

NORTH DAKOTA 2015 PLAN State Water Management



Table of Contents

A Message From The State Engineer

Introduction	1
Organization & Background	2
Authority	2
Purpose.....	2
2015 Water Planning Process	3
Partnerships.....	4
North Dakota's Water Resources	5
Climate	5
Surface Water Resources	9
Ground Water Resources	10
Atmospheric Water Resources	11
Water Quality.....	11
Current & Historic Water Use.....	13
Future Water Needs	15
Water Availability	20
Managing Resources	24
North Dakota Water Appropriation Law & Administration.....	24
Appropriation Responsibilities.....	24
Information & Data Resources: Acquisition & Use	25
North Dakota Water Permit Definitions.....	26
Ground Water Studies.....	27
Water Exploration, Monitoring, & Gaging.....	27
Water Permit Management & Challenges.....	28
Water Use Telemetry	28
Special Investigations	29
Other Regulatory Functions	29
Dam Safety Program	29
Environmental Reviews.....	30
Floodplain Management.....	30
Sovereign Lands Management	33
Developing North Dakota's Water Resources: Biennium In Review	35
2013-2015 Priority Projects.....	35
Completed Projects, 2013-2015 Biennium	42
Currently Active Projects, 2013-2015 Biennium	43
State Water Development Program	44
Cost-Share Policy & Project Prioritization.....	44
House Bill 1206.....	44
The Inventory Process.....	44
Water Development Funding Needs, 2015-2017 Biennium.....	45
Tribal Project Funding.....	58
Water Project Funding	59
General Fund	59
Resources Trust Fund	59
Water Development Trust Fund.....	59
Bonding.....	59
Infrastructure Revolving Loan Fund.....	61
Municipal, Rural, & Industrial Water Supply Program.....	61
Drinking Water State Revolving Loan Fund	62
Other Federal Funding	62

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Table of Contents (continued)

Project Funding Priorities: 2015-2017 Biennium	63
Devils Lake Outlet Operations.....	64
Fargo-Moorhead Area Diversion.....	64
General Water Management.....	65
Grafton Flood Control.....	65
Irrigation.....	65
Mouse River Flood Protection.....	65
Northwest Area Water Supply.....	66
Red River Valley Water Supply.....	66
Sheyenne River Flood Control.....	67
Southwest Pipeline.....	67
Water Supply Program.....	68
Western Area Water Supply.....	68
Williston Flood Control.....	69
Future Water Development Funding Needs Beyond 2015-2017.....	69
 Special Water Management & Development Topics	70
Apportionment.....	70
Aquatic Nuisance Species.....	71
Cloud Modification.....	71
Devils Lake.....	72
Drainage - Surface Systems.....	73
Drainage - Tile Systems.....	74
Drought Management Planning.....	75
Indian Water Rights.....	75
Information Technology (IT).....	76
International Border Dike.....	77
Missouri River Management.....	79
Mouse River Flood 2011.....	80
Oil & Gas Water Use Needs.....	81
Red River Flood Mitigation.....	82
Telemetry Pilot Study.....	85
Water Education.....	87
Water Use Technology Innovations.....	88
 Goals & Objectives - Meeting Challenges	90
 Appendix	93
SWC Water Project Prioritization Guidance Concept.....	94
SWC Cost-Share Policy Summary.....	95
Cost-Share Policy, Procedure, & General Requirements.....	96
Water Permitting Process.....	108
 Map Appendix	110
Devils Lake & Outlets.....	111
Fargo-Moorhead Area Diversion.....	112
Northwest Area Water Supply.....	113
Red River Water Supply Potential Alignments.....	114
Rural & Regional Water Supply Systems.....	115
Southwest Pipeline Project.....	116
North Dakota Cloud Modification Project Area.....	117
Western Area Water Supply.....	118



Table of Contents (continued)

Figures

Figure 1 - State Water Commission Basin Meeting Schedule	3
Figure 2 - 30 Year (1983-2012) Average Rainfall (April-September)	5
Figure 3 - January-December 2011 & 2012 Precipitation	6
Figure 4 - North Dakota Climate Quick Facts.....	6
Figure 5 - Air Temperature/Precipitation Composite Mean	8
Figure 6 - Major Watersheds Of North Dakota.....	9
Figure 7 - 2003-2013 Average Combined Consumptive & Non-Consumptive Water Use	13
Figure 8 - 2013 Combined Consumptive & Non-Consumptive Water Use.....	14
Figure 9 - 2013 Total Consumptive Water Use.....	15
Figure 10 - North Dakota's Ten Largest Cities.....	16
Figure 11 - North Dakota's Fastest Growing Cities.....	16
Figure 12 - 2012 North Dakota Statewide Housing Assessment Regions	18
Figure 13 - Aquifer Potential For Development.....	21
Figure 14 - Conditional & Perfected Water Permit Filings 2003-2013.....	25
Figure 15 - Temporary Water Permits: Applications Processed By Year	28
Figure 16 - Digitized Flood Maps.....	33
Figure 17 - Resources Trust Fund Revenues, 1997-2017	60
Figure 18 - Water Development Trust Fund Revenues, 1999-2017	60
Figure 19 - Federal MR&I Water Supply Program Dollars Received, 1987-2014	62
Figure 20 - Devils Lake Outlet Discharges 2007-2014	73
Figure 21 - Water Commission Digital Storage	77
Figure 22 - Mouse River Historic Crests At Minot.....	80
Figure 23 - North Dakota Oil Well Locations.....	82
Figure 24 - Top Ten Red River Floods At Fargo.....	83
Figure 25 - Water Depot Telemetry Map.....	85
Figure 26 - Aquifer Recharge & Recovery Project	89

Tables

Table 1 - Population Trends: North Dakota's Ten Largest Cities	16
Table 2 - Population Trends: North Dakota's Fastest Growing Cities.....	16
Table 3 - Population Estimates & Trends By Region	18
Table 4 - Estimated Increase In Domestic, Commercial, & Light Industrial Water Use By Region	19
Table 5 - Estimated Oil-Field Water Use (2014-2024).....	20
Table 6 - 2013 Water Use Permits.....	26
Table 7 - Completed Projects, 2013-2015 Biennium	42
Table 8 - Currently Active Projects, 2013-2015 Biennium	43
Table 9 - Water Development Needs, 2015-2017 Biennium	47
Table 10 - Summary Of Water Development Needs, 2015-2017 Biennium	56
Table 11 - Category 4 Water Supply Project Needs.....	57
Table 12 - Water Commission Funding Priorities: 2015-2017 Biennium	63





A MESSAGE FROM THE STATE ENGINEER:

I am pleased to present you with the 2015 North Dakota State Water Management Plan.

This new plan documents many of North Dakota's historic, current, and anticipated water management and development challenges. From flooding and drought, to inadequate or insufficient water supplies, and inappropriate federal policies – the challenges are most certainly great, and they are many. But what is even more important to draw our focus, is that there are also sound solutions; many of which are well underway, or are planned to improve the lives of North Dakotans well into the future.

A key statement in this plan that stands out is “the state recognizes that many of the best solutions are forged at the local level.” I firmly believe this. And, I also believe that the long history of cooperation between local and state water managers, and the general public must continue. For it is that culture of cooperation in North Dakota's water community that has enabled our state to make the progress we've seen over the past several decades to better manage and develop our water resources.

What is also very positive, is revenue available for water projects through the state's Resources Trust Fund (oil extraction tax) remains strong. Therefore, the state is poised financially to assist with moving critical water development projects forward in all of our major drainage basins.

With that, I hope you find the 2015 North Dakota Water Management Plan to be informative. And on behalf of North Dakota's Water Commission, I appreciate your interest and continued support of North Dakota's future water management and development endeavors.

Sincerely,

Todd Sando, P.E.
State Engineer
Chief Engineer-Secretary

To improve the quality of life and strengthen the economy of North Dakota by managing the water resources of the state for the benefit of its people.



Introduction

It is the vision of the North Dakota State Water Commission that, “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.”

The 2015 State Water Management Plan has been developed to serve as a pathway to achieve this vision.



ORGANIZATION AND BACKGROUND

The legislature established the Office of the State Engineer in 1905 to regulate the allocation of water, manage drainage and promote irrigation. The State Water Commission (Water Commission or Commission) was established in 1937 to promote, plan and build water development projects. The Water Commission is comprised of the Governor, the State Agriculture Commissioner, and seven members appointed by the Governor, that regionally represent the state. The Water Commission appoints the State Engineer. The State Engineer hires staff that provides technical assistance and essential decision-making information to support wise management of North Dakota's water resources by both the State Engineer and State Water Commission. Overall, both entities are responsible for the wise management and development of North Dakota's most precious resource – water.

AUTHORITY

By virtue of North Dakota Century Code (NDCC), Section 61-02-14, Powers and Duties of the Commission; Section 61-02-26, Duties of State Agencies Concerned with Intrastate Use or Disposition of Waters; and Section 61-02-01.3, Comprehensive Water Development Plan, the Commission is required to develop and maintain a comprehensive water development plan.

PURPOSE

The purpose of the 2015 State Water Management Plan is to:

- Outline the planning process;
- Provide an overview of North Dakota's water resources – including characteristics and extent, and factors affecting availability for beneficial uses;
- Provide an overview of water appropriation responsibilities and evolving challenges associated with increasing demand for water;
- Provide a progress report on the state's priority water management and development efforts;
- Provide information regarding North Dakota's current and future water development project funding needs and priorities;
- Provide information regarding North Dakota's revenue sources for water development;
- Serve as a formal request for funding from the Resources Trust Fund;
- Provide information regarding water management and development special topics; and
- Identify goals and objectives to meet water management and development challenges.

2015 Water Planning Process

To promote and encourage more local project sponsor participation in water planning and in legislative and agency biennial budgeting efforts, the 2013 Legislative Assembly passed House Bill 1206 (NDCC 61-02-01.3), requiring the Water Commission to schedule commissioner-hosted meetings within six major drainage basins. The meetings were to be held in the Red, James, Mouse, lower and upper Missouri River, and Devils Lake basins (Figure 1).

As a result, the 2015 water planning process began when water management and development stakeholders and project sponsors were invited and encouraged to attend a series of Water Commissioner-hosted meetings in November and December 2013.

At those meetings, local stakeholders and project sponsors were asked to identify and submit potential water projects that should be considered for inclusion into the 2015 State Water Management Plan. In addition, modifications to the Water Commission's cost-share policy and a

draft water project prioritization guidance concept were presented, and comments regarding these documents were requested. Comments were then incorporated into the Water Commission's cost-share policy and the prioritization guidance concept, and following further consultation with the state's interim Legislative Water Topics Overview Committee, the Cost-Share Policy, Procedures, and General Requirements, and the Water Project Prioritization Guidance Concept (See Appendix) were both formally adopted by the Commission in September 2014, and became effective October 1, 2014.

A second series of Water Commissioner-hosted meetings was held in September 2014. The purpose of these meetings was to review potential projects identified by stakeholders and project sponsors that were proposed for implementation in the next biennium and beyond. The revised Water Commission cost-share policy and prioritization guidance concept were also outlined at the meetings.

North Dakota State Water Commissioner Hosted Meetings

ROUND ONE: 2013


November 18 - Dickinson (Lower Missouri River Basin)
November 20 - Jamestown (James River Basin)
November 20 - Fargo (Red River Basin)
November 21 - Devils Lake (Devils Lake Basin)
November 25 - Minot (Mouse River Basin)
December 17 - Williston (Upper Missouri River Basin)

ROUND TWO: 2014

September 22 - Bismarck (Lower Missouri River Basin)
September 23 - Garrison (Upper Missouri River Basin)
September 23 - Minot (Mouse River Basin)
September 24 - Grand Forks (Red River Basin)
September 25 - Carrington (Devils Lake & James River Basins)



Figure 1. State Water Commission basin meeting schedule.



“...The state recognizes that many of the best solutions are forged at the local level.”

Partnerships

The 2015 State Water Management Plan process involved collaboration with stakeholders and the formation of partnerships with numerous government entities at all levels of government, as well as with the Legislature. It is also important to recognize the close relationships between the private sector and many of the state’s local government officials and water managers. This important tie completes North Dakota’s grass-roots approach to water management and development, where the state recognizes that many of the best solutions are forged at the local level. The Water Commission

has a long history of working together with all stakeholders, while encouraging partnerships to ensure the wise management and development of North Dakota’s water resources for the benefit of future generations.

As we look to the future, North Dakota faces many challenges in managing its water. But working together with all stakeholders will enable the state to move more efficiently toward effective development and management of the state’s water resources.

North Dakota's Water Resources

Like most states in the northern Great Plains, North Dakota faces a variety of water quantity and quality issues, which is why 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, it addresses surface and ground water quality issues, and present and future water use trends.

CLIMATE

Since settlement days, North Dakota has experienced extreme weather patterns such as the "Dirty Thirties," and the extended wet cycle that led to the rise of Devils Lake, beginning in 1993. In the last five years, the state has experienced record floods in 2009 and 2011, and an exceedingly dry year in 2012.

North Dakota spans a region that often swings from "too wet" to "too dry" (Figure 2). This range of climate varies not only geographically, east to west, but over time as well. It is not uncommon for the state to experience extreme drought in one place, and severe flooding in another, sometimes at the same time (Figure 3).

30 Year (1983 - 2012) Average Rainfall (April - September)

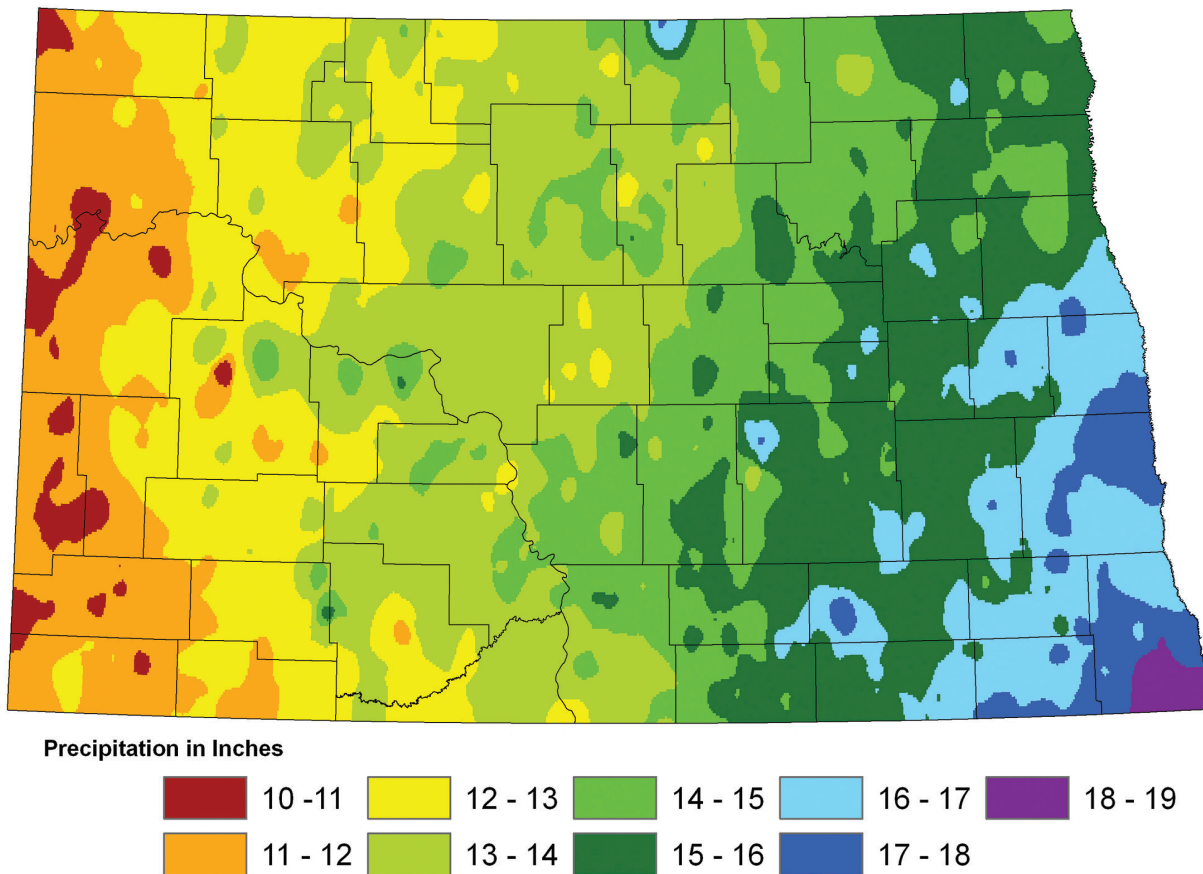
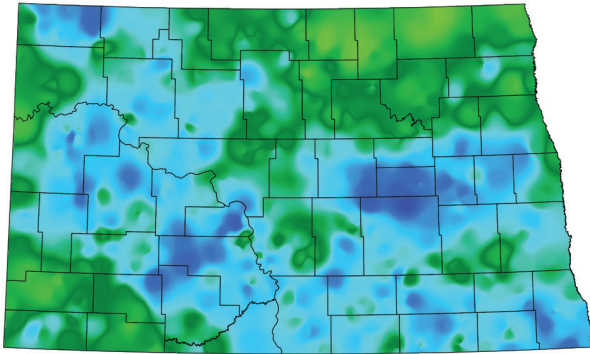


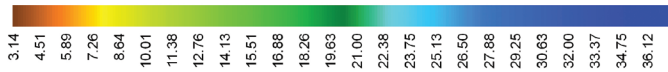
Figure 2. The state has experienced an extended wet cycle beginning in 1993 that has increased average annual precipitation statewide. (Courtesy NDARB)

January-December 2011 Precipitation

Source: NDARB Cooperative Observer Network

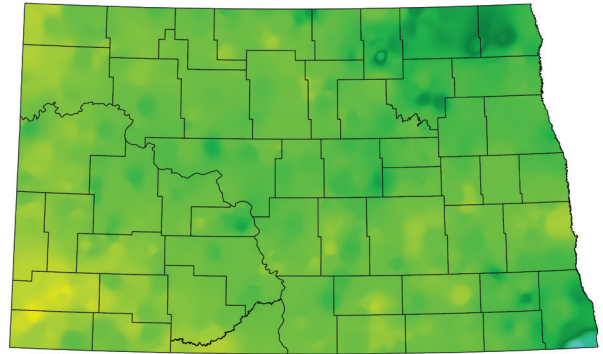


Precipitation in Inches



January-December 2012 Precipitation

Source: NDARB Cooperative Observer Network



Precipitation in Inches



Figure 3. North Dakota experiences extremes in precipitation, as shown in these annual precipitation maps for 2011 (a very wet year) and 2012 (a very dry year).

North Dakota Climate Quick Facts

- Highest temperature: 121 degrees, Steele, July 6, 1936.
- Lowest temperature: 60 degrees below zero, Parshall, February 15, 1936.
- Largest rainfall event in 24-hour period: 10.05 inches, Gilby, June 2000.
- Largest snowfall event in 24-hour period: 24.0 inches, Amidon, February 1998.
- The average first day of frost occurs in mid-September in northern parts of the state.
- The average last day of frost occurs in mid to late May.
- North Dakota receives a higher percentage of possible sunshine and more hours of sunshine annually than any other state along the Canadian border. On an annual basis, the state receives 58 to 62 percent of total possible sunshine.
- July is the sunniest month, when approximately three-quarters of possible sunshine is recorded.
- July and August will record about twice as many sunshine days than during any other month of the year.
- Average yearly rainfall ranges from 24 inches in the southeastern portion of the state, to 14 inches in the far west.
- When compared to the period from 1907-1992, average annual precipitation has increased during the “wet cycle” period (1993-2011) by approximately 29% in Fargo, 28% in Bismarck, and 11% in Dickinson.
- North Dakota’s greatest source of atmospheric moisture is the Gulf of Mexico - not the Pacific Ocean.



Figure 4. North Dakota climate quick facts.



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 generally 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. Geological evidence indicates that this boundary can shift even more dramatically.

Drought

Drought has often been a defining aspect of climate in North Dakota since settlement days, from the many problems caused by drought in the 1930s, through several shorter dry cycles experienced as recently as 2012. Drought can cause crops to fail, stress municipal water supplies, impact recreation, and make life generally miserable for anyone who makes their living from the land.

Drought certainly is not new to the region since settlement, with the most severe dry periods recorded in the 1930s, and more recently, the 1980s. Studies of isolated lakebeds 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 glaciers receded, droughts and wet cycles lasting more than 100 years have occurred.

While in an “average” year, there is often sufficient precipitation for the various uses that rely upon it, historical and paleoclimatological records indicate that there will be periods of time when there is not nearly enough moisture.

Flooding

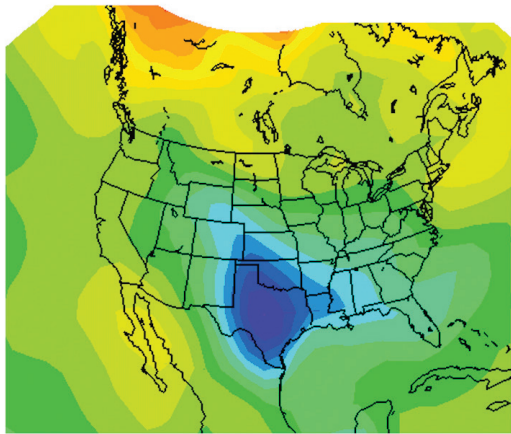
While droughts are common in the northern Great Plains it is also true that this region experiences wet cycles. Climatologists believe that North Dakota is currently in a wet cycle that began in 1993, which has led to flooding throughout the state. It is useful to note that although we are believed to 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 one of 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. 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 flooding of Devils Lake has been relentless, rising over 30 feet in a little over 20 years, with only the drought of 2012 and the operations of the Devils Lake outlets causing appreciable reductions in lake levels.

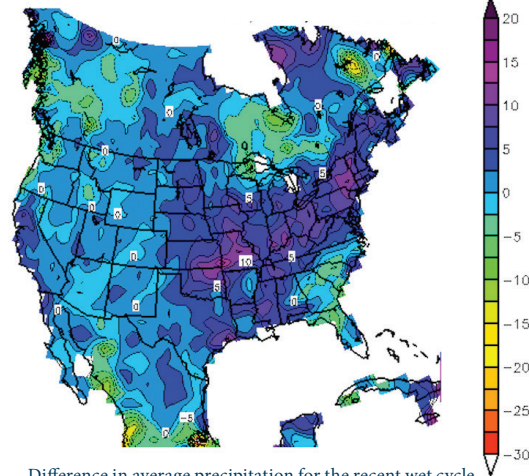
More recently, two significant and very damaging floods impacted most of the state in 2009, and 2011. Most of the major cities in the state were affected, with Minot, Bismarck, and Fargo being especially impacted. Additional discussion of the flooding events experienced in the Mouse, Missouri, Red River, and Devils Lake watersheds is included in the “Special Topics” section.

Air Temperature Composite Mean (Kelvins)



Difference in average temperature for the recent wet cycle, compared to the beginning of the 20th century.

Precipitation Composite Mean (mm)



Difference in average precipitation for the recent wet cycle, compared to the beginning of the 20th century.

Figure 5. A comparison of the average yearly temperature and total precipitation in North America. Numbers reflect the wet cycle (1993-2012), when subtracting the averages for the “normal” climate of North America (1952-1972). In general, North Dakota got slightly warmer and wetter. (Courtesy Mark Ewens, NOAA)

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, climate change and global warming have gained greater attention (Figure 4 & Figure 5). 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. With a wet cycle that has lasted for two decades, and models indicating a likelihood that current patterns could persist for decades more, regular flooding may become the new normal for much of the state.



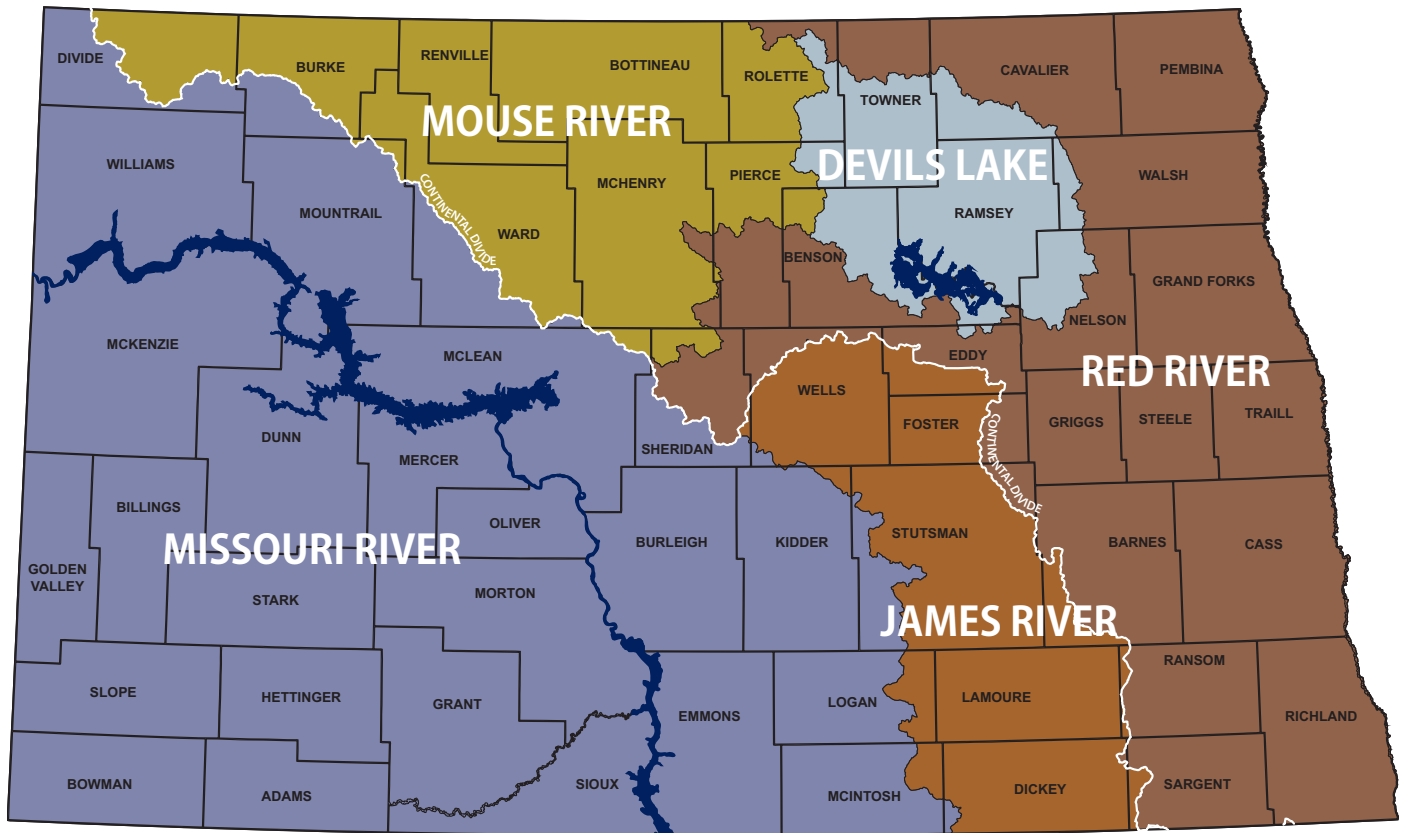


Figure 6. The major watersheds of North Dakota. The Mouse River, Devils Lake, and Red River basins are part of the Hudson Bay drainage, while the Missouri and James River basins are part of the Gulf of Mexico drainage.

SURFACE WATER RESOURCES

There are two major drainage basins in North Dakota, separated by a continental divide running from the northwest to the southeast corners of the state (Figure 6). The northeastern portion of the state drains into Hudson Bay, while the southwestern part is drained by the Missouri River to the Gulf of Mexico.

Flow in all North Dakota streams and rivers is seasonably and annually variable. Runoff is generally 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. However, dramatic flow variations in river discharges can be caused by changes in weather patterns, isolated storm events, evaporation rates, and snow pack conditions.

In 2012, the total recorded waterbodies in North Dakota covered approximately 1,331,840 acres. According to the North Dakota State Water Commission MapService and North Dakota’s Assessment Database (ADB), provided by North

Dakota’s Department of Health to the U.S. Environmental Protection Agency, there are 3,297 man-made reservoirs and 988 waterbodies greater than 10 acres in area in the state.

The state’s four largest reservoirs (Sakakawea, Oahe, Audubon, and Ashtabula) comprise about 30 percent of North Dakota’s total waterbody surface acres, accounting for a surface area of 397,467 acres. Of these, 375,669 acres, or 28 percent of the state’s entire waterbody acres are contained within the two mainstem Missouri River reservoirs (Lake Sakakawea and Lake Oahe) at their normal operating pool elevations.

Missouri River 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 naturally well drained with few 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.

James River Basin



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 River basin is naturally poorly to moderately drained, with a large number of wetlands.

Mouse River Basin



The Hudson Bay drainage includes the Mouse River, Red River, and Devils Lake basins. The Mouse River originates in Saskatchewan and then loops 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 lake plain in the east, and forested hills of the Turtle Mountains in the northeast.

Red River Basin



The Red River winds northward for almost 400 miles, forming the border between North Dakota and Minnesota. From the Canadian border, 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 with less than a foot of drop per mile downstream, and is home to some of the most productive farmland in the world.

Devils Lake Basin



The Devils Lake basin is a sub-basin of the Red River basin. Chains of waterways and connecting lakes form the drainage system; many of which ultimately terminate in Devils Lake. At its current elevation, the lake itself does not naturally connect to the Sheyenne River. However, two state outlets pump water to the Sheyenne River when they are being operated. In addition, small natural connections between the Devils Lake and Red River basins do exist along the eastern and northern borders of the basin.

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 aquifers consist primarily of shale, sandstone and lignite.

Aquifers of glacial origin are generally more productive than aquifers 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 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.

In recent years, the development of technologies such as horizontal drilling, and aquifer recharge and recovery (previously called artificial recharge) could also prove to be a vital tool in mitigating the boom-bust nature of precipitation that the state frequently experiences. (Please see pages 88 and 89 for more information on horizontal well drilling and artificial aquifer recharge.)

ATMOSPHERIC WATER RESOURCES

Mean annual precipitation ranges from a maximum of nearly 24 inches in the southeast corner of the state to just over 14 inches in the extreme west. It is worth noting that the maximum mean annual rainfall in southeast North Dakota has increased from just over 21 inches, to 24 inches due to the extended wet cycle, which started in 1993 and continues through 2014.

During North Dakota's growing season (April-September), precipitation ranges from about 18 inches in the southeast part of the state, to about 10 inches in the far west. 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 Rocky 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 summer air can hold enough moisture to allow a thunderstorm to generate several inches of rainfall in a short period of time, 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. Most 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 sometimes precipitation.

WATER QUALITY

In North Dakota, water quality monitoring is primarily the responsibility of the Department of Health. The Water Commission 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 Quality

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.

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-three percent of the rivers and streams assessed fully support the beneficial use designated as aquatic life. The remaining 17 percent assessed for this report were classified as not supporting aquatic life, and will be the focus of improvement strategies.

Of North Dakota’s approximately 1.3 million acres of surface water, 766,337 are contained within lakes and reservoirs, with the remainder in smaller wetlands and other temporary waterbodies. A total of 192 lakes and reservoirs (691,769 acres) were assessed for this report, with the state’s remaining lakes and reservoirs making up only 10 percent (74,568) of total acreage. Eighty-one percent were assessed as fully supporting aquatic life use. Of this total, 15 percent were considered threatened, while four 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, and hydrologic modifications (e.g., upstream impoundments, low-head dams, channelization, flow regulation and diversion, riparian vegetation removal, and wetland drainage).

Recreational use was assessed on 159 waterbodies in the state, and was classified as fully supporting, or not supporting on 97 and 3 percent, respectively. The primary cause of recreational use impairment was nutrient loading.

About 2,160 miles of rivers and streams were assessed for drinking water supplies for this report; with only 5 percent threatened for drinking water supply use, primarily through taste and odor problems that are not regulated in drinking water.

A total of 4,097 miles of rivers and streams were assessed for fish consumption. Of those, 4,093 miles of rivers and streams were identified as capable of supporting a sport fishery from which fish could be used for consumption. Based on the recommended EPA fish tissue criterion of 0.3 µg methyl-mercury/gram of fish tissue, only the Red River of the North was assessed as not supporting fish consumption. While there are many potential sources of methyl-mercury, both anthropogenic and natural, to date there have been no specific causes or sources identified for the mercury present in North Dakota fish.

There are five reservoirs: Lake Sakakawea, Lake Ashtabula, Homme Dam, Bisbee Dam and Mt. Carmel Reservoir that are currently being used either directly or indirectly as municipal drinking water supplies, with two others (Patterson Lake and Renwick Dam) serving as back-up water supplies in the event the primary water supplies should fail. Homme Dam, Mt. Carmel Reservoir 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 Quality

In North Dakota, most of the incorporated communities in the state rely on ground water from private wells, municipal distribution systems, or rural water systems. Ground water is virtually the sole source of all water used by farm families and residents of small communities having no public water distribution system. 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.

For the last 30 years North Dakota’s principle aquifers have been extensively monitored for nutrients and organic compound contamination. North Dakota has not identified widespread ground water contamination, although some naturally occurring compounds, such as arsenic, and uranium may make the quality of ground

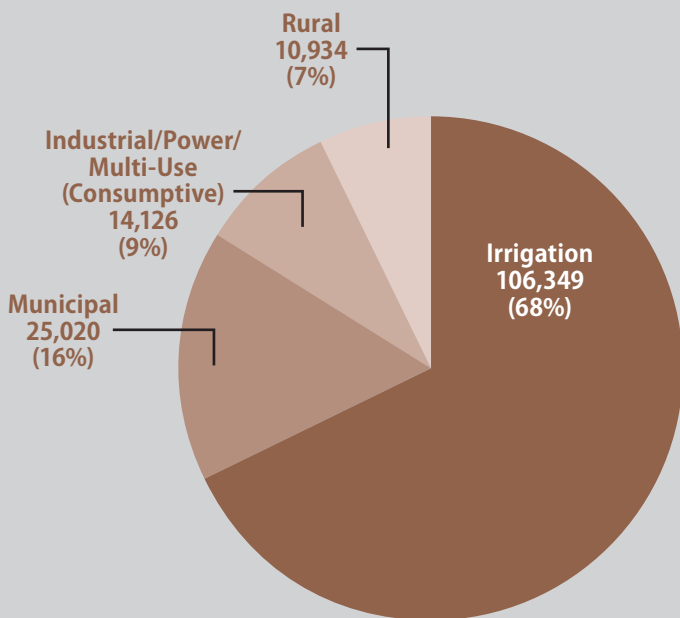
water undesirable in a small number of aquifers. Those areas where human-related ground water contamination has occurred have usually been associated with petroleum storage facilities, agricultural storage facilities, feedlots, poorly designed wells, abandoned wells, wastewater treatment lagoons, landfills, septic systems, and the underground injection of waste.

Monitoring and protection of the state’s ground water resources continues through a wide variety of state and federal programs. State Engineer monitoring efforts are outlined in greater detail in the “Managing Resources” section.

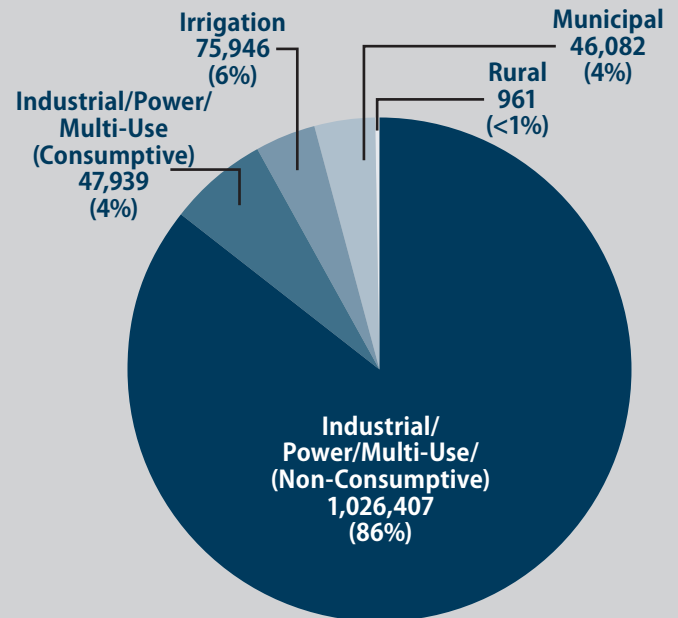
CURRENT AND HISTORIC WATER USE

Water in North Dakota is used in a variety of ways (Figure 7 & Figure 8). 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.

North Dakota’s 2003-2013 Average Combined Consumptive & Non-Consumptive Water Use



2003-2013 Ground Water Average Use (In Acre-Feet)
Total: 156,429



2003-2013 Surface Water Average Use (In Acre-Feet)
Total: 1,197,335

2003-2013 Average Annual Total Water Use = 1,353,764 Acre-Feet

Figure 7. North Dakota’s 2003-2013 average combined consumptive & non-consumptive water use.

Public and Domestic Water Use

In 2013, rural water use accounted for 13,249 acre-feet from ground water, and 1,680 acre-feet from surface water. Municipal water use was 23,482 acre-feet from ground water, and 48,838 acre-feet from surface water (Figure 8). In 2013, rural and municipal water use from both sources accounted for 24% of all consumptive water use in the state, and 7% of combined consumptive and non-consumptive water use.

Industrial Water Use

In 2007, oil hydrofracturing started to become a widespread technology, which in turn led to an increase in industrial water usage. Water use increased by an average of 43% for the period of 2008-2013, when compared to the period between 2003 and 2007. Hydrofracturing water use has appeared to stabilize, however related water use to maintain well production is likely to increase for a while, and then stabilize.

In 2013, industrial water use was 17,039 acre-feet from ground water, and 48,176 acre-feet from

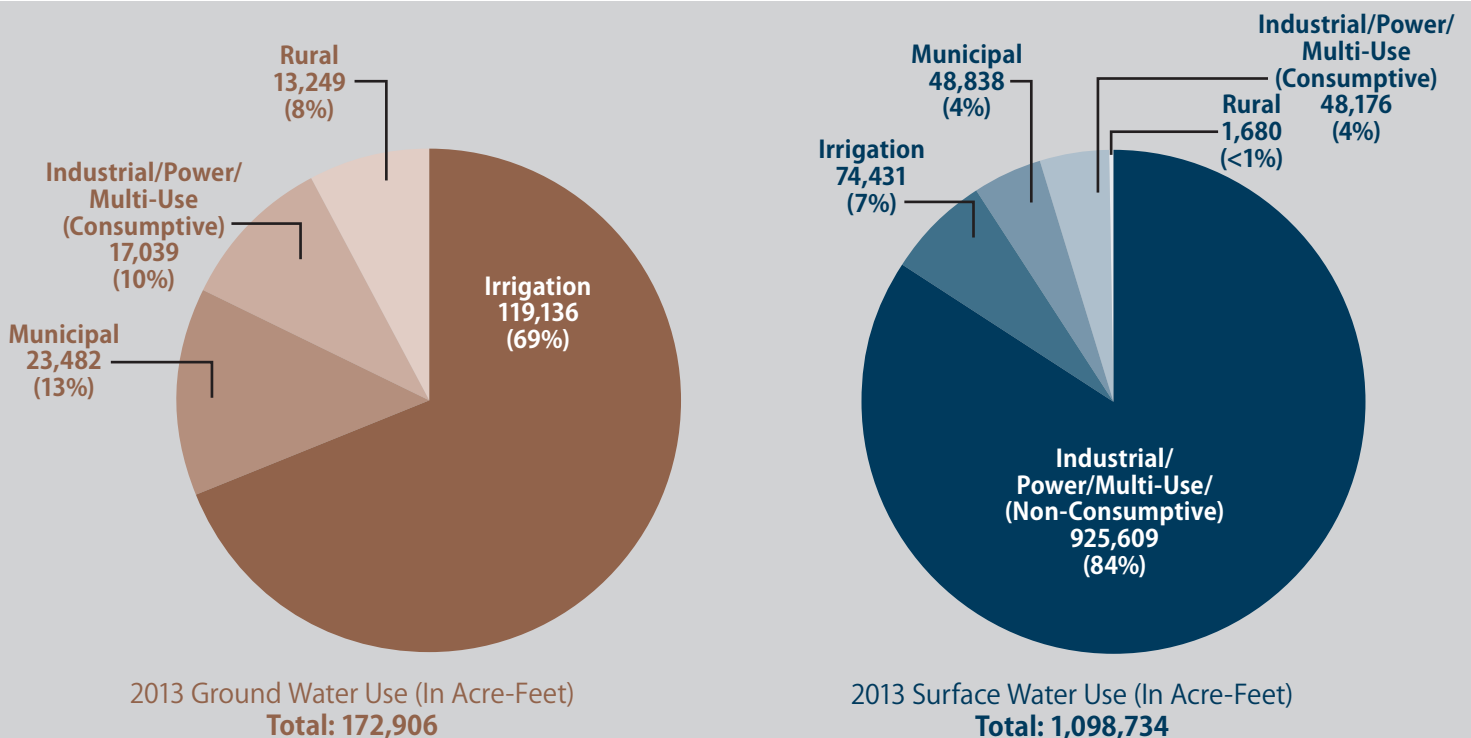
surface water (Figure 8). In 2013, industrial water use from surface and ground water accounted for 22% of all consumptive water use in the state, and 6% of combined consumptive and non-consumptive water use.

Though the use of water for oil production has increased, it is also important to note that water use for oil production only accounted for 5% of North Dakota's consumptive water use in 2013 (Figure 9).

Electric Power Water Use

There are currently ten water permits issued for electric power generation in North Dakota. The State Engineer requires reporting of both consumptive water use and non-consumptive water use for this purpose. Consumptive water use for electric power refers 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

North Dakota's 2013 Combined Consumptive & Non-Consumptive Water Use



2013 Total Water Use = 1,271,640 Acre-Feet

Figure 8. North Dakota's 2013 combined consumptive & non-consumptive water use.

the non-evaporated water is returned to the original source. According to Water Commission records, consumptive use for electric power generation ranged from 33,514 acre-feet in 2003, to 31,200 in 2013. Non-consumptive use averages approximately 1,000,000 acre-feet annually.

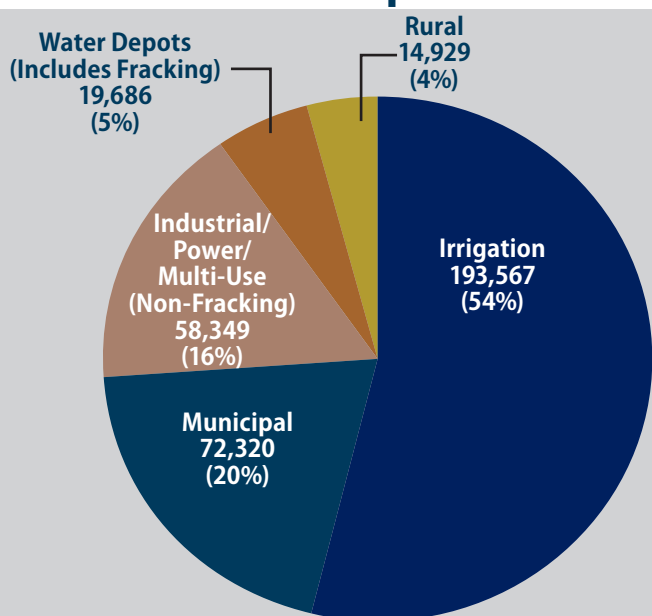
Agricultural Water Use

The primary use of water in agriculture in North Dakota is for irrigation. Irrigation is dependent upon climate conditions each year, with soil moisture and precipitation driving need. In 2013, irrigation used 119,136 acre-feet from ground water, and 74,431 acre-feet from surface sources (Figure 8). Irrigation remains the state’s single greatest water usage, accounting for an average of 56% of total consumptive water use, and around 13% of total consumptive and non-consumptive water use.

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 consumptive and non-consumptive water use.

2013 Total Consumptive Water Use



2013 Total Consumptive Use = 358,851 Acre-Feet

Figure 9. 2013 total consumptive water use.

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 climate, 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 economic development opportunity might occur, and what it might involve. The purpose of this section of the current planning effort is to discuss some of the influencing factors and anticipated water use scenarios for various uses.

From the time of statehood, North Dakota has experienced two general trends in population, people moving from rural to urban areas, and the outmigration from the state of young adults after high school or college. What this has meant is that the population of the state over the last century has been on a slow but steady decline, along with increasing urbanization. All of that changed with the advent of various economic development opportunities, particularly in the energy sector.

With the invention and use of technologies necessary to cost effectively extract shale-bound oil, the stage was set in 2007 for North Dakota to experience a relatively rapid increase in the state’s population. In 2013, statewide population reached almost 724,000 - a 7.6% increase between 2010 and 2013. Before current conditions, the highest population recorded was in 1930, when the state population was approximately 681,000.

Between the 2010 U.S. Census and 2012, estimates showed that 31 out of 53 North Dakota counties gained in population, in contrast with the 2009 State Water Management Plan, where only seven counties in the state were estimated to gain population between 2000 and 2020.

In western North Dakota, in the heart of oil development, these changes have been even more pronounced. Cities and counties that have experienced a long, steady loss in population are suddenly confronting massive increases in

population. This has presented significant challenges in order for these areas to support the rapid growth with housing and other basic services, like drinking water.

The expanding oil industry has meant rapid and substantial population and economic growth in the state in general. But, a major unknown is if the rate of population growth will hold steady, increase, decrease, or stop. Because the state's recent growth is so closely tied to oil development, and there are a wide variety of variables affecting regulations, the technology being used, and the

market forces driving oil development, it is difficult to predict where state population will be in twenty years. However, some forecasts have put the state's population over a million in the next few decades, if current trends persist.

The ten largest cities in the state are the same as they were in the 2009 State Water Plan: Fargo, Bismarck, Grand Forks, Minot, West Fargo, Dickinson, Mandan, Williston, Jamestown, and Wahpeton (Table 1). However, when considering relative changes in population, the ten cities with the greatest growth were Watford City, Williston,

Population Trends: North Dakota's Ten Largest Cities



Figure 10. North Dakota's ten largest cities.

City	2010 Census	2013 Estimate	% Growth
Fargo	105,549	113,658	7.7%
Bismarck	61,272	67,034	9.4%
Grand Forks	52,838	54,932	4.0%
Minot	40,888	46,321	13.3%
West Fargo	25,830	29,878	15.7%
Williston	14,716	20,850	41.7%
Dickinson	17,787	20,826	17.1%
Mandan	18,331	19,887	8.5%
Jamestown	15,427	15,440	0.1%
Wahpeton	7,766	7,853	1.1%

Table 1. Growth in the ten largest cities in North Dakota between 2010 and 2013. (Source: U.S. Census)

Population Trends: North Dakota's Fastest Growing Cities

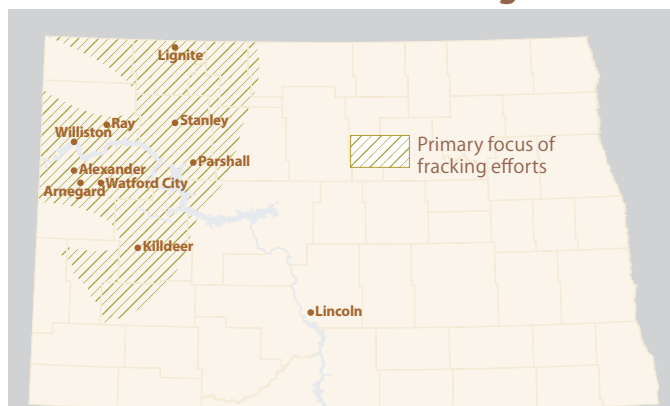
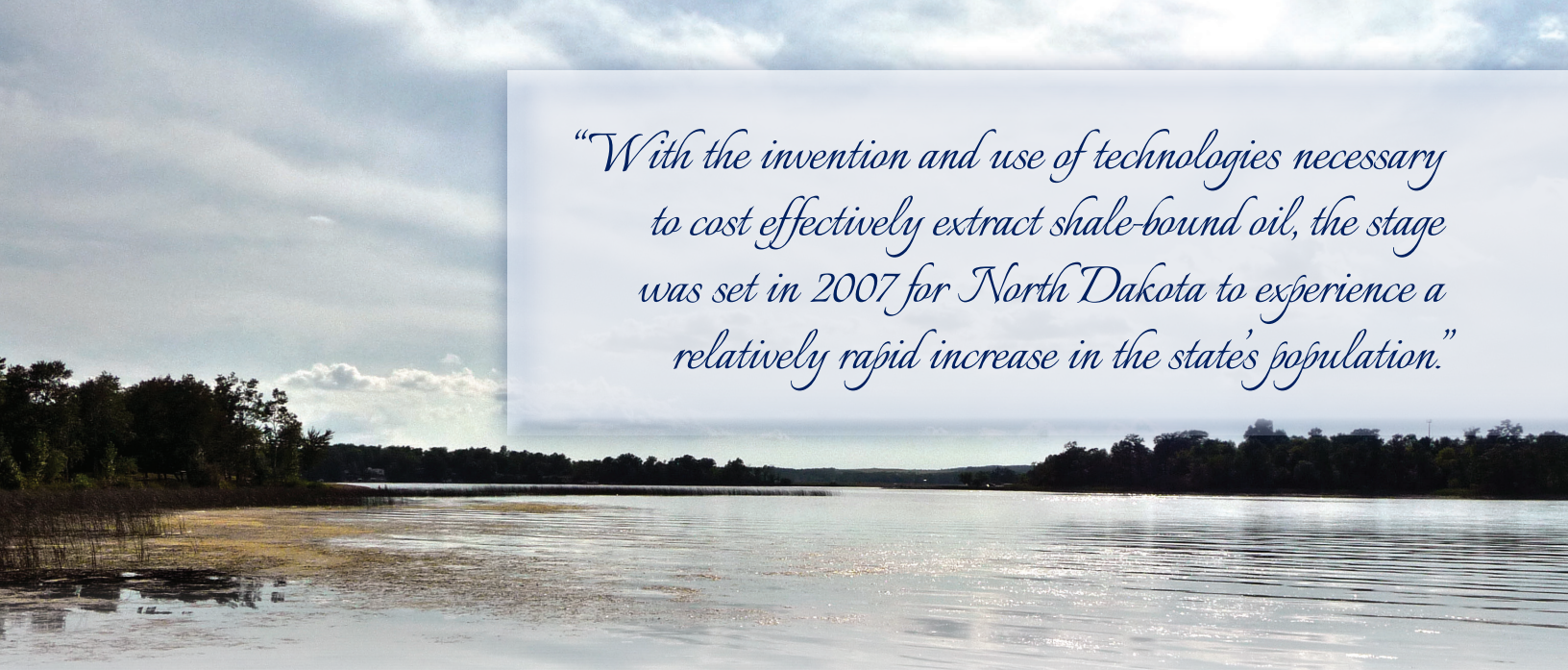


Figure 11. North Dakota's fastest growing cities.

City	2010 Census	2013 Estimate	% Growth
Watford City	1,744	3,284	88.3%
Williston	14,716	20,850	41.7%
Stanley	1,458	2,060	41.3%
Parshall	903	1,216	34.7%
Lignite	155	204	31.6%
Alexander	223	293	31.4%
Killdeer	751	975	29.8%
Arnegard	115	149	29.6%
Ray	592	766	29.4%
Lincoln	2,406	3,099	28.8%

Table 2. The ten cities that experienced the greatest proportional growth between 2010 and 2013. (Source: U.S. Census)



“With the invention and use of technologies necessary to cost effectively extract shale-bound oil, the stage was set in 2007 for North Dakota to experience a relatively rapid increase in the state’s population.”

Stanley, Parshall, Lignite, Alexander, Killdeer, Arnegard, Ray, and Lincoln, with Watford City seeing an 88% increase in population between 2010 and 2013 (Table 2). The greatest proportional gains in population were, with the exception of Lincoln, all in western North Dakota, a part of the state that has been losing population for decades.

Changes in long-term trends in population have led to a need for improving infrastructure in the western half of the state, including water supply. Rapid population growth has led to efforts to increase the capacity of regional projects such as the Southwest Pipeline Project, and the construction of a newer regional water supply project known as the Western Area Water Supply Project.

Prior to expansion of oil extraction efforts, infrastructure projects in the western half of North Dakota were designed under the assumption that populations were going to decline or hold steady. With a rapid influx in population, this meant that infrastructure, such as the Southwest Pipeline Project and the Western Area Water Supply, would need additional capacity to meet existing needs.

Along with the challenges of developing infrastructure sufficient to meet the needs of an unexpected growth in population, the state also faces challenges in several areas: such as legal challenges over the state’s right to Missouri River water, the largest source of fresh water in the state;

providing water for the oil extraction process; and future quantification of Native American water rights.

Future Population Estimates

A recent 2012 NDSU study titled “The 2012 North Dakota Statewide Housing Needs Assessment” developed projections for 2015, 2020, and 2025 for the entire state by region (Figure 12). Table 3 on the following page shows that the state is projected to see a population increase of 25 percent from 2010-2025, with the greatest percentage increases of 137%, 60%, and 35% in Regions I, VIII, and II in western and north central North Dakota. These areas of the state are also the focal point of large-scale, ongoing and planned regional water supply systems – including the Southwest Pipeline Project that serves much of Region VIII, Western Area Water Supply that serves Region I, and the Northwest Area Water supply in Region II.

The ten eastern Red River Valley counties in regions IV and V currently account for 41% of the state’s total population. But, the Red River in that region only accounts for 6% of the annual flows of North Dakota’s rivers. In addition, the Red River has a history of drying up during times of drought. In response, efforts to address looming water supply issues in the Red River Valley are continuing through cooperative efforts involving the state, Garrison Diversion Conservancy District, and Lake Agassiz Water Authority.



Figure 12. The 2012 North Dakota Statewide Housing Needs Assessment regions.

Population Estimates & Trends By Region

	Total Pop 2000	Total Pop 2010	Projection 2015	Projection 2020	Projection 2025	Change 2010-2025
Region I	27,781	30,829	50,529	66,938	73,164	42,335
Region II	88,089	89,967	114,709	121,425	121,443	31,476
Region III	43,168	40,672	41,434	42,254	43,016	2,344
Region IV	90,798	88,519	90,506	92,800	95,125	6,606
Region V	162,127	185,481	196,322	207,284	218,799	33,318
Region VI	61,454	56,363	56,813	57,349	58,222	1,859
Region VII	130,418	141,864	151,192	160,356	169,993	28,129
Region VIII	38,365	38,896	48,518	58,135	62,058	23,162
TOTAL	642,200	672,591	750,023	806,541	841,820	169,229

	Total Pop 2000	% Increase 2000-2010	% Increase Projection 2010-2015	% Increase Projection 2015-2020	% Increase Projection 2020-2025	Change 2010-2025
Region I	27,781	11%	64%	32%	9%	137%
Region II	88,089	2%	28%	6%	0%	35%
Region III	43,168	-6%	2%	2%	2%	6%
Region IV	90,798	-3%	2%	3%	3%	7%
Region V	162,127	14%	6%	6%	6%	18%
Region VI	61,454	-8%	1%	1%	2%	3%
Region VII	130,418	9%	7%	6%	6%	20%
Region VIII	38,365	1%	25%	20%	7%	60%
TOTAL	642,200	5%	12%	8%	4%	25%

Table 3. The 2012 North Dakota Statewide Housing Assessment population estimates.

Projected Domestic, Commercial, and Light Industrial Water Use

Based on state and regional projections of increased population, an additional total of about 11,000 acre-feet per year may be needed statewide for domestic, commercial, and light industrial use by 2025 (Table 4). The largest regional increases (between 1,820 and 3,043 acre-feet per year per region) are predicted for Regions I, V, VII and VIII, with the least in Regions III and VI.

The 2012, the North Dakota State Department of Commerce projected that the state population could reach as high as 841,820 by 2025, an increase of 91,797 (16%) from the 2015 estimate. A projected 10-year regional distribution for increased population and increased water needs for domestic, commercial and light industrial use, based on an estimated per capita use of 120 gallons per day (gpd) is shown in Table 4.

Projected Irrigation Water Use

Based on projections by representatives of the North Dakota Irrigation Association, an increase of about 15,000 to 20,000 acre-feet per year in irrigation development might be expected over the next ten years. Most of the development would be in the Turtle Lake area, from the McClusky Canal, with some development in the Nesson Irrigation District.

A small amount of irrigation development using on-land pond storage is expected.

From 2010 to 2014, about 1,250 acres per year have been developed for irrigation. Prior to that period, and since the early 21st century, about 2,000 acres were being developed annually statewide. Using an approximation of about 1,500 acres of irrigation development per year, and an average overall water use of one foot, an estimated increase of about 15,000 acre-feet, per year might be projected over ten years. Irrigation does not seem to show a relationship between population growth and water use at this time.

Projected Industrial Water Use

Over the next ten years, total oil-field water use for fracking, brine dilution and well drilling is expected to increase from about 20,000 acre-feet per year in 2013 to about 30,000 to 37,000 acre-feet per year by 2024. Most of that increase will occur between 2014 and 2020, after which water use for oil development is expected to increase slowly (Table 5). Of this, water for drilling fluid and for maintenance water is expected to be less than 3,000 acre-feet per year. Most of the water (24,000 to 31,000 acre-feet per year) will be used for fracking. Incidental water use (dust control etc.) is expected to be small in comparison to the larger uses. These numbers are

Estimated Increase In Domestic, Commercial, & Light Industrial Water Use By Region

	Estimated Pop in 2015	Estimated Pop in 2025	Difference	% Increase	Gal/Day 2025 Est	Acre-Feet/Year 2025 Est
Region I	50,529	73,164	22,635	44.8%	2,716,200	3,043
Region II	114,709	121,443	6,734	5.9%	808,080	905
Region III	41,434	43,016	1,582	3.8%	189,840	213
Region IV	90,506	95,125	4,619	5.1%	554,280	621
Region V	196,322	218,799	22,477	11.4%	2,697,240	3,021
Region VI	56,813	58,222	1,409	2.5%	169,080	189
Region VII	151,192	169,993	18,801	12.4%	2,256,800	2,527
Region VIII	48,518	62,058	13,540	27.9%	1,624,800	1,820
STATEWIDE	750,023	841,820	91,797	12.2%	11,015,640	12,339

Table 4. Projected population change and estimated 10-year increase in per capita domestic, commercial and light industrial water use by state region.

approximations based on narrative information from drilling companies, and discussions with the North Dakota Oil and Gas Division.

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 the success of industrial development – in particular, 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 (Figure 13).

Surface Water Availability

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 more recently during the last two decades, North Dakota experienced a wet cycle that had rivers flow bank full, and lakes rising to record levels. As was experienced during the 1930s, droughts have caused rivers to go dry, and lake beds to become salt flats.

In North Dakota, the Missouri River system contains most of the state’s surface water. 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 availability of surface water is an issue that is currently confronting the state, and will likely drive water management in the future. This is particularly the case with the Missouri River system, where federal incursions on state water appropriation authority have restricted North Dakota water users from Missouri River water within reservoir boundaries.

Estimated Oil-Field Water Use (2014-2024)

Year	^a Estimated No. Wells Completed	^b Estimated Total Annual Frack-Water Use (acre-feet)	Estimated Total Annual Oil-Field Maintenance Water Use (acre-feet)	Estimated Total Annual Drilling Fluid Water Use (acre-feet)	Estimated Total Annual Oil-Field Water Use (acre-feet)
2014	2,280	-	-	-	-
2015	2,470	27,170	450	2,223	29,843
2016	2,660	29,260	703	2,394	32,357
2017	2,850	31,350	973	2,565	34,888
2018	2,850	31,350	1,243	2,565	35,158
2019	2,850	31,350	1,513	2,565	35,428
2020	2,850	31,350	1,783	2,565	35,698
2021	2,850	31,350	2,053	2,565	35,968
2022	2,850	31,350	2,324	2,565	36,239
2023	2,850	31,350	2,594	2,565	36,509
2024	2,850	31,350	2,864	2,565	36,779

Table 5. Estimated oil-field water use.

^a Estimates provided by the North Dakota Department of Oil and Gas (June 24, 2014).

^b Estimate of total oil field water use based on frack water trend analysis by M.H. Hove (June 24, 2014).

Estimates are based on mean water use rates of 11 acre-feet per frack job. About 3% of wells were estimated as “slick frack” efforts, requiring approximately 30 acre-feet per well.

Aquifer Potential For Development

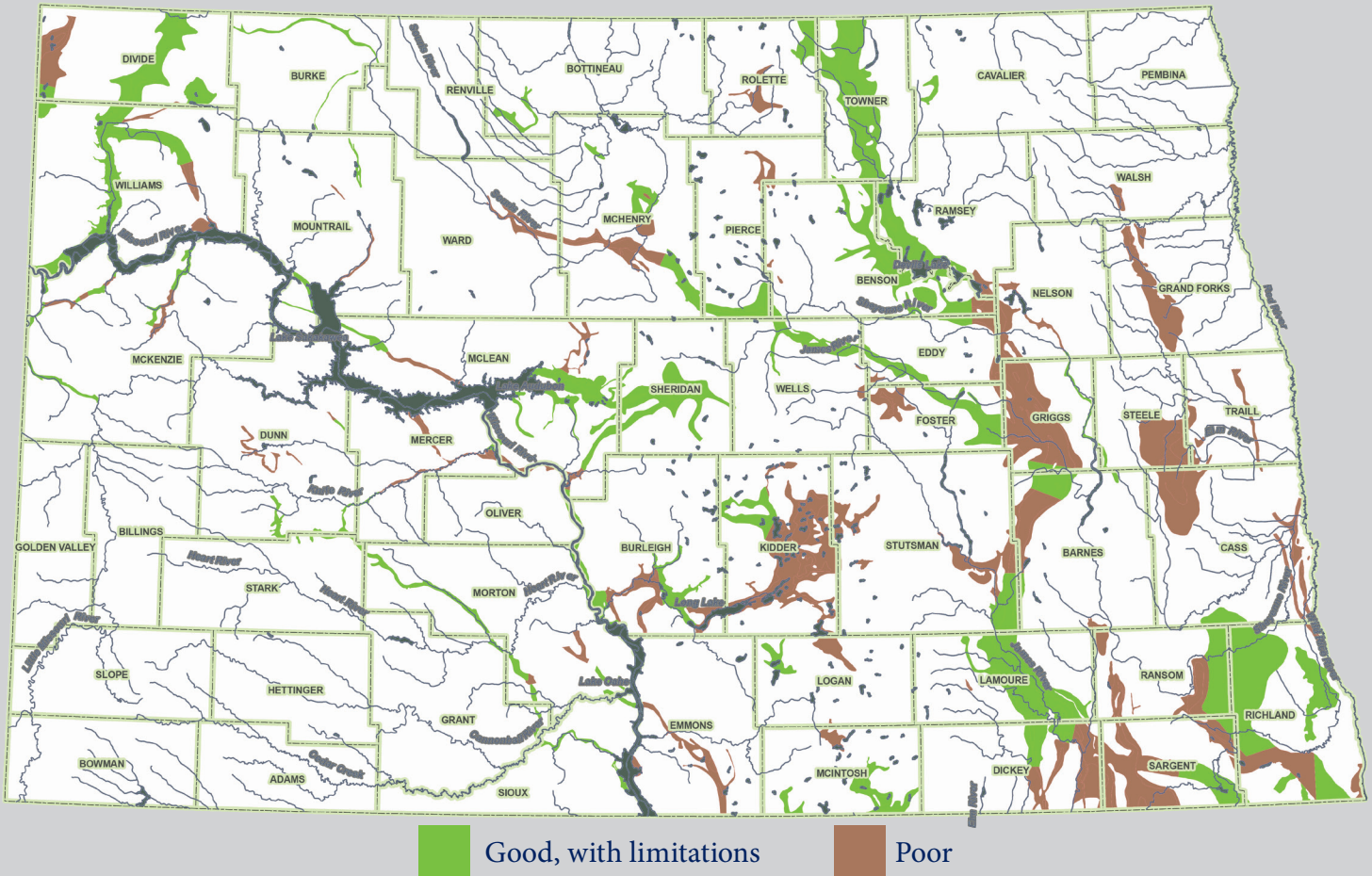


Figure 13. Aquifer potential for development.

Ground Water Availability

Ground water is water that occurs below the surface of the earth, where it occupies spaces in geologic strata. In North Dakota, ground water is found throughout the state, although often at great depth, or with a quality that makes it unsuitable as drinking water. The State Water Commission has spent many years collecting information on the quality and productivity of the state’s ground water, with detailed information available via the Commission’s website at www.swc.nd.gov.

Bedrock Aquifers

Bedrock aquifers occur throughout most of North Dakota. The bedrock aquifers most widely used by people are, the Lower Cretaceous Dakota Sandstone aquifer, the Upper Cretaceous Fox Hills Sandstone and Hell Creek aquifers, and the Tertiary Sand and 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 this aquifer. Due to 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. They occur beneath glacial overburden in the central part of the state 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 can be used as a source for domestic and livestock, 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, and 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 ground water 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).

The major glacial drift aquifers in North Dakota are outlined in the Ground Water Availability map on the previous page. In addition, the map shows areas in these aquifers where the potential for additional ground water development is good with limitations (areas shown in green) or poor (areas shown in brown). 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.

Little to moderate, or no existing ground water development generally characterizes the areas in the glacial drift aquifers where the potential for additional large-scale ground water development is good. 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, in several areas of the state where the water quality is too poor to irrigate soils, there is still the potential for those quantities of water to be available for other uses such as oil development. Therefore, 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 Water Commission 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.

Water Conservation and Recycling

Although North Dakota has been in an extended wet cycle for two decades, there have been exceedingly dry years, such as 2012, within that period. The reality is that drought has been, and will be a recurring issue in the state. And, with an increasing population and the concentration of people into urban areas, the demands upon available water resources will only grow.

Drought planning, 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 waste water, and increase costs.

In North Dakota, water reuse started with utilizing return flows from irrigation systems. Over the years, gray water produced through sewage lagoons became more widely used as an irrigation source. In the 1990s, the ethanol industry also began using gray water from municipal treatment plants and power generation. More recently, oil development water needs have begun to drive research into the feasibility of water reuse in western North Dakota. It is important to note that changes in beneficial use require a new water use permit from the Office of the State Engineer.

Ground water injection or infiltration are strategies that have been considered in the state in order to “bank” surface water when it is readily available as storage in shallow ground water. Studies conducted by the Commission in the 1980s have shown that the technology is feasible, although somewhat expensive. Currently, the Forest River Colony Artificial Recharge Project has shown positive results by infiltrating water from spring flow of the forest river into a local aquifer for use in irrigation later in the season.



Managing Resources

The availability and sustainability of North Dakota's waters is highly critical for the wellbeing of its citizens and the sustainability of its cities, farms and industries. In addressing the State Constitutional Convention in 1889, Major John Wesley Powell, second director of the U.S. Geological Survey made the following statement:

"...All other wealth falls into insignificance compared with that which is to come from these lands from the pouring on them of the running streams of this country. Don't let these streams get out of the possession of the people. If you fail in making a constitution in any other respect, fail not in this one. Take lessons from California and Colorado. Fix it in your constitution that no corporation – no body of men – no capital can get possessions and right to your waters. Hold the waters in the hands of the people."

Following this advice, the State Constitutional Convention wrote the General Provisions of the State Constitution to include: *"All flowing streams and natural watercourses shall forever remain the property of the state for mining, irrigation and manufacturing purposes."* Waters of the state, then, are reserved by the state and allocated to its citizens, cities, industries, and agricultural producers for beneficial use under the Prior Appropriation Doctrine.

Water supplies in North Dakota, while not critically lacking, have been heavily developed over the last half-century, and access to water has become increasingly competitive. The Missouri River is the only plentiful source of unappropriated water in the state. Most of the state's good quality ground water is found in aquifers of glaciofluvial origin, primarily in the eastern, central and northern portions of the state. Many of these aquifers are nearly fully appropriated within their known extents and are unavailable for additional large-scale future use. Other areas of the state are underlain by bedrock aquifers. Bedrock aquifers, however, frequently have limited yield, and often have challenging water

quality issues, with brackish, saline or hypersaline waters, high sodium, high iron or high alkalinity, as described in the previous chapter.

NORTH DAKOTA WATER APPROPRIATION LAW AND ADMINISTRATION

Water rights are not a trivial matter. Municipal needs and the investment costs of most industrial and agricultural enterprises are such that unexpected water shortages caused by spurious or hydrologically unsound appropriations can create severe hardship and in some cases, bankruptcies. For this reason, the administration and enforcement of water laws, rules and policies that assure the sustainability of the resource and protect established water rights of applicants, are of the utmost importance for the prosperity and welfare of the state's citizens. The State Engineer, assisted by the Water Appropriation Division of the North Dakota State Water Commission, is charged with managing the use of the state's waters as directed under Chapter 61-04 of North Dakota's Century Code, and Article 89-03 of the State Administrative Code.

APPROPRIATION RESPONSIBILITIES

The Water Appropriations Division guides applicants through the water permit application and public comment process. Each application is then assigned to a hydrologist/engineer responsible for the area or for the specific water resource requested.

Criteria evaluated by the Appropriations Division, specified under NDCC 61-04-06, are:

- a. The rights of a prior appropriator will not be unduly affected.
- b. The proposed means of diversion or construction are adequate.
- c. The proposed use of water is beneficial.
- d. The proposed appropriation is in the public interest. In determining the public interest the following shall be considered:

- i The benefit to the applicant.
- ii The effect of economic activity resulting from the proposed appropriation.
- iii The effect on fish and game resources and public recreational opportunities.
- iv The effect of loss of alternate uses of water that might be made within a reasonable time if not precluded or hindered by the proposed appropriation.
- v Harm to others resulting from the proposed appropriation.
- vi The intent and ability of the applicant to complete the appropriation.

Evaluations are comprehensive, and may require several months in areas where water supplies are limited and critical, or where substantive issues have been raised in public comments. Factors affecting the availability of water include: the amount of the request, the size of the water supply, whether the source is ground water or surface water, the period of use, the proximity of prior water appropriators, the locations of recharge and discharge areas, possible water quality impacts caused by diversion of water, and probable long-term effects of climatic variation on local water supplies. In highly competitive settings or where hydrologic data are sparse, further exploratory drilling and data acquisition may be needed. The development of appropriate ground water models is generally required in highly competitive settings. In some critical cases, evaluations may require several years. The Appropriations Division drafts a recommendation to the State Engineer for approval, denial, or in some cases to hold all or part of an application in abeyance until sufficient information is available to support a definite answer. The draft recommendation is submitted for review to “parties of record” who have expressed concern during the comment period. “Parties of record” may request information or an adjudicative hearing if they have further concerns over an application. (See Water Permitting Process in Appendix.)

Annual reports of water use are required for each water permit holder (Figure 14 & Table 6). The

Office of the State Engineer is currently developing a real-time telemetry system for monitoring high-priority and high-risk cases. Temporary water permits can be obtained for short-term temporary needs, such as road or building construction or other short-term or emergency needs. Immediate emergency needs, such as water for fire fighting, are accommodated with common sense, allowing for permission to be obtained verbally and filing the necessary paperwork post-facto. The State Engineer encourages water conservation, and accommodates innovative measures for optimizing beneficial use of existing resources, such as water treatment and reuse or aquifer recharge and recovery.

INFORMATION AND DATA RESOURCES: ACQUISITION AND USE

Because the need for water is critical for human habitation, and the possibility of running out of water is so costly for most enterprises, the State Engineer and the Water Appropriation Division staff place a high priority on due diligence and the information, tools and resources necessary to assure

Conditional & Perfected Water Permit Filings 2003-2013

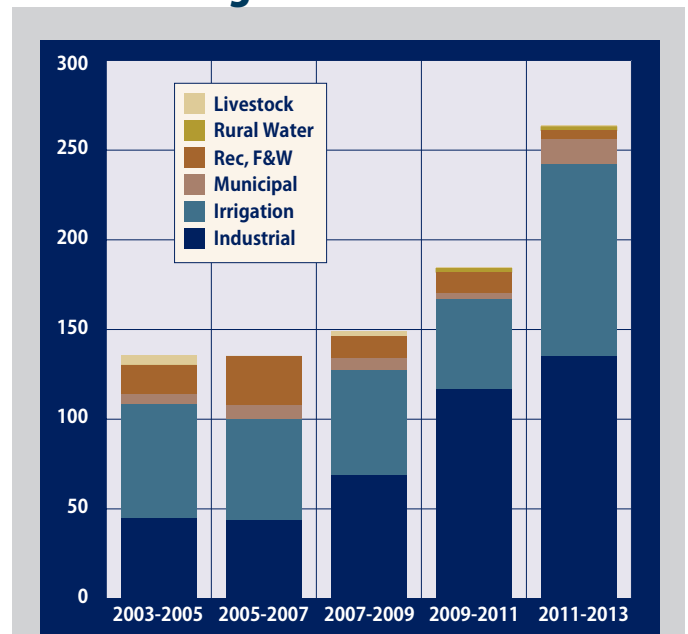


Figure 14. Water use in North Dakota from ground water and surface water sources between 2003 and 2013 held relatively constant, except for irrigation, (which is highly responsive to climate conditions), and fracking (which is influenced by world oil prices).

2013 Water Use Permits

	Conditionally Approved	Held In Abeyance	Perfected	Total
Commercial	4	0	9	13
Domestic	1	0	10	11
Fish & Wildlife	106	0	217	323
Flood Control	8	0	45	53
Industrial	161	46	240	447
Irrigation	429	58	1,812	2,299
Multiple-Uses	9	0	19	28
Municipal	26	3	253	282
Power Generation	0	0	10	10
Recreation	13	0	154	167
Rural Water	12	4	87	103
Stock	14	0	70	84
TOTAL	783	111	2,926	3,820

Table 6. 2013 water use permits.

NORTH DAKOTA WATER PERMIT DEFINITIONS

Temporary Water Permit: This type of permit allows an applicant to temporarily use a specified amount of water from a specific source for up to one year for beneficial uses. No water right accrues.

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 State Engineer 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.

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.

high-quality water resource evaluations. The Water Appropriation Division, during the 1950s through the 1980s, and in cooperation with the U.S. Geological Survey and the North Dakota State Geological Survey, completed a comprehensive County Ground Water Studies program.

GROUND WATER STUDIES

These county studies identified major aquifers, their location and extent, hydraulic properties, water chemistry, estimated well yields, sources of recharge, locations of discharge, and the occurrence and movement of ground water. The county studies have provided the basic framework for ongoing ground water resource evaluation. Numerous other reports and publications on ground water resources have been completed, including 118 “ND Ground Water Studies,” many of which are related to water supply needs of various communities and 55 Water Resource Investigations (WRI) pertaining to specific water resource issues and problems. For example, a comprehensive survey of water supplies for energy use was published as WRI report No. 49 in 2010. All reports are available in electronic format on the North Dakota State Water Commission website (www.swc.nd.gov) under the “Reports and Publications” section.

WATER EXPLORATION, MONITORING, AND GAGING

The division also maintains and operates a drill rig for ongoing ground water exploration and investigation. Division hydrologists use the drill rig to complete an additional 100 to 150 bore-holes and monitoring well installations every year. A total of 4,300 monitoring wells are measured monthly or quarterly for water levels, and approximately every five years for general chemistry and selected trace elements. The data (approx. 5 million water level readings and 71,000 water chemistry data measurements) are managed in a database that provides timely and cost effective data recovery and organization for staff hydrologists/engineers through development of database organizational tools. The data are also available for the general public through an easily accessible, interactive map web portal. The database also includes locations, lithologies, well construction, and other metadata

for each monitoring site; scanned copies of well drillers’ reports for private wells and test holes; water-permit descriptions and annual water-use data, and other supplementary metadata.

For surface water evaluation the agency supports, in cooperation with the U.S. Geological Survey, 80 gaging stations on state rivers and streams, and the agency obtains gage measurements on approximately 53 additional sites. Cooperative stream-flow and water quality measurements are available on the U.S. Geological Survey website <http://waterwatch.usgs.gov/?m=real&r=nd>.

Water resource issues are complex. There are inherent difficulties in evaluating the boundaries, properties, and highly complex depositional processes that created ground water reservoirs. Also, the variability and unpredictable effect of climate on surface water and ground water resources result in highly data intensive water resource evaluations that involve the use of ground water models, and mapping and statistical tools. The application framework and the associated data infrastructure is fully integrated into the daily workflow of the Water Appropriation Division. An array of analysis tools has been developed to address water resources management functions, which have been seamlessly integrated into the application/data management infrastructure. The scientific as well as system-design expertise of the agency information-resource personnel has enabled exceptional communication and interactive capabilities between hydrologic and data management staff, enhancing the timely problem-solving capabilities of the agency.

In a recent (2013) survey of data acquisition and dissemination capabilities for water management in seventeen western states by Sandia National Laboratory, the information acquisition and data delivery system maintained by the North Dakota State Water Commission’s Appropriation Division was rated as one of the most advanced in the nation.

WATER PERMIT MANAGEMENT AND CHALLENGES

A major challenge since about 2010 has been water supply for oil-well development. Scarcity of ground water and surface water in western North Dakota and Corps of Engineers encroachment on traditional state access rights to waters of the Missouri River along Lake Sakakawea and elsewhere has resulted in a situation where water has been hauled long distances, causing public risk and infrastructure damage. Pending adjustments to infrastructure, a substantial part of the water has been supplied by ephemeral surface waters created by large snowmelt and rainfall in the 2011 flood season, and thereafter. To facilitate transitional water supplies, the Office of the State Engineer has evaluated and processed a total number more than 2,600 temporary water permits from 2010 through the summer of 2014, compared with an annual average of about 200 temporary water permits before that time (Figure 15).

Temporary water permit applications, and other applications for oil-field water supply, as well as monitoring and regulatory requirements have required long hours of staff time. In addition, the value of water supply sales and an increase in illegal diversion for oil field supply sales has resulted in the need for more stringent monitoring and larger fines. Current policy is that illegal pumping for industrial use will be fined a dollar amount equal to the total revenue gained from illegal sales. Some fines have been quite substantial, ranging from a few hundred dollars, to recent fines of \$600,000 and \$800,000. In addition, if a user exceeds their allocated amount in a given year, the amount of overage is subtracted from their available amount the following year. Permit revocation is also a potential consequence.

WATER USE TELEMETRY

In 2011, the Water Commission initiated a study to determine the most effective and cost-efficient method of implementing telemetry to track water use by water depots in western North Dakota.

In general, the providers of the remote telemetry hardware being used to track water usage have

Temporary Water Permits: Applications Processed By Year

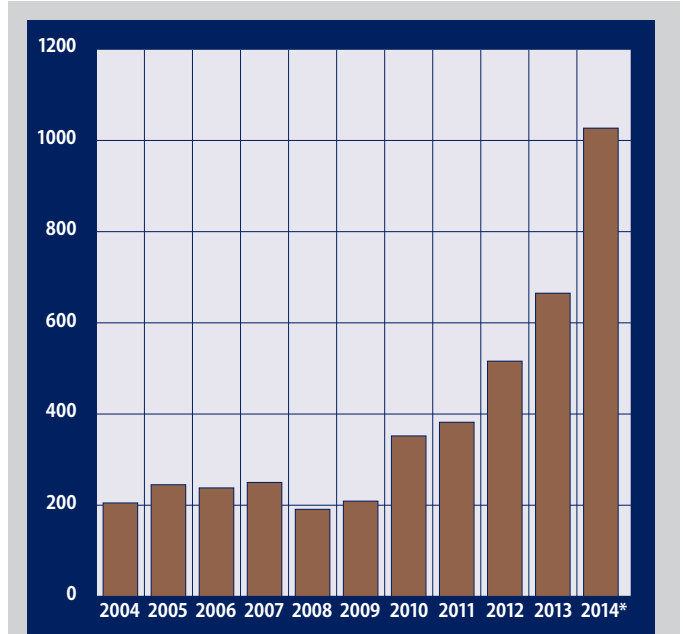


Figure 15. Temporary water permits have increased dramatically since 2004. *Projected.

developed proprietary methodologies for collecting and compiling information for their respective meter installations. This resulted in a lack of uniformity in the organization of the data from one vendor site to the next. Accessing, collecting, and analyzing the data would have required the Water Commission to maintain separate accounts to remotely login and collect the information for each site. This process would have been very time-consuming, and would have required significant resources to maintain and verify account information for each site with the remote telemetry installed.

To utilize the existing telemetry technology, the Water Commission would have been required to mandate the use of either a single vendor, or a limited selection of vendors to ensure consistency in the water use monitoring process. The telemetry study examined a range of alternatives, and ultimately developed recommendations that included the establishment of uniform data specifications through which users would “push” reported measurements through a computer program developed by the Water Commission.

Using this approach, the Water Commission provided the means to standardize the data and the reporting process, while avoiding interfering with the relationship between the water user and the remote telemetry provider.

The water use information was tracked using a program developed by Water Commission staff. The program provided specifications for exchanging formatted information between different computer and software systems via the Internet. The developed program provides a simple data format that allows water users to transmit data to a remote source.

The requirement to provide data in the same format through a standardized program has resulted in numerous benefits.

- 1) Ease and simplicity of data reporting
- 2) Simplicity and efficiency for data analysis
- 3) Portability for water users and regulatory entities

Prior to the implementation of the water use data computer program, water depot owners were required to file monthly meter reading reports. In addition, Water Commission staff needed to spend significant time inputting data from the various water users, which delayed reporting efforts, and hampered analysis. The Water Commission-designed program allows the data to be quickly and easily filed, reviewed, categorized, and scanned for trends.

Because the Office of the State Engineer is a regulatory entity, with the force of law behind its actions, it was able to require all water users to incorporate this methodology into their activities. Other water and natural resource managers outside of North Dakota have been closely watching North Dakota's telemetry data gathering efforts, and are now incorporating these services into their own project areas.

SPECIAL INVESTIGATIONS

In addition to water permit evaluation, water exploration, and water resource monitoring and data management, the Office of the State Engineer

conducts special investigations related to water resources. Examples include: policy analysis for state issues related to water appropriation; cooperative water supply studies for municipalities; state-authorized water projects; and cooperative water quality and water process investigations with the Health Department, the North Dakota National Guard, state universities, other state and federal agencies and programs, and other Water Commission divisions when requested and appropriate. Agency surface water engineers represent and advise the State Engineer on international issues related to water appropriation, including serving as co-secretary to the International Souris River Board and serving on the hydrology committee of the International Red River Board.

OTHER REGULATORY FUNCTIONS

As authorized by NDCC 61-03, 61-04, and 61-16.1, the State Engineer is responsible for regulating the construction of dams, dikes, and other water control facilities. Since 1957, NDCC 61-32 and NDCC 61-15 have authorized the State Engineer to regulate drainage. The State Engineer is also responsible for managing sovereign lands, dam safety, environmental reviews, and floodplain management.

In addition to these permitting and regulatory processes, the Office of the State Engineer and State Water Commission provide technical assistance to local water resource districts, conduct flow determinations in accordance with NDCC 24-03-08, make watercourse determinations in accordance with NDCC 61-01-06, provide appeal review of water resource district decisions, serve as sources of information to the public, handle easement releases for abandoned dams, and conduct reviews of Public Service Commission mining permits and U.S. Army Corps Section 404 permits.

DAM SAFETY PROGRAM

The purpose of North Dakota's dam safety program is to minimize the risk to life and property associated with the potential failure of dams in the state. A national dam inspection program took place in 1978-1981 under the direction of the U.S.

Army Corps of Engineers following a series of dam failures across the country in the 1970s. The North Dakota Dam Safety Program, administered by the Water Commission, was initiated to continue and build on the national program of inspecting dams and assessing their safety at the local level.

A primary function of North Dakota's dam safety program is to conduct dam inspections in order to identify dams in need of maintenance or repair. Staff members conduct full inspections of non-federally owned dams classified as high or medium hazard on a rotational basis. The hazard classification is determined based on the consequences if the dam were to fail, and is not a reflection of the condition of the dam. High hazard dams are currently scheduled for inspection at least once every four years, and medium hazard dams greater than ten feet high are currently scheduled for inspection at least once every ten years. This schedule is continually updated as necessary, such as when a new dam is constructed or the hazard classification of a dam is updated. Selected dams are also given a partial inspection annually to check for damage after the spring runoff season. Additional inspections are conducted on request from dam owners or the public, or when there are concerns at a dam, such as during flood events.

The completion of Emergency Action Plans (EAPs) for non-federal high and medium hazard dams is a priority of North Dakota's dam safety program. The purpose of EAPs is to develop a pre-planned strategy for individual dams that will help minimize the loss of life and property damage in the event of a dam failure. EAPs are the responsibility of dam owners. However, local entities that have limited staff and financial resources own many of North Dakota's dams, so the Water Commission has played an active role in assisting dam owners with developing EAPs for their dams.

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. This need has been

compounded by recent flood events. For example, in 2013 in northeast North Dakota, record snowfall coupled with later melt dates and significant rain events, resulted in flood damages to a number of dams in Pembina and Cavalier counties. Dams significantly affected by the 2013 flood include Olson, Bourbanis, and Renwick. In the past, the Water Commission has provided financial assistance for dam repairs throughout the state. With the aging of this infrastructure and the ongoing wet cycle, it is likely that the Water Commission will continue its support of improvements to these critical structures in the future.

ENVIRONMENTAL REVIEWS

Water Commission staff conduct and coordinate interagency environmental reviews involving projects associated with Community Development Block Grants and Loans, Hazard Mitigation Grant Program, Rural Development Loan Program, highway improvements, airport improvements, dike/levee projects, water storage impoundments, municipal and rural water supply development and treatment projects, municipal waste treatment projects, oil and gas well projects, oil and gas pipeline projects, electrical transmission line development/modification/maintenance projects, and various federal and state water, land, and wildlife management plans, studies, Environmental Assessments and Environmental Impact Statements.

Environmental review comments address compliance requirements involving State Engineer and Water Commission regulatory responsibilities in issuing permits pertaining to water appropriation, floodplain management, sovereign lands, and the construction of dikes, levees, dams, drains, and water holding ponds. Staff members also provide information concerning the location of water wells.

In 2013, Water Commission staff averaged 42 interagency environmental reviews per month.

FLOODPLAIN MANAGEMENT

North Dakota has a long history of flood-related challenges, and it has become even more common over the last decade. One way to reduce the potential

negative impacts of flooding 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 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 to build, develop, or redevelop relative to an identified flood hazard. All this is intended to help break the cycle of disaster-relief-repair-disaster that plagues many areas of the state.

National Flood Insurance Program

The NFIP works on a partnership formed of federal, state, and local governments. Local governments use state laws concerning planning, zoning and development as a basis to practice floodplain management. The North Dakota Floodplain Management Act of 1981 adopts the NFIP by reference in Chapter 61-16.2 of the North Dakota Century Code. This chapter was amended in 1999 and again in 2003 by the State Legislature, which broadened and refined the duties of the State Engineer.

FEMA provides partnership funding to states for their role in the Community Assistance Program (CAP), Map Modernization Management Support (MMMS) and its successor Risk MAP. Three staff

members work with these FEMA funded programs within the Regulatory Section.

The MMMS Coordinator manages Risk MAP, a program which was initiated in federal fiscal year (FFY) 2009 for the purpose of identifying, assessing, communicating, and mitigating flood hazard risks, with the goals of delivering quality data that will increase public awareness and lead to actions that will reduce the risk to life and property. Both the MMMS and Risk MAP programs are 100 percent FEMA funded.

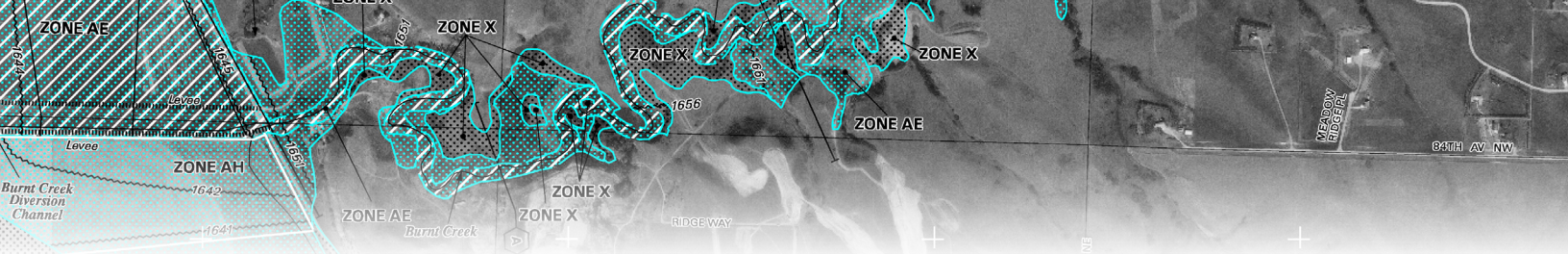
The MMMS Coordinator oversees the selection of engineering consultants chosen annually to do the work tasks of FIRM digitization and subsequent contract management. Funding of \$289,545 in FFY 2012 and \$342,960 in FFY 2013 were used for projects in Traill County and the Upper James River watershed.

Community Assistance Program

Two staff members work with the CAP, funded 75 percent by FEMA, concentrating on community floodplain management as practiced by the National Flood Insurance Program (NFIP). Through CAP, floodplain management staff assists 328 NFIP enrolled state communities with administration of their floodplain management responsibilities. Each community designates a representative as their floodplain administrator to oversee floodplain development within flood prone or identified floodplains. Staff work closely with these community administrators to provide technical assistance through a variety of means. NDCC Chapter 61-16.2 outlines state floodplain standards above the NFIP minimum standards that communities are expected to follow.

The financial stresses facing the NFIP led Congress to begin efforts to reform the program in 2012, which resulted in the passage of the Biggert-Waters Flood Insurance Reform Act (BWIRA) of 2012.

Only 20% of the NFIP policies were subsidized, but those 20% were generally in the areas with the greatest number of claims. The BWIRA was an attempt to address the fact that the subsidies



provided to property owners through the NFIP were unsustainable due to the rising costs of the program. Primarily, this was done by removing exceptions to the program and by eliminating the government subsidies the NFIP provided, causing policy holders to pay premiums for policies that more accurately reflected their higher flood risk. Additionally, communities in the NFIP that were constructed prior to the adoption of its first Flood Insurance Rate Map (FIRM), or were given exceptions for structure features, such as basements, would now have those additional risk factors reflected in their premium rates. For example, Fargo is a pre-FIRM city. What this means for the people living in areas affected by the changes to the NFIP, is that they would see rates increase by 25% or more, and may not receive exceptions for basements built before their FIRM was created.

Although the financial difficulties faced by the NFIP require action, there has been significant opposition by many, including North Dakota’s Congressional delegation to enacting BWIRA in its entirety. It is unknown at this time if those efforts will be successful.

Impacts to North Dakota if the BWIRA law goes into effect:

- There are currently 13,762 flood insurance policies in effect in the state.
- 21% of the 13,762 policies in effect are written in identified floodplains, and 79% are written for non-floodplain areas.
- Approximately 14% (1,900) of existing policyholders are now affected by the five-year timetable of flood insurance premium increases under the BWIRA.
- New policies written in the future for pre-FIRM structures will immediately be impacted.
- Historically, many North Dakotans have timed the purchase of flood insurance ahead of an impending spring snowmelt flood, with policies often dropped when the threat has passed.

- New policies will immediately be subject to full actuarial rates, meaning much higher premiums.
- The cost of all flood insurance will be increasing.

Risk MAP

In an effort to leverage the successes of the FEMA Map Modernization program, a program last funded in 2008 to modernize and digitize the nation’s FIRMs, FEMA developed the Risk Mapping, Assessment, and Planning (MAP) program.

The goal of the Risk MAP program is to deliver quality data that increases public awareness, which in turn leads to actions that reduce the risk to life and property from flooding. This new program further enhances the usability and value of flood hazard mapping by utilizing state and local partnerships to further identify flood hazards. The State Water Commission has continued its work with FEMA as a partner in this effort to more adequately portray the flood risks facing state residents.

Following FEMA’s nationwide prioritization criteria and with the assistance of local study contractors, the most populous and flood-prone communities of our state will be getting their FIRMs digitized. The counties that either already have, or will be receiving digitized flood maps through one of the two FEMA programs are: Grand Forks, Traill, Richland, Walsh, Pembina, Barnes, Ransom, Stutsman, Nelson, Ramsey, Benson, Bottineau, Rolette, McHenry, Ward, Stark, Bowman, Hettinger, Burleigh, Cass, Morton, McKenzie, Slope, Wells, Eddy, Foster, and Mercer.

The Water Commission continues to assume an active management role in the flood hazard identification and mapping process under each of these FEMA programs in an effort to assist

communities in obtaining more accurate FIRMs. To date, North Dakota has received roughly \$8.5 million in federal funds for either Map Mod or Risk MAP projects in 27 counties (Figure 16). In North Dakota, the NFIP has participation from 328 communities of which 228 communities have FIRMs.

SOVEREIGN LANDS MANAGEMENT

North Dakota’s sovereign lands are those areas, including beds and islands, lying within the ordinary high watermarks of navigable lakes and streams. The state of North Dakota plays an important role in the management of sovereign land through the State Engineer, who is responsible for administering the state’s non-mineral interests in North Dakota’s sovereign lands.

The goal of the State Engineer in managing this vital resource is to manage, operate, and supervise North

Dakota’s sovereign land, for multiple uses, that are consistent with the Public Trust Doctrine, and are in the best interest of present and future generations. Meeting these goals can be challenging given the increasing popularity of water-based recreation, and the draw of waterfront property for housing developments. The uses and issues surrounding North Dakota’s sovereign lands continue to increase, and this in turn has prompted the Office of the State Engineer to take a more active role in managing this popular resource.

In 2007, the Office of the State Engineer completed a North Dakota Sovereign Land Management Plan. This plan outlined the State Engineer’s authority to manage sovereign lands and it included recommendations and corresponding action strategies that are intended to improve management of this valuable resource. This management plan is still in use today to aid in the management of this resource.

Digitized Flood Maps

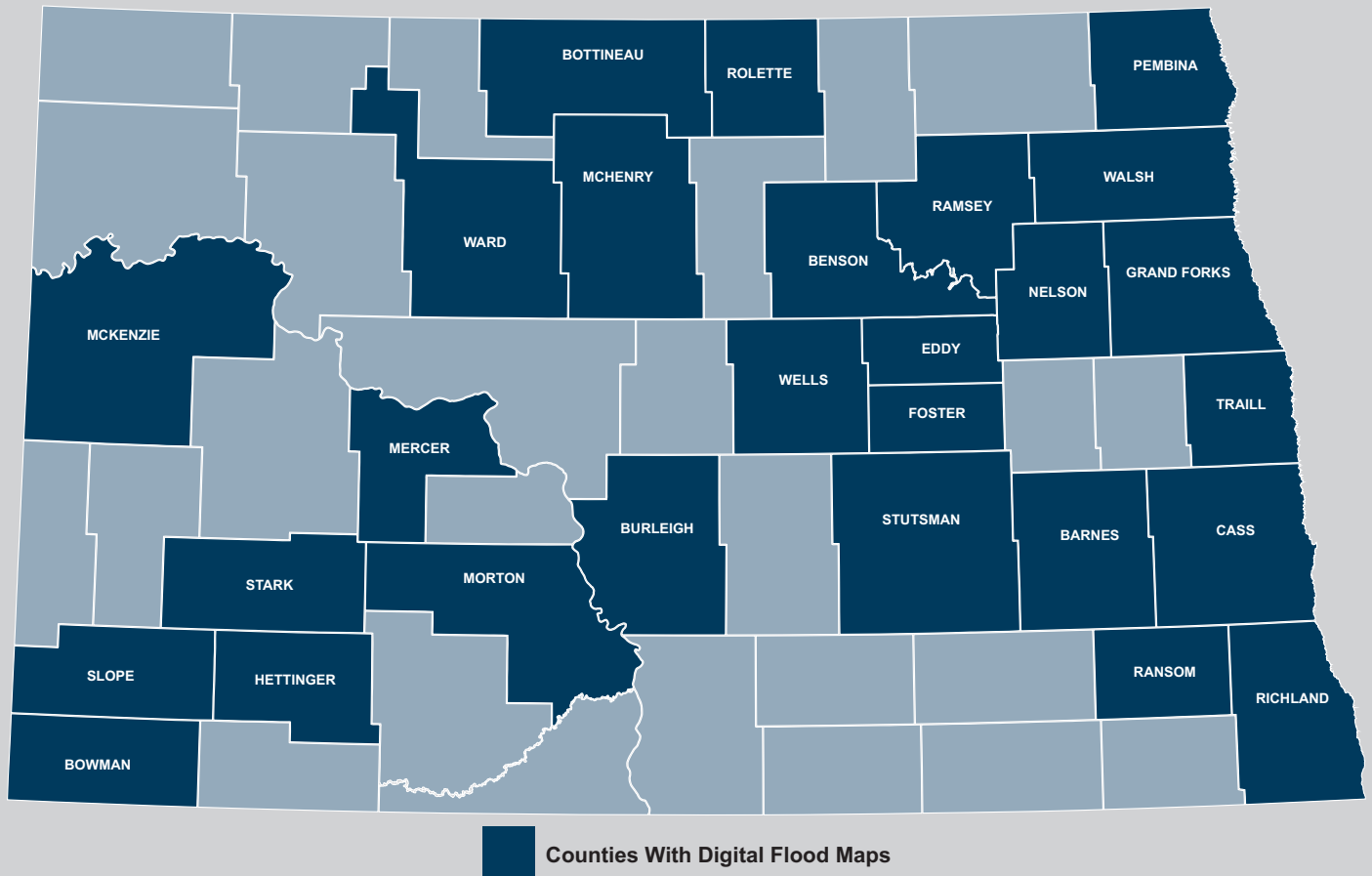


Figure 16. Counties with digital flood maps.

The Office of the State Engineer continues to make ordinary high watermark delineations throughout the state, mostly along the Missouri River. Recently, delineations were completed for areas of the Missouri River north of Bismarck. Delineations have also been completed near the confluence of the Missouri and Yellowstone Rivers.

During the summer of 2013 and the spring of 2014, the Office of the State Engineer launched an ongoing campaign of educating recreational users about the rules and regulations of sovereign lands. The campaign mainly focused on littering and the illegal use of glass bottles on sovereign lands. Educational signs have been installed in popular public use areas, and floating key chains with “Keep our Beaches Clean,” messages were distributed to the public at popular areas such as convenience stores, water sports retailers, and boat ramps. Water Commission staff have also taken part in public events and media interviews to explain the rules and regulations associated with the recreational use of sovereign lands. This campaign is expected to continue well into the future to encourage the public to keep sovereign lands clean and safe.

On land below the ordinary high watermark of navigable water bodies, motorized vehicle use is prohibited, except for a few exceptions that do provide for those types of opportunities. These exceptions can be found in N.D.A.C. 89-10-01-13. Signs have been installed in areas where off road vehicles are known to historically be accessing sovereign lands. By installing these signs, enforcement activities can take place with cooperation of the North Dakota Game and Fish Department, as well as other local law enforcement agencies.

Because the Office of the State Engineer does not currently employ law enforcement staff, a contract agreement has been developed with the Game and Fish Department to have their existing game wardens assist with sovereign land-related law enforcement, since they are already in the field. Coordination efforts for law enforcement have also been discussed with local law enforcement agencies in regard to off-road vehicle traffic.



Developing North Dakota's Water Resources - Biennium In Review

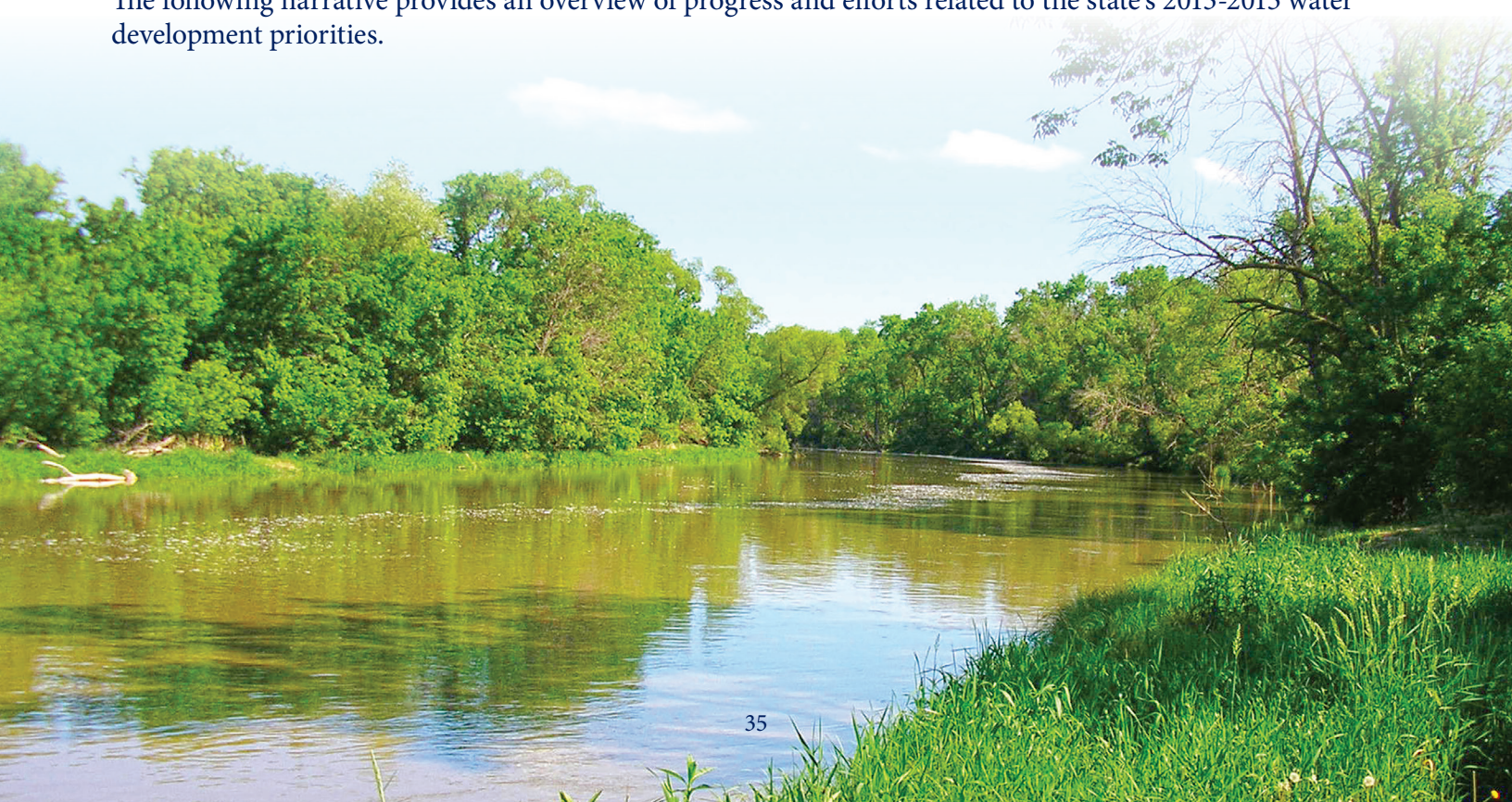
With the growth of North Dakota's oil industry over the course of the last four biennia, unprecedented revenues into the Resources Trust Fund have enabled the Commission and the water community to advance several water development priorities across the state. In preparing for the 2013-2015 biennium, a plan was forged through the cooperative efforts of the Water Commission, Governor's Office, Legislature, and the water community. The priorities of that plan for water development in North Dakota included loan opportunities, water supply, flood control, irrigation, general water management, and weather modification projects.

2013-2015 PRIORITY PROJECTS

- Community Water Facility Revolving Loan Fund
- Devils Lake Flood Control
- Fargo Flood Control
- Fargo Water Supply
- General Water Management
- Irrigation
- Mouse River Flood Control
- Northwest Area Water Supply
- Red River Valley Water Supply
- Sheyenne River Flood Control
- Southwest Pipeline Project
- Water Supply Program
- Weather Modification
- Western Area Water Supply

The initial funding plan for the above priorities totaled \$515 million from state sources – mostly the Resources Trust Fund. But in response to critical water supply infrastructure needs in oil producing counties in western North Dakota, state contributions to the above priorities were increased to \$546 million as of September 2014.

The following narrative provides an overview of progress and efforts related to the state's 2013-2015 water development priorities.



Community Water Facility Revolving Loan Fund

- Provided \$15 million to the Community Water Facility Revolving Loan Fund (CWFRLF).
- Monies transferred to this fund are used primarily for supplemental financing in conjunction with the U.S. Department of Agriculture’s Rural Development program for community water projects.
- The CWFRLF is administered by the Bank of North Dakota.

Devils Lake Flood Control

- Continued to implement the state’s multi-pronged approach to solving the Devils Lake region’s flooding problems, including: infrastructure protection, upper-basin water management, and operation of the state’s emergency outlets.
- Continued operation of both Devils Lake outlets. The maximum total discharge of the West and East Devils Lake outlets is now 600 cfs (See Map Appendix).
- Since the outlets began operating almost ten years ago, about 600,000 acre-feet of floodwater has been pumped from the lake. Of that total,

about 300,000 acre-feet of floodwater was pumped in 2012 and 2013 alone, with another 165,837 acre-feet removed in 2014.

- Continued to manage operational efforts associated with the Tolna Coulee Control Structure – which was completed in 2012 to reduce the risk of a catastrophic natural overflow of Devils Lake. The control structure was developed in cooperation with the U.S. Army Corps of Engineers. That project is now owned and operated by the Water Commission.
- Various efforts to store water and reduce runoff in the upper basin continue - mostly through a variety of conservation programs.

Fargo Flood Control

- A Record of Decision (ROD) was signed by the Assistant Secretary of the Army in April 2012. In 2014, President Obama signed the Water Resource Reform and Development Act (WRRDA), which authorized the Fargo-Moorhead (F-M) diversion project (See Map Appendix). The signing of WRRDA allows the federal government to appropriate funding for construction.



- During the 2013-2015 biennium, the Commission approved \$100 million for the diversion project, making the total state commitment \$175 million to date.
- Construction has been started on the Oxbow-Hickson-Bakke levee project upstream of the Fargo-Moorhead area.
- In downtown Fargo, and near El Zagal Golf Course, floodwall construction efforts and utility relocations are underway. And in south Fargo, work is moving forward to reduce flood impacts related to existing legal drains.
- Property acquisitions, and project planning and design are ongoing.

Fargo Water Supply

- Approved \$15 million in both the 2011-2013 and 2013-2015 biennia, for a total of \$30 million for water treatment improvements in Fargo that are needed to address increased sulfate concentrations in the Sheyenne River from Devils Lake outlet operations.
- This contribution from the state accounts for 50 percent of Fargo’s water treatment plant improvement costs related to mitigating Devils Lake outlet flows. All other water treatment plant improvement costs not related to Devils Lake outlet mitigation are being covered by the city of Fargo.

General Water Management

- By three-quarters of the way into the 2013-2015 biennium, the Water Commission had approved over \$30 million in funding for general water management projects across the state.
- General water management projects include rural flood control, snagging and clearing, channel improvements, recreational projects, dam repairs, planning efforts, special studies, and mitigation for operation of the Devils Lake outlets.

Irrigation

- Approved \$350,000 for an irrigation transmission line reroute at the Bufford Trenton Irrigation District, and about \$256,000 for irrigation development along the McClusky Canal at mile markers 10 and 49. The McClusky Canal project is expected to serve about 425 acres of farmland.

Mouse River Enhanced Flood Protection

- The Mouse River Enhanced Flood Protection Project (MREFPP) is designed to provide flood relief to North Dakota’s Mouse River valley residents – both urban and rural. The project was originally initiated by the Water Commission in response to a request for assistance from the Souris River Joint Water Resources Board following the record-breaking flood of 2011.





- Stakeholder workshops were held in late 2011 and early 2012; preliminary engineering reports and basin-wide erosion, sedimentation, and hydrologic modeling were completed a year later; and in the summer of 2013, the Rural Reaches Alternatives Report and final Mouse River Reconnaissance Study were issued. Implementation is now underway.
- The Souris River Joint Board has developed a long-range capital improvements plan (through 2039) that focuses on urban and rural improvements throughout the Mouse River valley. The total estimated cost of the MREFPP is \$1.03 billion.
- Local sponsors are still working with both federal and state agencies to advance the MREFPP.

Northwest Area Water Supply

- Since 2008, the Northwest Area Water Supply (NAWS) project has been providing water service to several systems through the city of Minot and their ground water wells.
- NAWS is currently providing water service to the communities of Berthold, Burlington, Kenmare, Sherwood, and Mohall; and to rural water systems including West River, All Seasons, Upper Souris, and North Prairie to alleviate some of the area's most severe water supply problems (See Map Appendix).

- The Water Commission continued to work with the Bureau of Reclamation on their Supplemental Environmental Impact Statement (SEIS) ordered by a federal court prerequisite to the lifting of an injunction. The public comment period on the SEIS ended in September 2014.
- In March 2013, a modification to an existing court injunction ceased further construction on the project.
- The final SEIS is expected in spring 2015.

Red River Valley Water Supply Project

- An EIS for the Red River Valley Water Supply Project (RRVWSP) was released back in 2007, but a Record of Decision (ROD) was never signed by the federal government.
- In 2013, it became apparent that a ROD would not be signed, so the State of North Dakota, in cooperation with the Lake Agassiz Water Authority and Garrison Diversion, began pursuit of a state and local project.
- In early 2014, the Water Commission issued a Request for Proposals for a Value Engineering (VE) study that focused on potential alternatives for a proposed state and local project.
- From the VE, three alignments were identified as being the most likely to meet criteria for future consideration. Those options were the

Washburn to Baldhill Creek, Bismarck to Lake Ashtabula, and Bismarck to Fargo and Grand Forks routes (See Map Appendix).

- Following completion of the VE, the state moved forward with an intake analysis effort to identify the potential availability of water from the Missouri River.

Sheyenne River Flood Control

- Following severe flood events in 2009 and 2011, Sheyenne River flood control efforts are being pursued by Valley City, Lisbon, and Fort Ransom.
- Valley City has initiated the process of moving forward with a multi-phased approach to developing permanent flood protection. Phase I is focused on the Valley City State University area, and the community expects to award bids in late 2014, with the majority of construction completed in 2015.
- Like Valley City, Lisbon is moving forward with a multi-phased approach to permanent flood protection. Phase I involves five separate levee locations, with one currently under construction. Other Phase I levee sections are in planning and design, with construction expected in 2015.

- Fort Ransom is in the early stages of developing permanent flood control. During 2009, 2010, and 2011, the city's existing (100-year) flood protection was not adequate. The city is now seeking protection from a 500-year event, though project specifics are still being developed.

Southwest Pipeline Project

- Southwest Pipeline is currently serving about 58,000 residents, including more than 5,350 rural service locations, 31 communities, and 23 raw water customers (See Map Appendix).
- Four contracts are under construction at the Oliver-Mercer-North Dunn Water Treatment plant. Those contracts include the installation of pumps inside the plant, membrane and ozone equipment procurement, and a 1.5 million gallon per day (MGD) upgrade.
- A supplemental raw water intake is under construction at Renner Bay, Lake Sakakawea. The secondary intake will increase capacity for the entire project.
- Main transmission lines are under construction to increase distribution capabilities and feed the North Dunn, Killdeer, and Fairfield service areas.



- Reservoir contracts are under construction at Zap (1.65 million gallons), Dunn Center (1 million gallons), Killdeer Mountain (250,000 gallons), and New Hradec (296,000 gallons).
- Rural service projects are underway to residents in the East and West Center Service Areas – including over 500 miles of pipeline and almost 700 rural service locations. And, Dunn and Halliday Service Area rural distribution system is under design.
- The supplemental water treatment plant in Dickinson is under design. This project will provide additional capacity of 6 MGD and a sludge handling facility.
- A finished water pump station is under construction through a joint effort between the Southwest Pipeline and Dickinson. This project will provide pumping capacity for the project and city of Dickinson.
- As of October 2014, the Commission had approved state funding assistance for several rural and regional water supply systems during the 2013-2015 biennium, including: Missouri West, Grand Forks-Traill, Northeast Regional, Walsh Rural, Cass Rural, Central Plains, Tri-County, Barnes Rural, Greater Ramsey, All Seasons, Southwest Pipeline, Northwest Area Water Supply, Western Area Water Supply, and Red River Valley Water Supply. Communities receiving Commission approval for funding assistance were Park River, Surrey, Mandan, Washburn, Grafton, Grand Forks, Dickinson, Watford City, Williston, and Fargo (See Map Appendix).
- Federal MR&I funding assistance was approved during the 2013-2015 biennium for projects in Stutsman Rural, McLean-Sheridan, North Central, and South Central.

Water Supply Programs

- Federal funding for water supply projects through the Municipal, Rural, and Industrial (MR&I) Water Supply Program has decreased dramatically in recent years. For that reason, the state has increased investments in community, rural, and regional water supply system advancements across the state.

Weather Modification

- The Atmospheric Resource Board (ARB) successfully operated weather modification programs in six counties in western North Dakota.
- The ARB Cooperative Observer Network had 546 active precipitation observers in 2014 – its thirty-eighth year of operation. All observers report growing season rainfall and



hail data, with 239 also reporting winter snow measurements. The snow data has helped fill gaps in existing snow data networks, assisting forecasters in predicting spring runoff and flooding risks.

Western Area Water Supply

- Western Area Water Supply (WAWS) project has involved a collaborative effort between the city of Williston, Williams Rural Water District, McKenzie Water Resource District, Burke-Divide-Williams Rural Water, and R&T Water Supply Association (including the cities of Ray, Tioga, and Stanley). As originally envisioned, WAWS has been making progress toward the development of this regional system to deliver Missouri River water from the Williston Regional Water Treatment Plant to areas throughout the northwest, oil producing areas of the state (See Map Appendix).
- The following water supply systems are currently being serviced by WAWS: Williston, Watford City, Ray, Tioga, Stanley, Wildrose, Crosby, Noonan, Columbus, and Fortuna, as well as McKenzie Rural Water, Burke-Divide-Williams Rural Water, and Williams Rural Water districts.

- In 2014, an expansion of the Williston Regional Water Treatment Plant was completed, bringing the plant from 10 MGD to 14 MGD. The next expansion is underway, upgrading the plant capacity to 21 MGD. That project is scheduled for completion in the spring of 2015.
- Additional contracts for primary transmission lines, pump stations, and reservoirs are also underway throughout the system. In addition, WAWS is rapidly expanding rural service connections. By the end of 2014, WAWS (through Williams and McKenzie Rural Water Systems) will be servicing about 3,300 rural locations, with plans for many more in the future.
- WAWS currently has the following water depots operating and generating revenue: McKenzie County's System II Keene, McKenzie County's Indian Hills, the city of Williston's 2nd Street and North Williston, 13 Mile Corner, Alexander, Watford City, R&T, and Stanley.
- Direct water pipeline connections have also been made available by WAWS to oil companies interested in supply lines to drilling locations.



COMPLETED PROJECTS, 2013-2015 BIENNIUM

The Completed Projects table lists the projects, programs, and studies that were completed through September 2014 of the 2013-2015 biennium (Table 7).

Table 7. Completed Projects, 2013-2015 Biennium

PROJECT SPONSOR	PROJECT NAME	PROJECT SPONSOR	PROJECT NAME
Argusville	Levee Recertification	Richland-Cass Joint WRD	Wild Rice River Watershed Retention Plan
Beulah	Beulah Dam Emergency Action Plan	Rush River WRD	Rush River Watershed Retention Plan
Bismarck State College	2014 ND Water Quality Monitoring Conference	Sargent County WRD	Drain #4 Reconstruction Project
Burleigh County WRD	Fox Island 2012 Flood Hazard Mitigation Evaluation Study	Sargent County WRD	Frenier Dam Improvement Project
Burleigh County WRD	Burleigh County Flood Control Alternatives Assessment	Southeast Cass WRD	Wild Rice, Bois de Sioux, & Antelope Creek Retention Study
Burlington	Interim Levee Project	Southeast Cass WRD	Recertification Of Horace To West Fargo Diversion Levee System
Garrison Diversion	Will & Carlson Consultant	Southeast Cass WRD	Recertification Of The West Fargo Diversion Levee System Geotechnical Analysis
James River Joint WRD	James River Engineering Feasibility Study Phase 1	Southeast Cass WRD	Recertification Of West Fargo Diversion Levee System
Maple River WRD	Maple River Watershed Floodwater Retention Study	Southeast Cass WRD	Wild Rice River Dam Study Phase II
McKenzie County Weed Control Board	Control of Noxious Weeds On Sovereign Lands	Southeast Cass WRD	Sheyenne River Diversion Low-Flow Channel - Areas 3 & 4
Minot	Minot 100-yr Floodplain Map & Profiles	Southeast Cass WRD	Sheyenne Diversion Phase VI - Weir Improvements
Minot Park District	Souris Valley Golf Course Bank Stabilization	Southeast Cass WRD	Horace Diversion Channel Site A (Section 7 - Phase V) Improvement
Natural Resource Conservation Service & U.S. Army Corps	LiDAR Data Collection	Southeast Cass WRD	Lower Sheyenne River Watershed Retention Plan
ND Game & Fish Department	Johnson Farms Water Storage	Southeast Cass WRD	Sheyenne River Snagging & Clearing Project - Reaches 1 & 3
ND Water Education Foundation	2014 Summer Water Tours	Traill County WRD	Elm River Diversion Project
ND Water Resources Institute	Institute Fellowship Program	Traill County WRD	Drain #27 (Moen) Lateral Channel Improvement Project
NDSU	ND Agricultural Weather Network	Traill County WRD	Goose River Snagging & Clearing Project
North Cass - Rush River Joint WRD	Drain #13 Channel Improvements	Traill County WRD	Buffalo Coulee Snagging & Clearing Project
Oxbow	Emergency Flood Fighting Barrier System	Traill County WRD	Drain #62 - Wold Drain Project
Pembina	U.S. Army Corps Of Engineers Section 408 Flood Control Review	Traill County WRD	Elm River Watershed Retention Plan
Pembina County WRD	Pembina County Snagging & Clearing Project	U.S. Geological Survey	Operation & Maintenance Of Rapid Deployment Gaging Stations
Pembina County WRD	Drain #8 Reconstruction Project	U.S. Geological Survey	Missouri River Gaging Station
Richland County WRD	Wild Rice River Snagging & Clearing - Reach 2	Ward County WRD	Souris River - Minot To Burlington Snagging & Clearing
Richland County WRD	Wild Rice River Snagging & Clearing - Reach 3	Ward County WRD	Countryside Villas & Whispering Meadows Drainage Improvement Project
Richland County WRD	Wild Rice River Snagging & Clearing - Reach 4		

CURRENTLY ACTIVE PROJECTS, 2013-2015 BIENNIUM

The projects and project categories listed in the Currently Active Projects (Table 8) represent water development efforts that are being pursued in the 2013-2015 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 2013-2015 Water Commission project budget as of September 2014, and the project funding the Commission had approved as of that time. As the table suggests, the Commission had approved 88 percent of the project budget by September 30, 2014.

Some of the projects listed in the Water Commission budget receive a combination of grants and loans.

Table 8. Currently Active Projects, 2013-2015 Biennium

PROJECTS	SWC BUDGET	APPROVED
CITY FLOOD CONTROL		
FARGO	\$136,740,340	\$136,740,340
GRAFTON	\$7,175,000	\$7,175,000
MOUSE RIVER	\$36,618,860	\$5,616,186
BURLEIGH COUNTY	\$1,282,400	\$1,282,400
VALLEY CITY	\$12,890,919	\$12,890,919
LISBON	\$3,325,650	\$3,325,650
FORT RANSOM	\$225,000	\$225,000
RICE LAKE RECREATION DISTRICT	\$2,842,200	\$2,842,200
RENWICK DAM	\$1,281,376	\$1,281,376
SHEYENNE RIVER	\$6,976,411	\$0
FLOODWAY PROPERTY ACQUISITIONS		
MINOT	\$33,684,329	\$33,684,329
WARD COUNTY	\$9,698,169	\$9,698,169
VALLEY CITY	\$1,822,598	\$1,822,598
BURLEIGH COUNTY	\$442,304	\$442,304
SAWYER	\$184,260	\$184,260
LISBON	\$888,750	\$888,750
WATER SUPPLY		
REGIONAL & LOCAL WATER SYSTEMS	\$103,578,652	\$103,578,652
FARGO WATER TREATMENT PLANT	\$27,864,069	\$27,864,069
SOUTHWEST PIPELINE PROJECT	\$101,694,178	\$101,694,177
NORTHWEST AREA WATER SUPPLY	\$21,241,433	\$7,241,433
COMMUNITY WATER LOAN FUND - BND	\$15,000,000	\$15,000,000
WESTERN AREA WATER SUPPLY	\$79,000,000	\$79,000,000
RED RIVER VALLEY WATER SUPPLY	\$11,000,000	\$3,295,000
IRRIGATION DEVELOPMENT		
IRRIGATION DEVELOPMENT	\$5,493,548	\$949,869
GENERAL WATER MANAGEMENT		
GENERAL WATER MANAGEMENT	\$50,193,326	\$32,096,659
DEVILS LAKE		
BASIN DEVELOPMENT	\$68,085	\$68,085
OUTLET	\$872,403	\$872,403
OUTLET OPERATIONS	\$15,140,805	\$15,140,805
TOLNA COULEE DIVIDE	\$102,975	\$102,975
EAST END OUTLET	\$2,774,011	\$2,774,011
GRAVITY OUTFLOW CHANNEL	\$13,686,839	\$13,686,839
STANDPIPE REPAIR	\$1,300,000	\$1,300,000
WEATHER MODIFICATION		
WEATHER MODIFICATION	\$805,202	\$805,202
TOTALS	\$705,894,092	\$623,569,660

State Water Development Program: Working With Project Sponsors

This section briefly describes the inventory process used by the Water Commission to identify future water project and program funding needs. A summary of those funding needs, as provided by project sponsors, is also presented.

COST-SHARE POLICY & PROJECT PRIORITIZATION

The Water Commission's cost-share policy has evolved over the years to respond to the challenges presented by drought, floods, and lack of dependable water supplies. With the significant increase in state funding available for water development, Commission staff began drafting policy revisions during the summer of 2013, following direction from Commissioners and the 63rd Legislature.

The new policy was drafted to ensure more consistency and direction where needed, while still maintaining awareness of the unique aspects of water management and development across the state.

In addition, a draft Water Project Prioritization Guidance Concept was drafted to develop a more formal means of developing a schedule of priority projects as part of the agency's budgeting process. The idea of the concept is to separate project types within priority categories including: essential, high, moderate, and low priorities.

In order to gain input on both documents, the Water Commission hosted basin meetings across the state and reviewed comments from a broad spectrum of water interests.

Both the cost-share policy, and project prioritization process were approved in September 2014, and became effective October 1, 2014 (See Appendix). Project financial needs as described in sections hereafter were estimated in consideration of the new cost-share policy and prioritization concept.

HOUSE BILL 1206

To promote and encourage improved local project sponsor participation in the planning process, the 2013 Legislative Assembly passed House Bill 1206 (NDCC 61-02-01.3), requiring the Water Commission to schedule commissioner-hosted meetings within six major drainage basins. The meetings were to be held in the Red, James, Mouse, lower and upper Missouri River, and Devils Lake basins.

As a result, the 2015 water planning process began when water management and development stakeholders and project sponsors were invited and encouraged to attend a series of Water Commissioner-hosted meetings in November and December of 2013. A second round of meetings were later conducted toward the final stages of the planning process in September 2014 (See 2015 Water Planning Process, Page 3).

THE INVENTORY PROCESS

As part of the Water Commission's water planning efforts, the agency biennially solicits project and program information from potential project sponsors. The results provide the Commission with an updated inventory of water projects and programs that could come forward for state cost-share in the upcoming 2015-2017 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 Commission sent project information forms to water boards,



joint water boards, the North Dakota Irrigation Association, communities, rural and regional water supply systems, and government agencies with an interest in water development projects and programs. Information requested on the forms included general project descriptions, location, cost estimates, permit information, and identification of potential obstacles, among other basic aspects of the projects.

Most importantly, sponsors were asked to assign the most realistic start dates possible to projects they expected to present to the Commission for cost-share consideration - particularly during the 2015-2017 and later biennia. As part of that effort, project sponsors needed to take into consideration when a funding commitment from the Commission would be needed for projects or programs to proceed.

As the project information forms were received by the Commission, each project was reviewed by a team of staff members to determine if portions of the project were eligible for cost-share, and if the proposed timeframes for project advancement were reasonable and justified by supporting information. Sponsors were also required to provide information on project benefits per HB 1206. That information was also used in project analyses.

After project reviews were completed, the information was transferred into a water project database. This provides the Commission with updated project information for older projects and an accounting of new projects that have developed

since the last inventory process, during the 2013-2015 biennium. Of course, circumstances change, and so do project costs over time. Therefore, the database is updated regularly leading up to the Legislative Assembly.

In addition, Commission staff worked closely with the North Dakota Water Coalition (which is made up of project sponsors from across the state), and the project sponsors themselves to maintain the most up-to-date project information possible. The second round of Commissioner-hosted meetings was also helpful for the agency and project sponsors to discuss projects and update information accordingly.

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 biennia. As stated earlier, this is an important tool for budget planning purposes for the Commission, the Office of Management and Budget, the Governor's Office, and the Legislature.

WATER DEVELOPMENT FUNDING NEEDS, 2015-2017 BIENNIUM

The following Water Development Funding Needs table contains projects that could move forward and request State Water Commission cost-share in the 2015-2017 biennium (Table 9). This accounting of projects simply represents a list of needs as submitted by project sponsors. *It does not guarantee, in any way, that all of the projects listed will receive*

funding or the amounts listed. In addition, upon further review of the projects and any notices of changes to the projects, the state's potential cost-share contribution may change based on the agency's cost-share policy and requirements for eligible items.

With the approval of the Project Prioritization Guidance Concept, projects were also listed with their priority ranking, and were organized by major drainage basin within each project type.

The list is organized into four categories including: flood control, general water management, irrigation, and water supply. The total financial need to implement all of the projects in the 2015-2017 inventory is about \$1.5 billion. The state's share of that total could be about \$954 million in grants and loans. However, those estimates will evolve pending closer analyses of cost-share requirements

once a request for funding has been made to the Commission. The federal government and local project sponsors would be responsible to make up the balance.

The 2015-2017 totals do not account for projects that may receive additional funding in the current 2013-2015 biennium. 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. Furthermore, the unpredictability of floods, droughts, and other unforeseen events can result in new funding needs that were not documented at the time this report was developed. As a result, the actual need for the upcoming biennium has the potential to change from what is presented here.



Table 9. Water Development Needs, 2015-2017 Biennium

FLOOD CONTROL								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
State of North Dakota	Devils Lake Outlet Operations	Essential	Devils Lake	\$0	\$11,000,000	\$0	\$0	\$11,000,000
Williston	West Williston Flood Control	High	Missouri	\$0	\$7,269,000	TBD	\$4,846,000	\$12,115,000
Souris River JWRD, Minot	Mouse River Flood Control	High	Mouse	\$0	\$110,000,000	TBD	\$73,333,333	\$183,333,333
F-M Diversion Authority	F-M Diversion	High	Red	\$80,000,000	\$68,750,000	\$0	\$250,000,000	\$398,750,000
Fort Ransom	Permanent Flood Protection	Moderate	Red	\$0	\$4,320,000	\$1,080,000	\$0	\$5,400,000
Grafton	Permanent Flood Protection	High	Red	\$0	\$25,200,000	TBD	\$16,800,000	\$42,000,000
Lisbon	Permanent Flood Protection	Moderate	Red	\$0	\$16,000,000	\$4,000,000	\$0	\$20,000,000
Valley City	Permanent Flood Protection	Moderate	Red	\$0	\$24,000,000	\$6,000,000	\$0	\$30,000,000
FLOOD CONTROL TOTAL				\$80,000,000	\$266,539,000	\$11,080,000	\$344,979,333	\$702,598,333

TBD = To Be Determined

IRRIGATION								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Dickey-Sargent ID	Oakes Test Area Irrigation	Moderate	James	\$0	\$2,500,000	\$0	\$2,500,000	\$5,000,000
Garrison Diversion Conservancy District	McClusky Canal Irrigation	Moderate	Missouri	\$0	\$1,250,000	\$0	\$1,250,000	\$2,500,000
Nesson Valley ID	Nesson Valley Irrigation	Moderate	Missouri	\$0	\$5,500,000	\$0	\$5,500,000	\$11,000,000
IRRIGATION TOTAL				\$0	\$9,250,000	\$0	\$9,250,000	\$18,500,000

Table 9. Water Development Needs, 2015-2017 Biennium

GENERAL WATER MANAGEMENT								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Bisbee, Towner WRD, Towner County	Big Coulee Dam Repair	Moderate	Devils Lake	\$0	\$4,500,000	TBD	\$1,500,000	\$6,000,000
State of North Dakota	Devils Lake Outlet Mitigation	Essential	Devils Lake	\$0	\$5,000,000	\$0	\$0	\$5,000,000
Burleigh WRD	Apple Creek Industrial Park Levee	High	Missouri	\$0	\$900,000	TBD	\$600,000	\$1,500,000
Burleigh WRD	Fox Island Flood Control	High	Missouri	\$0	\$1,320,000	TBD	\$880,000	\$2,200,000
Burleigh WRD	Missouri River Correctional Center Flood Control	High	Missouri	\$0	\$574,200	TBD	\$382,800	\$957,000
Burleigh WRD	Sibley Island Flood Control	High	Missouri	\$0	\$0	TBD	\$0	\$0
Burleigh WRD	Missouri River Snag & Clear	Moderate	Missouri	\$0	\$625,000	\$0	\$625,000	\$1,250,000
Burleigh WRD	McDowell Dam Supplemental Water Supply	Low	Missouri	\$0	\$276,000	\$0	\$414,000	\$690,000
Mandan	High Service Pump Optimization Phase II	Low	Missouri	\$0	\$70,350	\$0	\$130,650	\$201,000
Mandan	Pretreatment Expansion Design	Low	Missouri	\$0	\$477,750	\$0	\$887,250	\$1,365,000
Mandan	Flood Risk Reduction Study	Low	Missouri	\$0	\$140,000	\$0	\$260,000	\$400,000
McLean WRD	Painted Woods Creek Rural Flood Control	Low	Missouri	\$200,000	\$585,000	\$0	\$715,000	\$1,500,000
McLean WRD	Fort Mandan/4H Camp Rural Flood Control	Low	Missouri	\$0	\$990,000	\$0	\$1,210,000	\$2,200,000
Parshall	East-Side Flood Control	High	Missouri	\$0	\$150,000	TBD	\$100,000	\$250,000
Williams WRD	Epping Dam Repair	Moderate	Missouri	\$0	\$266,250	TBD	\$88,750	\$355,000
Williston	Airport Drainage Ditch Floodplain Study	Low	Missouri	\$0	\$17,500	\$0	\$32,500	\$50,000
Williston	Camp Creek Floodplain Study	Low	Missouri	\$0	\$21,000	\$0	\$39,000	\$60,000
Williston	Stony Creek Floodplain Study	Low	Missouri	\$0	\$21,000	\$0	\$39,000	\$60,000

TBD = To Be Determined

Table 9. Water Development Needs, 2015-2017 Biennium

GENERAL WATER MANAGEMENT (continued)								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
McHenry WRD	Mouse River Bank Stabilization	Moderate	Mouse	\$0	\$125,000	\$0	\$125,000	\$250,000
North Prairie RWD	Study of Coop Project with Garrison & Garrison RWD	Low	Mouse	\$0	\$52,500	\$0	\$97,500	\$150,000
Ward WRD	Makoti Lake Flood Control	Low	Mouse	\$0	\$900,000	\$0	\$1,100,000	\$2,000,000
Barnes & Griggs JWRD	Silver Creek Watershed Detention Study	Low	Red	\$300,000	\$105,000	\$0	\$195,000	\$600,000
Barnes WRD	Kathryn Dam Repair & Modification	High	Red	\$100,000	\$750,000	TBD	\$250,000	\$1,100,000
Barnes WRD	Eckelson/Fox Lake Watershed Detention	Moderate	Red	\$0	\$1,200,000	\$0	\$800,000	\$2,000,000
Barnes WRD	10 Mile Lake Outlet	Low	Red	\$0	\$900,000	\$0	\$1,100,000	\$2,000,000
Cass JWRD	Buffalo Creek Watershed Detention Study	Low	Red	\$900,000	\$315,000	\$0	\$585,000	\$1,800,000
Cass JWRD	Rush River Watershed Detention Study	Low	Red	\$900,000	\$315,000	\$0	\$585,000	\$1,800,000
Cass JWRD	Swan Creek Watershed Detention Study	Low	Red	\$900,000	\$315,000	\$0	\$585,000	\$1,800,000
Cass JWRD	Upper Maple Watershed Detention Study	Low	Red	\$900,000	\$315,000	\$0	\$585,000	\$1,800,000
Cavalier	Tongue River Bank Stabilization	Moderate	Red	\$431,291	\$71,882	\$0	\$71,882	\$575,055
Cavalier	Tongue River Snag & Clear	Moderate	Red	\$0	\$12,500	\$0	\$12,500	\$25,000
Crystal	Flood Risk Reduction Study	Low	Red	\$0	\$175,000	\$0	\$325,000	\$500,000
Dickey WRD	Drain #1 Channel Improvement	Low	Red	\$0	\$337,500	\$0	\$412,500	\$750,000
Dickey-Sargent JWRD	Jackson Township Improvement District #1	Low	Red	\$0	\$450,000	\$0	\$550,000	\$1,000,000
Grafton	Park River Snag & Clear	Moderate	Red	\$35,000	\$22,500	\$0	\$22,500	\$80,000
Maple River WRD	Cass Drain #37 Channel Improvement	Low	Red	\$0	\$225,000	\$0	\$275,000	\$500,000

TBD = To Be Determined

Table 9. Water Development Needs, 2015-2017 Biennium

GENERAL WATER MANAGEMENT (continued)

*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.

Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Maple River WRD	Maple River District #2 Channel Improvement	Low	Red	\$0	\$675,000	\$0	\$825,000	\$1,500,000
Maple River WRD	Upper Swan Creek Channel Improvement	Low	Red	\$0	\$900,000	\$0	\$1,100,000	\$2,000,000
McVille	McVille Dam Repair	Moderate	Red	\$0	\$611,250	TBD	\$203,750	\$815,000
North Cass WRD	Drain #24 Channel Improvement	Low	Red	\$0	\$90,000	\$0	\$110,000	\$200,000
North Cass WRD	Drain #55 Channel Improvement	Low	Red	\$0	\$90,000	\$0	\$110,000	\$200,000
Park River JWRD	North Branch Park River Detention Study	Low	Red	\$0	\$350,000	\$0	\$650,000	\$1,000,000
Pembina WRD	Senator Young Dam Repair	High	Red	\$4,000,000	\$2,250,000	TBD	\$750,000	\$7,000,000
Pembina WRD	Tongue River Snag & Clear	Moderate	Red	\$0	\$200,000	\$0	\$200,000	\$400,000
Red River JWRD	Lower Red Detention Site Modeling	Low	Red	\$0	\$50,750	\$0	\$94,250	\$145,000
Richland WRD	Sheyenne River Snag and Clear	Moderate	Red	\$0	\$100,000	\$0	\$100,000	\$200,000
Richland WRD	Wild Rice River Snag & Clear	Moderate	Red	\$0	\$200,000	\$0	\$200,000	\$400,000
Richland WRD	Drain #2 Reconstruction	Low	Red	\$0	\$450,000	\$0	\$550,000	\$1,000,000
Richland WRD	Drain #14 Reconstruction	Low	Red	\$0	\$225,000	\$0	\$275,000	\$500,000
Richland WRD	Drain #18 Reconstruction	Low	Red	\$0	\$337,500	\$0	\$412,500	\$750,000
Richland WRD	Drain #15 (27) Reconstruction	Low	Red	\$0	\$450,000	\$0	\$550,000	\$1,000,000
Rush River WRD	Drain #52 Channel Improvement	Low	Red	\$0	\$675,000	\$0	\$825,000	\$1,500,000
Rush River WRD	Amenia Township Drain #75	Low	Red	\$0	\$225,000	\$0	\$275,000	\$500,000
Sargent WRD	Nelson Dam & Brummond-Lubke Dam Repair	Moderate	Red	\$0	\$75,000	TBD	\$25,000	\$100,000
Sargent WRD	Drain #7 Channel Improvement	Low	Red	\$0	\$67,500	\$0	\$82,500	\$150,000
Sargent WRD	Drain #8 Channel Improvement	Low	Red	\$0	\$202,500	\$0	\$247,500	\$450,000
Sargent WRD	Drain #11 Channel Improvement	Low	Red	\$0	\$1,125,000	\$0	\$1,375,000	\$2,500,000

TBD = To Be Determined

Table 9. Water Development Needs, 2015-2017 Biennium

GENERAL WATER MANAGEMENT (continued)

***PLEASE NOTE:** This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.

Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Sargent WRD	Drain #12 Channel Improvement	Low	Red	\$0	\$225,000	\$0	\$275,000	\$500,000
Southeast Cass WRD	Sheyenne-Maple Flood Control Project #2 Improvements	High	Red	\$0	\$600,000	TBD	\$400,000	\$1,000,000
Southeast Cass WRD	Sheyenne & Wild Rice Rivers Snag & Clear	Moderate	Red	\$0	\$500,000	\$0	\$500,000	\$1,000,000
Southeast Cass WRD	Drain #53 Channel Improvement	Low	Red	\$0	\$675,000	\$0	\$825,000	\$1,500,000
Steele WRD	Drain #1 Channel Improvement	Low	Red	\$0	\$337,500	\$0	\$412,500	\$750,000
Steele WRD	Drain #6 Channel Improvement	Low	Red	\$0	\$337,500	\$0	\$412,500	\$750,000
Steele WRD	Drain #8 Channel Improvement	Low	Red	\$0	\$337,500	\$0	\$412,500	\$750,000
Steele WRD	Drain #12 Channel Improvement	Low	Red	\$0	\$337,500	\$0	\$412,500	\$750,000
Steele WRD	Golden Lakes Improvement	Low	Red	\$0	\$180,000	\$0	\$270,000	\$450,000
Steele WRD	Sharon Drain #20 Improvement	Low	Red	\$0	\$540,000	\$0	\$660,000	\$1,200,000
Steele WRD	Goose River Watershed Detention Study	Low	Red	\$300,000	\$105,000	\$0	\$195,000	\$600,000
Traill WRD	Elm River, Goose River, Buffalo Coulee Snag & Clear	Moderate	Red	\$0	\$200,000	\$0	\$200,000	\$400,000
Traill WRD	Buxton Channel Improvement	Low	Red	\$0	\$213,750	\$0	\$261,250	\$475,000
Traill WRD	Drain #23-40 Channel Improvement	Low	Red	\$0	\$708,750	\$0	\$866,250	\$1,575,000
Traill WRD	Drain #64 Construction	Low	Red	\$0	\$195,750	\$0	\$239,250	\$435,000
Traill WRD	Morgan Drain #36 Channel Improvement	Low	Red	\$0	\$900,000	\$0	\$1,100,000	\$2,000,000
Traill WRD	Preston Floodway Improvement	Low	Red	\$0	\$562,500	\$0	\$687,500	\$1,250,000
Traill WRD	Roseville Drain #19 Channel Improvement	Low	Red	\$0	\$877,500	\$0	\$1,072,500	\$1,950,000
Traill WRD	Stavanger-Belmont Drain #52 Channel Improvement	Low	Red	\$0	\$2,475,000	\$0	\$3,025,000	\$5,500,000

TBD = To Be Determined

Table 9. Water Development Needs, 2015-2017 Biennium

GENERAL WATER MANAGEMENT (continued)

***PLEASE NOTE:** This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.

Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Traill WRD	Elm River Watershed Detention Study	Low	Red	\$300,000	\$105,000	\$0	\$195,000	\$600,000
Traill WRD	Goose River Watershed Detention Study	Low	Red	\$600,000	\$210,000	\$0	\$390,000	\$1,200,000
Tri-County JWRD	Tri-County Drain Reconstruction	Low	Red	\$0	\$1,035,000	\$0	\$1,265,000	\$2,300,000
Walsh WRD	Matecjek Dam Rehabilitation	High	Red	\$16,900,000	\$6,825,000	TBD	\$2,275,000	\$26,000,000
Walsh WRD	Forest River Flood Control	High	Red	\$0	\$4,200,000	TBD	\$2,800,000	\$7,000,000
Walsh WRD	Park River Snag & Clear	Moderate	Red	\$0	\$200,000	\$0	\$200,000	\$400,000
Walsh WRD	Walsh Drain #87 (McCloud Drain)	Low	Red	\$0	\$3,380,850	\$0	\$4,132,150	\$7,513,000
Walsh WRD	Walsh Drain #90	Low	Red	\$0	\$3,150,000	\$0	\$3,850,000	\$7,000,000
Walsh WRD	Forest River Watershed Detention Study	Low	Red	\$0	\$140,000	\$0	\$260,000	\$400,000
Walsh WRD	Oslo, MN Agricultural Levee	Low	Red	\$0	\$65,625	\$0	\$121,875	\$187,500
West Fargo	Water Supply Study	Low	Red	\$0	\$70,000	\$0	\$130,000	\$200,000
GENERAL WATER MANAGEMENT TOTAL				\$26,766,291	\$61,560,157	\$0	\$52,387,107	\$140,713,555

TBD = To Be Determined



Table 9. Water Development Needs, 2015-2017 Biennium

WATER SUPPLY								
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Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Rolla	Service to Rolla From Turtle Mountain Band of Chippewa Public Utilities	Moderate	Devils Lake	\$401,637	\$240,982	\$80,328	\$80,328	\$803,275
Stutsman RWD	Phase V Expansion	Low	James	\$0	\$0	\$3,160,800	\$790,200	\$3,951,000
Dickinson	North Side Tank	High	Missouri	\$0	\$1,800,000	\$600,000	\$600,000	\$3,000,000
Dickinson	South Side Tank	High	Missouri	\$0	\$2,700,000	\$900,000	\$900,000	\$4,500,000
Dickinson	State Avenue Watermain	High	Missouri	\$0	\$900,000	\$300,000	\$300,000	\$1,500,000
Dickinson	Watermains To North Dickinson Annexation Area	High	Missouri	\$0	\$900,000	\$300,000	\$300,000	\$1,500,000
Ellendale	Elevated Water Storage	Low	Missouri	\$0	\$0	\$1,200,000	\$300,000	\$1,500,000
Garrison	Garrison Water Treatment Plant & Supply	Moderate	Missouri	\$0	\$5,400,000	\$1,800,000	\$1,800,000	\$9,000,000
Killdeer	HWBL Industrial Subdivision Water Supply	High	Missouri	\$0	\$294,000	\$98,000	\$98,000	\$490,000
Killdeer	South Water Storage Reservoir	High	Missouri	\$0	\$270,000	\$90,000	\$90,000	\$450,000
Killdeer	Southwest Utility Extension	High	Missouri	\$0	\$216,720	\$72,240	\$72,240	\$361,200
Mandan	Conventional Raw Water Intake	Low	Missouri	\$0	\$0	\$13,252,000	\$3,313,000	\$16,565,000
Mandan	High Service Pump Optimization Phase I	Low	Missouri	\$0	\$0	\$1,510,400	\$377,600	\$1,888,000
Mandan	I&C Upgrades	Low	Missouri	\$0	\$0	\$222,400	\$55,600	\$278,000
Mandan	20-inch Pressure Reducing Valve at Boundary Road	Low	Missouri	\$0	\$0	\$90,720	\$22,680	\$113,400
Mandan	South End Pump Station Generator	Low	Missouri	\$0	\$0	\$160,000	\$40,000	\$200,000
Mandan	South End Pump Station Improvement	Low	Missouri	\$0	\$0	\$202,055	\$50,514	\$252,569
Mandan	Sunset Booster Station Pumps	Low	Missouri	\$0	\$0	\$353,704	\$88,426	\$442,130
Mandan	Ultraviolet Light Disinfection	Low	Missouri	\$0	\$0	\$1,129,600	\$282,400	\$1,412,000
Mandan	Zone 2100 Elevated Water Storage	Low	Missouri	\$0	\$0	\$1,081,000	\$270,250	\$1,351,250

Table 9. Water Development Needs, 2015-2017 Biennium

WATER SUPPLY (continued)								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
New England	Water System Improvements	Low	Missouri	\$0	\$0	\$2,240,000	\$560,000	\$2,800,000
Southwest Water Authority	Southwest Pipeline Project	High	Missouri	\$0	\$100,000,000	\$0	\$0	\$100,000,000
Tioga	System Expansion	High	Missouri	\$0	\$2,310,000	\$770,000	\$770,000	\$3,850,000
Tioga	System Expansion	High	Missouri	\$0	\$480,000	\$160,000	\$160,000	\$800,000
Watford City	11th Ave. S Watermain	High	Missouri	\$0	\$744,357	\$248,119	\$248,119	\$1,240,595
Watford City	12th St. E Watermain (HWY 23 to 17th Ave N)	High	Missouri	\$0	\$428,168	\$142,723	\$142,723	\$713,614
Watford City	12th St. E Watermain (24th Ave SE to 11th Ave SE)	High	Missouri	\$0	\$371,854	\$123,951	\$123,951	\$619,756
Watford City	14th St. W Watermain (US HWY 85 to 4th Ave N)	High	Missouri	\$0	\$194,688	\$64,896	\$64,896	\$324,480
Watford City	14th St. W Watermain (4th Ave N to 10th Ave N)	High	Missouri	\$0	\$168,730	\$56,243	\$56,243	\$281,216
Watford City	14th St. W Watermain (US HWY 85 to 17th Ave S)	High	Missouri	\$0	\$182,358	\$60,786	\$60,786	\$303,930
Watford City	14th St. W Watermain (10th Ave N to 17th Ave N)	High	Missouri	\$0	\$226,016	\$75,339	\$75,339	\$376,694
Watford City	17th Ave. N Watermain (12th St to HWY 1806)	High	Missouri	\$0	\$759,472	\$253,157	\$253,157	\$1,265,786
Watford City	17th Ave. NE Watermain - Pheasant Ridge	High	Missouri	\$0	\$305,011	\$101,670	\$101,670	\$508,351
Watford City	17th Ave. NW Watermain	High	Missouri	\$0	\$430,800	\$143,600	\$143,600	\$718,000
Watford City	24th Ave. SE Watermain	High	Missouri	\$0	\$700,338	\$233,446	\$233,446	\$1,167,230
Watford City	HWY 23 Bypass Loop	High	Missouri	\$0	\$231,000	\$77,000	\$77,000	\$385,000
Watford City	HWY 85 (24th Ave S to 37th Ave S)	High	Missouri	\$0	\$371,854	\$123,951	\$123,951	\$619,756
Watford City	Southeast Water Tower	High	Missouri	\$0	\$2,309,571	\$769,857	\$769,857	\$3,849,285
Watford City	Southwest Water Tower	High	Missouri	\$0	\$1,492,570	\$497,523	\$497,523	\$2,487,616

Table 9. Water Development Needs, 2015-2017 Biennium

WATER SUPPLY (continued)								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Western Area Water Supply	Phase IV	High	Missouri	\$0	\$82,000,000	\$38,000,000	\$0	\$120,000,000
Williston	11th St Watermain	High	Missouri	\$0	\$1,137,120	\$379,040	\$379,040	\$1,895,200
Williston	16th Ave Watremain	High	Missouri	\$0	\$687,264	\$229,088	\$229,088	\$1,145,440
Williston	26th St Watermain	High	Missouri	\$0	\$840,000	\$280,000	\$280,000	\$1,400,000
Williston	Airport Watermain & Pump Station	High	Missouri	\$0	\$4,350,000	\$1,450,000	\$1,450,000	\$7,250,000
Williston	Hi-Land Heights Water Supply	High	Missouri	\$0	\$3,052,320	\$1,017,440	\$1,017,440	\$5,087,200
Williston	Hgh School Area Watermain	High	Missouri	\$0	\$1,203,840	\$401,280	\$401,280	\$2,006,400
Williston	Wegley Green Acres Water Supply	High	Missouri	\$0	\$849,000	\$283,000	\$283,000	\$1,415,000
Williston	West Reservoirs	High	Missouri	\$0	\$2,640,000	\$880,000	\$880,000	\$4,400,000
Williston	Williston Park Water Supply	High	Missouri	\$0	\$630,000	\$210,000	\$210,000	\$1,050,000
All Seasons WUD	System 1 Expansion - Bottineau County & Lake Metigoshe	High	Mouse	\$0	\$13,045,500	\$869,700	\$3,478,800	\$17,394,000
All Seasons WUD	System III Improvements	Low	Mouse	\$0	\$0	\$636,800	\$159,200	\$796,000
Glenburn	Distribution System Improvement	High	Mouse	\$0	\$570,000	\$190,000	\$190,000	\$950,000
Glenburn	Water Tower & Primary Transmission Line Improvement	High	Mouse	\$0	\$840,000	\$280,000	\$280,000	\$1,400,000
Minot	NE Transmission from County 12 to 46th Ave.	High	Mouse	\$0	\$2,400,000	\$800,000	\$800,000	\$4,000,000
Minot	NE Water Tower	High	Mouse	\$0	\$1,687,754	\$562,585	\$562,585	\$2,812,924
Minot	NE Transmission from 30th Av. to 46th St.	High	Mouse	\$0	\$1,551,750	\$517,250	\$517,250	\$2,586,250
Minot	NW Water Transmission from County 10 to 30th St.	High	Mouse	\$0	\$960,000	\$320,000	\$320,000	\$1,600,000
Minot	SE Transmission from 42nd St. to 46th St.	High	Mouse	\$0	\$450,000	\$150,000	\$150,000	\$750,000
Minot	SW Water Tank	High	Mouse	\$0	\$1,687,754	\$562,585	\$562,585	\$2,812,924
Minot	Northwest Area Water Supply	High	Mouse	\$0	\$18,400,000	\$0	\$9,907,700	\$28,307,700

Table 9. Water Development Needs, 2015-2017 Biennium

WATER SUPPLY (continued)								
*PLEASE NOTE: This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.								
Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Minot	NE Transmission from 55th St. to 46th Ave.	High	Mouse	\$0	\$1,320,000	\$440,000	\$440,000	\$2,200,000
Sherwood	Water Quality Improvements	Low	Mouse	\$0	\$0	\$366,400	\$91,600	\$458,000
Sherwood	Water Supply Improvements	Low	Mouse	\$0	\$0	\$356,000	\$89,000	\$445,000
Lake Agassiz Water Authority	Red River Valley Water Supply	High	Multi-Basin	\$0	\$150,000,000	TBD	TBD	\$150,000,000
Fargo	Water System Regionalization	Moderate	Red	\$0	\$7,200,000	\$2,400,000	\$2,400,000	\$12,000,000
Grand Forks	Regional Water Treatment Plant	Moderate	Red	\$0	\$30,000,000	\$41,000,000	\$6,400,000	\$77,400,000
Kindred	Water Storage Improvement & System Expansion	Low	Red	\$0	\$0	\$880,000	\$220,000	\$1,100,000
Langdon	Water Treatment Plant Improvements	Low	Red	\$0	\$0	\$6,800,000	\$1,700,000	\$8,500,000
Northeast RWD	New Water Supply & Rural Users	Low	Red	\$0	\$0	\$11,600,000	\$2,900,000	\$14,500,000
Southeast WUD	System Wide Expansion	Moderate	Red	\$0	\$3,888,000	\$1,296,000	\$1,296,000	\$6,480,000
West Fargo	Replace Production Well #8	High	Red	\$0	\$600,000	\$200,000	\$200,000	\$1,000,000
West Fargo	South Side Water Tower & Transmission Line	High	Red	\$0	\$1,650,000	\$550,000	\$550,000	\$2,750,000
West Fargo	South Side Water Distribution System	High	Red	\$0	\$600,000	\$200,000	\$200,000	\$1,000,000
WATER SUPPLY TOTAL				\$401,637	\$458,668,791	\$146,852,676	\$52,838,067	\$658,761,171

TBD = To Be Determined

Table 10. Summary Of Water Development Needs, 2015-2017 Biennium

SUMMARY OF WATER DEVELOPMENT NEEDS				
Project Type	Federal Cost	State Cost (Grant & Loan)	Local Cost	Total Cost
Flood Control	\$80,000,000	\$277,619,000	\$344,979,333	\$702,598,333
General Water Management	\$26,766,291	\$61,560,157	\$52,387,107	\$140,713,555
Irrigation	\$0	\$9,250,000	\$9,250,000	\$18,500,000
Water Supply	\$401,637	\$605,521,467	\$52,838,067	\$658,761,171
Total	\$107,167,928	\$953,950,624	\$459,454,507	\$1,520,573,059

Table 11. Category 4 Water Supply Project Needs

CATEGORY 4 WATER SUPPLY PROJECT NEEDS

The following projects are State Water Commission Policy “Category 4” water supply projects that did not make the top quartile for affordability. Per policy, eligible projects are those that “Assist[s] with improvements in service areas where the anticipated cost per user each year (based on 5,000 gallons per month) divided by the average annual median income per user is in the top quartile or other ranking as determined by the Commission of its peer group (large city, small city, and regional) water systems that submitted planning information forms for the biennium.” The Water Commission does have the ability to adjust eligibility criteria, so it is possible that the following projects may be considered for funding assistance later in the 2015-2017 biennium.

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Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Carrington	Elevated Water Storage & Pumping	Low	James	\$0	\$0	\$1,528,800	\$382,200	\$1,911,000
Beulah	Water Supply & Treatment Improvements	Low	Missouri	\$0	\$0	\$4,640,000	\$1,160,000	\$5,800,000
Garrison RWD	East Booster Station & Storage	Low	Missouri	\$0	\$0	\$159,600	\$39,900	\$199,500
Garrison RWD	Northwest System Expansion	Low	Missouri	\$0	\$0	\$876,560	\$219,140	\$1,095,700
Garrison RWD	Pump Station Improvements	Low	Missouri	\$0	\$0	\$142,560	\$35,640	\$178,200
Garrison RWD	Storage Facility & Booster Station	Low	Missouri	\$0	\$0	\$728,000	\$182,000	\$910,000
Makoti	New Well & Transmission	Low	Missouri	\$0	\$0	\$800,000	\$200,000	\$1,000,000
Makoti	Water Storage System Improvement	Low	Missouri	\$0	\$0	\$960,000	\$240,000	\$1,200,000
Missouri West WS	I-94 Business Loop Improvements	Low	Missouri	\$0	\$0	\$324,000	\$81,000	\$405,000
Burlington	South Water Tower	Low	Mouse	\$0	\$0	\$1,400,000	\$350,000	\$1,750,000
Mohall	Water Tower Improvements	Low	Mouse	\$0	\$0	\$960,000	\$240,000	\$1,200,000
North Prairie RWD	South Minot Distribution Line Improvements	Low	Mouse	\$0	\$0	\$3,040,000	\$760,000	\$3,800,000
North Prairie RWD	South Minot Elevated Water Tower	Low	Mouse	\$0	\$0	\$1,120,000	\$280,000	\$1,400,000
Rugby	Water Treatment Plant Improvements	Low	Mouse	\$0	\$0	\$1,740,800	\$435,200	\$2,176,000
Westhope	Water Supply Improvements	Low	Mouse	\$0	\$0	\$340,000	\$85,000	\$425,000
Casselton	Water Storage & Feed Line Improvements	Low	Red	\$0	\$0	\$1,600,000	\$400,000	\$2,000,000
Cavalier	Water Tower	Low	Red	\$0	\$0	\$880,000	\$220,000	\$1,100,000
Dakota RWD	System Improvements	Low	Red	\$0	\$0	\$1,599,144	\$399,786	\$1,998,930

Table 11. Category 4 Water Supply Project Needs

CATEGORY 4 WATER SUPPLY PROJECT NEEDS

The following projects are State Water Commission Policy “Category 4” water supply projects that did not make the top quartile for affordability. Per policy, eligible projects are those that “Assist[s] with improvements in service areas where the anticipated cost per user each year (based on 5,000 gallons per month) divided by the average annual median income per user is in the top quartile or other ranking as determined by the Commission of its peer group (large city, small city, and regional) water systems that submitted planning information forms for the biennium.” The Water Commission does have the ability to adjust eligibility criteria, so it is possible that the following projects may be considered for funding assistance later in the 2015-2017 biennium.

***PLEASE NOTE:** This inventory of financial needs is for planning and budgeting purposes only. It does not guarantee, in any way, that projects listed will receive funding from the state. In addition, the estimated financial needs from the state (grant or loan) may change based on further review of the projects in accordance with cost-share program eligibility requirements.

Local Sponsor	Project Name	Priority	Basin	Federal 2015-2017	Potential SWC Grant 2015-2017	Potential SWC Loan 2015-2017	Local 2015-2017	Total 2015-2017
Drayton	Clearwell Replacement	Low	Red	\$0	\$0	\$1,280,000	\$320,000	\$1,600,000
Enderlin	Treatment & Storage Expansion	Low	Red	\$0	\$0	\$10,560,000	\$2,640,000	\$13,200,000
Grafton	Surface Water Intake Improvement	Low	Red	\$0	\$0	\$80,000	\$20,000	\$100,000
Grand Forks	North Water Tower Looping	Low	Red	\$0	\$0	\$172,000	\$43,000	\$215,000
Wahpeton	New Ground Water Supply	Low	Red	\$0	\$0	\$480,000	\$120,000	\$600,000
Wahpeton	Treatment Plant Capacity & Process Improvements	Low	Red	\$0	\$0	\$4,400,000	\$1,100,000	\$5,500,000
Walsh RWD	System Improvement	Low	Red	\$0	\$0	\$1,509,569	\$377,392	\$1,886,961
CATEGORY 4 WATER SUPPLY PROJECTS TOTAL				\$0	\$0	\$41,321,033	\$10,330,258	\$51,651,291

TRIBAL PROJECT FUNDING

During the project inventory process, several tribal water supply projects were submitted to the Commission. However, only those tribal projects with eligible local sponsors were included in the inventory.



Water Project Funding

North Dakota funds a majority of its water projects through the Water Commission. Funding that is provided through the Commission for water development has historically come from several sources, including: the state's General Fund; the Dakota Water Resources Act, federal 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 Commission is also authorized to issue revenue bonds for water projects, and 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 proposed State Water Commission budget does not include any revenue from the state's General Fund. During the 2013 Legislative Assembly, the agency's operational functions were funded entirely through the Resources Trust Fund.

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 State Water Commission report. This 2015 North Dakota Water Plan satisfies that requirement for requesting funding from the RTF for the 2015-2017 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 the Legislature to be used for water-related projects and energy conservation. The Water Commission budgets 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 2013-2015 biennium are expected to total \$676 million. When combined with the fund's 2013 beginning balance of \$293 million, less the estimated expenditures of \$371 million, the balance in the RTF at the beginning of the 2015-2017 biennium could be \$598 million. Of that amount, \$190 million has not been committed to projects.

Because revenues from the oil extraction tax are highly dependent on world oil prices and production, it is very difficult to predict future funding levels. With that in mind, the November 2014 forecast includes \$872 million for the 2015-2017 biennium from oil extraction. Additional revenue into the RTF will come from Southwest Pipeline Project reimbursements, State Water Commission water supply program loan repayments, interest earnings, and oil royalties. These are estimated to total an additional \$16.1 million (Figure 17).

WATER DEVELOPMENT TRUST FUND

Senate Bill 2188 (1999) set up the 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 2013-2015 biennium are expected to total about \$19.2 million. The Office of Management and Budget estimates revenues of \$18 million for the 2015-2017 biennium (Figure 18).

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

BONDING

The Water Commission has bonding authority (NDCC 61-02-46) to issue revenue bonds of up to \$2 million per project. The Legislature must

Resources Trust Fund Revenues, 1997-2017

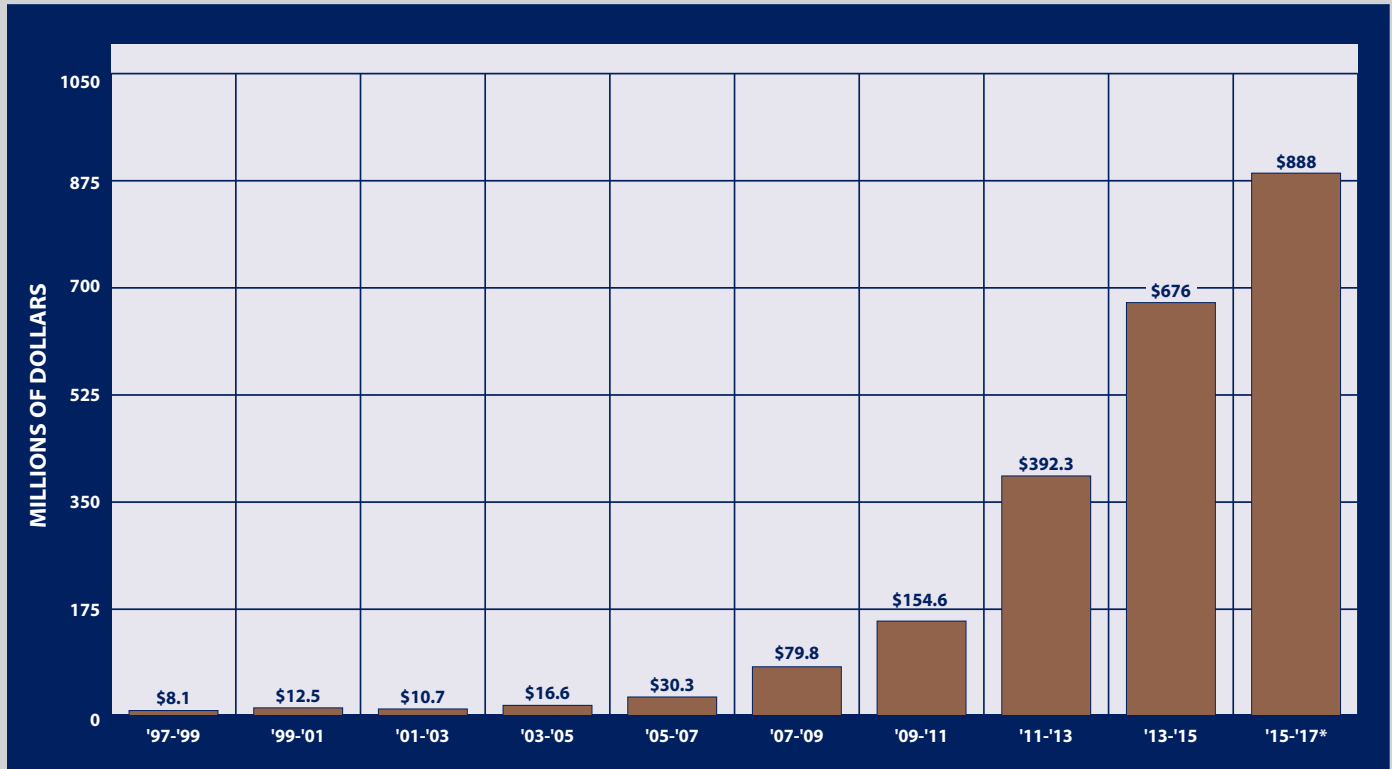


Figure 17. Resources Trust Fund revenues, 1997-2017. * Projected

Water Development Trust Fund Revenues, 1999-2017

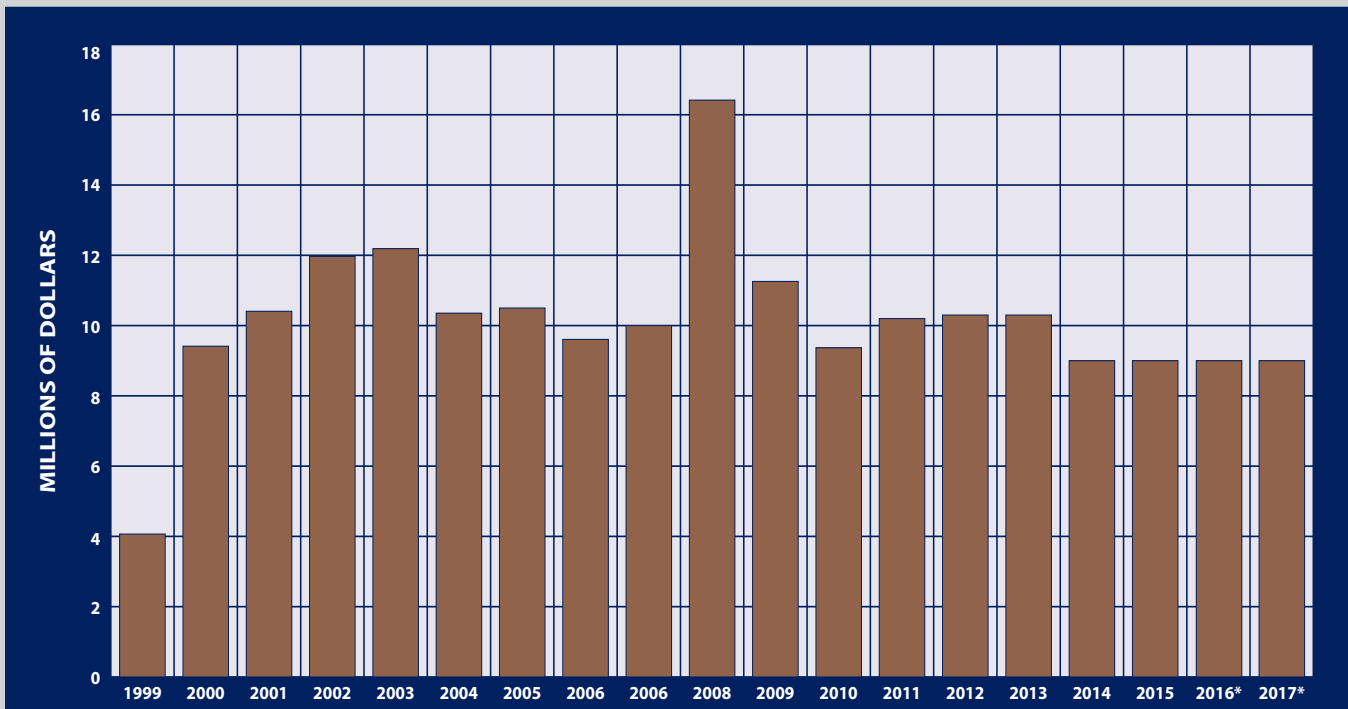


Figure 18. Water Development Trust Fund revenues, 1999-2017. * Projected

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. Because of very strong Resources Trust Fund revenues the state anticipates that by the end of this biennium it will retire all outstanding Southwest Pipeline Project bonds. There are no outstanding bonds for the Northwest Area Water Supply project.

In 1999, the Water Commission 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 Water Commission 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 Water Commission did issue bonds generating \$60 million.

By the end of the 2013-2015 biennium, it is anticipated that all of the Water Commission's outstanding water project bonds will be retired.

INFRASTRUCTURE REVOLVING LOAN FUND

An Infrastructure Revolving Loan Fund (IRLF) was established during the 2013 Legislative Assembly. NDCC 61-02-78 requires that a fund be established as of January 1, 2015, within the RTF to provide loans for water supply, flood protection, or other water development and management projects. Funding for the IRLF will come from ten percent of oil extraction revenue deposited in the RTF. The Water Commission will approve projects and loans from the IRLF, and the Bank of North Dakota will manage and administer the loans.

Specific requirements and terms will be established and approved by the Water Commission for each loan.

MUNICIPAL, RURAL, AND INDUSTRIAL WATER SUPPLY PROGRAM

A major source of grant funding for water supply development in North Dakota in previous biennia has been through the federal MR&I Water Supply Program. Funding of this program was authorized by Congress through the 1986 Garrison Diversion Unit Reformulation Act, and it is jointly administered by the Garrison Diversion Conservancy District, and Water Commission.

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. 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. 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.

Annual MR&I funding is dependent upon U.S. Congressional appropriation. As of October 2014, \$335 million in federal funds had been approved for North Dakota’s MR&I program with \$6.8 million and \$1.5 million for federal fiscal years 2013 and 2014 (Figure 19).

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 North Dakota Department of Health. The DWSRLF provides below market-rate interest loans of 2.5 percent to public water systems for capital improvements aimed at increasing public health protection and compliance under the federal Safe Drinking Water Act.

The Water Commission’s involvement with the DWSRLF is two-fold. First, the Department of Health must administer and disburse funds with the approval of the Commission. Second, the Department of Health must establish assistance priorities and expend grant funds pursuant to the priority list for the DWSRLF, after consulting with, and obtaining Commission 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 2014 comprehensive project priority list includes 200 projects with a cumulative total project funding need of \$672 million. The funded list of 184 projects includes \$414 million in loans for fiscal years 1997 through 2014. Available funding for the DWSRLF program for 2014 is anticipated to be approximately \$22.7 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 and water supply 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 construction.

Federal MR&I Water Supply Program Dollars Received, 1987-2014

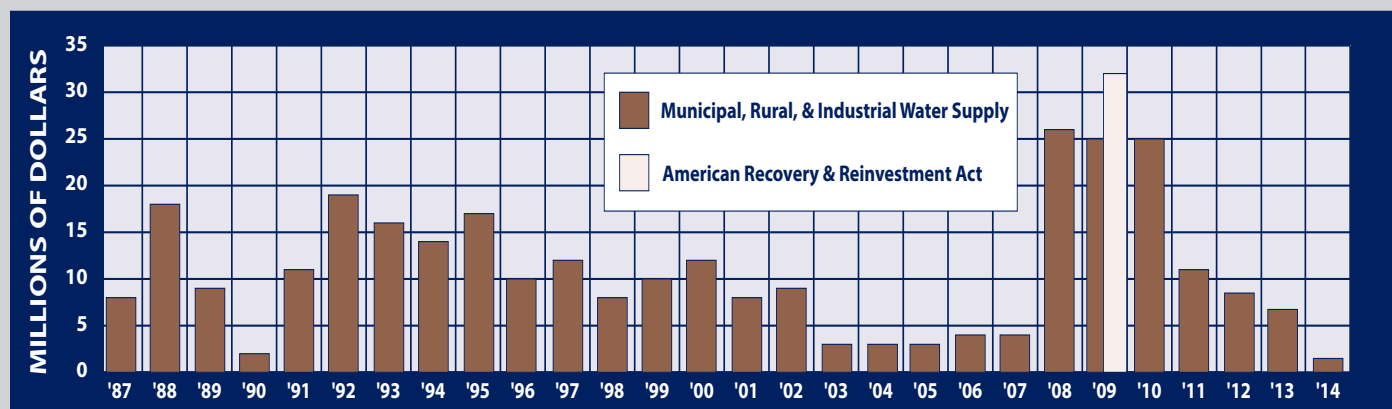


Figure 19. Federal MR&I Water Supply Program dollars received, 1987-2014.

Project Funding Priorities: 2015-2017 Biennium

This section discusses the state’s priority water development efforts and funding for the 2015-2017 (Table 12) biennium. It includes one course of action for water development in North Dakota that is subject to change during the 64th Legislative Assembly, further review of Water Commission cost-share requirements and eligibility, and other unforeseen events that may occur during the biennium.

The Water Commission’s new water development funding priorities totaling \$930 million are summarized hereafter.

Water Commission Funding Priorities, 2015-2017 Biennium			
Priority Categories	SWC Total 2015-2017 (Millions)	SWC Grant Estimate 2015-2017 (Millions)	SWC Loan Estimate 2015-2017 (Millions)
Devils Lake Outlet Operations	\$11	\$11	\$0
Fargo-Moorhead Area Diversion	\$69	\$69	\$0
General Water Management	\$50	\$50	TBD
Grafton Flood Control	\$25	\$25	TBD
Irrigation	\$9	\$9	\$0
Mouse River Flood Protection	\$110	\$110	TBD
Northwest Area Water Supply	\$18	\$18	\$0
Red River Valley Water Supply	\$150	\$150	TBD
Sheyenne River Flood Control	\$55	\$44	\$11
Southwest Pipeline Project	\$100	\$100	Cap. Repayment
Water Supply Program	\$206	\$96	\$110
Western Area Water Supply	\$120	\$82	\$38
Williston Flood Control	\$7	\$7	TBD
TOTAL	\$930	\$771	\$159

Table 12. Water Commission Funding Priorities, 2015-2017 Biennium
TBD = To Be Determined



DEVILS LAKE OUTLET OPERATIONS

The state's west end Devils Lake outlet was initially completed in 2005 with an operational capacity of 100 cubic feet per second (cfs). In the summer of 2010, an expansion was completed, increasing the outlet's capacity to 250 cfs.

During the summer of 2012, the Water Commission completed an additional outlet from East Devils Lake. This outlet has a maximum operating capacity of 350 cfs. Together, the combined operating capacity of the west end and East Devils Lake outlets is 600 cfs.

The Water Commission has budgeted \$11 million for costs related to the operation and maintenance required to keep both outlets operating to the maximum extent allowable during the 2015-2017 biennium.

FARGO-MOORHEAD AREA DIVERSION

After narrowly escaping extensive damages during the major floods of 1997, 2009, 2010, and 2011, the city of Fargo, Cass County, and other members of the Flood Diversion Board of Authority have been working diligently toward the development of permanent flood control projects that would protect Fargo and the greater metro area from future flood events.

Initially, the project that the city of Fargo pursued following the 1997 flood was the Southside Red River and Wild Rice River Levee Alternative, which was primarily designed to protect areas in south Fargo. But after the flood of 2009, it became apparent that a larger-scale flood control project would better serve both Fargo and Moorhead, and the greater metro area. Since that time, the U.S. Army Corps of Engineers, in cooperation with Flood Diversion Board of Authority members (Fargo, ND, Moorhead, MN, Cass County, ND, Clay County, MN, Cass County Joint Water Resources District, and the Buffalo-Red River Watershed District, MN) worked jointly to complete an EIS to assess potential measures to reduce the entire metro area's flood risk. The EIS was completed

in late 2011, and a Record of Decision was signed by the Assistant Secretary of the Army in April 2012. In 2014, President Obama signed the Water Resource Reform and Development Act (WRRDA), which authorized the Fargo-Moorhead area diversion project. The signing of WRRDA allows the federal government to appropriate funding for construction.

The preferred alternative is a 20,000 cfs diversion channel on the North Dakota side of the Red River that will be approximately 36 miles in length. The project is also expected to have a 150,000 acre-foot staging area upstream of the southern-most portion of the diversion. In addition to the diversion features, extensive in-town levee constructions are also part of ongoing efforts (See Map Appendix).

In 2015 and 2016, Fargo estimates that about \$525 million will be invested in project efforts, with over \$200 million of that directed toward land acquisitions for in-town levees, the Oxbow-Hickson-Bakke levee, outlet and control structures, the Sheyenne aqueduct, and within the planned staging area. Approximately \$271 million will be allocated toward construction of in-town levees, the Oxbow-Hickson-Bakke levee, and bridge-related efforts. Remaining expenditures during the 2015 and 2016 timeframe will be related to project design and permitting, technical oversight, and utility relocations.

During the 2013 Legislative Assembly, the State of North Dakota pledged \$450 million toward completion of the Fargo-Moorhead area diversion project. In past biennia, including the 2013-2015 biennium, the Water Commission has budgeted and approved \$175 million for this project. With the state's remaining commitment at \$275 million, the city of Fargo has requested this amount be allocated over the course of the next four biennia. In the 2015-2017 biennium, the Water Commission has budgeted \$69 million toward the project as required by HB 1020. The total project cost is estimated at \$1.8 billion.

GENERAL WATER MANAGEMENT

General water management projects include rural flood control, small-scale flood control, snagging and clearing, channel improvements, recreational projects, dam repairs, planning efforts, special studies, and downstream mitigation for operation of the Devils Lake outlets.

The \$50 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 2015-2017 biennium.

GRAFTON FLOOD CONTROL

The Park River at Grafton has reached major flood stage 29 times since record keeping began in 1882 – with ten major floods since 1979 alone. Today, it is estimated that damages to the city from a 100-year event, without flood protection, would total about \$94 million (2014 dollars). With approximately 90 percent of Grafton located in the 100-year floodplain, the community is interested in moving forward with a permanent solution to their ongoing flood risks from the Park River.

To reduce their risk, Grafton is pursuing a comprehensive flood damage reduction project that will include levees, a diversion channel, and possible modification to the Park River through Grafton. When completed, the project will provide 100-year protection to the community.

For the 2015-2017 biennium, the Water Commission has budgeted about \$25 million, or up to 60 percent of eligible costs. Per Water Commission policy, this project may also be eligible to receive loans for a portion of the local share.

IRRIGATION

Irrigation efforts during the 2015-2017 biennium are planned for the Oakes Test Area (OTA), McClusky Canal, and Nesson Valley Irrigation District.

The OTA project is to secure a firm water supply for the 5,000-acre irrigation project, using ground water from the Oakes aquifer in and near the project area. The project will consist of principal supply works to capture and convey ground water to the existing

OTA distribution system. Irrigation efforts along the McClusky canal are expected to add another 3,000 acres of irrigation using central supply works. And at Nesson Valley, project sponsors expect to move forward with supply works that will bring several thousand acres of irrigation online. The Water Commission has budgeted \$9 million for irrigation development during the 2015-2017 biennium.

MOUSE RIVER FLOOD PROTECTION

On June 25, 2011, Mouse River flood flows peaked in Minot at 27,400 cfs. This was more than five times greater than the city's existing flood control channels and levees had been designed to handle, and almost nine times greater than any documented flood since the construction of major upstream storage reservoirs decades before.

The record breaking flooding of 2011 overwhelmed most flood fighting efforts along the entire reach of the Mouse River in North Dakota, causing unprecedented damages to homes, businesses, public facilities, infrastructure, and rural areas. The U.S. Army Corps of Engineers estimates that 4,700 commercial, public, and residential structures in Ward, Renville, and McHenry counties sustained structural and content damages totaling almost \$700 million. Had no emergency flood fighting measures been implemented, it is estimated that number could have totaled about \$900 million.

Immediately following the devastating flood events in the summer of 2011, stakeholder workshops were held in late 2011 and early 2012. Preliminary engineering reports and basin-wide erosion, sedimentation, and hydrologic modeling were completed a year later. And in the summer of 2013, the Rural Reaches Alternatives Report and final Mouse River Reconnaissance Study were issued.

The result of these efforts is a Mouse River Enhanced Flood Protection Project (MREFPP) that is designed to provide flood relief to Mouse River valley residents – both urban and rural. The focus of the MREFPP has now shifted toward implementation, and several efforts are expected to move forward in the 2015-2017 biennium in Renville, Ward, McHenry, and Bottineau Counties.

Renville County efforts will involve rural structure acquisitions, relocations, or ring dikes; and bridge and road modifications.

Ward County efforts may include rural structure acquisitions, relocations, or ring dikes; Burlington property acquisitions, levee segments, and bridge improvement efforts; Tierracita Vallejo housing development acquisitions, pump station construction, railroad closures, and levees; Minot acquisitions, levees, and floodwalls; and in Sawyer – bridge replacement. In addition, engineering and permitting efforts will also be underway for several projects in Ward County.

McHenry County efforts may include J. Clark Salyer structure modifications; rural structure acquisitions, relocations, or ring dikes; Velva bridge replacement; rural channel modifications; and rural bridge and road modifications.

In Bottineau County, sponsors will be pursuing J. Clark Salyer structure modifications, rural channel modifications, and rural bridge and road modifications.

The aforementioned priorities for the MREFPP were developed by the Souris River Joint Water Resource Board – which estimates a financial need of \$228 million for the MREFPP through 2017.

The Water Commission budgeted \$61 million to advance various elements of the MREFPP during the 2013-2015 biennium. For the 2015-2017 biennium, the Commission has budgeted \$110 million to cover up to 60% of eligible project costs. Per Water Commission cost-share policy, this project may also be eligible to receive loans for a portion of the local share.

NORTHWEST AREA WATER SUPPLY

NDCC, Section 61-24.6 declares necessary the pursuit of a project “...that would supply and distribute water to the people of northwestern North Dakota through a pipeline transmission and delivery system...” NDCC 61-24.6 authorizes the Water Commission to construct, operate, and manage a project to deliver water throughout northwestern North Dakota.

The Water Commission began construction on the Northwest Area Water Supply (NAWS) project in April 2002 (See Map Appendix). The first four contracts involving 45 miles of pipeline from the Missouri River to Minot were completed in the spring of 2009. The project is currently serving Berthold, Kenmare, Burlington, West River Water District, Upper Souris Water District, Mohall, Sherwood, All Seasons Water District, and Minot (also serves North Prairie Water District and Minot Air Force Base). NAWS is getting interim water supply through a 10-year contract with Minot, which expires in 2018.

In 2002, lawsuits were initiated, but various elements of project construction have been allowed to proceed by court order including most of the distribution system and nearly all of the supply pipeline.

Depending upon findings of a Supplemental EIS and legal decisions, efforts are planned to move NAWS forward. To support NAWS, the Water Commission has budgeted \$18 million to: complete construction of pipeline between Renville Corner and Westhope; complete construction of pipeline between Glenburn and Renville; initiate design work on a biota treatment plant intake, and remaining contracts to move water from the Missouri River system to Minot; and develop plans and manuals as required by the Supplemental EIS.

RED RIVER VALLEY WATER SUPPLY

Over the years, various projects have been proposed to supply Missouri River water to eastern North Dakota. More recently, between 2000 and 2007, the U.S. Bureau of Reclamation and Garrison Diversion Conservancy District developed plans for a Red River Valley Water Supply Project (RRVWSP). This effort culminated in an EIS and preferred alternative, but the Secretary of the Interior never signed a Record of Decision – a requirement to move that federal project forward. In 2013, when it became apparent that a Record of Decision would not be signed, the State Water Commission, in cooperation with the Lake Agassiz Water Authority began pursuit of a state and local project.

In early 2014, the Water Commission entered into an agreement for a Value Engineering (VE) study that focused on potential alternatives for a proposed state and local project. From the VE, three alignments were identified as being the most likely to meet criteria for future consideration. Those options were the Washburn to Baldhill Creek, Bismarck to Lake Ashtabula, and Bismarck to Fargo and Grand Forks routes (See Map Appendix).

Following completion of the VE, the state moved forward with an intake analysis effort to identify the potential locations and design of an intake from the Missouri River between Washburn and south Bismarck.

To support the advancement of this water supply project that will eventually provide a reliable, high quality source of water to eastern North Dakota, the Water Commission has budgeted \$150 million during the 2015-2017 biennium.

SHEYENNE RIVER FLOOD CONTROL

Flood events along the Sheyenne River in recent years have severely impacted and tested communities like Valley City, Lisbon, and Fort Ransom. For that reason, each of those communities is working to implement more permanent flood protection.

During the 2015-2017 biennium, Phase II of the Valley City permanent flood protection project will focus on protecting downtown areas – including critical infrastructure such as the city hall, fire department, police station, public works, Mercy Hospital, Sanford Clinic, and downtown business district.

Like Valley City, Phase II of Lisbon’s permanent flood protection project will proceed during the 2015-2017 biennium. Phase II projects will consist

of levees, a floodwall, infrastructure relocations, property acquisitions, storm water pump stations, and removable floodwall closure structures.

Fort Ransom is seeking protection from a 500-year event, though project specifics are still being developed.

Recognizing the need for improved flood control efforts along the Sheyenne River, the Water Commission has budgeted \$55 million to advance projects in those communities. It is expected that a portion of the budgeted amount will be provided in the form of loans.

SOUTHWEST PIPELINE

NDCC, Section 61-24.3 declares necessary that the Southwest Pipeline Project “...be established and constructed, to provide for the supplementation of the water resources of a portion of the area of North Dakota south and west of the Missouri River with water supplies from the Missouri River for multiple purposes, including domestic, rural, and municipal uses.” The Water Commission has been working to develop the Southwest Pipeline ever since – with construction beginning in 1986. (NDCC 61-24.5 authorizes the Commission and Southwest Water Authority to construct, operate, and maintain the project.)

Southwest Pipeline is currently serving about 58,000 residents, including more than 5,350 rural service locations, 31 communities, and 23 raw water customers (See Map Appendix). With unprecedented growth continuing in that portion of the state, the need for reliable water supplies to support that growth has never been greater. During the 2013-2015 biennium, unprecedented progress has been made on this project, with plans for additional advancements in the 2015-2017 biennium.



The \$100 million budgeted for the Southwest Pipeline Project will be used to build additional water treatment plant capacity, increase storage capacity of raw water and potable water, and increase pumping and pipeline capacity by upgrading and paralleling pipelines. When the main transmission lines are completed, the city of Killdeer will be connected to the project. Other construction efforts will provide water service to the city of Rhame.

WATER SUPPLY PROGRAM

Federal funding for water supply projects through the Municipal, Rural, and Industrial (MR&I) Water Supply Program has decreased dramatically in recent biennia. For that reason, the state has increased investments in municipal, rural, and regional water supply system advancements across the state.

As previously outlined in the inventory of water project funding needs for the 2015-2017 biennium, there is a large number of communities, and rural systems seeking funding for a broad spectrum of efforts. To support many of these projects, the Water Commission has budgeted \$206 million for municipal and rural water supply projects during the 2015-2017 biennium, including a combination of grants and loans.

WESTERN AREA WATER SUPPLY

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 – both for drilling processes, and a growing workforce.

With current drilling activity in the region, existing water supplies are being stretched to their limits. And, with future drilling expected to continue in the coming years, the strain on water supplies is only expected to intensify. This is particularly true of areas that are relying heavily on ground water resources. For that reason, development of water supply systems that utilize abundant Missouri River water have become a priority in that region of the state.

Western Area Water Supply (WAWS) project has involved a collaborative effort between the city of Williston, Williams Rural Water District, McKenzie Water Resource District, Burke-Divide-Williams Rural Water, and R&T Water Supply Association (including the cities of Ray, Tioga, and Stanley). As originally envisioned, WAWS has been making progress toward the development of this regional system to deliver Missouri River water from the Williston Regional Water Treatment Plant to areas throughout the northwest, oil producing areas of the state (See Map Appendix).

Several water supply systems are currently being serviced by WAWS, including Williston, Watford City, Ray, Tioga, Stanley, Wildrose, Crosby, Noonan, Columbus, and Fortuna, as well as McKenzie Rural Water, Burke-Divide-Williams Rural Water, and Williams Rural Water districts.

In 2014, an expansion of the Williston Regional Water Treatment Plant was completed, bringing the plant from 10 MGD to 14 MGD. The next expansion is underway, upgrading the plant capacity to 21 MGD. That project is scheduled for completion in the spring of 2015. Additional contracts for primary transmission lines, pump stations, and reservoirs are also underway throughout the system. And, WAWS is rapidly expanding rural service connections. By the end of 2014, WAWS (through Williams and McKenzie Rural Water Systems) will be servicing about 3,300 rural locations, with plans for many more in the future.

WAWS currently has the following water depots operating and generating revenue: McKenzie County's System II Keene, McKenzie County's Indian Hills, the city of Williston's 2nd Street and North Williston, 13 Mile Corner, Alexander, Watford City, R&T, and Stanley. Direct water pipeline connections have also been made available by WAWS to oil companies interested in direct supply lines to drilling locations.

In response to this increased demand for water service and the associated planning efforts that have been completed, the WAWS Authority board of directors has requested funding for Phase IV during

the 2015-2017 biennium - totaling \$120 million. The Water Commission has designated that amount for this project, including a combination of grant and loan.

More specifically, during the 2015-2017 biennium, the WAWS Authority will: expand rural water distribution in the Burke-Divide-Williams service area; make transmission system improvements and expand rural distribution in the McKenzie County Water Resource District service area; construct water treatment plant improvements, make transmission system improvements, and expand rural distribution in the R&T Water Supply System service area; design the next water treatment plant expansion, make transmission system improvements, and construct elements of a pretreatment superstructure in Williston; and complete various transmission system improvements and rural water system expansions in the Williams Rural Water District service area.

WILLISTON FLOOD CONTROL

Williston's Bell Acres subdivision and other properties located on the west side of Williston have historically experienced periodic flooding – both from local watersheds and backwater from Sand Creek. The city expects the frequency and duration of these flood events to increase given rapid development occurring in the watershed. To address this issue, Williston commissioned a study that recommended a combination of upstream detention and downstream conveyance improvements. Once this four-phase project is completed it will provide 100-year protection for this portion of Williston.

The Water Commission has budgeted for up to 60 percent of eligible costs associated with this project, or about \$7 million during the 2015-2017 biennium. Per Water Commission cost-share policy, this project may also be eligible to receive loans for a portion of the local share.

FUTURE WATER DEVELOPMENT FUNDING NEEDS BEYOND 2015-2017

Many of North Dakota's largest water projects cannot be completed in one or even two biennia, but rather, require longer-term financial planning. This is particularly the case for some of North Dakota's larger water project funding priorities. Though water projects are some of the most complicated to move forward, and are incredibly difficult to plan for financially, it is worthwhile to recognize and plan for future commitments that may be needed to move critical water infrastructure forward in future biennia.

In flood control efforts, major projects like the Fargo-Moorhead area diversion, Mouse River enhanced flood protection, Grafton, Williston, and Sheyenne River flood control will all be seeking future funding commitments from the state. In addition, major regional water supply projects like Southwest Pipeline, Western Area Water Supply, Northwest Area Water Supply, and an eastern North Dakota water supply project will all require large amounts of financial support to succeed in the future. This is also the case for numerous communities and rural water systems seeking to expand and improve their water supply systems in all corners of the state.

Special Water Management & Development Topics

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

APPORTIONMENT

Water quantity apportionment can be defined as a “sharing and/or dividing” of water amongst its shareholders based upon a legally binding agreement or plan.

Two river basins in North Dakota are involved with apportionment agreements. The first was formalized in the 1940s when the International Joint Commission recommended interim measures for the sharing of the water of the Mouse (Souris) River. The interim measures were approved by the U.S. and Canadian governments in 1941 with most recent revisions made in 2000. The other apportionment agreement involves the 1950 Yellowstone River Compact. The compact agreement involves Montana, Wyoming and North Dakota.

In recent years there has been an interest, particularly by the Province of Manitoba, to apportion waters of the Red River. The Red River is an international river that is shared by North Dakota, Minnesota, South Dakota and the Province of Manitoba, Canada. Historic streamflow records reveal that flows in the Red River of the North are extremely variable seasonally, annually and during both drought and wet climatic cycles. At times during extreme drought conditions, the Red

River has had extended periods of no flow at Fargo. Several factors, such as increase demand for water due to population increase, economic growth, and the uncertainty of climate change have resulted in concern expressed by some that target flows should be determined at the international boundary to ensure that a minimal amount of water is available for downstream users in the basin.

With more demands placed on the flows of the Red River by current and anticipated future water users in the basin, the International Red River Board (IRRB), a board of the International Joint Commission, is responding to the concerns raised and is studying apportionment issues relating to the Red River basin. The ultimate goal is to assess, identify, and recommend a process for the development and implementation of a flow target rate at the international boundary that will enable equitable sharing of flows in the Red River between Canada and the United States. The flow target rate would also take into consideration minimum instream flow needs for water flow conditions to sustain aquatic life such as fish and their life stages that are dependent upon streamflow regimes for survival.

To date, the IRRB has funded a literature review on apportionment of the Red River, the development of a report that identifies a process to develop and implement water quantity apportionment procedures, and an instream flow needs study. The IRRB continues to pursue an equitable resolution to the international water quantity apportionment issue involving the Red River basin.

At some point, formal discussion and negotiation regarding apportionment of the Red River will most likely begin. The process will be lengthy, requiring detailed hydrologic studies involving analysis of water appropriations, instream flow requirements, water use and flow conditions. Any formal agreement will require negotiations that must be mutually acceptable to all entities involved. It is anticipated that this process will take several years to complete.

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.” Over the last two decades, ANS have become increasingly important in regards to North Dakota water projects.

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 Red River Valley Water Supply have all had to address the ANS issue in one way or another.

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 North Dakota, the ANS that have been documented in the waters of the state include curlyleaf pondweed, Eurasian watermilfoil, silver carp, and zebra mussels. In general, these ANS are found in some parts of the state, and not others, or have been documented once, but not in following years. For example, zebra mussel veligers (juveniles) were observed in the Red River near the Ottertail River confluence for several years, but have not been identified anywhere else in the Red River in North Dakota, nor for the last several years. 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 the coming years North Dakota will have to grapple with numerous ANS threatening to invade from all directions.

In a study from the University of Notre Dame, the impact of zebra mussels on the Great Lakes region was \$27 million annually for municipalities, power plants, and other industrial water uses. 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.

Water management organizations throughout the state are finding that ANS are requiring an increasing amount of their time and resources. The key to addressing this problem in North Dakota is 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.

CLOUD MODIFICATION

The North Dakota Cloud Modification Project (NDCMP) has been in existence for many years, and it currently serves six western counties in the state. The NDCMP has two goals: 1) suppression of damaging hail; and 2) enhancement of rainfall. Because of the long period that the NDCMP has operated in North Dakota, it has allowed a thorough examination of the science of cloud seeding.

Cloud seeding provides an opportunity to increase the number of efficient ice nuclei in the seeded cloud, which in turn reduces the severity of hail, and increases the amount, frequency, and distribution of rain. The most recent evaluations of the cloud seeding program in North Dakota indicate a 45 percent reduction in crop-hail losses, a six percent increase in wheat yields, and up to a 10 percent increase in rainfall. The analysis of hail reduction or hail suppression shows the average crop value saved through cloud seeding is \$3.7 million per year, and with a 10 percent increase in rainfall, a total direct impact of \$19.7 million per year.

When the top of a growing cumulonimbus (thunderstorm) cools below freezing, water droplets don't immediately freeze. Instead, they become "super cooled." Windblown dust and soil particles provide the "seeds" for the development of ice crystals. Many times, however, these dust particles are either too inefficient or too few in number to provide sufficient nucleation.

Cumulonimbus clouds can also generate damaging hail. Cloud seeding can be used to reduce a storm's severity by adding efficient nuclei and increasing competition for cloud water altering energy transfer in the cloud, changing the trajectory of cloud particles, and ultimately modifying the size of ice particles.

The cloud seeding process increases precipitation by enhancing ice crystal or raindrop production in clouds. This is accomplished by using ice-forming agents, such as silver iodide or dry ice, or water attracting agents like salt. As seeding accelerates the precipitation process, the seeded cloud becomes a more efficient producer of precipitation. To reduce the severity of a potential hailstorm, cloud seeding is used to increase competition for cloud water through the addition of more efficient ice nuclei, and to spread the energy released by the storm over a larger area.

Silver iodide and dry ice (solid carbon dioxide) have been selected for their environmental safety and superior efficiency in producing ice in clouds. Research has clearly documented that cloud

seeding with silver iodide aerosols shows no environmentally harmful effect.

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. Because Devils Lake does not have a natural outlet at its current elevation, it is either rising or falling in response to climatic conditions, a condition that 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 winter 2014, was at an elevation of 1,452.3 feet above mean sea level (amsl), a rise of over 29 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, 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 outlets to the Sheyenne River, basin water management, and infrastructure protection.

The Devils Lake Outlets

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. In 2010, construction increased the capacity of the West Devils Lake outlet to a maximum of 250 cfs. In 2012, in response to rapid increases in lake levels, the state built an additional outlet on the east side of Devils Lake, with a maximum capacity of 350 cfs. The combined operating capacity of both east and west outlets is 600 cfs (Figure 20). To keep stakeholders informed about outlet operations, the Devils Lake Outlets Advisory Board meets at least once per year.

Upper Basin Water Management

There have been numerous efforts at upper basin water management in the Devils Lake Basin, including storage and land management programs. Various efforts to store water and reduce runoff in the upper basin continue - mostly through a variety of conservation programs.

Infrastructure Protection

Since the lake began its rise in 1993, over \$1 billion has been spent on infrastructure 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. While vital infrastructure such as roads, the levee around the city of Devils Lake, or rail lines have, or are being raised above the overflow elevation of Devils Lake, the lake continues to flood homesteads and farm land in rural areas, creating significant impacts.

DRAINAGE - SURFACE SYSTEMS

Surface drainage has been a popular tool in North Dakota since statehood. Primarily it is associated with agriculture and the clearing of water to include ponds, sloughs, lakes, and sheetwater. By draining water off of agricultural land, farmers can increase yields in marginal areas of their property, increase planting acreage, plant fields earlier in the year, and increase the value of their property overall.

Unlike subsurface drainage, or drain tiling, surface drainage has a clear-cut permitting process and is outlined in Article 89-02 "Drainage of Water" in the Office of the State Engineer's Administrative Code.

Devils Lake Outlet Discharges, 2007-2014

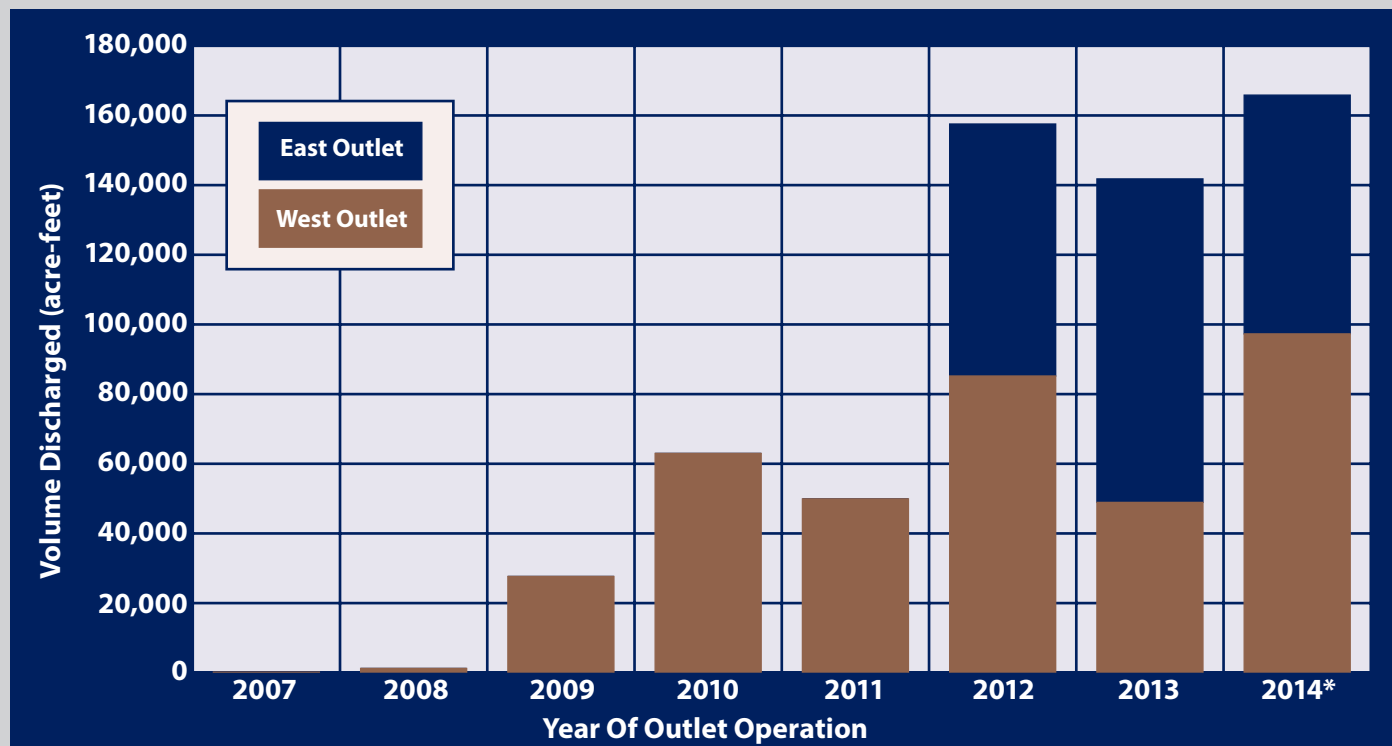


Figure 20. Devils Lake outlet discharges, 2007-2014.

A permit is required before any person may drain by pumping a pond, slough, lake, sheetwater, or any combination having a watershed of eighty acres or more. Permits are also required for instances of constructing a drain and modifying a drainage that had previously been permitted.

Additionally, a permit is required when a person wants to fill a pond, slough, lake, or sheetwater which has a watershed of eighty acres or more, for the purpose of causing the water body to be drained by elimination of all or a portion of the existing storage.

DRAINAGE - TILE SYSTEMS

Historically, most drain tile was made from short, cylindrical sections of concrete or clay called “tile,” resulting in sub-surface drains being called “tile drains.”

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 ground water that is saturating the soils, and transports it away from the field. From there, the water is discharged into a water body, 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. Other benefits of tile drainage include higher land values, reduction of soil moisture levels for optimal crop growth, and increased productivity for crop growth.

Tile drainage allows for timely fieldwork, and crop growth on soils that would otherwise be marginal for agriculture because of flooded land or a high water table. The downside of this practice is that it has the potential to 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. However, the use of well designed flood control structures can maximize water storage and reduce flood flows, when properly managed.

One major change that has occurred since the last writing of the State Water Management Plan is the procedures in which tile drainage project applications are processed and permitted. During the 2011 Legislative Session, N.D.C.C. 61-32-03.1 was passed. This new law transferred the primary permitting responsibilities away from the Office of the State Engineer, to individual Water Resource



Districts. The Office of the State Engineer is only involved in the permitting process if a project is determined by a water resource district to be of statewide significance.

In the 10 years preceding the writing of the last edition of the 2009 State Water Plan, approximately 180 tile drain permits were approved and issued. Since that time, the number of applications approved by local water resource districts has increased tremendously; including 158, 182 and 200 permits approved in 2011, 2012, and 2013, respectively. But, not all water resource districts have been submitting approved permit information to the Office of the State Engineer. So, these numbers are based off the ones that have.

Since the law changed in 2011, it is estimated that 88,100 acres or 132 square miles of land have been tiled in North Dakota.

All permits received from the water resource districts have been entered into the database of the Office of the State Engineer as of the writing of this document.

It is expected that based on the benefits to landowners and farmers, installation of tile drainage will continue into the future.

DROUGHT MANAGEMENT PLANNING

Drought is a climatic phenomenon that will always occur. The uncertainty surrounding drought is not if another drought will occur, but rather what will be the severity, regional extent and duration of the next drought. North Dakota has experienced numerous droughts and will continue to do so. The hardship of drought is not only economic but also affects the social well being of those impacted. As the impacts of drought are multifaceted, it dramatically affects peoples lives in many different ways.

North Dakota does not have a comprehensive drought contingency plan, however the state does have a statewide Drought Response Plan that goes into effect during serious drought. The Drought

Response Plan is typically initiated by impacts that occur in the agricultural sector, such as lack of forage or water supplies for livestock, and crop failure due to drought. To activate the Drought Response Plan, the Governor declares a drought emergency – including identifying a geographic area within the state. Federal and state agencies can then respond to the drought by activating programs that will assist in the drought emergency. Any type of assistance, available from federal or state drought programs, is dependent upon money being available or appropriated for the specific drought programs.

Most of the federally managed reservoirs have incorporated into their individual reservoir operating plans modification to reservoir operations that go into effect during prolonged drought conditions. In addition, many of North Dakota's major cities have drought contingency plans that are triggered when drought conditions, contamination, or mechanical failure affects their water supply. Some measures that are implemented by cities during drought conditions include requests by the cities to individual water users to limit and/or restrict outdoor water use, such as watering lawns and washing cars.

In addition, the Red River Basin Commission is pursuing drought-planning efforts for the Red River Basin. This includes a communication process that will ultimately result in enabling decisions regarding water use and restriction among the state and international jurisdictions in the Red River Basin.

A North Dakota Drought Contingency Plan that clearly identifies those responsible for monitoring the precursors to drought, plus establishing drought indicators and trigger mechanisms to determine appropriate responses would be helpful to prepare for and mitigate drought impacts more quickly and effectively.

INDIAN WATER RIGHTS

Over a hundred years ago, the United States Supreme Court issued one of the 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 pre-date state law water rights.

While the Winters case 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 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.

As a result, 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.

The Water Commission and State Engineer are committed to building a foundation for a meaningful relationship with the Indian nations located within the state to establish cooperative water management. Presently, preliminary discussions are ongoing with the Standing Rock Sioux Tribe involving their tribal reserved water rights.

INFORMATION TECHNOLOGY (IT)

The Water Commission utilizes IT in almost all aspects of water resource management. The primary responsibility of the IT Section, is to provide the technology infrastructure required to support the scientific and regulatory functions, as well as the routine office and back-office automation functions that the agency utilizes to meet its stated mission.

As the demands on the state's water resources continue to grow and evolve, the Water Commission is faced with additional challenges to provide

more and better information related to the state's water resources. These challenges continue to place an increasing emphasis on both the spatial and temporal relationships that are inherent to managing water resource systems. In order to address these areas, the agency has developed and deployed additional spatial and graphical tools to address the complex relationships within the water resource data. In many cases, these tools have been integrated directly into the data management applications to address these complexities within the data development and data management processes.

With increasing demands for water related to oil activity in western North Dakota, the Water Commission has faced additional challenges associated with monitoring water withdrawals from both surface and ground water sources. In an effort to provide more effective capabilities for monitoring water withdrawals in western North Dakota, the Water Commission has deployed SOAP (Simple Object Access Protocol) services for real-time reporting, using available industry telemetry solutions. The service designed by the Water Commission provides a minimal footprint, with limited intrusion into the commercial telemetry software and hardware that are currently available. Not only does the web services solution provide simple accessibility, it provides scalability for North Dakota to extend this type of monitoring beyond the limited scope of water withdrawals for oil activity in western North Dakota.

The initial implementation was tested at a couple of sites in 2012. As testing was completed, production services were implemented at a few sites in mid-2013. It is likely that utilization of this service will be expanded to include most of the oil-related water depots in western North Dakota by early 2015. As demands for water continue to grow, it is possible that in the future these types of services may be extended to other resource monitoring areas.

Beyond the basic requirements and demands for better tools and management capabilities, the agency has also been faced with significant demands for additional bandwidth and capacity. As more and more data are collected to support an array

of management initiatives, an additional burden is placed on the IT infrastructure to provide the necessary storage, bandwidth, and computational capabilities to store, process, and analyze these data. Increasing demands for aerial imagery and LiDAR data have placed tremendous demands upon the agency infrastructure for data storage, and for the associated tools to maintain and disseminate these data. The agency's storage infrastructure has grown from just under 1 terabyte (TB) in 2002 to over 180 TB in 2013, and is expected to exceed 280 TB by 2015 (Figure 21).

In addition to the tools and resources that are used internally, the Water Commission has also leveraged IT infrastructure to provide complete access to all of the data resources that the agency maintains to the public, through an array of web services. All of the water resource data for North Dakota are made available through the agency web site (<http://www.swc.nd.gov>). This includes all of the site information that is used for monitoring ground water resources in the state, which includes subsurface lithology, water levels, water chemistry and associated site information. The agency web site also includes data on precipitation, dams, drains, dikes, and other retention structures that are monitored by the Water Commission.

Water Commission Digital Storage

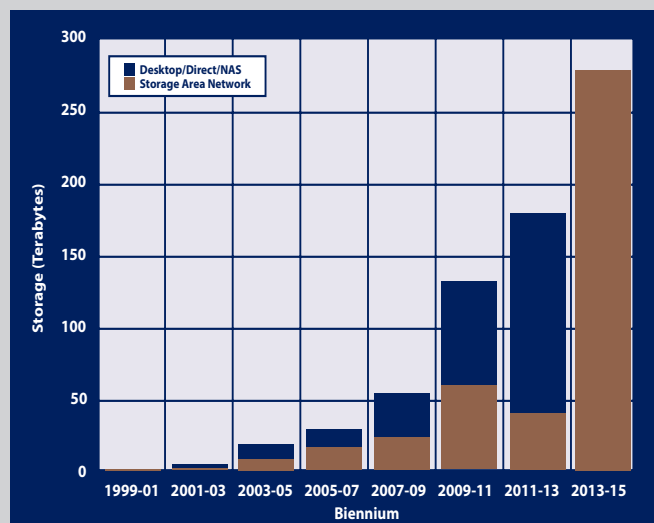


Figure 21. Water Commission digital storage.

In addition to the wide range of data resources that are integrated into the agency's web services, the Water Commission maintains a site dedicated to the surveying community that includes more than 2,800 Government Land Office plat maps, along with all of the first and second order benchmarks (<http://survey.swc.nd.gov>). During the 2011-2013 biennium, the Water Commission developed a map service that was originally designed to address the storage and dissemination of the massive amounts of LiDAR data collected in North Dakota (<http://lidar.swc.nd.gov>). This site has grown, and now includes LiDAR data from nearly a dozen different projects, which includes approximately 15 TB of raw data.

Data available for public use:

- Government Land Office Plats
- Precipitation and Hail Data
- Survey Horizontal and Vertical Control
- Water Permit Data
- Various Groundwater Studies
- Drainage Permit Data
- Well and Site Location Data
- Stream Flow Data
- Lithologic Data
- Construction Permit Data
- Water Chemistry Data
- Retention Structure Data
- Water Level Data
- Digital Map Data
- Lidar
- Well Driller's Reports
- Weather Radar Data

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.



Aerial image looking east over the international border dike during the 2009 flood. North Dakota 18 is in the foreground, the town of Neche is ½ mile south.

The slope of the land in this portion of 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 threatening to flood farmsteads.

The dike has been periodically raised and lengthened since its original construction, and it 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 Water Commission, and Manitoba government officials. In 1956, a large drain to relieve flooding was jointly constructed by the Water Commission and Manitoba's Rural Municipality (RM) of Rhineland. The drain runs parallel to the border, on the Canadian side, from about 1 mile west of Gretna, and continues east about 8 miles to the Aux Marais crossing. The drain crosses the dike and ties into the Aux Marais channel.

Along the western portion of the dike, two crossings have been equipped with substantial culverts designed to handle the local runoff in a cooperative 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, where breakout flows from the Pembina River occur. As a result, Pembina County has initiated a lawsuit in Manitoba to have the

dike completely removed or breached in critical locations. A judgment is expected in the lawsuit in 2016.

While the lawsuit has been ongoing, a separate effort to address the border dike issue has been attempted by the governmental entities with responsibilities related to this inter-jurisdictional challenge. The Pembina River Basin Advisory Board, consisting of local leaders from North Dakota and Manitoba, requested that the International Red River Board (IRRB) help to solve the flooding issues being faced. The IRRB, (created under the authority of the International Joint Commission), developed a technical team to oversee the development of a model to analyze the current conditions as well as possible alternatives to reduce flood damage.

The modeling report, entitled "Simulation of Flood Scenarios on the Lower Pembina River Flood Plains with the Telemac2D Hydrodynamic Model-Phase 3" by National Research Council Canada and a report by the Lower Pembina River Flooding Task Team were finalized in the fall of 2012. Several proposed alternatives were analyzed.

In addition, the Governor of North Dakota and the Premier of Manitoba have organized the Pembina River Basin Task Team, with membership from North Dakota, Manitoba, and the IRRB. This effort is designed to review data and output from models in order to develop recommendations for a mutually agreeable solution for all concerned parties. Along with reviewing the possible alternatives described in the previous reports, additional information is being collected. A final report on this effort is expected in 2014 or early 2015.

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, federal access restrictions, 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 interest 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 the beneficial use of its citizens.

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 supported.

Most recently, a potentially new Missouri River stakeholder group is in the process of being formed.

A coordinator has been hired to move the process forward, and it is jointly funded by the Garrison Diversion Conservancy District, and the State Water Commission. The coordinator will work with various Missouri River stakeholders to identify issues important to them, to gage stakeholder interest in the development of some type of formal group, and to plan a Missouri River working conference for stakeholders to discuss issues and a potential path forward for a more formal group.

In recent years, North Dakota has again been challenged by the U.S. Army Corps of Engineers on its rights to Missouri River water. In 2010, the Corps placed a moratorium on issuing new real estate permits, which essentially blocked any new industrial water intakes around Lake Sakakawea. Their proposed solution to issuing real estate leases was to charge North Dakota water users for the use of “Surplus Water” stored behind Garrison Dam. The Corps has not yet charged any users, and in February 2013 lifted the moratorium, but has not been forthcoming with the issuance of easements and access.

The Missouri River is the state’s most valuable and readily available water source, and it is needed for a broad spectrum of beneficial uses, such as irrigation, drinking water supplies, and industry. The State of North Dakota owns the natural flows of the Missouri River, into and through Lake Sakakawea and Oahe. Historic, pre-Garrison Dam flows of the Missouri River near Williston are approximately 17.6 million acre-feet annually. Only 570,000 acre-feet were permitted by the state for beneficial uses in 2010. Approximately 81% of the permitted usage of water is used for power generation and returned to the river. By evaluating the inflows and permitted water usage for beneficial use, it is clear that the people of North Dakota use only a small portion of water that flows through the Missouri River. Thus, North Dakota’s Missouri River water users do not rely on water stored behind the dams.

Areas along the Missouri River in Bismarck are still involved in flood recovery projects in response to the flooding that took place in 2011. These efforts are expected to continue in years to come.

MOUSE RIVER FLOOD 2011

The Mouse River, or the Souris River as it is known in Canada, originates in southeast Saskatchewan near the city of Wayburn. From there, the Mouse river meanders into North Dakota near Sherwood, through Minot, to its southernmost point at Velva, North Dakota. From Velva, the Mouse turns back to the north and into Manitoba.

The Mouse River basin drains nearly 23,600 square miles and has a long history of flooding. Some of the biggest floods on record happened in 1969, 1976, and 2011. The Mouse River flood of 2011 has been the biggest flood event in recorded history by far (Figure 22).

The meteorological conditions that contributed to the 2011 Mouse River flood were extremely unusual. In order to comprehend the chain of weather events that set the flooding in motion, it is necessary to look back on the 2010 growing season. The entire Mouse River basin received above-normal precipitation from April through September. In North Dakota, 150-200 percent of normal precipitation was commonplace along the Mouse River. According to Environment Canada, the spring of 2010 was southern Saskatchewan's wettest on record. As the growing season came to an end, unbelievable amounts of precipitation had fallen over the basin. Regina, Saskatchewan, just north of where the river originates, received a record 20.35 inches of precipitation between April and September.

Mouse River Historic Crests At Minot

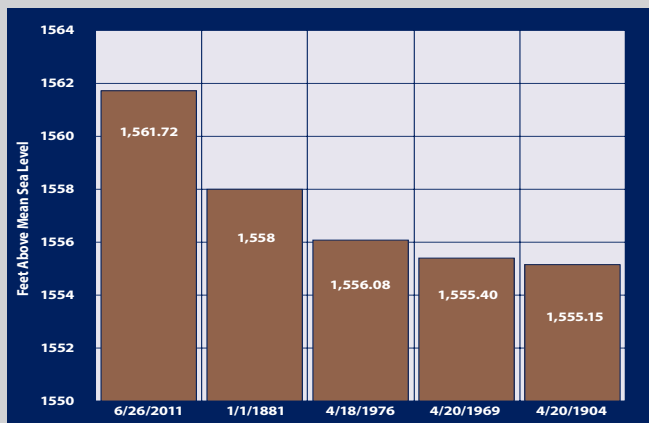


Figure 22. Mouse River historic crests at Minot.

Following the extremely wet growing season of 2010, North Dakota and Saskatchewan were bombarded with additional moisture in the form of heavy rain and snow before the ground froze in mid-November. Environment Canada reported that November 2010 was the snowiest on record for Regina, and that nearly two-thirds of the city's average annual precipitation was received in snowfall in October and November alone. Farther south at the Minot Experimental Station, similar conditions were reported. The stations snowfall through December 3 had already reached 24.3 inches, just 15 inches under the July 1 through June 30 seasonal average.

The winter months in the Mouse River basin continued to be snowier than average, with below-average temperatures. These conditions raised considerable concerns for spring flooding. According to the March 1, 2011 Snow Water Equivalent Map, a widespread six to eight inches of water was already in place over the frozen saturated soils before snowmelt even began.

Then, in early May, heavy rains began to fall. These rains consumed reservoir storage and set a new May 1 through June 30 record rainfall total for Estevan, Saskatchewan. Canada's "The Weather Network" reported that Estevan had received 12.76 inches of rain between May 1 and June 21. The average annual rainfall for Estevan is 13.11 inches, making it apparent that this was yet another unprecedented period of weather leading up to a large-scale flood. Looking farther downstream at North Dakota's rainfall, 9 to 11 inches of rain were recorded from May 1 through June 30, 2011.

During the time that the region was receiving so much precipitation in the form of rain during the spring of 2011, there were already signs of flooding, and actions were being taken throughout the region to mitigate for the flooding. Levees were being built and raised, critical infrastructure such as schools and lift stations were being diked, and every road in Minot, except for Broadway and 3rd, and the Highway 83 bypass from North Hill to South Hill was closed. This meant that there was a two and a half, to four-hour wait to get anywhere in town.

Despite all of the preparations, the volume of water that was filling up the Mouse River valley proved too enormous for the communities to defend against. It was obvious that homes, businesses, and infrastructure was going to be affected to varying degrees along the Mouse River.

Minot's two major dikes protected some 600 homes, a half dozen churches, several businesses, Trinity Nursing Home, two elementary schools, and two major roads. While the dikes in Minot protected some homes, businesses, and infrastructure, most of the valley was not so lucky. Mouse River Park in Renville County was under water, the bridges in Logan and Sawyer were washed out, the bridge in Velva was lost for a period of time, and the Burlington Bridge on Colton Avenue was closed with 20-plus houses under water. In Minot, of the 13 lift stations protected by ring dikes, all but one was inundated, all of Oak Park Shopping Center and Arrowhead Shopping Center were severely damaged, as were many other businesses in the valley. The North Dakota State Fair was cancelled. However, the most devastating losses were the 4,200 Minot homes that were damaged or lost in the flood. While most were salvageable, 805 homes were damaged beyond repair and were ultimately demolished. Damages were estimated to be \$1.3 billion dollars.

It was not only houses, businesses, and municipal works that were damaged. Agricultural damage from flooding was tremendous. There was damage to bridges, rural roads, riverbank erosion, and an entire floodplain that was full of trash, logs, and other debris that needed to be cleaned up.

Today, houses have been removed, repaired, or replaced. Businesses have rebuilt, and to the layperson, the region seems to be back to where it was pre-flood in 2011. However, flood recovery efforts are ongoing and will be well into the future.

Since the floodwaters receded and cleanup began, a multi-disciplinary team of professionals have been working together to create a comprehensive flood protection plan for the Mouse River. This plan is

called the Mouse River Enhanced Flood Protection Plan. Municipalities, county water resource districts, engineering firms, the State Water Commission, and the Corps of Engineers have been working together in an effort to figure out what the most useful and cost effective flood mitigation options will be.

For these efforts, the State Water Commission has funded three studies for the Mouse River Enhanced Flood Protection Plan. One concerned hydrologic and hydraulic modeling of the Mouse River, another study outlined and evaluated rural flood risk reduction, and the third focused on erosion and sedimentation that occurs during high flows of the Mouse. Plans have also been made for enhanced flood protection around municipalities.

Currently, stakeholders are still working closely with one another, and it is expected that the process will continue well into the future to provide the Mouse River valley with adequate permanent flood protection.

OIL AND GAS WATER USE NEEDS

Hydraulic fracturing for oil or gas, commonly called "fracking," is a process where water and other materials are injected into oil-bearing formations of rock under high pressure, fracturing the rock, and releasing the oil.

North Dakota has proven to have substantial deposits of oil-bearing rock suitable for fracking in two formations - the Bakken and the Three Forks. Because the drilling process requires a fair amount of water to fracture the oil-bearing rock, both surface water and ground water sources have been used. Where ground water has been used, it has generally come from freshwater aquifers within two thousand feet of the surface. The Appropriations Division of the Office of the State Engineer manages that water.

Oil wells of this type in North Dakota (Figure 23) generally require approximately eleven acre-feet of fresh water for the drilling and hydraulic fracturing process, necessitating access to reliable water supplies. The effectiveness of fracking has allowed

North Dakota to become the second largest oil producing state in the United States, with a recent estimate of 7.4 billion barrels of recoverable oil reserves.

As the technology for fracking has matured, it has become apparent that a small amount of water will need to be injected into producing oil wells in order to keep the wells producing at an acceptable level. On average, it is estimated that it will take about the same amount of water to maintain production over the life of an oil well, that it took to frack that well in the first place.

The preferred source for water used in the fracking process is the Missouri River, which runs through the heart of where oil extraction is occurring. The Missouri River system is an extremely valuable source of water, both in terms of quality and quantity. However, federal restrictions to access to

Missouri River water within the boundaries of the mainstem reservoirs has provoked water users to seek other sources.

The water being used in the fracking process represents a very small proportion of water available in North Dakota. The 19,686 acre-feet of water used for fracking in 2013 represents about 5% of total consumptive water use in the state, or less than five days of evaporation from Lake Sakakawea.

RED RIVER FLOOD MITIGATION

The Red River basin covers the eastern portion of North Dakota, the northwest portion of Minnesota, a small area in the northeast corner of South Dakota, and in Manitoba, from the international border to Lake Winnipeg. The geography is categorized by an ancient lake bed which gives the region its generally flat topography. The Red River flows north to the Hudson Bay in Canada.

North Dakota Oil Well Locations

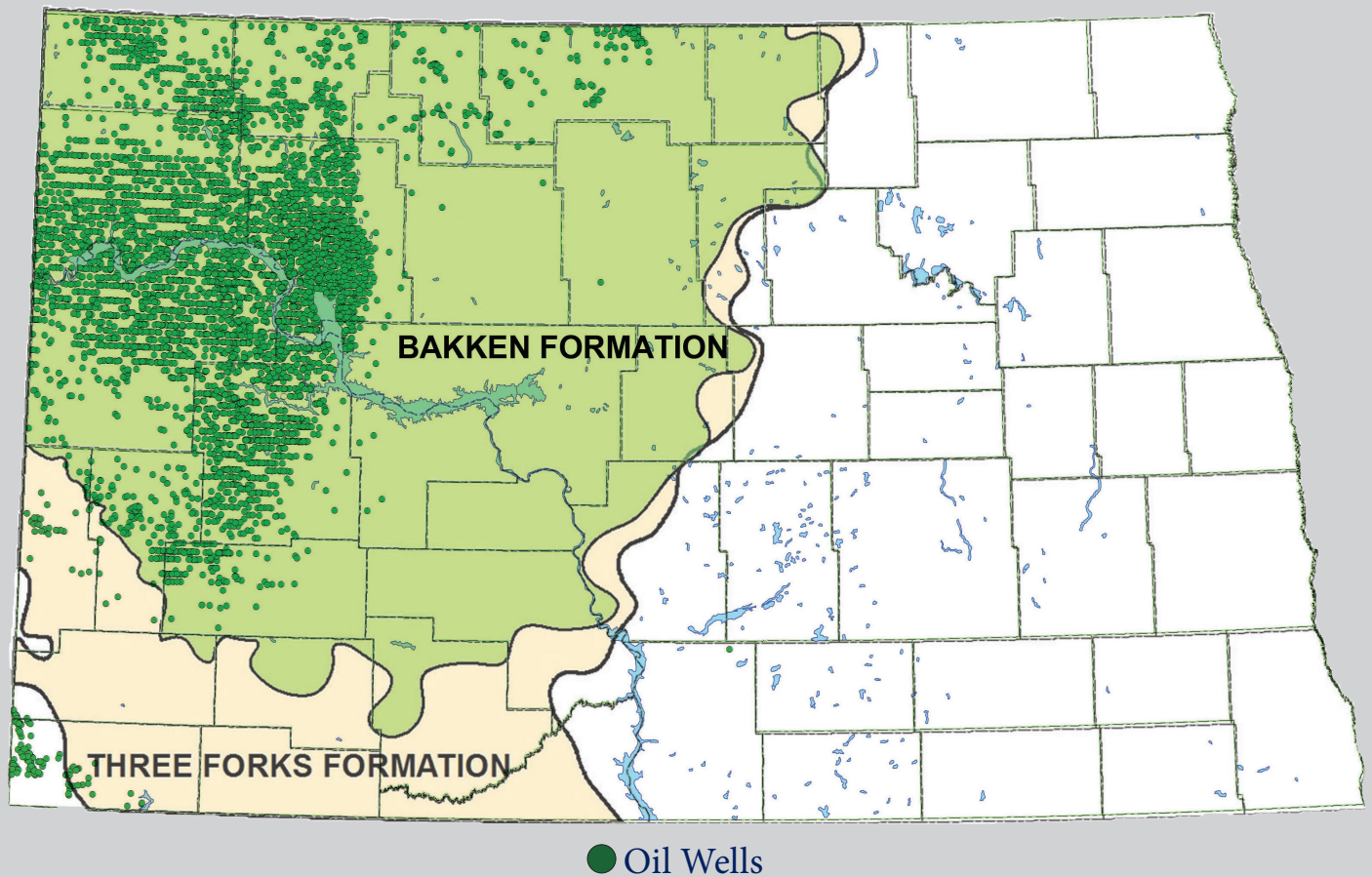


Figure 23. The location of the 7,471 oil wells in North Dakota drilled between 2007 and July 1, 2013. Not all drilled wells end up producing oil.

The Red River basin is well known for its fertile, high-value farmland, which supports a strong agricultural production industry. Fargo, the largest city in North Dakota, is situated in the central portion of the basin at the crossroads of I-94 and I-29, along the border with Minnesota. Fargo is a major commerce hub, as well as Grand Forks and Wahpeton, North Dakota. Moorhead, East Grand Forks, and Breckenridge are major towns along the Red River in Minnesota. A significant portion of North Dakota's population lives in the narrow stretch of land between I-29 and the Red River.

A History of Flooding

The Red River Basin is characterized by periodic and serious flooding (Figure 24). Depending on the year, flooding can be local or widespread. Local flooding can take place in rural areas along tributaries of the Red River, causing damage to cropland, farmsteads, and small towns situated along tributaries. It also causes economic hardship to farmers when floodwaters delay the planting of

crops. In years with heavy snowpack, depending on the spring melt conditions, widespread flooding can occur. Because of the flat topography, floodwaters can spread and threaten every city and town on the bed of what used to be Glacial Lake Agassiz.

For the past 21 years, North Dakota has been in a wet cycle, and the Red River basin has had more frequent occurrences of major flooding. In 1997, cities throughout the basin experienced major flooding. Grand Forks, ND and East Grand Forks, MN experienced the worst of the flooding, which destroyed large sections of the two cities. After that flood, the U.S. Army Corps of Engineers built a system of levees to help protect the communities from future flooding in the footprint of structures that had been destroyed by the flood. Fargo has been threatened by major flood events since 1997, including most recently in 2009 and 2011. But Fargo has been able to wage large scale and expensive food fights to protect the city. Wahpeton, ND and Breckenridge, MN have traditionally encountered

Top Ten Red River Floods At Fargo

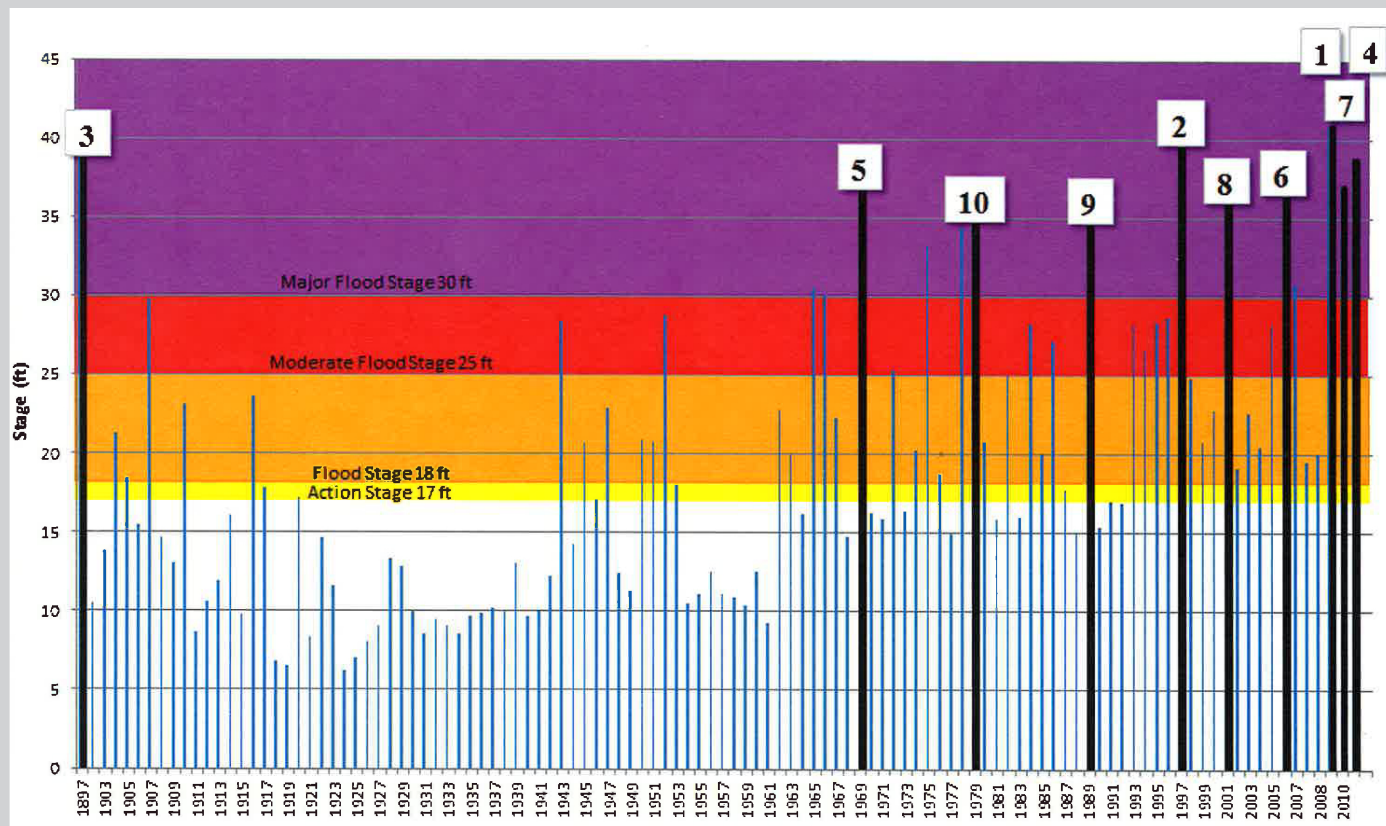


Figure 24. The top ten Red River floods at Fargo. Five of the top ten Red River floods have occurred since 2001.



flooding problems by the Red River. These communities were also severely flooded in 1997, and have since pursued and developed permanent flood protection.

Flood Damage Reduction

To combat the “Disaster-Relief-Repair-Disaster” cycle that the Red River basin has historically experienced, a multi-faceted approach has been taken to help reduce flooding impacts within the region. The work is continual, and will take many years to fully implement. The strategy takes a basin-wide approach and includes, structural and non-structural methods of flood mitigation.

Floodplain Management has been the main focus for land use practices for most of the last century. Floodplain management focuses on the avoidance of building new structures within the 100-year floodplain. This allows the regulation of human actions, rather than the regulation of humans. It requires planning on how to best develop, build, or redevelop relative to the flood hazard.

In areas of dense development, such as those that were developed adjacent to rivers, municipalities have, and are currently using buyouts in order to provide structural flood protection such as levees. Levees have been used successfully in portions of, or entire communities throughout the Red River basin to hold back floodwaters. Levees do have their drawback though; they can be intrusive, and they require a lot of maintenance and monitoring, and they run the risk of being overtopped or breached by floodwaters that exceed the design parameters of the structure.

An ongoing project in the Red River basin is the Fargo-Moorhead area diversion. This project is being led by the U.S. Army Corps of Engineers. The Red River Diversion is intended to reduce floodwaters that run through the Red between Fargo and Moorhead. To do this, floodwater staging upstream from the diversion must be approved and acquired. Further, a diversion channel is being planned that would run excessive flows around the communities and deposit the water back into the main channel further north. There are some challenges associated with this, including environmental concerns, routing, cooperation between the States of North Dakota and Minnesota, funding, and providing appropriate flood protection that would not further impact areas both to the north and south of Fargo-Moorhead.

Red River Valley Retention

The Red River Basin Commission and the Red River Retention Authority have identified floodwater retention (retention) as an important element in easing flood impacts during high water flows within the Red River Valley. Retention can be defined as the temporary holding of water in an area upstream of the area protected. Retention generally will hold back water and temporarily flood an area, while offering flood relief to areas downstream. After a period of high flow has passed, water collected in the retention area is released downstream. In recent years, the Red River Basin Commission has set a goal for 20% reduction in flood flows for each tributary of the Red River.

Recently, the State Water Commission assisted in the funding of several studies to identify potential

areas where floodwater could be retained. A large number of potential areas have been identified through computer analysis of elevations produced with LiDAR data.

TELEMETRY PILOT STUDY



The city of Parshall's water depot during the installation of their new telemetry system in February 2012. The old billing system of 53 clipboards are still hanging on the walls. The new telemetry system is at the far right of the picture.

In 2011, in response to legislative concerns about monitoring of water withdrawals in North Dakota, especially in the process of oil extraction, the Office of the State Engineer initiated a telemetry (remote, real-time data collection) pilot study at the request of Governor Dalrymple.

To address these concerns, the State Engineer took the following actions:

- An increase in the frequency of monitoring of meters by staff;
- A monthly report to be submitted by water permit holders;
- And the implementation of a pilot study, examining the feasibility of deploying telemetry at water depots.

The pilot study was divided into three phases. The first phase was research and review of existing technologies and monitoring regimes in comparable situations to avoid duplication of previous efforts, and making the process as cost effective and efficient as possible. The second phase tested the methods and feasibility of data transmission from field sites to the Office of the State Engineer using telemetry. This was potentially a large obstacle, with some regions of the state receiving sporadic or no cell phone coverage. The last phase was the installation of telemetry at four test sites, and subsequent analysis of those sites (Figure 25).

During the first phase, four possible methods of data transmission were investigated, with satellite and cell phone technologies determined to be the most effective and cost efficient.

In the second phase, sites with existing telemetry were analyzed. Only one site had existing telemetry at the beginning of the pilot study. Data communication effectiveness from that site was evaluated.

For the third phase, telemetry was installed in January 2012 at four water depots; Dodge Depot, Timber Creek, Trenton Depot, and Schaper Depot.

The end of the testing phase, which concluded in late 2012, resulted in several preliminary findings.

- Each telemetry vendor provides useful and convenient tools for analyzing data. However, all of that data is in a file format unique to that vendor. Conversion of that data into a format useful for the Office of the State Engineer would be time consuming and unmanageable for a greater number of depots than were included in the pilot study. While technology provided a manageable hurdle for telemetry, the greatest obstacles were on the data processing side, where no simple options existed to collect, process and interpret the large volumes of data that would result from telemetry for all water withdrawals.

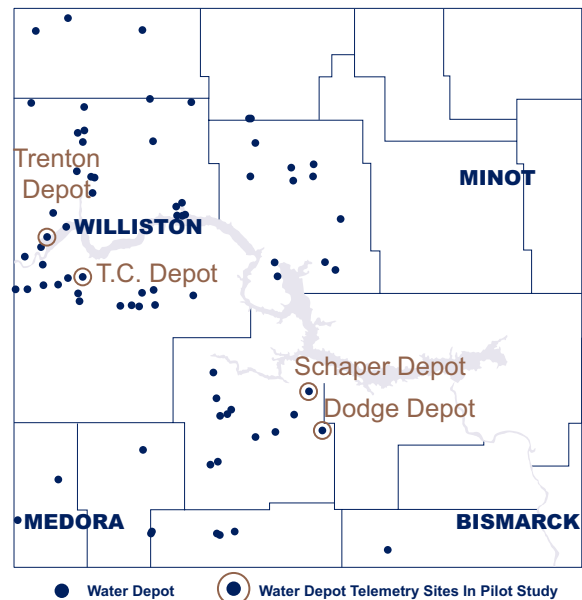
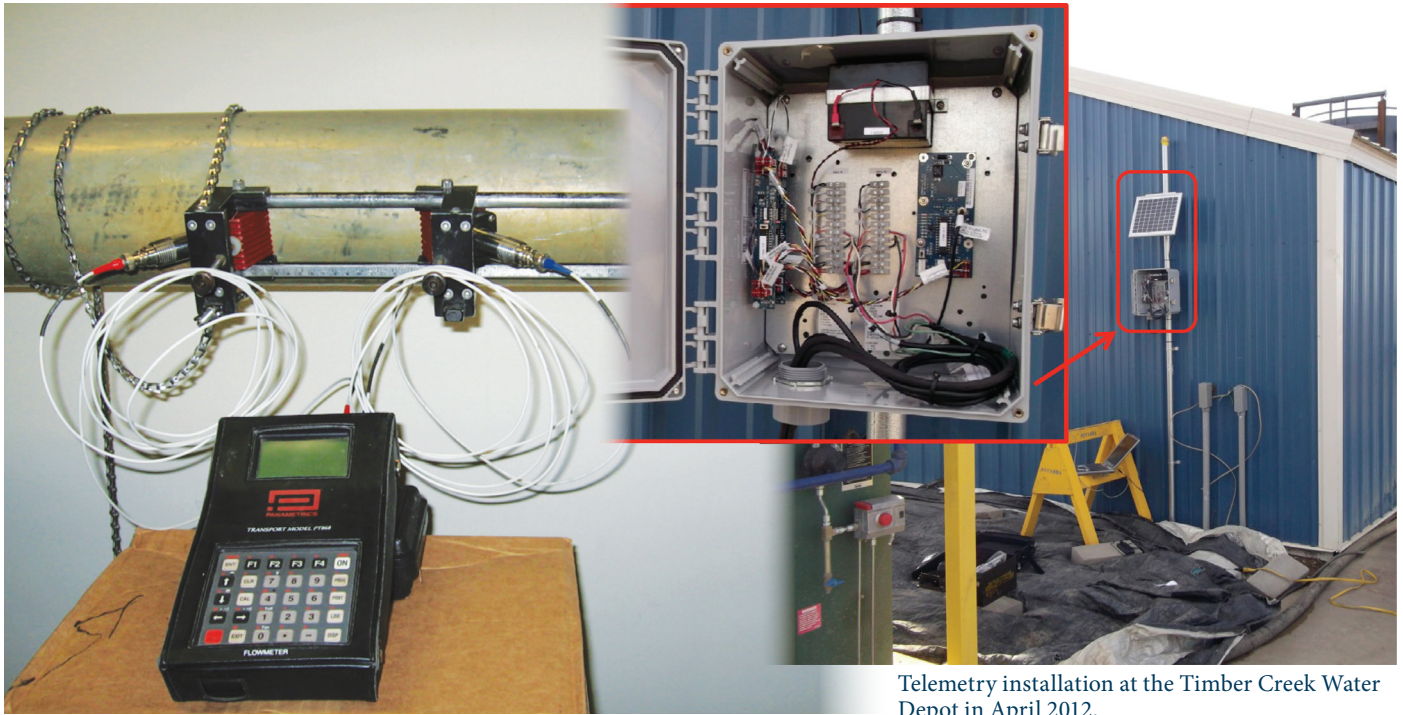


Figure 25. The location of the four telemetry sites during the pilot study in 2012.



Telemetry installation at the Timber Creek Water Depot in April 2012.

A Panametrics Ultrasonic Flow Meter - one of the devices used to measure water use.

- Any solution for statewide telemetry monitoring of water withdrawals will incur additional costs, ranging from \$1,000 to \$40,000 per site, and \$200 to \$500 in annual costs for communication and data storage services.

The completed Telemetry Pilot Study resulted in the following conclusions:

- a. One additional staff member to accommodate the increased workload will be needed in order to prevent long-term, cumulative impacts to the water resources of the state, with changes in the reporting interval at depots for water permits were determined to be sufficient, without the addition of telemetry.
- b. If telemetry is ultimately utilized, there are several alternatives.
 - i A comprehensive, completely state-controlled system, essentially creating a state-controlled supervisory control and data acquisition (SCADA) system for water depots.
 - ii A “pull” system, where the depot client chooses the telemetry vendor and associated technology from the wide variety and quality available, and the state

accesses that data periodically, resulting in what would likely be an extremely expensive and time consuming effort.

- iii A “push” system, which would result in the state mandating that water use permit holders follow consistent technologies, methodologies and data outputs, in order to facilitate rapid and accurate data analysis.
- c. That water supply depot water permit holders should pay the cost of any telemetry system, plus operations and maintenance.
 - d. Even if telemetry is pursued, regular field inspections in order to verify telemetry accuracy will still be necessary.
 - e. It is impossible to guarantee freedom from inaccuracies in the reporting of water withdrawals using telemetry. Further, the existence of telemetry data does not imply state responsibility, or liability for notification of water suppliers when they utilize the water resource beyond the permitted amount, or serve as justification for mitigation of penalties.

In addition to the telemetry pilot study, during the 2013 legislative session and during the 2014 interim

period, additional staff were approved for the Water Commission to handle the dramatic increase in water permit related workload.

WATER EDUCATION

During the 1984 public planning process, the State Water Commission identified the need to include water education as one of the agency's functions to help ensure that future generations become good stewards of the state's water resources. During the period of 1987 through 1992, the WET (Water Education for Teachers) program was developed and refined to offer a variety of hands on curriculum aimed at educating the public regarding the nature and occurrence of North Dakota's water resources.

Since 1993, WET became Project WET and expanded into an international supplemental and interdisciplinary water science education program for k-12 students and educators. The WET program that began here in North Dakota has now grown to having a Project WET program in every state in the U.S. and several other countries.

Today, North Dakota Project WET is know as the North Dakota Water Education Program. This program encompasses Project WET curriculum materials and educational resources in conjunction

with other water education resources as a means of enhancing public awareness, promoting action learning, and promoting knowledge through exploration and stewardship of North Dakota's water resources. North Dakota Water Education Program teaches water science, conservation, and best management practices by demonstrating how water interacts with both humans and natural environments within North Dakota's watersheds. Many of the programs are presented using indoor and outdoor educational experiences and the dissemination of classroom-ready teaching aids.

North Dakota's K-12 students receive water education through classroom programs, water festivals hosted across the state, or by participating in other educational programs such as environmental awareness events, camps, and community programs. The Explore Your Watershed program provides adult educational programs through credited institutes, workshops, seminars, inservice sessions for teachers, facilitator training and university preservice programs.

North Dakota Water Education programs, resources, and materials address a wide range of issues and topics in many water-related disciplines, while considering the various learning styles of

By January 1, 2015, the Office of the State Engineer is requiring that all industrial water depots in North Dakota install remote telemetry to track water use.





adults and youth. These programs are designed to enhance and compliment North Dakota’s educational standards. All programs are self contained, easy to use, non-biased, and age appropriate to develop problem solving skills and understanding of today’s water issues.

Messages are transferred to youth through informed educators, natural resource professionals, and community leaders that have participated in a Project WET, Explore Your Watershed or other water resource programs offered in North Dakota.

Since 1993, North Dakota’s Water Education Program served approximately 179,000 youth and adults. In 2013-2014 the North Dakota Water Education Program increased the Make a Splash Water Festival programs from 7 festivals to 11 festivals to ensure that students across the state have an opportunity to participate in a water program. Make A Splash Water Festivals are now hosted in Williston, Dickinson, Bottineau, Minot, Grand Forks, Fargo, Wahpeton, Kathryn, Bismarck, Fort Totten, and Mandan.

The dramatic increase in the diversity and number of residents, the prominent occurrence of flooding and drought, and other water issues that have surfaced in the oil fields have been the driving force behind the need to expand water education programs across the state.

The North Dakota Water Education Program has embraced technology as another avenue to promote stewardship and best practices. Through the use of social media, webpages and promotion of Discoverwater.org, the program is able to have a greater impact. Using social media,

such as Facebook, and flicker, the public is able to be informed of upcoming events, meetings and educational opportunities in their area. The program is able to distribute education and informational materials and resources by posting them on the state webpage that is accessible to the public at any time. Both students and adults can learn basic water principles through a fun, interactive, educational program at Discoverwater.org.

As we continue to grow, North Dakota Water Education Program will explore different avenues to ensure the public has the opportunity to learn more about how water impacts their lives every day, and how to guarantee tomorrow’s generation access to clean and useable water.

WATER USE TECHNOLOGY INNOVATIONS

Horizontal Wells

Irrigation development in some areas has been limited due to thin saturated thickness and/or fine textured sediments resulting in very low yields per well. There are limits to the number of small wells that can practically be grouped closely together. Horizontal well technology, first introduced to the state in 2012, has proven to be a cost effective means of improving water supply yields in these types of areas. The technique uses large trenching equipment, similar to tiling equipment, capable of placing eight-inch, flexible, perforated plastic tubing at depths of a little over 20 feet. This restricts the use of the technology to areas with relatively shallow water tables. However, in test cases where 800 foot laterals were installed, yields of 800 gallons per minute resulted – making the practice worthwhile where appropriate.

Irrigators are also installing these wells in low areas to help control high water tables in parts of an irrigated field. There are larger machines capable of deeper depths, but this has not been considered cost effective for irrigation development so far.

Aquifer Recharge and Recovery (ARR)

In highly developed unconfined aquifers having sufficient drawdown and saturated thickness which are located within the proximity of rivers or streams, water can be captured from streams and stored in the aquifer for supplemental storage and use (Figure 26). ARR methods are particularly useful, because water can be captured during periods of high flow and stored for later use. Both Valley City during the 1930s, and Minot during the 1950s have used ARR in the past. Experimental ARR projects were operated during the late 1980s and early 1990s at Oakes, ND; and a successful ARR facility has been operated by the Forest River Hutterite Community to supply as much as 1,000 additional acre-feet per year for agricultural use.

ARR requires the presence of coarse aquifer materials to within a few feet of land surface to allow for adequate infiltration in an excavated basin. Water stored using ARR is available for short term use (usually about one to three years in North Dakota), but is usually lost to evaporation, returned to the stream through seepage, or transported beyond the area of use over extended periods.

Tile Drain Sub-Irrigation

Researchers in the Department of Agricultural Engineering at North Dakota State University have been investigating the feasibility and cost effectiveness of optimizing soil moisture and yields in agricultural fields using water-table controls on tile drains. This process involves supplementing water during dry periods through sub-irrigation, pumping ground water and distributing it through the tile drains.

Aquifer Recharge & Recovery Project

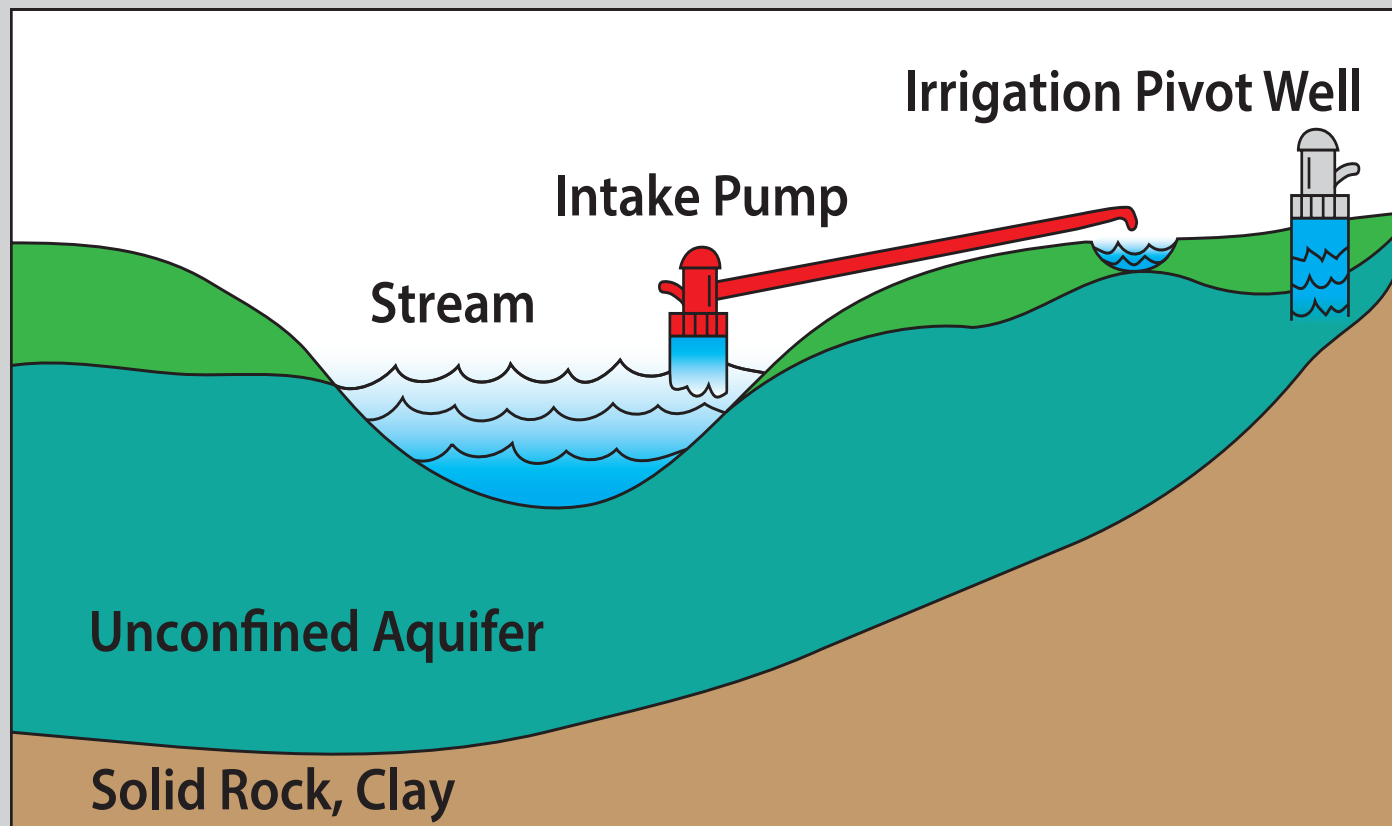


Figure 26. An example of an aquifer recharge and recovery project.

Goals & Objectives - Meeting Challenges

A number of water management and development challenges and issues were covered in the 2015 North Dakota Water Management Plan. In response, the following goals and objectives have been developed to help the state meet those challenges, and to more clearly define where North Dakota's long-term water management and development efforts will be directed in the future.

GOAL:

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

OBJECTIVES:

- Encourage efficient use of water by all users.
- Appropriate water resources in consideration of availability and impacts to exiting permit holders.
- Maintain comprehensive water rights records to ensure that appropriations are based on the best available information.
- Implement requirement of remote telemetry on all industrial water depots.

GOAL:

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

OBJECTIVES:

- Support development and advancement of large regional water supply systems, such as the Northwest Area Water Supply, the Southwest Pipeline Project, Western Area Water Supply, and a Red River Valley water supply.
- Assist communities and rural water associations in developing water supplies as deemed appropriate, per agency policies.
- Support the development of structural flood control projects in population centers, where appropriate.
- Support the development of ring dikes for farmstead protection.

- Support irrigation development in order to encourage growth and diversification in the agricultural industry.
- Develop water supply systems that provide sufficient quantities of Missouri River water to support North Dakota's existing and future municipal, rural, and industrial water demands.
- Develop small dams where appropriate to retain water for flood damage reduction and water supplies for beneficial uses.
- Protect North Dakota's right to Missouri River water, and to appropriate it for beneficial use.

GOAL:

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

OBJECTIVES:

- Permit beneficial water use in support of 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 in monitoring water quality and wellhead protection.
- Encourage and implement a balance of structural and non-structural techniques to reduce flood damages.
- Ensure all cloud seeding projects are conducted in a scientifically sound and an environmentally safe manner.

Goals & Objectives - Meeting Challenges

- Encourage and assist with the development of a comprehensive state drought mitigation plan.
- Maintain channel flow capacity of rivers and streams.
- Support 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 impacts of flooding through more comprehensive floodplain management planning.
- Encourage the consideration of water quality in floodplain management and emergency planning.
- Assist communities with technical evaluations of floodplains for potential future 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).
- Continue to develop, implement, and maintain a comprehensive State Water Management Plan and database.
- Continue to collaborate to resolve interstate and international water management issues involving the Missouri, Red, and Mouse River basins and Devils Lake.
- Encourage and assist the owners of dams to develop Emergency Action Plans (EAPs) for dams classified as high or median significant hazard dams.
- Promote dam safety by supporting, assisting, and funding dam repairs, restorations and/or demolitions where necessary to return dams to a state of being safe from failure, damage, error or accident.

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 and education efforts regarding our atmosphere and how it works, and the capabilities and limitations of cloud seeding.
- Continue public information and education regarding the use, management, and characteristics of North Dakota's water resources through publications, public events and outreach, and the Internet.
- Enhance public information and education programs on floodplain management.
- Improve training opportunities for floodplain managers.
- Encourage and educate water managers and the general public regarding the reuse, reclamation, and conservation of water.
- Improve public information and education efforts regarding sovereign lands of the state, with particular emphasis on littering, off-road vehicle use, and mineral rights.
- Support efforts that improve water managers' and general publics' understanding of drainage techniques, scope, and impacts.

Goals & Objectives - Meeting Challenges

GOAL:

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

OBJECTIVES:

- Evaluate the 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.
- Continue automated tracking of water use for oil extraction, through state-of-the-art data collection efforts.
- Ensure that adequate records are kept of all cloud seeding operations.
- Continue and improve the statewide growing season and snowfall precipitation reporting network.
- Continue the dissemination of project weather radar and precipitation data, via the Internet.
- Maintain and improve the existing precipitation monitoring network to aid in flood forecasting.
- Continue to implement the Commission's Web-based Map Service.
- Continue to provide and improve the Water Commission's web-based Water Resources Information Management Systems.
- Maintain or enlarge the state's existing stream gage 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 optimize long-term, cost-effective, and 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 sustainable use throughout the state.
- Evaluate the impacts of cloud seeding on precipitation patterns and the environment.
- Conduct basic storm research in cooperation with universities and federal agencies.

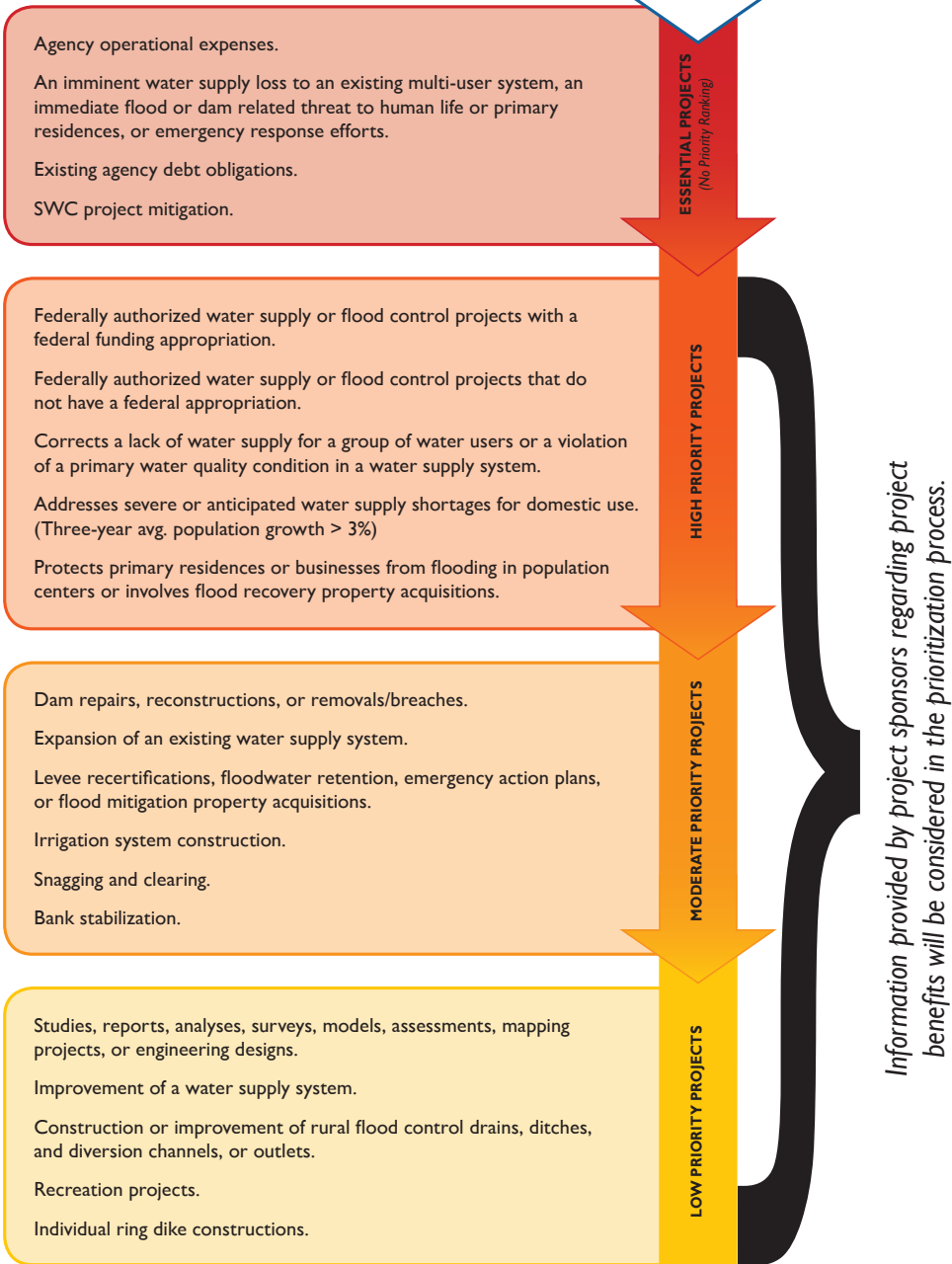


ND State Water Commission Drill Rig

Appendix

SWC WATER PROJECT PRIORITIZATION GUIDANCE CONCEPT

Projects submitted during the project planning inventory process¹ that meet SWC cost-share eligibility requirements will be considered for prioritization. Projects that do not meet local cost-share match requirements, (per SWC cost-share policies), will be dropped to the next lowest priority category. Ineligible projects will be diverted toward alternative funding sources.



Footnotes

1. All local sponsors are encouraged to submit project and study financial needs during the budgeting process. Projects and studies not submitted as part of the project information collection effort may be held until action can be taken on those that were included during budgeting, unless determined to be an emergency that directly impacts human health and safety or that are a direct result of a natural disaster.

Disclaimer

This process is meant to provide guidance for prioritizing water projects during the budgeting process that may be eligible for cost-share assistance through the State Water Commission. Interpretation and deviations from the process are within the discretion of the state as authorized by the State Water Commission or Legislature.

State Water Commission Cost Share Policy Summary

Effective October 1, 2014

Cost-Share Policy Outline	Description	Prelim Eng	Design Eng	Const Eng	Construction
I. Definitions and Eligibility	Cost-Share defined as a grant or a loan. Engineer services defined relating to pre-construction and construction. Programs defined as typically associated with federal initiatives.	Provides overall guidance and consistency with cost-share			
II. Cost-Share Application and Approval Procedures	Cost-share exceeding \$100M, additional information requested by the State Water Commission will be used to determine cost-share.	\$100,000,000			
III. Cost-Share Categories					
A. Pre-Construction Expenses	Development of feasibility studies, mapping, and engineering designs.	up to 35%	NA		
B. Water Supply Projects					
1. Water Supply Project - Uses state funding - loan funding for all categories, allows combination of grant and loan up to 80%	Addresses upgrades of water supply to SDWA primary standards or expansion into new service areas.	up to 35%	Total up to 80% with up to 60% grant, up to 75% grant in special cases		
	Improvements and expansions of a system serving an area with 3-year average population growth in excess of 3% per year, as determined by the Chief Engineer	up to 35%	Total up to 80% with up to 60% grants.		
	Water treatment improvements that address impacts from other State Water Commission projects. Grant based on level of impact by the State Water Commission project.	Primarily Devils Lake Impacts			
	Provides special consideration for improvements in service areas where the anticipated cost per user divided by the average annual median income per user is in the top quartile of its peer group water systems (large city, small city, and regional) as determined by the Chief Engineer.	up to 80% loans			
	Addresses extraordinary repairs or replacement needs of a water supply system due to damages from a recent natural disaster.	up to 80% loans			
2. MR&I Water Supply Program	Federal Funding - no changes - preliminary engineering not funded	up to 75%			
3. Drought Disaster Livestock Water Supply Project Assist.	Program uses state funding in support of a federal initiative, program is defined in Administrative Code.	Program mentioned in policy, implemented during droughts			
C. Flood Control Projects					
1. Flood Recovery Property Acquisition Grant Program	Flood damage has occurred. Property needed for construction of flood protection.	up to 75%			
	Flood damage has occurred. Property needed for conveyance.	up to 60%			
2. Flood Protection Program	Provide long term flood reduction benefits. (Needed for preventing future damage) SWC may lend portion of local share based on demonstrated financial need.	up to 35%	up to 60%		
	Provide long term flood reduction benefits with Federal participation (Needed for preventing future damage.) SWC may lend portion of local share based on demonstrated financial need.	up to 35%	up to 50%		
3. FEMA Levee System Accreditation Program	FEMA requirement to accredit the levee system for flood insurance mapping purposes.	up to 60%	N/A		
4. Dam Safety and Emergency Action Plans (EAP)	Addresses dam safety issues. SWC may lend portion of local share based on demonstrated financial need.	up to 35%	up to 75%		
	EAP for high or medium/significant hazard dam. Dam break model only on high hazard.	up to 80%			
5. Water Retention Projects	No Federal participation. Includes property purchase.	up to 35%	up to 60%		
	Federal participation. Includes property purchase.	up to 35%	up to 50%		
6. Snagging and Clearing Projects	Snagging and clearing on watercourses.	up to 35%	up to 50%		
D. Rural Flood Control Projects					
1. Drains, Channels, or Diversion Projects	Cost-share for drains, channels, or diversion projects.	up to 35%	up to 45%		
2. Individual Ring Dike Program	Cost-share up to \$40,000, combined NRCS & SWC funding capped at 80% of eligible costs.	up to 35%	up to 60%		
E. Recreation	Water based recreation, typically associated with dams.	up to 35%	up to 40%		
F. Irrigation	Costs associated with principal supply works.	up to 35%	up to 50%		
G. Bank Stabilization	Protects public infrastructure or facilities.	up to 35%	up to 50%		

NORTH DAKOTA STATE WATER COMMISSION

COST-SHARE POLICY, PROCEDURE, AND GENERAL REQUIREMENTS

The State Water Commission has adopted this policy to support local sponsors in development of sustainable water related projects in North Dakota. This policy reflects the State Water Commission's cost-share priorities and provides basic requirements for all projects considered for prioritization during the agency's budgeting process. Projects and studies that receive cost-share funding from the agency's appropriated funds are consistent with the public interest. The State Water Commission values and relies on local sponsors and their participation to assure on-the-ground support for projects and prudent expenditure of funding for evaluations and project construction. It is the policy of the State Water Commission that only the items described in this document will be eligible for cost-share upon approval by the State Water Commission, unless specifically authorized by State Water Commission action.

I. DEFINITIONS AND ELIGIBILITY

- A. CONSTRUCTION COSTS** include earthwork, concrete, mobilization and demobilization, dewatering, materials, seeding, rip-rap, re-routing electrical transmission lines, moving storm and sanitary sewer system and other underground utilities and conveyance systems affected by construction, mitigation required by law related to the construction contract, irrigation supply works, and other items and services provided by the contractor. Construction costs are only eligible for cost-share if incurred after State Water Commission approval and if the local sponsor has complied with North Dakota Century Code (N.D.C.C.) in soliciting and awarding bids and contracts, and complied with all applicable federal, state, and local laws.

- B. COST-SHARE** is grant or loan funds provided through the State Water Commission.

- C. ENGINEERING SERVICES** include pre-construction and construction engineering. Pre-construction engineering is the engineering necessary to develop plans and specifications for permitting and construction of a project including preliminary and final design, material testing, flood insurance studies, hydraulic models, and geotechnical investigations. Construction engineering is the engineering necessary to build the project designed in the pre-construction phase including construction contract management, and project inspection. Administrative services and support services performed and charged by engineering companies are not engineering services. Engineering services are eligible costs if incurred after State Water Commission approval. If cost-share is expected to be greater than \$25,000, the local sponsor must follow the engineering selection process in NDCC 54-44.7 and provide a copy of the selection committee report to the Chief Engineer. The

Effective October 1, 2014

local sponsor will be considered to have complied with this requirement if they have completed this selection process for a general engineering services agreement at least once every three years and have formally assigned work to a firm or firms under an agreement. The local sponsor must inform the Chief Engineer of any change in the provider of general engineering services.

- D. IMPROVEMENTS** are construction related projects that upgrade a facility to provide increased efficiency or capacity. Improvements do not include any activities that are maintenance, replacement, or reconstruction.

- E. INELIGIBLE ITEMS** excluded from cost-share include:
 - 1 Administrative, easement, and permit related costs;
 - 2 Property acquisitions, property surveys, and legal expenses unless specifically identified as eligible within the Flood Recovery Property Acquisition Program, the Flood Protection Program, or the Water Retention Projects;
 - 3 Work and costs incurred prior to a cost-share approval date, except for emergencies as determined by the Chief Engineer;
 - 4 Project related operation, maintenance, replacement, and reconstruction costs;
 - 5 Funding contributions provided by federal, other state, or other North Dakota state entities that supplant costs;
 - 6 Work incurred outside the scope of the approved study or project.

- F. EXPANSIONS** are construction related projects that increase the project area or users served. Expansions do not include maintenance, replacement, or reconstruction activities.

- G. LOCAL SPONSOR** is the entity submitting a cost-share application and must be a political subdivision, state entity, or commission legislatively granted North Dakota recognition that applies the necessary local share of funding to match State Water Commission cost-share. They provide direction for studies and projects, public point of contact for communication on public benefits and local concerns, and acquire necessary permits and rights-of-way.

- H. MAINTENANCE COSTS** include repairs, deferred repairs, and general upkeep of facilities to allow facilities to continue proper operation and function.

- I. PROGRAM** is a subcategory of cost-share that is typically associated with a federal initiative and may cover all phases of a study or implementation of a project.

- J. PROJECT** is the water-related construction activity.

- K. REPLACEMENT AND RECONSTRUCTION COSTS** include the removal of portions of facilities or components that have completed their useful life and substitution with different components to obtain the same or similar function of the original facilities or components.

Effective October 1, 2014

- L. SUSTAINABLE OPERATION, MAINTENANCE, AND REPLACEMENT PLAN** is a description of the anticipated operation, maintenance, and replacement costs with a statement that the operation, maintenance, and replacement of the project will be sustainable by the local sponsor.

II. COST-SHARE APPLICATION AND APPROVAL PROCEDURES. The State Water Commission will not consider any cost-share applications for water related projects or studies unless the local sponsor first makes an application to the Chief Engineer. No funds will be used in violation of Article X, § 18 of the North Dakota Constitution (Anti-Gift Clause).

- A. APPLICATION REQUIRED.** An application for cost-share is required in all cases and must be submitted by the local sponsor on the State Water Commission Cost-Share Application form. Applications for cost-share are accepted at any time. Applications received less than 30 days before a State Water Commission meeting will not be considered at that meeting and will be held for consideration at a future meeting. The application form is maintained and updated by the Chief Engineer and must include the following:

- 1 Category of cost-share activity
- 2 Location of the proposed project or study area
- 3 Description, purpose, goal, objective, narrative of the proposed activities
- 4 Delineation of costs
- 5 Potential federal, other state, or other North Dakota state entity participation
- 6 Engineering plans, if applicable
- 7 Status of required permitting
- 8 Potential territorial service area conflicts or service area agreements, if applicable
- 9 Sustainable operation, maintenance, and replacement plan for projects
- 10 Additional information as deemed appropriate by the Chief Engineer

Applications for cost-share are separate and distinct from the State Water Commission biennial project information collection effort that is part of the budgeting process. All local sponsors are encouraged to submit project and study financial needs during the budgeting process. Projects and studies not submitted as part of the project information collection effort may be held until action can be taken on those that were included during budgeting, unless determined to be an emergency that directly impacts human health and safety or that are a direct result of a natural disaster.

- B. PRE-APPLICATION.** A pre-application process is allowed for cost-share of assessment projects. This process will require the local sponsor to submit a brief narrative of the project, preliminary designs, and a delineation of costs. The Chief Engineer will then review the material presented, make a determination of project eligibility, and estimate the cost-share funding the project may anticipate receiving. A project eligibility letter will then be sent to the local sponsor noting the percent of cost-share assistance that may be expected on eligible items as well as listing those items that are not considered to be eligible costs. In addition, the project eligibility letter will state that the Chief Engineer will recommend approval when all cost-share

Effective October 1, 2014

requirements are addressed. The local sponsor may use the project eligibility letter to develop a project budget for use in the assessment voting process. Upon completion of the assessment vote and all other requirements an application for cost-share can be submitted.

- C. REVIEW.** Upon receiving an application for cost-share, the Chief Engineer will review the application and accompanying information. If the Chief Engineer is satisfied that the proposal meets all requirements, the Chief Engineer will present the application along with a recommendation to the State Water Commission for its action. The Chief Engineer's review of the application will include the following items and any other considerations that the Chief Engineer deems necessary and appropriate. For cost-share applications over \$100 million, additional information requested by the State Water Commission will be used to determine cost-share.

- 1 Applicable engineering plans;
- 2 Field inspection, if deemed necessary by the Chief Engineer;
- 3 The percent and limit of proposed cost-share determined by category of cost-share activity and eligible expenses;
- 4 Assurance of sustainable operation, maintenance, and replacement of project facilities by the local sponsor;
- 5 Status of permitting and service area agreements;
- 6 Available funding in the State Water Commission budget and budget priorities.

The Chief Engineer is authorized to approve cost-share up to \$75,000 in state funds and also approve cost overruns up to \$75,000 in state funds without State Water Commission action.

- D. NOTICE.** The Chief Engineer will give notice to local sponsors when their application for cost-share is placed on the tentative agenda of the State Water Commission's next meeting.

- E. AGREEMENT AND DISTRIBUTION OF FUNDS.** No funds will be disbursed until the State Water Commission and local sponsor have entered into an agreement for cost-share participation. No agreement will be entered until all required State Engineer permits have been acquired.

For construction projects, the agreement will address indemnification and vicarious liability language. The local sponsor must require that the local sponsor and the state be made an additional insured on the contractor's commercial general liability policy including any excess policies, to the extent applicable. The levels and types of insurance required in any contract must be reviewed and agreed to by the Chief Engineer. The local sponsor may not agree to any provision that indemnifies or limits the liability of a contractor.

For any property acquisition, the agreement will specify that if the property is later sold, the local sponsor is required to reimburse the Commission the percent of sale price equal to the percent of original cost-share.

The Chief Engineer may make partial payment of cost-sharing funds as deemed appropriate. Upon notice by the local sponsor that all work or construction has been

Effective October 1, 2014

completed, the Chief Engineer may conduct a final field inspection. If the Chief Engineer is satisfied that the work has been completed in accordance with the agreement, the final payment will be disbursed to the local sponsor, less any partial payment previously made.

- F. LITIGATION.** If a project submitted for cost-share is the subject of litigation, the application may be deferred until the litigation is resolved. If a project approved for cost-share becomes the subject of litigation before all funds have been disbursed, the Chief Engineer may withhold funds until the litigation is resolved. Litigation for this policy is defined as legal action that would materially affect the ability of the local sponsor to construct the project; that would delay construction such that the authorized funds could not be spent; or is between political subdivisions related to the project.

III. COST-SHARE CATEGORIES. The State Water Commission supports the following categories of projects and studies for cost-share. Generally, engineering expenses are cost-shared as follows: Pre-construction expenses and pre-construction engineering approved by the State Water Commission are cost-shared up to 35 percent. Engineering expenses related to construction are cost-shared at the same percent as the construction costs when approved by the State Water Commission.

- A. PRE-CONSTRUCTION EXPENSES.** The State Water Commission supports local sponsor development of feasibility studies, engineering designs, and mapping as part of pre-construction activities to develop support for projects within this cost-share policy including:
- 1 Feasibility studies to identify water related problems, evaluate options to solve or alleviate the problems based on technical and financial feasibility, and provide recommendation and cost estimate, of the best option to pursue.
 - 2 Engineering design to develop plans and specifications for permitting and construction of a project, including associated cultural resource and archeological studies.
 - 3 Mapping and surveying to gather data for a specific task such as flood insurance studies and flood plain mapping, LiDAR acquisition, and flood imagery attainment, which are valuable to managing water resources.

Copies of the deliverables must be provided to the Chief Engineer upon completion. The Chief Engineer will determine the payment schedule and interim progress report requirements.

B. WATER SUPPLY

- 1 **WATER SUPPLY PROJECT.** The State Water Commission supports water supply efforts and will use a grant and loan program. The local sponsor may apply for water supply funding, and the application will be reviewed to

Effective October 1, 2014

determine project priority. Projects will be prioritized within categories (1) thru (5) below. Projects within category (1) may be considered for grant funding up to 60 percent cost-share or in special cases up to 75 percent of cost-share and projects in category (2) may be considered for grant funding up to 60 percent of cost-share. Grant funding within category (3) will be on a case-by-case basis. Projects within categories (1) through (5) may be considered for loan funding. After cost-share for grant funding has been determined, the local sponsor may be considered for loan funding in addition to the grant funding. The combination of grant and loan funding will not exceed 80 percent from the State Water Commission.

- (1) Addresses upgrades to meet primary drinking water standards or expansion into new service areas. If the expansion into a new service area requires at least ten miles of new transmission pipeline, grant funding up to 75 percent may be considered. Factors considered for water system expansions are:
 - (a) Connection of communities to the regional system as part of this expansion as determined by the Chief Engineer.
 - (b) Willingness of water users at far reaches of the system to pay additional costs for water service as an indicator of greater need for access to water and local commitment in the project as determined by the Chief Engineer.
 - (c) Affordable and sustainable water rate as determined by the Chief Engineer.
- (2) Supports improvements and connection of new customers within the existing service area of a water system that has a 3-year average population growth in excess of 3% per year, as determined by the Chief Engineer
- (3) Water treatment improvements that address impacts from other State Water Commission projects. Grant funding to be determined based on level of impact by State Water Commission project.
- (4) Assists with improvements in service areas where the anticipated cost per user each year (based on 5,000 gallons per month) divided by the average annual median income per user is in the top quartile or other ranking as determined by the Commission of its peer group (large city, small city, and regional) water systems that submitted planning information forms for the biennium. The Chief Engineer will rank the projects.
- (5) Addresses extraordinary repairs or replacement needs of a water supply system due to damages from a recent natural disaster.

Debt per capita, either actual or anticipated, may be used as an additional determinant of financial need.

The State Water Commission will periodically set the interest rate on the loan program, taking into consideration other loan programs. If ability to pay for the local share is a concern, the Chief Engineer may provide a recommendation for public finance options or loan funding.

Water Depots for industrial use receiving water from facilities constructed using State Water Commission funding or loans have the following additional requirements:

Effective October 1, 2014

- a) Domestic water supply has priority over industrial water supply in times of shortage. This must be explicit in the water service contracts with industrial users.
- b) If water service will be contracted, public notice of availability of water service contracts is required when the depot becomes operational.
- c) A portion of the water supply at any depot must be available on a non-contracted basis for public access.

- 2 **MUNICIPAL, RURAL, AND INDUSTRIAL WATER SUPPLY PROGRAM.** The Municipal, Rural, and Industrial Water Supply Program, which uses federal funds, is administered according to North Dakota Administrative Code Article 89-12.
- 3 **DROUGHT DISASTER LIVESTOCK WATER SUPPLY PROJECT ASSISTANCE PROGRAM.** This program is to provide assistance with water supply for livestock impacted during drought declarations and is administered according to North Dakota Administrative Code Article 89-11.

C. **FLOOD CONTROL.** The State Water Commission may provide cost-share for eligible items of flood control projects protecting communities from flooding and may include the repair of dams that provide a flood control benefit.

- 1 **FLOOD RECOVERY PROPERTY ACQUISITION GRANT PROGRAM.** This program is used to assist local sponsors with flood recovery expenses that provide long term flood damage reduction benefits through purchase and removal of structures in areas where flood damage has occurred. All contracted costs directly associated with the acquisition will be considered eligible for cost-share. Contracted costs may include: appraisals, legal fees (title and abstract search or update, etc.), property survey, closing costs, hazardous materials abatement needs (asbestos, lead paint, etc.), and site restoration.

The State Water Commission may provide cost-share of the eligible costs of approved flood recovery expenses that provide long term flood reduction benefits based on the following criteria and priority order:

- a) Local Sponsor has flood damage and property may be needed for construction of temporary or long-term flood control projects, may be cost-shared up to 75 percent.
- b) Local Sponsor has flood damage and property would increase conveyance or provide other flood control benefits, may be cost-shared up to 60 percent.

Prior to applying for assistance, the local sponsor must adopt and provide to the Chief Engineer an acquisition plan (similar to plans required by Hazard Mitigation Grant Program (HMGP)) that includes the description and map of properties to be acquired, the estimated cost of property acquisition including contract costs, removal of structures, the benefit of acquiring the properties, and information regarding the ineligibility for HMGP funding. Property eligible for HMGP funding is not eligible for this program. The acquisition plan must also

Effective October 1, 2014

include a description of how the local sponsor will insure there is not a duplication of benefits.

Over the long-term development of a flood control project following a voluntary acquisition program, the local sponsor's governing body must officially adopt a flood risk reduction plan or proposal including the flow to be mitigated. The flow used to develop the flood risk reduction plan must be included in zoning discussions to limit new development on other flood-prone property. An excerpt of the meeting minutes documenting the local sponsor's official action must be provided to the Chief Engineer.

Local sponsor must fund the local share for acquisitions; this requirement will not be waived. Federal funds are considered "local" for this program if they are entirely under the authority and control of the local sponsor.

The local sponsor must include a perpetual restrictive covenant similar to the restrictions required by the federal HMGP funding with the additional exceptions being that the property may be utilized for flood control structures and related infrastructure, paved surfaces, and bridges. These covenants must be recorded either in the deed or in a restrictive covenant that would apply to multiple deeds.

The local sponsor must provide justification, acceptable to the Chief Engineer, describing the property's ineligibility to receive federal HMGP funding. This is not meant to require submission and rejection by the federal government, but rather an explanation of why the property would not be eligible for federal funding. Example explanations include: permanent flood control structures may be built on the property; project will not achieve required benefit-cost analysis to support HMGP eligibility; or lack of available HMGP funding. If inability to receive federal funding is not shown to the satisfaction of the Chief Engineer, following consultation with the North Dakota Department of Emergency Services, the cost-share application will be returned to the local sponsor for submittal for federal funding prior to use of these funds.

- 2 FLOOD PROTECTION PROGRAM.** This program supports local sponsor efforts to prevent future property damage due to flood events. The State Water Commission may provide cost-share grants for up to 60 percent of eligible costs. For projects with federal participation, the cost-share may be up to 50 percent of eligible costs.

Engineering design suitable for permitting by the State Engineer must be completed before any construction cost-share is approved. The cost-share application must include the return interval or design flow for which the structure will provide protection. Local share must be provided on a timely basis. The State Water Commission may lend a portion of the local share based on demonstrated financial need.

Property acquisition costs limited to the purchase price of the property that is not eligible for HMGP funding and within the footprint of a project may be eligible under this program. The local sponsor must include a perpetual

Effective October 1, 2014

restrictive covenant on any properties purchased under this program similar to the restrictions required by the federal HMGP funding with the additional exceptions being that the property may be utilized for flood control structures and related infrastructure, paved surfaces, and bridges. These covenants must be recorded either in the deed or in a restrictive covenant that would apply to multiple deeds.

- 3 FEMA LEVEE SYSTEM ACCREDITATION PROGRAM.** The State Water Commission may provide cost-share up to 60 percent for eligible services for FEMA 44 CFR 65.10 flood control or reduction levee system certification analysis. The analysis is required for FEMA to accredit the levee system for flood insurance mapping purposes. Typical eligible costs include site visits and field surveys to include travel expenses, hydraulic evaluations, closure evaluations, geotechnical evaluations, embankment protection, soils investigations, interior drainage evaluations, internal drainage hydrology and hydraulic reports, system modifications, break-out flows and all other engineering services required by FEMA. The analysis will result in a comprehensive report to be submitted to FEMA and the Chief Engineer.

Administrative costs to gather existing information or to recreate required documents, maintenance and operations plans and updates, and emergency warning systems implementation are not eligible.

- 4 DAM SAFETY AND EMERGENCY ACTION PLANS.** The State Water Commission supports dam safety including repairs and removals, as well as emergency action plans. The State Water Commission may provide cost-share for up to 75 percent of the eligible items for dam safety repair projects and dam breach or removal projects. Dam safety repair projects that are funded with federal or other agency funds may be cost-shared up to 75 percent of the eligible non-matched 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. The State Water Commission may lend a portion of the local share based on demonstrated financial need.

The State Water Commission may provide cost-share up to 80 percent, for emergency action plans (EAPs) of each dam classified as high or medium significant hazard. The cost of a dam break model is only eligible for reimbursement for dams classified as a high hazard.

- 5 WATER RETENTION PROJECTS.** The goal of water retention projects is to reduce flood damages by storing floodwater upstream of areas prone to flood damage. The State Water Commission may provide cost-share up to 60 percent of eligible costs for flood retention projects including purchase price of the property. For projects with federal participation, the cost-share may be up to 50 percent. Water retention structures constructed with State Water Commission cost-share must meet state dam safety requirements, including the potential of cascade failure. A hydrologic analysis including the operation plan, quantifying the flood reduction benefits for 25, 50, and 100-year events must be submitted with the cost-share application.

Effective October 1, 2014

- 6 **SNAGGING AND CLEARING PROJECTS.** Snagging and clearing projects consist of the removal and disposal of fallen trees and associated debris encountered within or along 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 State Water Commission may provide cost-share for up to 50 percent of the eligible items for snagging and clearing as well as any sediment that has accumulated in the immediate vicinity of snags and any trees in imminent danger of falling in the channel on watercourses as defined in N.D.C.C. § 61-01-06. Items that are not eligible include snagging and clearing of man-made channels; the dredging of watercourses for sediment removal; the clearing and grubbing of cattails and other plant vegetation; or the removal of any other unwanted materials.

D. RURAL FLOOD CONTROL. The primary purpose of rural flood control projects is to manage runoff or 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. Items that are not eligible include projects that are managing runoff or drainage from residential or urban sources.

- 1 **DRAINS, CHANNELS, OR DIVERSION PROJECTS.** These projects are intended to improve the drainage and management of runoff from agricultural sources. The State Water Commission may provide cost-share up to 45 percent of the eligible items for the construction of drains, channels, or diversion ditches. Expansions and improvements may be cost-shared on the basis of increased drainage capacity achieved or increased area served. Construction costs for public road crossings that are integral to the project are eligible for cost-share as defined in N.D.C.C. § 61-21-31 and 61-21-32. If an assessment-based rural flood control project involves multiple districts, each district involved must join in the cost-share application.

Cost-share applications for rural assessment drains will only be processed after the assessment vote has passed, the final design is complete, and a drain permit has been obtained. If the local sponsor wishes to submit a cost-share application prior to completion of the aforementioned steps, a pre-application process will be followed.

- 2 **RING DIKE PROGRAM.** This program is intended to protect individual rural homes and farmsteads. All ring dikes within the program are subject to the Commission's Individual Rural and Farmstead Ring Dike Criteria provided in Attachment A. Cost-share is limited to \$40,000 per ring dike. Protection of a city, community or development area does not fall under this program, but may be eligible for the flood control program. The State Water Commission may provide up to 60 percent cost-share of eligible items for ring dikes.

Landowners enrolled in the Natural Resource Conservation Service's (NRCS) Environmental Quality Incentive Program (EQIP) who intend to construct rural or farmstead ring dikes that meet the State Water Commission's elevation design criteria are eligible for a cost-share reimbursement of 20 percent of the NRCS

Effective October 1, 2014

construction payment, limited to a combined NRCS and State Water Commission contribution of 80 percent of eligible project costs.

- E. RECREATION.** The State Water Commission may provide cost-share up to 40 percent for projects intended to provide water-based recreation. Typical projects provide or complement water-based recreation associated with dams.
- F. IRRIGATION.** The State Water Commission may provide cost-share for up to 50 percent of the eligible items for irrigation projects. The items eligible for cost-share are those associated with new central supply works, including water storage facilities, intake structures, wells, pumps, power units, primary water conveyance facilities, and electrical transmission and control facilities.
- G. BANK STABILIZATION.** The State Water Commission may provide cost-share up to 50 percent of eligible items 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 or watercourses, as defined in N.D.C.C § 61-01-06, 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 damage to public facilities including utilities, roads, or buildings adjacent to a lake or watercourse.

Effective October 1, 2014

ATTACHMENT A
INDIVIDUAL RURAL AND FARMSTEAD RING DIKE CRITERIA

MINIMUM DESIGN CRITERIA

- HEIGHT: The dike must be built to an elevation 2 ft above either the 100-year flood or the documented high water mark of a flood event of greater magnitude, whichever is greater.
- TOP WIDTH: If dike height is 5 ft or less: 4 ft top width
If dike height is between 5 ft and 14 ft: 6 ft top width
If dike height is greater than 14 ft: 8 ft top width
- SIDE SLOPES: 3 horizontal to 1 vertical
- STRIP TOPSOIL AND VEGETATION: 1 ft
- ADEQUATE EMBANKMENT COMPACTION: Fill in 6-8 inch layers, compact with passes of equipment
- SPREAD TOPSOIL AND SEED ON RING DIKE

LANDOWNER RESPONSIBILITY

Landowners are responsible to address internal drainage on ring dikes. If culverts and flap gates are installed, these costs are eligible for cost-share. The landowner has the option of completing the work himself or hiring a contractor to complete the work.

If contractor does the work, payment is for actual costs with documented receipts.

If landowner does the work, payment is based on the following unit prices:

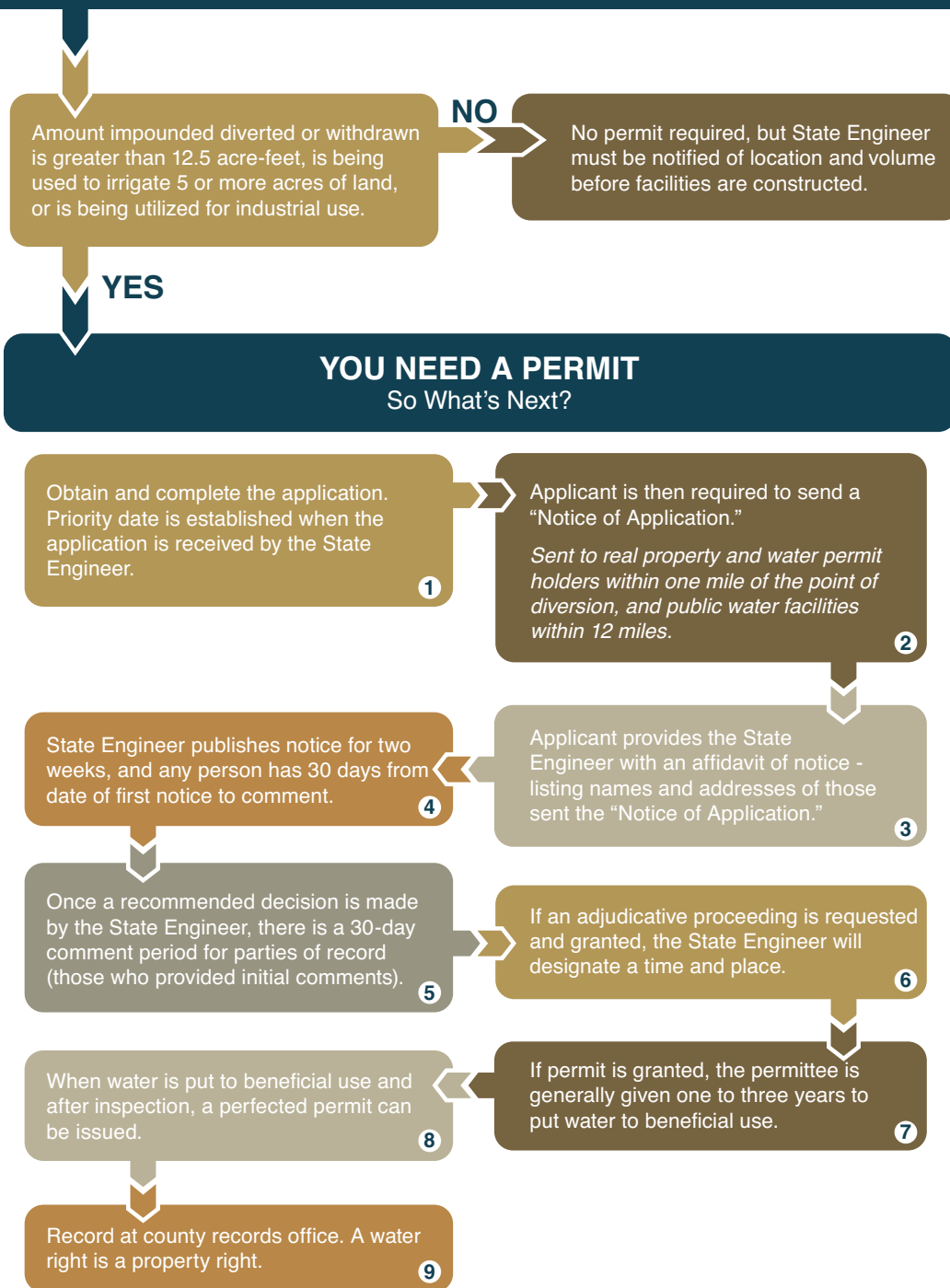
- STRIPPING, SPREADING TOPSOIL, AND EMBANKMENT FILL: Chief Engineer will determine rate schedule based on current local rates
- SEEDING: Cost of seed times 200%
- CULVERTS: Cost of culverts times 150%
- FLAP GATES: Cost of flap gates times 150%

OTHER FACTS AND CRITERIA

- The topsoil and embankment quantities will be estimated based on dike dimensions. Construction costs in excess of the 3:1 side slope standard will be the responsibility of the landowner. Invoices will be used for the cost of seed, culverts, and flap gates.
- Height can be determined by existing FIRM data or known elevations available at county floodplain management offices. Engineers or surveyors may also assist in establishing height elevations.
- The projects will not require extensive engineering design or extensive cross sections.
- A dike permit is required if the interior volume of the dike consists of 50 acre-feet, or more.

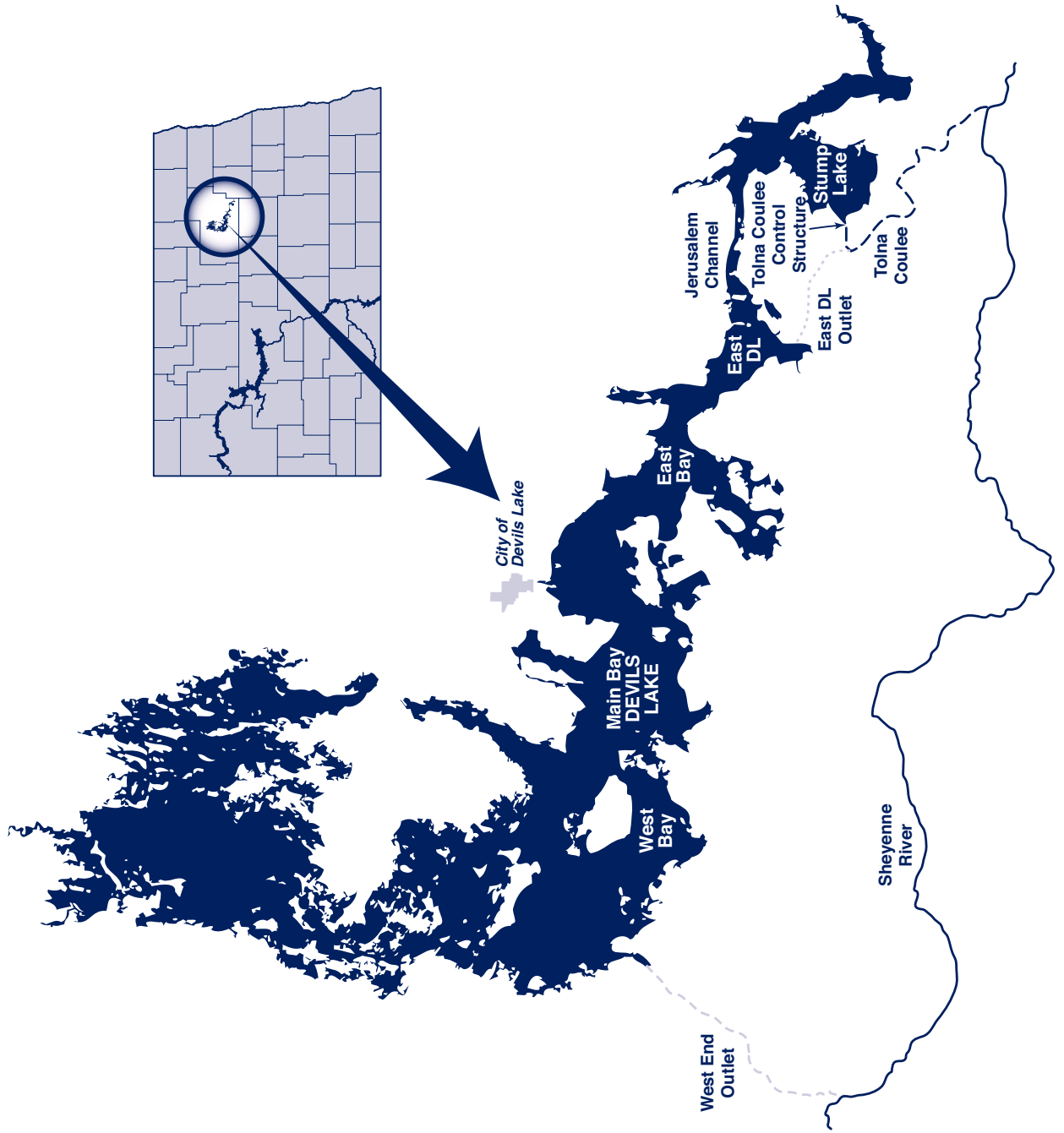
Effective October 1, 2014

North Dakota's Water Permitting Process

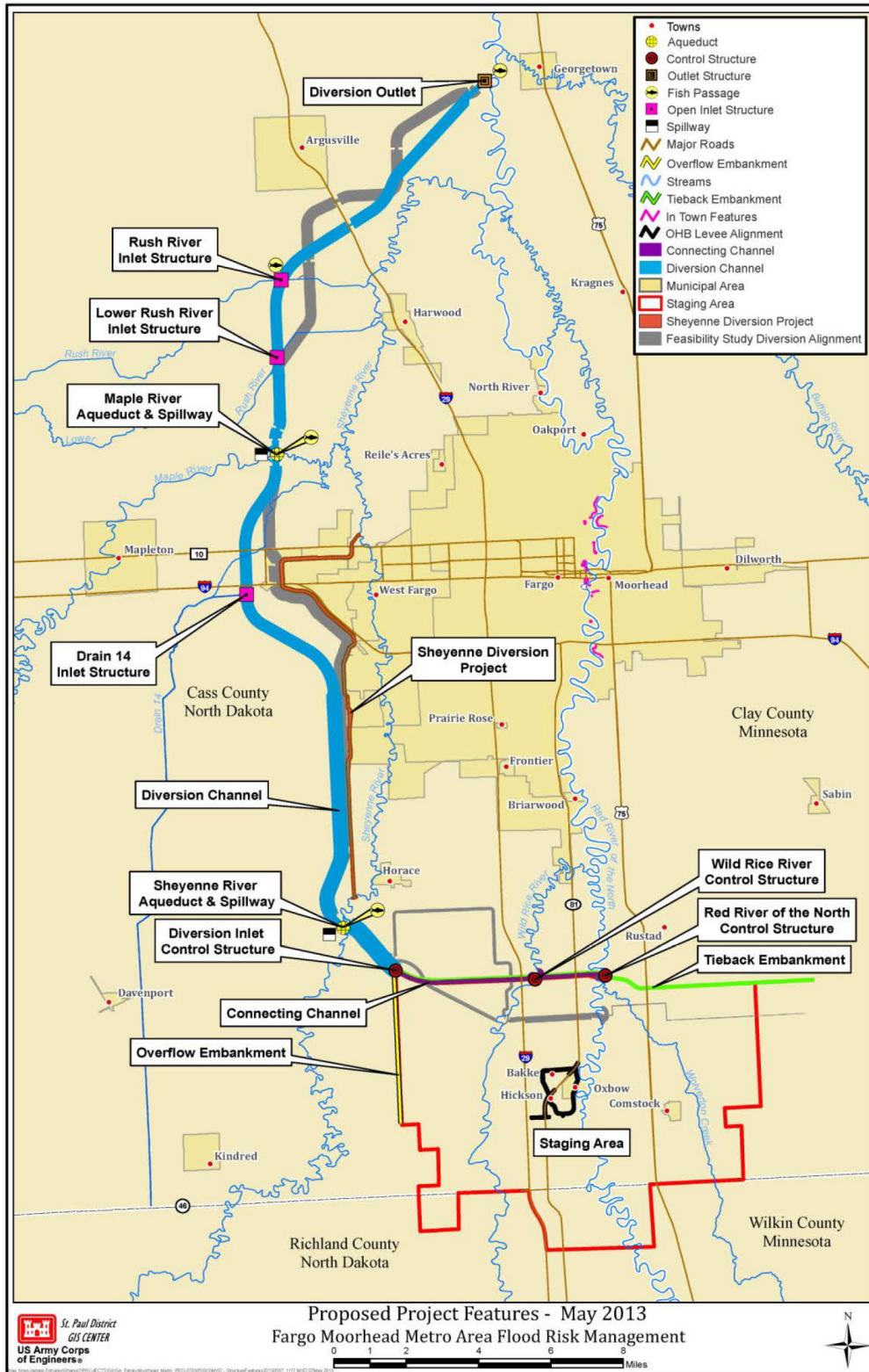


Map Appendix

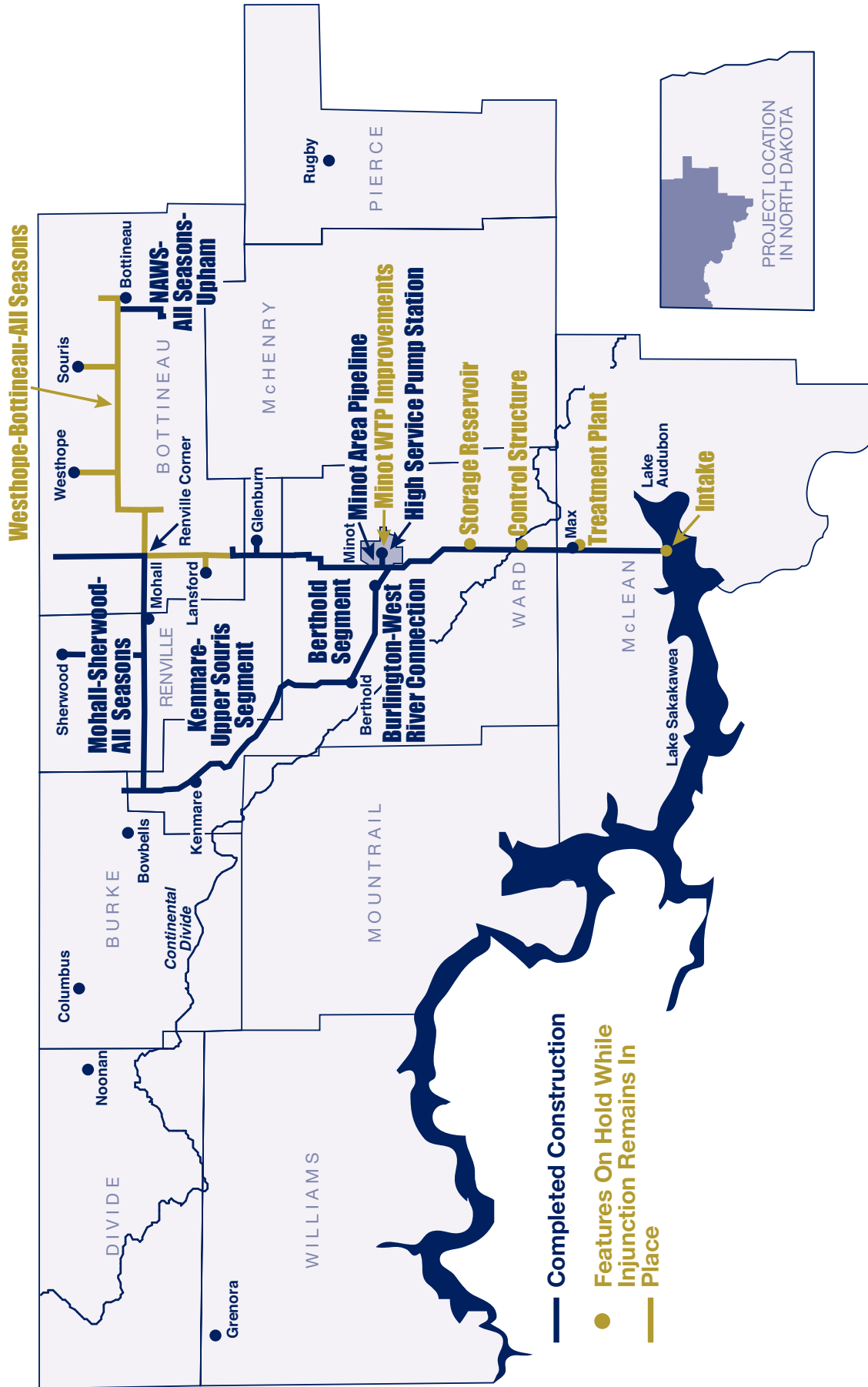
Devils Lake & Outlets



Fargo-Moorhead Area Diversion

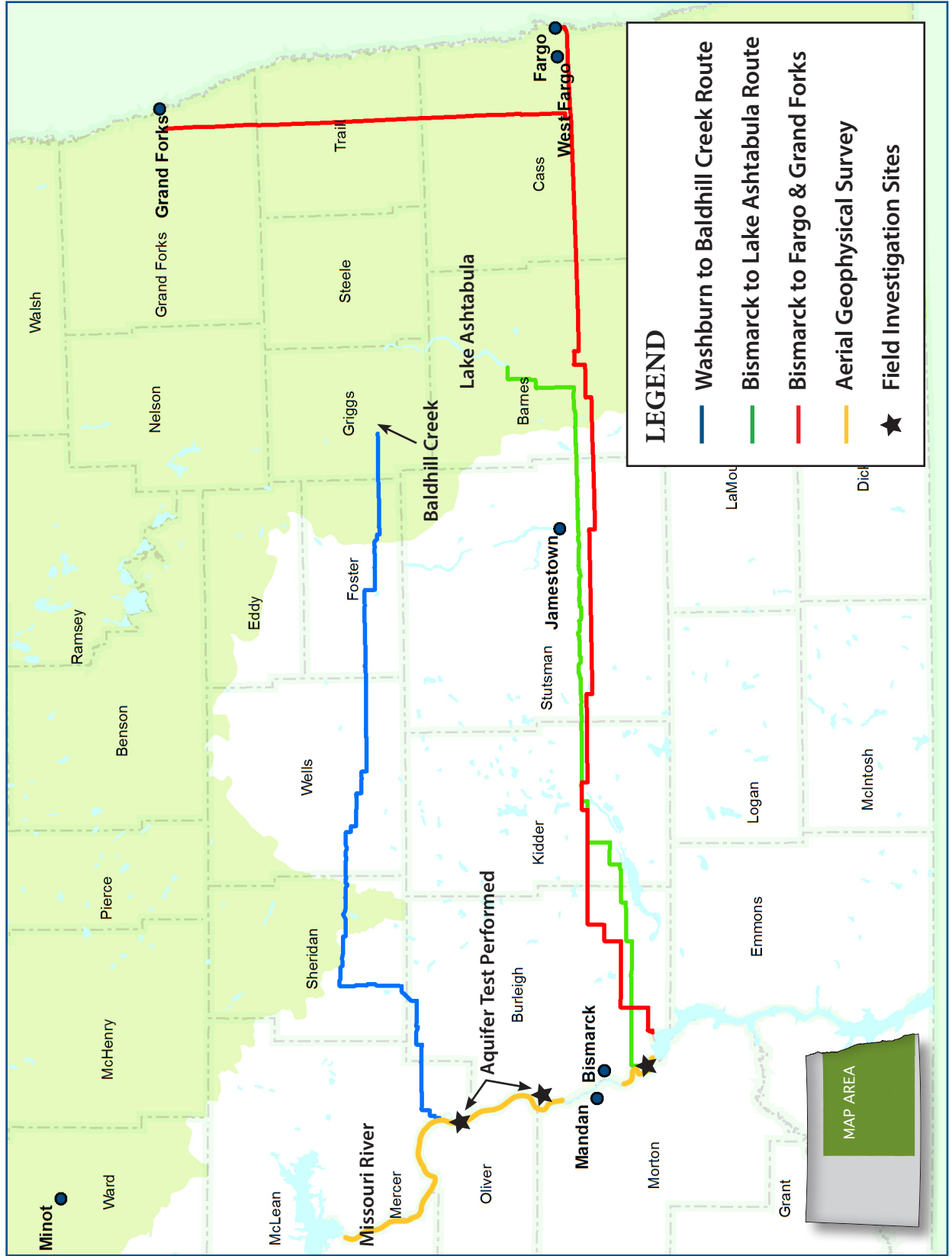


Northwest Area Water Supply

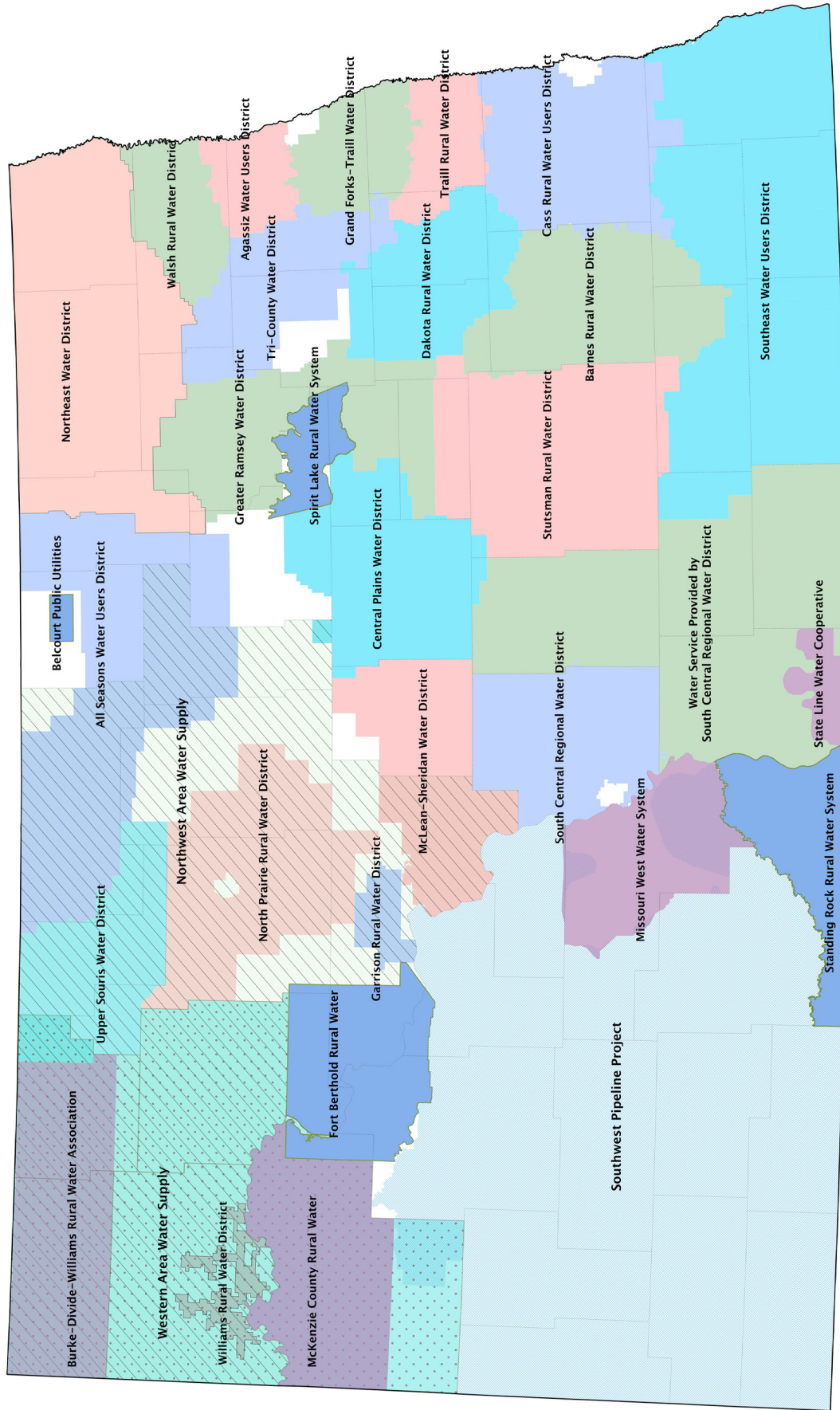


Red River Water Supply Potential Alignments

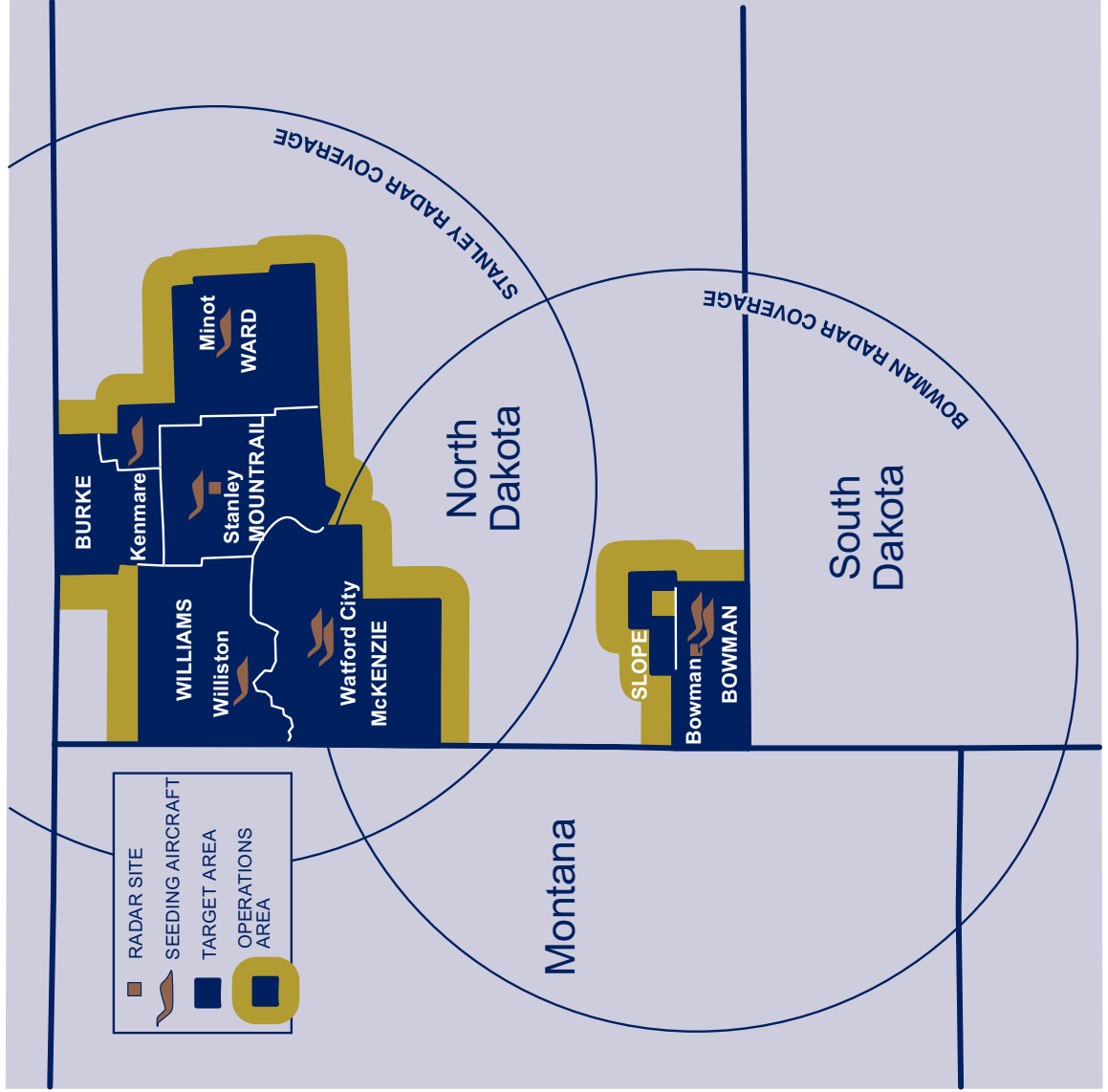
These alternatives were identified in a value engineering study as being the most likely for future consideration.



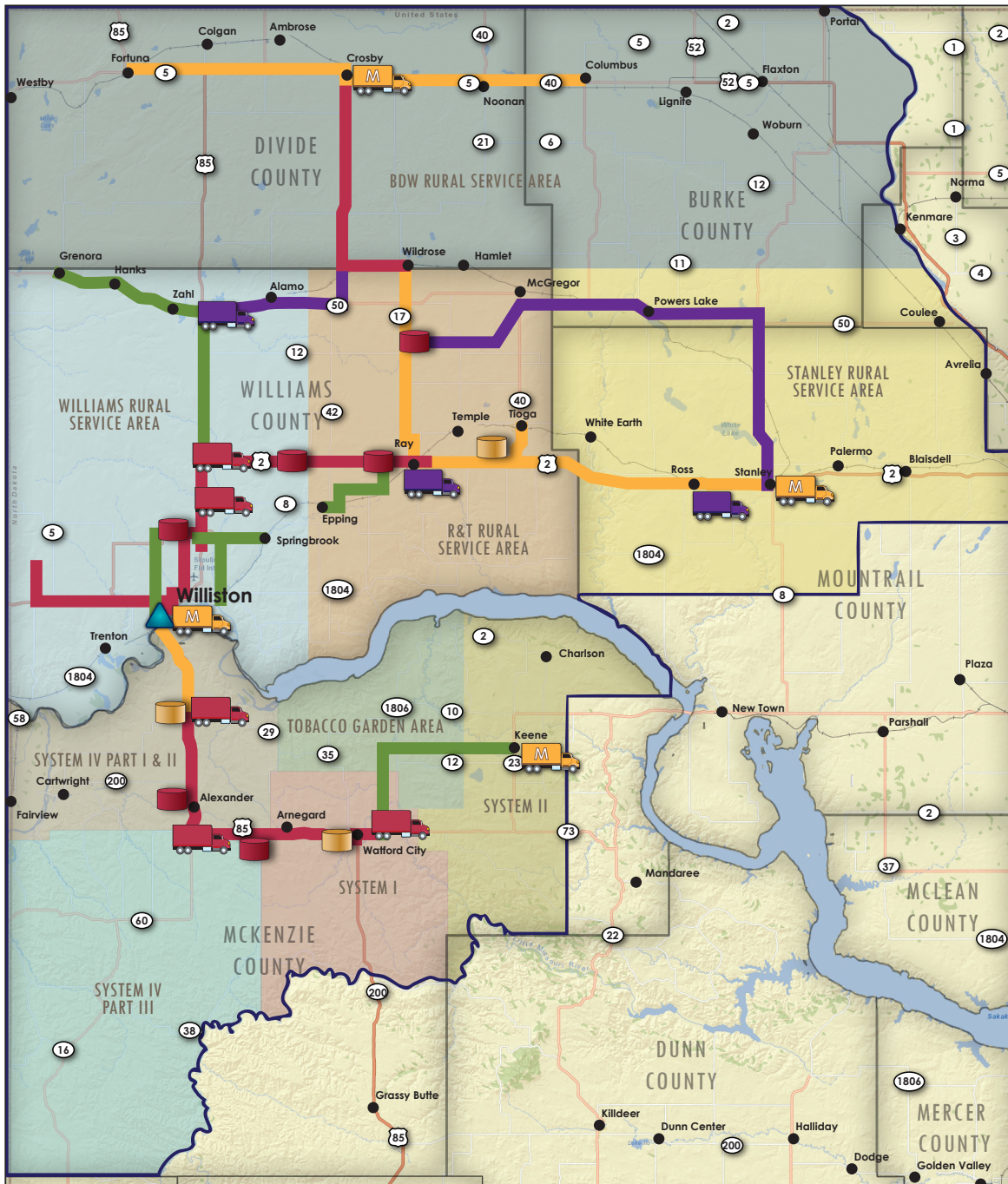
Rural & Regional Water Supply Systems



North Dakota Cloud Modification Project Area



Western Area Water Supply



- | | | |
|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
|  Existing Transmission Lines |  Existing Reservoir |  Existing Member Depots in Operation |
|  2011/2012 Improvements |  2011/2012 Reservoir |  WAWSA Depots in Operation |
|  2013/2014 Improvements |  2013/2014 Reservoir |  Future WAWSA Depots |
|  2015/2016 & Beyond Improvements |  WTP/Intake Expansion/Improvements | |
|  WAWSA Project Boundary Line | | |





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