought the need for the development of EAPs, or Emergency Action Plans to the forefront. The purpose of EAPs is to develop a pre-planned strategy for individual dams that will help reduce the loss of life and property damage in the event of a dam failure.

EAPs are the responsibility of dam owners. However, many of North Dakota's dams are owned by local water boards that have limited staff and financial resources.

In response, the SWC increased the amount of cost-share assistance available for the development of EAPs to 80 percent of eligible costs. The assistance is capped at $25,000 per dam, and is only available for high and significant hazard classification dams.

Devils Lake

Devils Lake is a terminal lake in the Devils Lake basin, which means that water leaves Devils Lake through evapotranspiration, or when its elevation is high enough to overflow the basin's boundary. The natural condition of Devils Lake's elevation is either rising or falling, a condition which has led to numerous challenges since settlement times. There is geological evidence that Devils Lake has overflowed into the Sheyenne River and dried up completely on several occasions over the last 10,000 years.

Devils Lake's most recent rise began in 1993, and as of late summer 2008, was at elevation 1,446.72 feet above mean sea level (amsl), a rise of over 23 feet since 1992. In August 2001, Devils Lake reached an elevation sufficient to allow water to flow naturally from east Devils Lake, through the Jerusalem Channel, into Stump Lake. In 2007, Devils Lake had moved enough water through the Jerusalem Channel to equalize the elevation of Stump Lake with Devils Lake. The equalization means that Stump Lake and Devils Lake will rise together, and the significant storage capacity that Stump Lake once provided has been utilized.

Some of the challenges associated with Devils Lake's flooding situation include tens of thousands of acres of flooded agricultural land, and the relocation of houses, roads, and structures, such as the

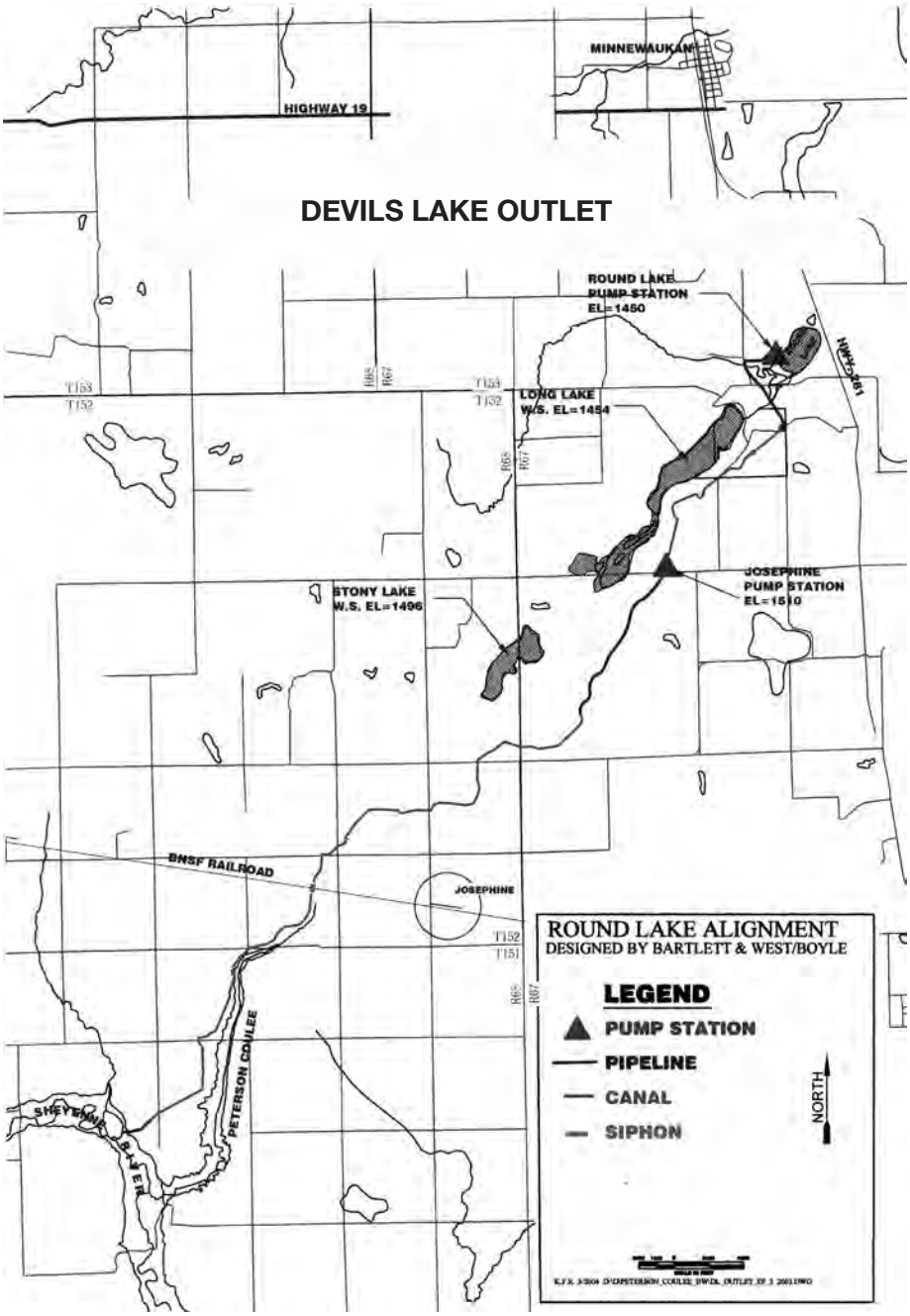
City of Devils Lake's water supply line.

The state of North Dakota has identified three broad strategies to attempt to mitigate water issues in the basin: including upper basin water management, infrastructure protection, and an outlet to the Sheyenne River.

The Devils Lake Outlet

The state of North Dakota began construction on an outlet from the West Bay of Devils Lake to the Sheyenne River in 2002, and completed it in 2005. The outlet began operating during the summer of 2005, was not operated due to permit constraints in 2006, and was operated again in 2007 and 2008.

The construction and operation of the outlet generated several lawsuits with the Province of Manitoba, as the primary litigant, but the State of Minnesota, and several grass-roots water interest groups were involved as well. As of 2008, the water discharge permit has been unsuccessfully challenged twice in court proceedings. In July 2008, the water discharge permit for the outlet was reissued, with an expiration date of June 2013.



Devils Lake Water Supply

Because of Devils Lake's rise, the pipeline that provides the City of Devils Lake with its supply of drinking water was inundated. It was feared that any pipe failure would be unfixable, so the city decided to put in a new water supply at a total cost of approximately $16 million.

Another water supply issue has to do with changing standards for water quality standards. A decrease in the allowable amount of naturally occurring arsenic in drinking water has forced many municipalities to search extensively for alternative supplies. The cost of doing this is often prohibitive and has proven a formidable obstacle to many small communities in the basin.

Upper Basin Water Management

There have been numerous efforts at upper basin water management, including storage and land management programs. The Commission utilizes the Extended Storage Acreage Program (ESAP), which pays landowners to store water on their land. Other entities, such as the U.S. Fish and Wildlife Service, the Natural Resource Conservation Service, ND Natural Resources Trust, and the Devils Lake Joint Board, are also involved in water storage projects.

In addition, the Devils Lake Basin Joint Water Resource Board has been administering an irrigation test project since 2005. The project is funded through a joint effort between the federal government, the SWC, and local interests. The purpose of the project is to utilize excess floodwater in the upper reaches of the Devils Lake basin for irrigation that might otherwise make its way into the lake.

Results from the study are expected in 2009. If those results are favorable, the Devils Lake Joint Board will begin working towards an expansion of the project to study irrigation feasibility over more acres.

Infrastructure Protection

Since the lake began its rise in 1993, over $650 million has been spent in the Devils Lake region. As the lake crept higher, the levee that protects the city of Devils Lake was raised numerous times, roads were raised or moved, as were homes, businesses, and all of the other structures that make modern life possible. If the lake continues its rise, even more money will need to be spent to further protect infrastructure. The region is currently facing the issue of again raising the Devils Lake levee. Protection to a higher lake level will cost tens of millions of dollars, and will require the relocation of some homes. Roads will also need to be raised, if flooding continues. An ongoing concern to the basin is the local cost-share match required for state and federal projects. After 16 years and millions of dollars of infrastructure protection spending, many basin counties are finding it increasingly difficult to come up with matching funds.

Drought Management Planning

Drought has been an influence on the lives of people, and impacted the environment of the northern plains for thousands of years, and will continue to be an ever-present factor long into the future. With this reality in mind, the state of North Dakota has tried to position itself to cope with the negative impacts of drought through various drought planning and mitigation efforts.

North Dakota's current Department of Emergency Services drought plan, which has been updated in recent years, is primarily response oriented. And though the plan is well suited to deal with impacts during droughts, a need exists to pursue a more comprehensive approach to drought planning at the state level.

Specifically, comprehensive drought planning could include elements of monitoring and impact assessment, in addition to reactionary or mitigation efforts. Procedures could be established for monitoring drought conditions, and specific trigger points could be identified to put various reaction efforts in motion as drought conditions change. In addition, development of an impact assessment element in a comprehensive drought plan could assist the state in understanding what impacts might be expected with various levels of drought severity.

By incorporating these types of preparedness elements, the state could substantially reduce financial and social impacts associated with future drought conditions. However, the development of a comprehensive drought management plan would be a substantial effort, requiring involvement and technical expertise from a number of federal, state, and local government entities.

Floodplain Management

Flooding is a not-so-infrequent event in North Dakota. One way to soften its detrimental effects is to have effective state and community floodplain management

programs in place to help mitigate and minimize losses.

Floodplain management supplements the structural approach, which uses dams, diversions, and levees to move the water away from people, and uses the regulation of land and development to make it less susceptible to damage from this natural hazard. This non-structural approach is done under the umbrella of the National Flood Insurance Program (NFIP), which trades the availability of flood insurance for the floodplain management oversight of participating cities, counties, and townships within the state.

The Federal Emergency Management Agency (FEMA) administers the NFIP and through community floodplain management, helps guide development and building within identified floodplain areas. Flood Insurance Rate Maps (FIRMs) which identify areas of the 1 percent chance flood, are the basis for these community floodplain management programs.

Floodplain management determines how human activity can best build, develop, or redevelop relative to an identified flood hazard. All this is intended to help to break the seemingly unrelenting cycle of disaster-relief-repair-disaster that plagues many areas of the state.

In the 43-year period from 1965 through 2008, 28 Presidential Flood Disasters have been declared in North Dakota. Flooding creates adverse impacts such as inundating farmland, damaging buildings and possessions, and destroying infrastructure. However, a combination of both structural and non-structural approaches statewide to alleviate and mitigate flood damages has proven to bring the most success.

Significant progress has been made in mitigating flood damages since the last statewide flood of 1997, which devastated the Red River Valley, historically the state's most flood prone area. Among many other factors, North Dakota's decision makers recognized and acted on the need to refine the state's floodplain management polices. The Legislature strengthened existing laws in 1999 and 2003 resulting in the following floodplain management changes in North Dakota:

• NDCC 61-16.2-14: the State Engineer will review all documentation associated with development proposed in regulatory floodways for technical completeness. The State Engineer is authorized to review technical documentation to ensure it complies with state and federal regulation.

•NDCC 61-16.2-08: the state, by virtue of the Floodplain Management Act of 1981, adopted the NFIP. In 2003, legislative changes were made, adopting state standards for buildings to either elevate on fill and/or employ dry floodproofing techniques. Both exceed NFIP minimum standards. For new and substantially improved structures, fill must elevate and place the lowest floor at least one-foot above base flood elevation. Where structures are allowed to dry floodproof, they must elevate and dry floodproof the lowest opening at least two feet over base flood elevation. This action better ensures homes and businesses protection from future flooding during 100-year flood events, or even smaller events. This freeboard buffer also allows structures built in the identified floodplain to remain dry in a 100-year flood event. Additional benefits include lower floodplain insurance premiums for consumers or removal of the mandatory purchase of flood insurance requirements mandated by lenders.

• NDCC 11-33.2-12-1: the state requires new county subdivision plats to delineate by topographic elevation, the boundary of the identified 100-year floodplain.

• NDCC 11-33-03; NDCC 40-47-03; and NDCC 58-03-12: specifies that the comprehensive plans adopted by zoning authorities will consider "emergency management" as defined in NDCC 37-17.1-04 (4). "Emergency management," as defined, means a comprehensive integrated system at all levels of government and in the private sector which provides for the development and maintenance of an effective capability to mitigate, prepare for, respond to, and recover from, known and unforeseen hazards or situations, caused by an act of na-

ture or man, which may threaten, injure, damage, or destroy lives, property, or our environment.

• NDCC 61-16.2-13: encourages communities to participate in the NFIP.

• NDCC61-16.2: allows the State Engineer to establish a base flood for lakes and nonfederal reservoirs.

The Commission is committed to working with decision makers at all levels of government to assist local entities in adopting and enforcing good floodplain management regulations to further reduce the risk of flood damages.

Map Modernization

FEMA developed the Map Modernization (Map Mod) program in 2004 to modernize and digitize the nations flood maps. Many of North Dakota's FIRMs are over 10 years old and some are 15 to 20 years old. Because of population growth and increased development in many communities, these older FIRMs may not adequately portray the flood risks facing state residents.

To address this problem, the state is working with FEMA as a partner in Map Mod. Following FEMA's nationwide prioritization criteria, the most populous and flood prone communities of our state will be getting their FIRMs digitized. Counties which have received digitized flood maps directly from FEMA are Cass, Burleigh, and Morton. Counties which will receive digitized flood maps through the Map Mod are Grand Forks, Traill, Richland, Walsh, Pembina, Barnes, Ransom, Stutsman, Nelson, Ramsey, Benson, Bottineau, Rolette, McHenry, Ward, Stark, Bowman, Hettinger, and Mercer. Williams and McLean Counties are the next candidates for digitized flood maps.

One aspect of Map Mod is placing the flood hazard on improved topographical base maps. Topographical data has always been key to accurate flood maps. The Commission has assumed an active management role in the flood hazard identification and mapping process of this 5-year Map Mod effort. In North Dakota, the NFIP has 185 communities with FIRMs of the 295 communities which participate in it.

The goals of the Map Mod program are studying community flood hazards, remapping these hazards, developing and/or enhancing Geographical Information Systems, and facilitating the digitization of the flood hazard areas. The Commission is also participating in the Cooperating Technical Partner program (CTP) of the NFIP, contributing state and local resources to partner in this effort. All Map Mod digitization efforts are undertaken by local study contractors. The Commission's Map Coordinator works with study contractors and monitors progress. In North Dakota, the study areas for the Map Mod program are broken down by county-level. The Map Mod process includes scoping local needs, digital map data collection, hydrologic and hydraulic analyses, public review of the preliminary FIRM and FIS and then public adoption of the FIRM. With Map Mod, NFIP participating communities (cities, counties, townships, tribes) and the state are using this opportunity to play a significantly larger role in flood hazard identification and mapping.

The total cost of the Map Mod effort in North Dakota is estimated at about $4.3 million. To date, North Dakota has received about $2.6 million for Map Mod projects in 20 counties. All Map Mod projects are expected to be completed in the fall of 2010. The final year of FEMA funding of Map Mod was FY 2008.

In order to leverage the sucesses of Map Modernization and further enhance the usability and value of flood hazard mapping, FEMA has developed the subsequent Risk MAP Strategy. The Risk MAP program will continue flood hazard mapping by utilizing state and local partnerships to further identify flood hazards.

Indian Water Rights

One hundred years ago the United States Supreme Court issued one of its most important decisions for water law, and for Native Americans. In Winters v. United States, the Court ruled that when Indian reservations are established, water rights are reserved for the tribe.

Thus, the priority date for tribal water rights is the date that the reservation was created. Because North Dakota reservations were all created in the 1800s, water rights reserved to tribes here pre-date state law water rights.

While the Winters Court declared the tribal water right, it did not explain how the right would be quantified. Based primarily upon subsequent decisions in other courts, the method by which tribal water rights have been adjudicated is the practicable irrigable acres (PIA) standard, i.e., quantifying the water right based on the reservation's potential for irrigated agriculture. The tribes have rejected this purely objective method for quantifying water rights on the reservations in favor of a more flexible standard. They argue that the reservations were established as a permanent homeland and that they are entitled to use all water necessary to achieve economic self-sufficiency.

Uncertainty about appropriate application of the Winters doctrine, and the quantity of water that Indian tribes might control, has led to significant lawsuits throughout the West. Litigation has proven to be a particularly inefficient, impractical, and ultimately an undesirable method to resolve tribal-state water disputes. These adjudications typically involve tens of thousands of individual claims to water rights. For example, in the 1990s South Dakota filed – though quickly dismissed – an action to adjudicate water rights in the Missouri River, and printed 50,000 claim forms in anticipation of the claims that would be filed. Further, Indian water adjudications can drag on for decades. The Klamath Basin case in Oregon started 30 years ago and is still ongoing. The Colorado River adjudication lasted a half century. And it is unusual to get court decisions that definitively resolve all issues, and that do not raise even more questions. In the Big Horn adjudication, all five justices on the Wyoming Supreme Court issued an opinion, one of whom prepared a three-page "road map to the court's splintered offering." Lastly, these adjudications have been terribly expensive for the states. Wyoming state agencies and court system spent from $30 to $40 million. The Snake River adjudication has cost Idaho at least $20 million.

North Dakota and the Indian tribes located here, have been wise to avoid bitter public controversies over water. State and tribal leaders have exercised restraint and good sense, favoring serious efforts at compromise rather than resorting to litigation.

Still, while there have been cooperative efforts, tribal reserved water rights remain open-ended and unsettled. As a result, water rights under North Dakota law are somewhat uncertain. State-created rights could be vulnerable to tribal claims. Should tribes claim their water, the claims may implicate water that many North Dakota citizens have come to rely on.

With this background, the Commission is committed to building a foundation for a meaningful relationship with the Indian nations located here in order to establish cooperative water management. While there have been significant efforts in the past, today there are no institutions in place to facilitate cooperation or even substantive discussions. We lack even protocols that could provide regular dialogue. This is an unfortunate situation that needs to change.

Instream Flows

Instream flow is defined in the simplest of terms as "water flow conditions needed to sustain aquatic life." There is a direct relationship between the amount of streamflow and the quality of aquatic habitat for aquatic life. North Dakota does not have a law that directly provides for setting aside a prescribed streamflow for aquatic and environmental purposes. The appropriation of water in North Dakota is by statute the responsibility of the State Engineer and is addressed in Chapter 61-04 of the North Dakota Century Code.

An appropriation of water must involve an actual diversion and works before a water permit may be issued. Therefore, a mechanism for the issuance of water permits for the preservation of a naturally occurring instream flow is not provided for in current law. However, current law does allow a water permit to be issued for a project

to store water in a reservoir and release it to maintain an instream flow. In addition, the law requires the State Engineer to take into consideration the effect of issuing a water permit on fish and game resources and public recreation opportunities when determining public interest of a proposed appropriation. As a result, limited indirect avenues are available under current law to provide for instream water for aquatic purposes.

As the use of water continues to increase, the stress placed upon the aquatic environment and life forms will become more prevalent. With continuing development we can expect that there will be an increased interest to provide minimum instream flows for aquatic life forms. It is anticipated that establishing minimum instream flows will become more of an issue as users compete for use of limited water in North Dakota's streams and rivers.

International Border Dike

The International Border Dike is a water retention structure that North Dakota considers to be a dike and the Province of Manitoba considers a road. The structure in question was developed over 60 years ago, and is located just north of Pembina County in Manitoba, Canada.

The slope of the land in Pembina County is generally from southwest to northeast. The dike, built in 1944, cuts across the natural gradient, creating a serious flooding problem for landowners on the North Dakota side of the border, while protecting the land that would normally be flooded on the Manitoba side. In wet years and after heavy spring runoff events, the dike can cause significant flooding on the U.S. side, inundating many square miles of agricultural land and farmsteads.

The dike has been periodically raised and lengthened since its original construction and is now almost 30 miles long. There have been numerous discussions between county officials, landowners on both sides of the border, the Governor's office, the SWC, and Manitoba government officials. In 1956, a large drain to relieve flooding was jointly constructed through the dike by the Water Commission and Manitoba's Rural Municipality (RM) of Rhineland. In 1964, that drain was unilaterally filled in by the RM of Rhineland.

Along the western portion of the dike, two crossings have been equipped with substantial culverts in a joint effort involving the counties, the Water Commission, and Manitoba. However, these structures do not alleviate flooding problems further east in Pembina County along the eastern portion of the dike. As a result, Pembina County has initiated a lawsuit in Manitoba to have the dike completely removed or breached in critical locations. The lawsuit is expected to go to trial in 2009.

Some of the flooding issues that residents along the Pembina River have historically experienced have improved in recent years as a result of flood control projects recently built in North Dakota.

Missouri River Management

With a basin that covers all or portions of ten states and two Canadian provinces, the Missouri River stretches 2,540 miles from central Montana, to its confluence with the Mississippi River, making it the longest river in the United States. Along with the sheer magnitude of this river system in terms of size, comes a multitude of complex management issues, such as competition between water users, loss of habitat, endangered species protection, bank erosion, and delta formation, just to name a few.

Six dams and reservoir projects make up the Missouri River reservoir system. Each of the projects were constructed by the federal government and are operated and maintained by the U.S. Army Corps of Engineers for the purposes of flood control, water supply, recreation, irrigation, hydropower, water quality, fish and wildlife habitat, and navigation. Harnessing the Missouri River has brought substantial economic, environmental, and social benefits to North Dakota and the other states.

For decades, the State of North Dakota has worked diligently to protect and develop its interests

in the Missouri River, while recognizing that our state makes up only a portion of the basin as a whole. North Dakota has supported cooperative basin-wide efforts, such as those by the Missouri River Association of States and Tribes and the Missouri River Recovery Implementation Committee, that strive to balance the varied interests. At the same time, North Dakota will continue to affirm that the state will utilize the Missouri River for beneficial use.

Locally, the state has supported grassroots efforts to improve management of Missouri River basin natural resources, including those pursued by the Missouri River Joint Water Resource Board. Other efforts that promote the benefits, uses, and future potential of the Missouri River system, such as those pursued by the Friends of Lake Sakakawea, and the Voices for Lake Oahe, are also applauded.

House Concurrent Resolution 3044

During the 2007 Legislative Assembly, the passage of House Concurrent Resolution (HCR) 3044 directed the Legislative Council to study how the state might pursue additional uses of Missouri River water for domestic, industrial, recreation, fish and wildlife, and irrigation uses. HCR 3044 also called on the Legislative Council to look at how the state might promote a Congressional review of the 1944 Flood Control Act, and to reexamine the Corps' management of the Missouri River system.

The Water Commission has always played an integral role in the development of Missouri River water. And in the wake of findings resulting from HCR 3044, the Commission will continue to be an instrument for the development of that vital resource in the future. Through cooperative efforts with local entities, state and federal agencies, and members of the North Dakota Water Coalition, the Commission will continue to work toward helping the state achieve the Missouri River's full development potential.

Northwest Area Water Supply

In northwestern North Dakota, water supply has been a problem since the state was settled. The Souris, which is the largest river in the region after the Missouri, is a less desirable water source in terms of both quality and quantity, and existing ground water sources are limited. The NAWS project is being constructed to provide needed high quality drinking water.

NAWS is a bulk supply system able to deliver a maximum flow of 26 million gallons per day that will serve the municipal and rural water needs of the project area. The planning, design, and construction of NAWS is being led by the SWC in consultation with the NAWS Advisory Committee. Funding for NAWS is through Garrison Diversion MR&I, the SWC, and the City of Minot. The federal portion of NAWS funding is appropriated by Congress on an annual basis. As a result, persistent local support is important in ensuring that funding is adequate to complete this vitally important project.

Planning studies for NAWS were initiated in 1987. During this process, environmental issues associated with the construction, operation and maintenance of NAWS were evaluated through an Environmental Assessment (EA). The main environmental concern on the part of NAWS opponents was the risk of transferring aquatic invasive species from the Missouri River basin (Lake Sakakawea) to the Hudson Bay basin where the majority of the communities and rural water systems to be served by NAWS are located. Based on the EA, the BOR issued a Finding of No Significant Impact (FONSI) in September 2001. The FONSI established environmental commitments in order to avoid, minimize, or mitigate potential impacts resulting from NAWS.

Construction on the main water pipeline between Lake Sakakawea and Minot began in the spring of 2002. In October of that same year, the Canadian Province of Manitoba filed a lawsuit against the Department of Interior in U.S. District Court challenging the FONSI issued for NAWS and requesting federal funds and construction activities on NAWS be halted.

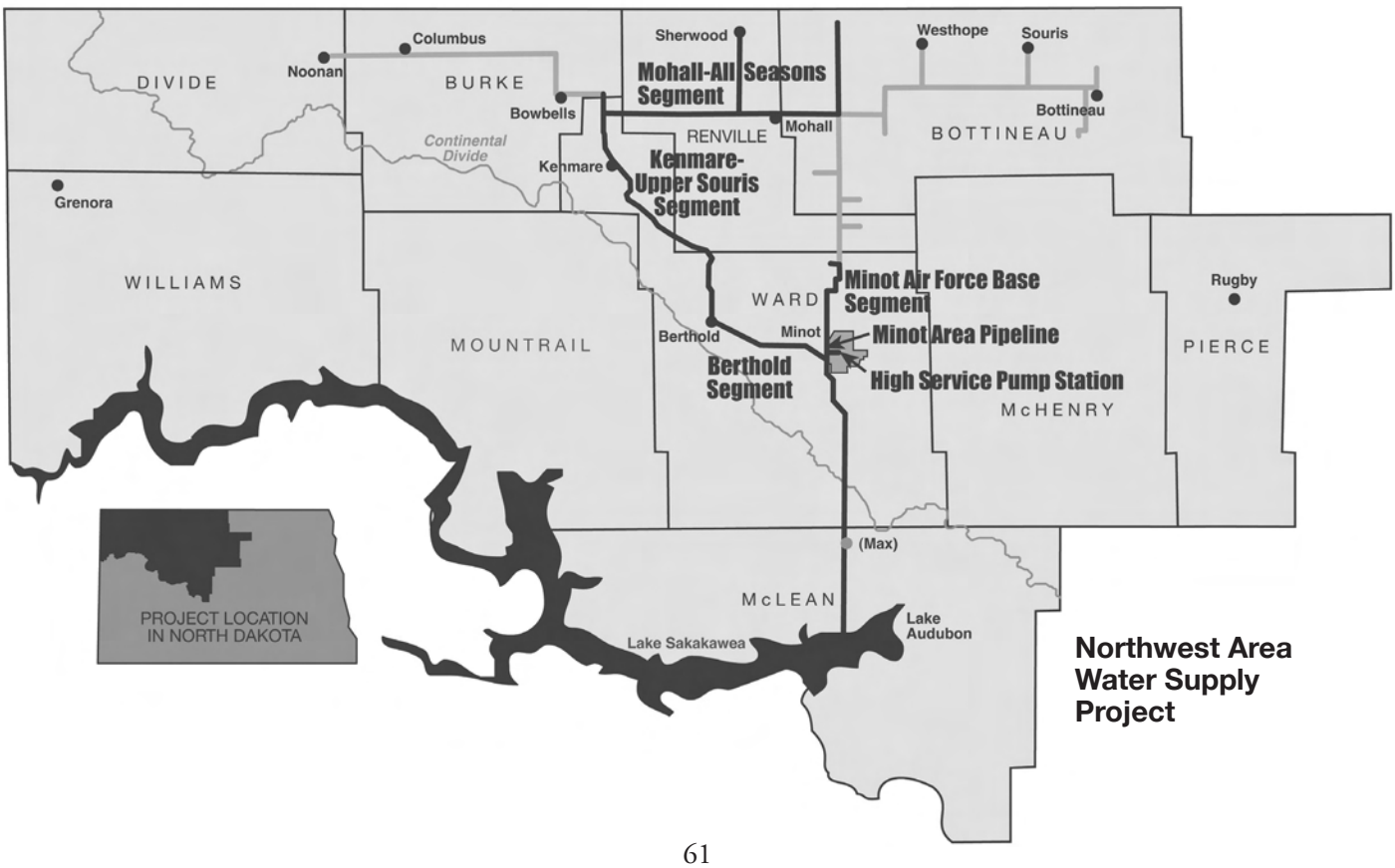
On February 3, 2005, the court ordered the BOR to revisit the FONSI through further environmental analysis. The order states that additional analyses should consider potential impacts associated with not fully treating the Missouri River water at its source, and potential impacts that could occur due to pipeline leaks and possible failure of water treatment facilities. A second ruling from the court on April 15, 2005 denied the request for an injunction on construction work. This second ruling, while allowing existing contracts to continue, also required the BOR to request permission from the court for the design and construction of additional NAWS features until the environmental analyses are completed. Based on this direction from the court, construction of the 45 miles of main water transmission pipeline between Lake Sakakawea and Minot continued. Motions were granted in March 2006 (following the BOR's announcement that they would complete an EIS for NAWS) and March 2008 (following the release of the NAWS Draft EIS) to continue construction on NAWS features north of the drainage divide that did not affect treatment decisions.

The DEIS was released for public review in December 2007. The DEIS evaluated four water treatment alternatives that would further reduce the risk of transferring invasive species from the Missouri River drainage to the Hudson Bay drainage through the construction and operation of NAWS. The BOR is expecting to complete the EIS by the end of 2008. The DEIS shows that if there are aquatic species in the Missouri River system different from what is already found in the Hudson Bay drainage, they are far more likely to make their way across the continental divide via numerous other existing pathways.

Construction costs for the four NAWS treatment alternatives range between $8.1 million to $90 million, with annual operation and maintenance costs ranging between $230,000 and $2 million.

Project WET

The SWC began development of its WET (Water Education for Teachers) program in 1984 through the SWC's public planning processes. During the period



of 1987 through 1992, the WET Program offered a variety of educational programs.

The SWC began a far-reaching enhancement of its Project WET program in 1993. And today, Project WET is an international supplemental and interdisciplinary water science and water education program for K-12 formal and non-formal educators and for K-12 students.

North Dakota's Project WET *Explore Your Watershed* program is delivered to K-12 educators through multi-credit instructional institutes, single-credit workshops, seminars, inservice sessions, and preservice teacher workshops. K-12 students receive water education programs directly through their own classroom and through education events such as youth camps, youth water festivals, and community water or environmental awareness events.

Project WET *Explore Your Watershed* facilitates and promotes the learning, awareness, knowledge, exploration, and stewardship of North Dakota water resources, and teaches how water interacts with both the human and natural environments within the watersheds of North Dakota. Programs are carried out through the development of indoor and outdoor educational experiences and the dissemination of classroom-ready teaching aids.

Project WET educational programs, resources, and materials address a wide range of water resource issues and topics and water-related disciplines, take into consideration the various learning styles of educators and youth, and are designed to "fit" into existing subjects and curriculum. Other characteristics of Project WET programs include hands-on, self-contained, easy to use, non-biased, age-appropriate problem-solving skills.

Project WET programs are designed to provide young people with the knowledge, skills and commitment needed to make informed decisions about water resource management. This message is transferred to youth through educators, natural resource professionals, and youth leaders. Specifically, Project WET programs target the following groups:

- K-12 public and private classroom teachers
- Preschool and daycare educators
- Youth organization leaders (4-H, scouts, bible, etc.)
- Preservice faculty and students
- Natural resource program educators, environmental learning center staff, and park interpreters
- Home school educators
- Corporate community educators
- Zoo educational staff
- Museum, nature, and science center staff
- K-12 students
- Adults and general public

From 1993 to 2008, Project WET completed 17 instructional multi-credit institutes serving 594 K-12 educators, 67 single-credit workshops serving 938 K-12 educators, and 35 preservice workshops serving 718 preservice educators. There were also 224 inservice sessions completed during the same time period, with 3,136 K-12 educators attending. The total number of K-12 educators served was 5,386.

During that same time period, approximately 35,350 K-6 grade students attended 62 Project WET sponsored water festivals; 52,450 K-12 students attended 420 youth camps, environmental youth events, and community youth education events where Project WET was involved. About 1,800 youth have participated in 62 youth programs and projects in their local communities with Project WET involvement.

Also from 1993 to 2008, nearly 10,000 individuals (parents and children) have been involved in 46 Project WET sponsored family and community-centered water or environmental education events. Project WET services to K-12 educators, preservice teachers, K-12 students and adults/families, were provided to a total of about 104,986 individuals in 930 programs, projects, or events. Project WET was also involved in about 480 additional educational events. These events included booths, exhibits, presentations, and water/environmental meetings.

Many new educational initiatives

have been developed and implemented since the major expansion of Project WET in 1993. For example, the multi-credit instructional institutes have grown from one option in 1993-1998 to over nine different options in 2008. The single-credit workshop has grown from one option in 1993-1997 to over 15 different options in 2008. The number and types of youth education and community education events has also grown dramatically since 1993.

The dramatic increase in the diversity and number of youth and community educational initiatives are in response to the many agencies and organizations that are advocating for increased environmental literacy of K-12 students and adults through Project WET and other environmental education programs.

From January 2009 through June 2011, it is anticipated that over 400 K-12 educators will receive Project WET educational services through 18 graduate credit offerings. Additionally, over 150 preservice teachers and 350 inservice teachers will attend either a university preservice workshop or short educational sessions, respectively, totaling 32 workshops or sessions.

It is anticipated that from January 2009 through June 2011, about 10,000 K-12 students will attend 15 Project WET *Explore Your Watershed* sponsored water festivals, another 2,500 will attend 20 youth educational events, about 250 youth will complete 12 youth service learning projects in their local community, and about 2,500 individuals will attend six Project WET sponsored community education events. Total Project WET *Explore Your Watershed* services to K-12 educators, preservice teachers, K-12 students, and adults/families during this timeframe could be 16,150 individuals in 103 events.

Project WET was also involved in about 480 additional educational events during the period July 1, 1993 through December 31, 2008. These events included booths, exhibits, presentations and water/environmental meetings. It is anticipated that Project WET *Explore Your Watershed* will be involved in an additional 60 of the above type of events during the period January 1, 2008 through June 30, 2011.

Educational methods, standards, and techniques have changed dramatically over the past 10-15 years. One of the most profound changes is in the area of water resource technology. While Project WET *Explore Your Watershed* will continue programing that has been proven and widely accepted, strides will be made to increase programing in the areas of watershed technology and applied science, especially at the secondary level.

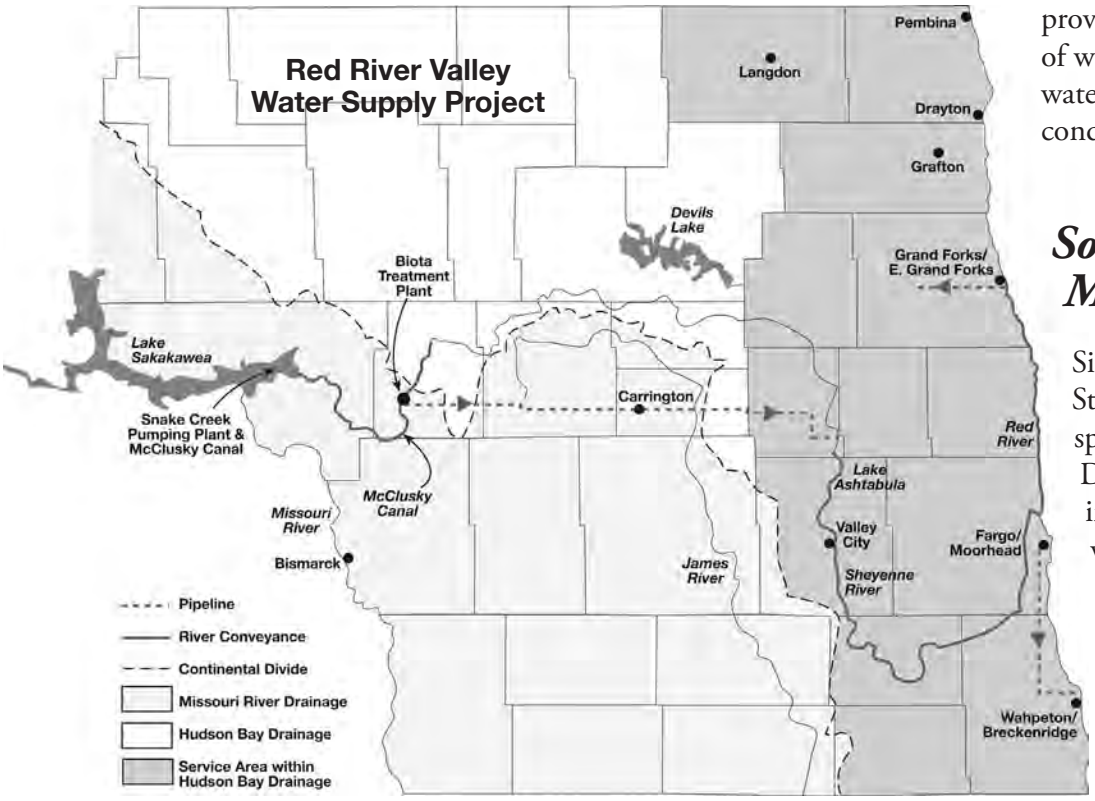
Specific areas where Project WET may be enhanced or extended are outlined in the Recommendations section of this plan.

Red River Valley Water Supply Project

The Red River and its tributaries are a major source of domestic and industrial water within the Red River basin. During the 1930s segments of the Red River actually had no flow for extended periods. According to climatic studies, it is not a question of if the next major drought will occur, but rather when it will occur.

When the next major drought does occur, studies have confirmed the region will not have enough water from existing available water sources to meet the needs of people living in the basin. With continued population growth expected in the region, the magnitude and severity of the water shortage will also increase. The hardship of little to no fresh water caused by a severe drought will be devastating to the region and state. The crisis will certainly be economic, but more importantly, it will severely impact the health and social well-being of a large portion of the region's population.

Therefore, it is imperative that another source of water to augment water supplies is found for Red River basin residents. Recent studies conducted by the BOR and the Garrison Conservancy District, representing the State of North Dakota, concluded after analysis of several alternatives, including conservation, that there is not enough water available within the basin to meet the regions projected water supply needs. The preferred



alternative is the Garrison Diversion Unit (GDU) Import to the Sheyenne River.

A Record of Decision that finalizes the EIS process is expected to be announced by the Secretary of Interior in the near future. Congressional authorization will be required, if the selected alternative uses Missouri River water. Construction on the project can start after Congress authorizes the project.

The GDU Import to the Sheyenne River Alternative creates international and interstate issues. Despite the treatment of the Missouri River water to remove biota before entering the Red River basin, the states of Minnesota and Missouri, and Canada are opposed to any Missouri River import alternative to augment water supplies in the Red River basin. The primary issues involve the potential transfer of biota from the Missouri River into the Hudson Bay drainage system and the loss of water from potential water users along the Missouri River when water is diverted to another basin for use.

Obtaining a reliable quality source of water for the Red River basin is one of the most urgent water supply needs facing the state at this time. Major water supply distribution systems take years and even decades to complete. Time is of the essence in starting a project in the Red River basin, since it can't be predicted how soon the next major drought will occur.

The Commission is committed to providing a reliable quality source of water to augment inadequate water supplies during drought conditions in the Red River basin.

Sovereign Land Management

Since 1989, the Office of the State Engineer has been responsible for managing North Dakota's non-mineral interests in the state's sovereign lands, which include those areas below the ordinary high water mark of navigable lakes and streams. With the increasing popularity of water-based recreation, and the draw of housing developments toward waterfront property, the use of, and issues surrounding North Dakota's sovereign lands have increased substantially in the last decade. This in turn has prompted the Office of the SE to take a much more active role in managing this popular resource.

The Office of the SE completed a North Dakota Sovereign Land Management Plan in January 2007. The plan was developed in response to a 2005 Attorney General Opinion that outlined the requirement for such a plan. Generally speaking, North Dakota's Sovereign Land Management Plan outlines the State Engineer's authority to manage sovereign lands, and it includes 19 recommendations and corresponding action strategies that are aimed at improving management of this valuable resource. Some

of the recommendations called for amendments and additions to sovereign land-related Statutes and Administrative Code, and others were geared toward general policy and management improvements.

In developing North Dakota's Sovereign Land Management Plan, the Office of the SE recognized the need for diverse technical expertise, and therefore sought assistance from several other state agencies including the: Attorney General's Office, Department of Agriculture, Game and Fish Department, Garrison Diversion Conservancy District, Department of Health, Historical Society, Land Department, Parks and Recreation Department, and the State Water Commission. Public input was also an important element in developing the final version of the plan.

Several of the recommendations will result in the Office of the SE taking a more active regulatory role. Because the State Engineer and Water Commission do not currently employ law enforcement-type staff, an agreement will be developed with Game and Fish to have their existing game officers assist with sovereign land-related law enforcement – since they are already in the field.

Another Sovereign Land Management Plan recommendation called for the development of ordinary high water mark delineation guidelines for North Dakota. Those guidelines were completed, and they have been used to conduct delineations in several locations, mostly along the Missouri River.

The Sovereign Land Management Plan, Ordinary High Water Mark Delineation Guidelines, and the new sovereign land-related North Dakota Administrative Code changes are all available on the Commission's website.

Tile Drainage

Legal drainage of land remains a powerful tool in North Dakota for enhancing the productivity of agriculture. Tile drainage is a relatively new technique to the state, which has seen increasing use over the past ten years, resulting in over 180 permitted tile drains. Drain tile is known as such, because up until the 1970s, most drain pipes were made from short, cylindrical sections of concrete or clay called "tile."

Today tile drains commonly consist of perforated polyethylene tubing buried in fields, generally at depths of three to six feet. The pipe takes in surrounding groundwater that is saturating the soils, and transports it away from the field. From there, the water is discharged into a waterbody, such as a large wetland, lake, ditch, or other natural watercourse. As a result, drain tile can help improve farmland that might otherwise be lost to flooding.

Tile drainage allows for timely fieldwork, and crop growth on soils that would otherwise be marginal for agriculture. The downside of this practice is that it can potentially increase flooding downstream, and cause negative effects on water quality due to sedimentation, and leaching of agricultural chemicals, which ultimately can impact habitat for wildlife.

Draining land, filling, or pumping an area that has a watershed, or contributing area of more than 80 acres, requires a permit from North Dakota's State Engineer.

With tile drain systems, it is important to understand and account for the fact that the contributing area may be larger than the perimeter of the drain tile. Because tile drains require a permit the same as surface drains, it can also be of statewide significance, making it subject to additional restrictions as well.

And, because drain tiling has been increasing, the issues of educating the public and regulating its use will be of increasing importance to the Office of the SE in the future.

Water Management Technology

Over the past 20 years, the State Water Commission has dramatically increased its use of, and the public's access to water management technology, anticipating the challenges and needs the agency will face in the next ten years.

This increase in technologies suitable for water management has not been limited to the Commission. Software and computing power have increased exponentially, and costs have decreased markedly. A few trained professionals in an afternoon can produce information that required hundreds of man-hours to develop a decade ago. Additionally, access to many of these products via the Internet has allowed a wide variety of users to rapidly and efficiently utilize products that many would not have had the necessary knowledge base, time, or expertise to employ in the past.

As technological capacity has increased over the years, so too has the Commission's facility in managing, analyzing, and distributing data. A consequence of the increasing data access and volume of production of that data has been a greater demand for tools powerful enough to adequately handle large volumes of information, and its dissemination and utilization as a useful product.

The water management technology being used by the Commission has been designed in anticipation of the challenges and needs that the agency will face in the future, such as the cost of some of the higher-end software. While many solutions for addressing water resource management are available commercially, there are also significant resources available as open source software. During the 2005-2007 biennium, the Commission's Information Technology (IT) infrastructure was enhanced to leverage open source solutions to provide an open and flexible framework to accommodate both commercial and open source technology.

There are several great examples of areas where the Commission has made an effective use of technology. One such example, is the mapping application that the public can readily access via the Commission's website (http://mapservice.swc.state.nd.us/). This application provides a fairly robust mapping program for water resource information such as aquifers, rivers, and other hydrology, while allowing readily downloadable free access to the 31,000 well sites, 2,000,000 water level records, and 54,000 chemistry analyses that the agency has in its records. This application was developed through open source software, and provides many of the same benefits of a much more expensive mapping program.

Another area in which the Commission is staying ahead of the technology curve is through the scanning and subsequent digitization of most of the agency's paper and aerial photograph archives, such as the approximately 2,800 Government Land Office (GLO) plat maps from the original statewide government survey of North Dakota, and more than 28,000 color infrared aerial photographs. Converting these files into a digital format makes it much easier to archive and provide widespread access for these resources for greater utilization of these resources, and to preserve them for long-term archival.

Information available via the Water Commission's mapping service include:

- Glacial drift aquifers (delineated at 1:500,000);

- Water permit records (including the location and application type);

- Precipitation sites (observed precipitation records throughout North Dakota);

- Driller's logs (contractor logs of more than 55,000 sites throughout the state)
- Ground/surface water sites (more than 33,000 sites throughout North Dakota used for the collection of ground and surface water information, including subsurface lithology, water levels, discharge, and water chemistry data);

- Retention structures (which includes dams, dikes, ponds, lagoons, and dugouts); and

- Drains (includes many of the permitted drains in North Dakota).

Anticipating where technology is headed is never an easy task, and with the dramatically increasing rate of innovation in the computer world, it will not get any easier. The Commission's IT efforts have been highly effective at keeping pace with that change, while increasing the availability of water resource information to the people who need it the most.

Water Organizations in North Dakota

In North Dakota, water is not only managed by state and federal agencies, but through local governmental entities as well. These reflect how North Dakota understands that water is best managed from the local level, up through the state and federal levels.

If trends experienced over the past ten years continue, joint water resource boards will become increasingly involved in driving water management development throughout the state, funding priorities at the state level, and ensuring that the interests of all of North Dakota's counties are heard.

Water Resource Districts and Joint Boards

North Dakota Century Code provides counties with the ability to form water boards, the authority to levy mills, build projects, and deal with complaints. Many of the state's boards are quite active, being involved in a number of major water management projects.

In addition, because water management issues often involve several jurisdictions, it is possible through NDCC 61-16.1-11 for individual water boards to join together as joint water boards. Some of the more active joint boards are focussed on the Missouri, Red, Souris, and Upper Sheyenne Rivers, and Devils Lake.

Devils Lake Basin Joint Water Resources Board (DLBJWRB)
Formed in 1979, the DLBJWRB draws its membership from Eddy, Cavalier, Nelson, Pierce, Ramsey, Rolette, Towner, and Walsh counties. The DLBJWRB's mission is water management at the basin level for the benefit of the basin's citizens. Recent projects that the board is involved in include: the Road and Railroad Inventory Crossing Project through the BOR; an ongoing water quality monitoring program; an ongoing, water quality trend analysis and sampling design through the USGS; and the Upper Basin Water Utilization Test Project.

Missouri River Joint Water Board (MRJWB)
Organized in 2005, the MRJWB includes the counties of Burleigh, Dunn, Emmons, Mercer, Morton, Mountrail, Oliver, and Sioux. The MRJWB's goal is to jointly exercise their powers in order to provide a cooperative and coordinated effort in addressing the management, conservation, protection, development, and control of water resources in the Missouri River basin. In recent years, the MRJWB has been working with the U.S. Army Corps of Engineers to develop a Missouri River report on siltation, and to advance a Shoreline Protection Project south of Bismarck.

Red River Joint Water Resource District (RRJWRD)
Formed in 1979, the RRJWRD has a goal of providing a coordinated and cooperative approach to planning and implementing a comprehensive water management program in the Red River Valley. There are currently 14 individual water resource districts that make up the RRJWRD. The RRJWRD has been involved in the advancement of numerous water management and development efforts throughout the Red River basin.

Souris River Basin Joint Board (SRBJB)
The SRBJB draws its membership from the counties of Renville, Ward, McHenry, and Bottineau in the Souris River basin. The primary purpose of the SRBJB was as the local sponsor for the construction and maintenance of the Souris River Flood Control Project, which was two dams in Canada, and levees and other water control structures in North Dakota.

Upper Sheyenne River Joint Water Resources Board (USRJWRB)
Created in the 1980s, the USRJWRB includes the counties of Barnes, Benson, Eddy, Foster, Griggs, McHenry, Nelson, Pierce, Sheridan, Steele, Stutsman, and Wells. It is the goal of the USRJWRB to provide a coordinated and cooperative approach to planning and implementing a comprehensive water management program in the upper Sheyenne watershed. Notable projects of the USRJWRB include: a restoration and enhancement of Sheyenne Dam in Eddy County; a water quality analysis of the entire Sheyenne River basin; and a crossings

survey of the Baldhill Creek watershed through the BOR.

Other Joint Boards
Several joint boards also have formed for specific purposes including: Cass County; James River; Hurricane Lake; Maple River and Barnes; Maple River-Ransom; Maple River-Richland; Maple River-Rush River; McLean-Sheridan; North Cass and Rush River; Richland-Sargent; Rocky Run; Sheyenne River; Southeast Cass-Rush River; Tri-County; and West River.

Other Water Resource Entities

In addition to joint water boards, there are other entities that are involved with water resource issues that go beyond the borders of North Dakota. These entities strive to facilitate communication, promote projects, and provide input on statewide, interstate, and international issues. The following are a few examples:

Garrison Diversion Conservancy District
The purpose of Garrison Diversion Conservancy District is to provide a reliable, high quality and affordable water supply for the benefit of North Dakota. It includes 28 counties in North Dakota. The District has a long history since its inception after Congress authorized the 1944 Flood Control Act and constructed the six mainstem dams on the Missouri River for flood control, navigation, irrigation and hydropower. Today a major focus of the District is supplying reliable, quality drinking water to the Red River Valley. In addition, the District is also the state entity receiving federal money through the U.S. Bureau of Reclamation to fund the state's Municipal, Rural and Industrial Water Supply program, established by the 1986 Garrison Diversion Reformation Act.

International Joint Commission (IJC)
Created in 1909 by the Boundary Waters Treaty Act, the United States and Canada created the IJC with three American, and three Canadian members to manage lake and river systems along the border. The IJC has set up more than 20 boards to help it carry out its responsibilities. Two of those boards are directly involved in North Dakota water issues, the International Red River Board, and the International Souris River Board.

International Water Institute (IWI)
The IWI has its origins in the 2000 International Flood Mitigation Initiative. The IWI is charged with oversight to the Red River Center for Watershed Education and the Center for Flood Damage and Natural Resources. The IWI is also largely involved with Red River watershed education and tours and more recently LiDAR data collection in the Red River basin.

Missouri River Association of States and Tribes (MoRAST)
The MoRAST is a regional, interstate organization including Wyoming, Montana, North Dakota, South Dakota, Nebraska, Iowa, and Kansas, and the Mni Sose Intertribal Water Rights Coalition. The group's purpose is to resolve relevant water resource issues, and to foster and facilitate the management of the natural resources in the Missouri River basin.

Missouri River Recovery Implementation Committee (MRRIC)
The purpose of the MRRIC is to make recommendations and provide guidance on various federal studies of the Missouri River and its tributaries based upon the existing Missouri River recovery and mitigation plan. The efforts of the MRRIC will provide a forum for discussions about Missouri River recovery; guide the prioritization, implementation, monitoring, evaluation, and adaptation of recovery action; and ensure a comprehensive approach to Missouri River recovery implementation while providing for congressionally authorized Missouri River project purposes to ensure that public values are incorporated into the study and recovery plans.

National Water Resources Association (NWRA)
The National Water Resources Association was established as a formal organization in 1932 with its origin going back to the 1890s. The NWRA membership is comprised primarily of western state organizations that

represent rural water districts, municipal water entities, commercial companies and individuals. It is the oldest national organization concerned with water resources policy, management, conservation and development. The NWRA is actively involved in legislation and regulations impacting water quality and quantity.

ND Water Coalition (NDWC)
The NDWC was established in 1994 with a goal of completing North Dakota's water infrastructure for economic growth and quality of life, and to bring together all water interests to reach consensus and unity on water funding issues. Major efforts include: providing a unified voice for statewide water development; establishing a statewide water priorities plan each biennium; working to secure state funds and bonding authority for water development each Legislative session; helping to enact the state Water Development Trust Fund in 1999, and the federal Dakota Water Resources Act of 2000.

ND Water Education Foundation
The North Dakota Water Education Foundation was created in 1993 to help North Dakotans face the challenges of water. The purpose of the Foundation is to develop and implement water information and water education programs in North Dakota as well as to increase understanding and knowledge of North Dakota's water resource issues. The Foundation consists of a 15-member board of directors, representing a variety of areas and interests across North Dakota.

ND Irrigation Association
The North Dakota Irrigation Association is a statewide organization composed of irrigators, potential irrigators, irrigation dealers and suppliers, energy suppliers, irrigation districts, businesses, and other supporters of irrigation and economic development for North Dakota. The purpose of the Association is to strengthen and expand irrigation in North Dakota and to build and diversify North Dakota's economy.

ND Natural Resources Trust
Created under the Garrison Diversion Reformation Act of 1986 as the North Dakota Wetlands Trust, its mission was to preserve, restore, mange and enhance wetlands and associated habitat in North Dakota. With passage of the Dakota Water Resources Act 2000, the mission was broadened to include grassland conservation and riparian areas. Congress originally authorized $13.2 million in federal and state funding for the Trust, with an additional $25 million added as part of the Dakota Water Resources Act of 2000. The Trust can only spend interest from the funds on projects.

ND Water Users Association (NDWUA)
Created in 1959, the NDWUA was organized to protect, develop, and manage North Dakota's water resources. Major project areas include providing support for: the Red River Valley Water Supply Project, the Devils Lake outlet, the Northwest Area Water Supply Project, the Southwest Pipeline Project, various flood control projects, rural water systems, water for industry, recreation and wildlife, municipal water supplies, water management projects and programs, irrigation, river and bank protection, water education, and other projects and programs to protect, develop, and manage North Dakota's water resources.

Red River Basin Commission (RRBC)
The RRBC draws its membership from various federal, state, and local representatives from North Dakota, South Dakota, Minnesota, and Manitoba, as well as from various water-related interest groups. Its mission: is "to develop a Red River basin integrated natural resources framework plan; to achieve commitment to implement the framework plan; and to work toward a unified voice for the Red River Basin." Projects include: a Natural Resource Framework Plan; annual water management concerns/solutions conferences; the South Valley (Fargo-Moorhead) Initiative; the Mike 11 Model of the Red River main stem; a Drought Mitigation Plan; water quality data compilation for the IJC; regular contributions to radio and newspapers on water resource issues; and other various educational efforts.

Red River Water Resources Council (RRWRC)
Formed in 1982, the purpose of the RRWRC is to enhance com-

munication and cooperation between governments and citizens in the management of water and related land resources for the benefit of the citizens of the Red River basin. The RRWRC includes representation from natural resource governmental entities from the states of North Dakota and Minnesota, and the Province of Manitoba; in addition to representation from federal natural resource agencies from both the United States and Canada.

Western States Water Council (WSWC)
Created in 1965, the WSWC consists of governor-appointees from 18 western states, including North Dakota. The WSWC's purpose is to: "provide effective water resource cooperation among western states; maintenance of vital state prerogatives; providing a forum for communication; and analysis of federal and state water resource developments."

Upper Missouri River Water Users Association (UMRWUA)
The UMRWUA is a non-profit regional organization, which includes representatives from the states of Montana, North Dakota, South Dakota, and Wyoming concerned about upper Missouri basin water issues from a variety of areas. Membership is drawn from large and small businesses, individuals, farmers, ranchers, irrigators, engineers, contractors, companies, rural electric and other cooperatives, irrigation districts, rural water systems, and cities. The purpose of the Association is to protect, develop, and manage Upper Missouri River System water.

WATER MANAGEMENT RECOMMENDATIONS

The following recommendations all require future study and are intended to serve as a starting point to addressing long-term water management issues.

• Funds must be secured to address dam safety issues and dam repairs. Throughout the state there are numerous dams in need of major repair or removal if the dam is deemed no longer needed. The SWC should consider changing the cost-share policy to provide local governments with more state cost-share to either fix or demolish unwanted structures.

• Drought planning, including monitoring, impact assessment, and mitigation planning efforts must be implemented. This will require a multi-agency (local, state, and federal) concerted effort. The state currently has a drought reaction plan that addresses mitigating drought impacts to varying degrees. However, the current plan is reactionary and mostly targeted to initiate federal response and assistance to the agricultural sector.

• Providing reliable quality water to eastern North Dakota during drought conditions is of critical importance to the region and the entire state. There are institutional and funding issues that must be resolved so that this can be accomplished in a timely manner. As such, the state must be diligent in solving the water supply shortage that exists during drought in eastern North Dakota. The consequences of no water supply to this region will result in tremendous social and economic hardship.

• Conservation measures must be evaluated and implemented so that water requirements for all water users and interests can be met.

• The State Engineer will continue to study and collect water resource data that is essential in identifying available water sources for agricultural and industrial users; for meeting municipal demand; and for fish and wildlife and recreation purposes.

• The state must continue to protect and preserve North Dakota's right to use Missouri River water now and for future generations.

• Climate change and the possible effect it may have on the state's water resources is an unknown factor that will have to be monitored and assessed closely in the future.

• The state must continue to work to address the flooding crisis involving the rise of Devils Lake. The uncertainly of predicting what will happen to the lake levels and the social and environmental consequents associated with some of the measures make this a very difficult issue.

• Some counties simply do not have the revenue or the capability of raising revenue to meet their local cost-share requirements in funding many of the much-needed water development projects. The SWC should study the ability-to-pay concept to determine if a more equable cost-share policy can be developed and implemented for local entities that have difficulty in coming up with their cost-share requirement based upon current policy.

• New partnerships involving cooperative and collaborative efforts must be sought to resolve water management problems and issues.

• Water resources managers at all levels are encouraged to partner in efforts not only to educate the public about the potential problems involving aquatic nuisance species (ANS), but also to monitor and mitigate for the occurrence of ANS in North Dakota's waters.

• The Commission should continue to educate potential future industrial water users about the

quality and availability of North Dakota's surface and ground water resources.

• In response to declining water levels in the Fox Hills aquifer, the State Engineer will continue to direct large-scale ground water diversions to other sources.

• A Summer Advanced Watershed Applications Workshop (two credits) could be designed through Project WET to provide up to 20 secondary educators per year the tools they would need to connect their classroom students with practicing watershed scientists and scientific methods and techniques. This could provide a real world application to science currently being taught in their classrooms.

• A Youth Technology and Career Exploration Program could be designed through Project WET for a select group of Grade 9-12 students whose teachers have been involved in the Summer Advanced Watershed Applications Workshop. Students could earn a one-half high school ecology credit and also a one-semester hour of college credit. Students would use learning acquired in the classroom on advanced watershed methods and techniques, and apply that learning in the field on a local water body in their own watershed. Data would be collected and shared with other students involved in the program through distance learning techniques. And, professional scientists would also share career awareness education through the same distance learning techniques.

• Project WET, with the cooperative effort of many organizations, associations, and government agencies, will develop water and natural resource education programs that involve individuals in their own communities. This will include increased emphasis on community service learning projects intended to involve educators and students in tackling problems and issues related to water or environmental resources at home, in the school, in the community, or on the farm or ranch.

CONCLUSION

While great progress in water development in North Dakota has been made in the past, much remains to be accomplished now and into the future. The state is faced with ever evolving challenges including shifting population distribution, changes in agriculture and technology, rapid oil and gas development, infrastructure repair needs and the possible reduction in federal funds for water development projects. The state has the responsibility to face these new and changing challenges with determination and a commitment to providing a prosperous future for all North Dakotans.

APPENDIX

NORTH DAKOTA STATE WATER COMMISSION
COST-SHARE POLICY, PROCEDURE, AND GENERAL REQUIREMENTS

It is the policy of the State Water Commission that the following categories of projects shall be eligible for cost-sharing, and that the projects are consistent with the public interest to receive cost-share funding from the agency's appropriated funds. Projects that receive Federal Emergency Management Agency funding and/or financial support from the State's Division of Emergency Management Fund are not eligible for funding through the State Water Commission. No funds shall be used in violation of the Anti-Gift Clause of the North Dakota Constitution.

ELIGIBLE ITEMS

It is the policy of the State Water Commission that the following items shall be eligible for cost-sharing upon approval by the State Water Commission:

I. Construction costs, which include but are not limited to, earthwork, concrete, mobilization and demobilization, dewatering, materials, seeding, rip-rap, re-routing electrical transmission lines, moving storm and sanitary sewer systems, and other underground utilities and conveyance systems, irrigation supply works, and other items and services provided by the contractor. The costs must have been incurred after the cost-share approval date.

II. Preliminary engineering costs preceding the cost-share approval date up to a maximum of two years. Final engineering costs incurred after the cost-share approval date. All preliminary engineering and engineering feasibility studies for flood control projects are exempt from any time restrictions.

The eligibility of certain items for cost-share may be addressed on an individual basis and presented to the State Water Commission for consideration if deemed warranted by Commission personnel.

NON-ELIGIBLE ITEMS

It is the policy of the State Water Commission that the following items shall not be eligible for cost-sharing by the State Water Commission:

I. Acquisition of property interests in fee or easement for projects.

II. Administrative and legal expenses incurred in connection with any project.

III. Maintenance, deferred maintenance, repairs. Maintenance work and deferred maintenance on any project shall not be an eligible item for cost-sharing, except for maintenance that may be required as a result of an unusual climatological event or dam safety repairs.

IV. Projects that do not receive cost-share approval prior to the commencement of the project.

V. Construction and final engineering costs incurred prior to cost-share approval.

VI. Preliminary engineering costs incurred earlier than two years preceding the cost-share approval date. Flood control projects are exempt.

VII. Funding contributions provided by other entities that reduce the project cost to the applicant.

VIII. Work incurred outside the scope of the project.

IX. Technical assistance provided as in-kind may not be submitted for cost-share reimbursement.

The eligibility of certain items for cost-share may be addressed on an individual basis and presented to the State Water Commission for consideration if deemed warranted by Commission personnel.

COST-SHARE APPLICATION AND APPROVAL PROCEDURES

It is the policy of the State Water Commission to provide cost-share funding for water development projects. The State Engineer has the

authority to cost-share up to $20,000 without State Water Commission action. Projects estimated in excess of $20,000 must be presented to the State Water Commission for approval. The State Engineer has the authority to approve cost overruns equal to or less than 10% of the total amount approved for the project, not to exceed $20,000.

The following are general cost-share application procedures and requirements for State Water Commission and State Engineer approval:

I. APPLICATION REQUIRED. The State Water Commission will not consider any request for cost-sharing for water-related projects unless an application is first made to the State Engineer. The applicant must be a federal or state entity, a political subdivision, or a commission legislatively granted North Dakota recognition.

II. PERMITS. The applicant for cost-sharing must also address the appropriate federal, state, and local permits required. No contract will be initiated until all required permits have been issued.

III. CONTENTS OF APPLICATION. An application for cost-sharing must be in writing, but is not required to be in a prescribed format. A "North Dakota State Water Commission Project Information and Cost-Share Request Form" is available from the Commission upon request. The application must include the following:

A. Description and location of the proposed project
B. Purpose, goal, objective/narrative of the proposed project
C. Delineation of costs
D. Preliminary designs, if applicable
E. Scope of work for an engineering feasibility study
F. Additional information as deemed appropriate by the State Engineer

IV. REVIEW. Upon receiving an application for cost-sharing, the State Engineer shall review the application and accompanying information. If the State Engineer is satisfied that the proposal meets all the requirements, the State Engineer shall present the application to the State Water Commission for approval (for projects where the state cost-share amount is greater than $20,000), or he may make a determination for approval (state cost-share amount is $20,000 or less). The State Engineer's review of the application will include the following items, and any other considerations that the State Engineer deems necessary and appropriate.

A. If the application for cost-sharing is for project construction, a field inspection will be made, if deemed necessary by the State Engineer. Previous field inspections made by the State Engineer as part of a permit application may satisfy this requirement.
B. Engineering plans and specifications will be reviewed.
C. If the request is for a study, the State Engineer will review the application to ensure that the study qualifies as an eligible study as defined by the State Water Commission.
D. The amount of eligible cost-share will be determined by the project type or the amount requested by the applicant.

V. NOTICE & APPEARANCE OF THE APPLICANT. For projects with an excess state cost-share amount of $20,000, the State Engineer shall place the application for cost-sharing on the tentative agenda of the State Water Commission meeting at which the application will be presented. The State Engineer shall give notice to such applicant when the project will be presented to the State Water Commission.

VI. STATE ENGINEER'S RECOMMENDATION. The State Engineer will make a recommendation to the State Water Commission on an application in excess of $20,000 for state cost-sharing at the meeting of the commission when such application for cost-sharing is presented for approval. No funds will be disbursed until the State Water Commission and applicant(s) have entered into a contract for state cost-share participation.

VII. LITIGATION. If a project for which an application for cost-sharing has been submitted is the subject of litigation, the application may be deferred until the litigation is resolved. If a project for which the State Water Commission or State Engineer has approved a cost-sharing request becomes the subject of litigation before the funds approved by the Commission have been disbursed, the State Engineer may withhold such funds until the litigation is resolved.

VIII. ENGINEERING DESIGNS, PLANS & SPECIFICATIONS. Engineering designs, plans, and specifications for the construction of a project must be approved by the State Engineer. The applicant/project sponsor must also comply with the North Dakota Century Code in the soliciting and awarding of bids and contracts, and all federal, state, and local laws.

IX. COST SHARING BY OTHER AGENCIES. All applications for cost-sharing shall be reviewed to determine if other local or state agencies are participating in the project costs. If so, the State Water Commission will take this into account, and may reduce the percentage of commission cost-sharing accordingly.

X. PARTIAL & FINAL PAYMENTS The State Engineer may make partial payment of cost-sharing funds as deemed appropriate. Upon notice by the applicant/project sponsor that all work or construction has been completed, the State Engineer may conduct a final field inspection. If the State Engineer is satisfied that construction has been completed in accordance with the designs, plans and specifications for the project, the final payment for cost-sharing as approved by the State Water Commission shall be disbursed to the project sponsor, less any partial payment previously made. Engineering Feasibility Studies are only entitled to one payment.

XI. MAINTENANCE AND REPAIRS. Except as otherwise provided, the State Water Commission shall require that the applicant for cost-sharing be responsible for maintenance and repairs of the project.

PROJECTS ELIGIBLE FOR COST-SHARE

I. *Rural Flood Control Projects.* The primary purpose of rural flood control projects is to manage runoff/drainage from agricultural sources or to provide flood control in a rural setting. Typically, rural flood control projects consist of drains, channels, diversion ditches, or ring dikes. The State Water Commission has established design criteria for rural flood control projects. Projects that are managing runoff/drainage from urban sources are not eligible for State Water Commission cost-share participation.

A. Drains, Channels, Diversion Ditches. The Commission will provide cost-sharing up to 35 percent of the eligible items for the construction of drains, channels, and diversion ditches. Improvement reconstructions are reimbursed at 35 percent. The cost-share of any one project is capped per biennium. County and township road crossing work that are an integral part of the drains, channels, and diversion ditches and the appropriate costs for engineering work, excluding any land rights, administration and legal costs, are eligible for cost-share. A Water Resource District applying for cost-sharing for a rural assessment-based flood control project must comply with regulatory statutes per the North Dakota Century Code. If an assessment-based rural flood control project is to be established within two or more districts, or the project is sponsored by two or more districts, and financial participation is sought from the State Water Commission, each district involved must join in the application for financial assistance.

B. Ring Dikes. A ring dike program shall be developed and sponsored by a Federal, State, or Political Subdivision consisting of one or more occupied farmsteads and/or rural residences. Ring dikes will receive up to a 50 percent cost-share of the eligible items, limited to a maximum of $40,000 per ring dike. All ring dikes within the program are subject to the Commission's minimum design criteria standards, eligible items, and costs.

II. *Water Supply Projects.* The State Water Commission will provide cost-sharing for up to 50 percent of the eligible items of any cost-sharing application approved for water supply projects. Theses projects are commonly associated with dams and water retention methods. If sufficient funds are not available for all competing cost-sharing applications, water supply projects for domestic, municipal, and rural uses shall receive highest priority.

III. *Flood Control Projects.* The State Water Commission will provide cost-sharing for up to 50 percent of the eligible items of any cost-sharing application approved for flood control projects. The nature of these projects is to protect communities from flooding and may include the repair of dams that provide a flood control benefit. These projects are commonly associated with dams, dikes, levees, diversion channels, water retention structures/methods, dam repairs, drop structures, and miscellaneous flood control programs.

IV. *Dam Safety Projects.* The State Water Commission will provide cost-share for up to 65 percent of the eligible items of any cost-sharing application approved for dam safety repair construction projects. The cost-share percentage of 65 percent is only applicable to those dam safety repairs that do not have any other contributing partners. The local level would be responsible for 35%. On those dam safety repairs of which the North Dakota Game and Fish will be a third contributing party, the SWC will fund 33.33%, NDG&F 33.33%, and the local level will be at 33.33%. Dam safety repairs that are funded with federal funds, will be cost-shared at 50% of the non-federal costs. The intent of these projects is to return the dam to a state of being safe from the condition of failure, damage, error, accidents, harm or other events that are considered non-desirable.

V. *Recreation Projects.* The State Water Commission will provide cost-sharing for up to 33.33 percent of the eligible items of any cost-sharing application approved for the purpose of water-based recreation. Various types of projects may constitute a recreation project.

VI. *Snagging & Clearing.* The State Water Commission will provide cost-share for up to 50 percent of the eligible items for snagging and clearing on watercourses as defined in NDCC 61-01-06. Snagging and clearing projects consist of the removal and disposal of fallen trees and associated debris encountered within or along the primary channel as well as any sediment that has accumulated in the immediate vicinity and any trees in imminent danger of falling in the channel. Snagging and clearing projects are intended to prevent damage to structures such as bridges, and maintain the hydraulic capacity of the channel during flood flows. The snagging and clearing of artificial/man-made channels; the dredging of watercourses for sediment/silt removal; the clearing and grubbing of cattails and other plant vegetation; or the removal of any other unwanted materials are not eligible under State Water Commission's snagging and clearing cost-share policy.
The State Engineer reserves the right to determine the eligibility of projects and the percentage of cost-share up to 50 percent.

VII. *Studies, Reports, Analyses, Surveys, Models, Assessments, Mapping.* The State Water Commission will provide cost-sharing for up to 50 percent of the eligible items of any cost-sharing application approved for studies, reports, analyses, surveys, models, assessments, and mapping projects. The percentage of funds is limited by the maximum cost-share limits of eligible project categories to which the purpose of the project corresponds. A paper and electronic copy of the study, report, analysis, survey, model, assessment or mapping project must be provided to the State Water Commission upon completion. One payment will be reimbursed to the project sponsor upon the copy receiving review and approval from State Water Commission personnel.

A. Engineering Feasibility Studies. An engineering feasibility study identifies a water-related problem and the alternatives/options to solve or alleviate the problem, an evaluation of the alternatives/options for technical, engineering, and financial feasibility, and the selection of an alternative/option.

B. Other Studies, Reports, and Analyses. The purpose of these projects is to gather data and/or accomplish a specific task such as flood insurance studies, hydraulic modeling, and flood insurance mapping projects.

C. Emergency Action Plans. The State Water Commission will provide cost-share up to 80 percent, limited to $25,000, for emergency action plans (EAP's) of each classified high and significant hazard dam. Reimbursement per actual costs incurred.

VIII. *Irrigation.* The State Water Commission will provide cost-sharing for up to 40 percent of the eligible items of any cost-sharing application approved for irrigation projects. The cost-share must be limited to supporting the irrigation development efforts of political subdivisions. The items eligible for cost-share are those associated with new central supply works, to include water storage facilities, intake structures, wells, pumps, power units, primary water conveyance facilities, electrical transmission and control facilities, and engineering.

IX. *Bank Stabilization.* The State Water Commission will provide cost-share for up to 50 percent of eligible items of any cost-sharing application approved for bank stabilization projects on public lands or those lands under easement by federal, state, or political subdivisions. Bank Stabilization projects are intended to stabilize the banks of lakes and of watercourses, as defined in 61-01-06 of the NDCC, with the purpose of protecting public facilities. Drop structures and outlets are not considered for funding as bank stabilization projects, but may be eligible under other cost-share program categories.

Bank Stabilization projects, typically consist of a rock or vegetative design, and are intended to prevent the loss of land or damage to utilities, roads, buildings or other facilities adjacent to the lake or watercourse. The State Engineer reserves the right to determine the eligibility of projects and the percentage of cost-share up to 50 percent.

X. *Technical Assistance.* The State Water Commission will provide cost-share of up to 50 percent of eligible costs based on the type of project as described above. In some cases a portion of the assistance provided may be in the form of in-kind technical assistance. The cost or value of the technical assistance will count toward the Commission's total contribution. The project sponsor, upon awarding a contract for the construction or other work to be performed for a project in which the State Water Commission is providing technical assistance, shall file a copy of the contract with the State Engineer.

XI. *Emergency Municipal, Tribal, and Rural Water Supply Projects.* The State Water Commission will provide cost-share on the eligible items of any cost-share application approved for emergency municipal, tribal, and rural water supply projects. The percentage of cost-share will be calculated upon review of the application. Theses projects are associated water systems, whose primary source of water is the Missouri River, Lake Sakakawea, or Lake Oahe, that request emergency assistance due to low water conditions on the Missouri River, Lake Sakakawea, or Lake Oahe, and face a critical need or health risk as a result of the inability of the water intake system to supply an adequate quantity of quality water to the people served by the municipal, tribal, or rural water system.

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