TODAY'S **MISSOURI RIVER**

The Missouri River has been an important resource for people living along or near it for thousands of years. As time went on and the corridor of the Missouri River was developed and populations increased, efforts have been made to control flows, create storage, and prevent flooding. As a result, six mainstem dams have been in place for more than half a century, with the goal of bringing substantial economic, environmental, and social benefits to the people of North Dakota and nine other states.

Since the building of the mainstem dams, it has been realized that for all of the benefits that were provided, the dams have also brought controversy. They have created competition between water users, loss of riparian habitat, impacts to endangered species, stream bank erosion, and delta formation - which are only a few of the complex issues related to today's Missouri River management.

This educational booklet will outline the many benefits that the Missouri River provides, and also summarize some of the biggest issues that are facing river managers and residents within the basin today. Topics discussed throughout this publication include: the development of the reservoir system, water use, federal policies and regulations, sovereign lands, threatened and endangered species, the 2011 flood, riparian development, water supply challenges, recreation, water quality, sediment deposition, and delta formation.

DID YOU KNOW?

The Missouri River is the longest river in North America.

The Missouri is the world's 15th-longest river.

The Missouri has the nickname "Big Muddy," because of the large amount of silt that it carries.

There are approximately 150 fish species in the Missouri River, and about 300 species of birds live in the Missouri River's region.

The Missouri's aquatic and riparian habitats also support several species of mammals, such as mink, river otter, beaver, muskrat, and raccoon.

The major dams built on the river were Fort Peck, Garrison, Oahe, Big Bend, Fort Randall, and Gavin's Point.

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MISSOURI RIVER **MAINSTEM DAMS**

The U.S. Army Corps of Engineers (USACE) operates the Missouri River Dams under the guidance of the Master River Water Control Manual (Master Manual). The manual was originally developed in 1960, however it has been modified as needed with the latest revision in 2004. The Master Manual incorporates management strategies for the multitude of purposes that the river system supports.

THE RIVER **SYSTEM**

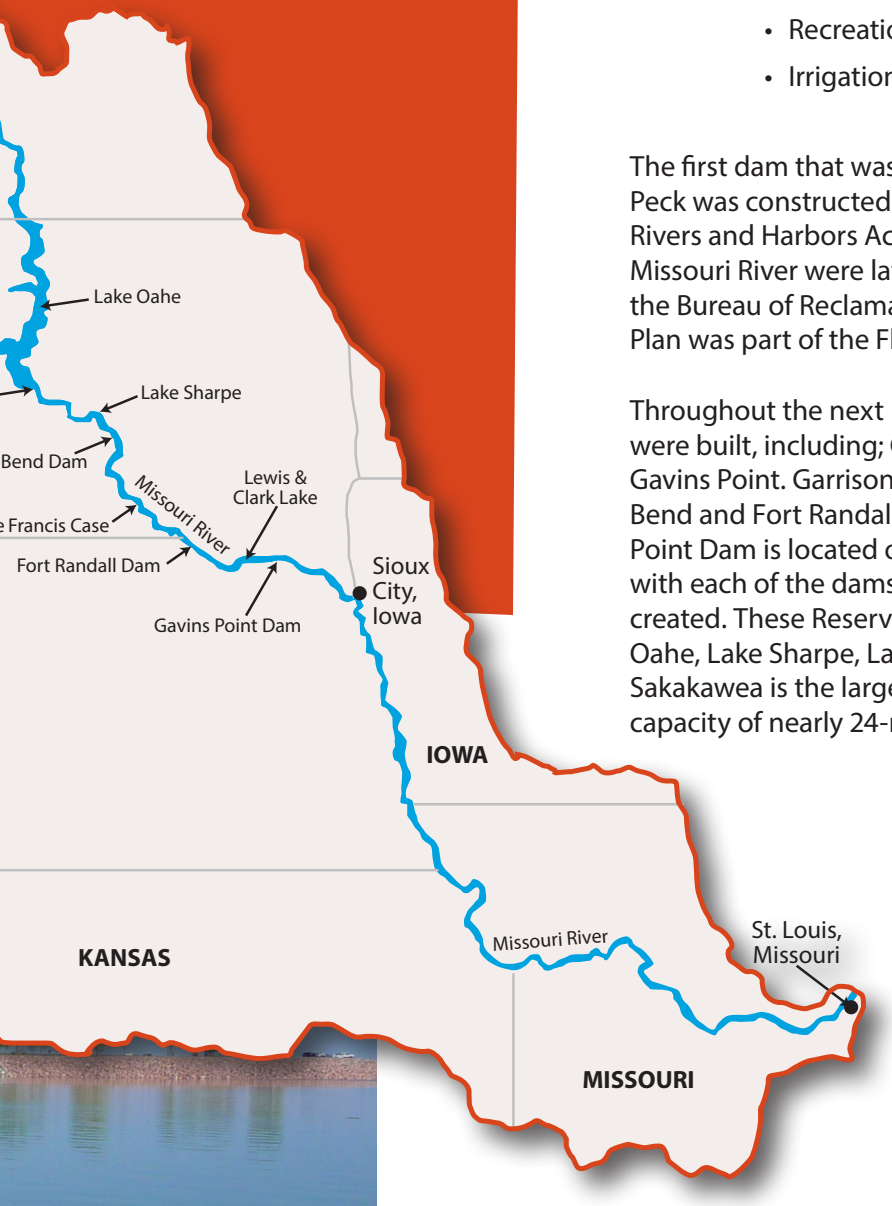
The Missouri River was once free flowing with meandering braided channels, sand bars, and expansive tree-covered riparian areas. The river was free to make its own banks, which were ever changing, and seasonal flooding was a common occurrence.

Today, six dams and reservoir projects make up the Missouri River reservoir system. All of these dams were constructed by the federal government and are maintained and operated by the USACE for the following authorized purposes:

- Flood Control
- Water Supply
- Recreation
- Irrigation
- Hydropower
- Water Quality
- Fish and Wildlife
- Navigation

The first dam that was constructed was Fort Peck in Montana. Fort Peck was constructed under Congressional authorization from the Rivers and Harbors Act of 1935. The other five mainstem dams on the Missouri River were later built in cooperation between the USACE and the Bureau of Reclamation under the Pick-Sloan Plan. The Pick-Sloan Plan was part of the Flood Control Act of 1944.

Throughout the next 19 years, the five remaining mainstem dams were built, including; Garrison, Oahe, Big Bend, Fort Randall, and Gavins Point. Garrison Dam is located in North Dakota, while Oahe, Big Bend and Fort Randall Dams are all located in South Dakota, Gavins Point Dam is located on the South Dakota/Nebraska border. Along with each of the dams on the Missouri River, reservoirs were also created. These Reservoirs are Fort Peck Lake, Lake Sakakawea, Lake Oahe, Lake Sharpe, Lake Francis Case, and Lewis and Clark Lake. Lake Sakakawea is the largest reservoir on the Missouri River, with a storage capacity of nearly 24-million acre-feet.



SOVEREIGN LAND **MANAGEMENT**

North Dakota's sovereign lands are those areas lying within the ordinary high water mark of navigable lakes and streams, including beds and islands. More specifically, sovereign lands are those areas located below what is known as the ordinary high water mark – which is basically the line created by a river or lake when it is at an ordinarily high level. With the exception of oil, gas, and related hydrocarbons, which are the responsibility of the Department of Trust Lands, the State Engineer in responsible for administering the state's interests on North Dakota's sovereign lands.

In North Dakota, the Missouri River is considered to be navigable and therefore, management of its associated sovereign lands falls on the State Engineer for the best interest of present and future generations of North Dakotans.

The Missouri River's abundant and expansive sandbars and islands, clear water, and beauty have contributed to a tremendous amount of interest from recreationists, landowners, and developers. This is especially true in the Bismarck-Mandan area. Numerous new housing developments have been built along the river and private landowners enjoy the benefits of living in close proximity to the river.

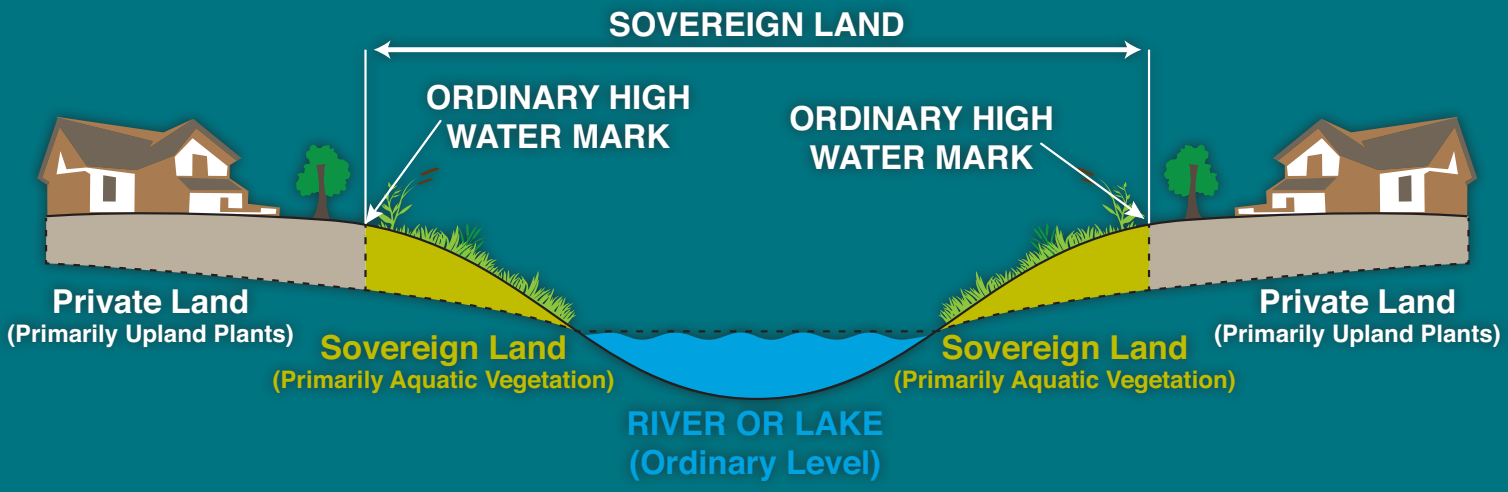
The recreational use of the Missouri River has also become increasingly popular. Boating, paddling, fishing, picnicking, and other general water-based recreation activities take place, especially in the summer.

At times, the popularity of the river and its heavy use can cause conflicts between users, particularly between private landowners along the river and the recreating public. In addition, staff of the State Engineer continually survey sovereign lands for encroachments such as unauthorized structures, yards, and other non-compliant uses.

Another issue with the high and ever-increasing recreational uses of sovereign lands along the Missouri River is trash and litter. In the spring of 2014, the State Engineer increased efforts to reduce littering and glass containers on sovereign lands. Signs were installed at access points to make the public aware that it is illegal to litter or possess glass containers on sovereign lands. The fines are $250 for littering and $100 for the possession of glass containers. The intention of this enforcement is not to issue a lot of citations, but to protect our waters and beaches by keeping them an attractive and safe places to recreate.

Sovereign lands are those areas located below what is known as the **ordinary high water mark,** which is basically the line created by a river or lake when it is at an ordinarily high level.

Also in 2014, administrative rules were modified to clarify that operation of motorized vehicles is not legal on sovereign land. The use of motorized vehicles on sovereign lands is allowed when it is a necessary part of an authorized project; when launching or loading a watercraft; when the operator or rider is physically impaired and their vehicle displays the handicap sticker or tag; when accessing for ice fishing via trails or roads authorized by the State Engineer; and by agricultural producers when herding livestock, maintaining a livestock fence, installing or maintaining an agricultural irrigation water intake, or for other ordinary agricultural practices. The fine for illegal motorized vehicle use on sovereign lands is $100.



Piping Plover
sparrow-sized
shorebird

Pallid Sturgeon
is a prehistoric
fish species

Least Tern
smallest tern in
North America

THREATENED & ENDANGERED SPECIES

There are many wildlife, plant, and insect species that are listed as, or proposed to be, threatened or endangered throughout North Dakota. However, there are two bird species and one fish species on the Threatened and Endangered list specific to the Missouri River. These are the piping plover, least tern, and pallid sturgeon. Each of these species have been negatively impacted by the construction of the mainstem dams, and river channelization.

The threatened piping plover and the endangered least tern are shore birds that traditionally relied on the natural flows of the Missouri River to provide their preferred habitat along the shorelines and on sandbars. These birds prefer a specific aggregate type where they build their nests. Prior to the building of the mainstem dams, the Missouri River would flood in the spring and early summer coinciding with the prairie snowmelt and mountain snowmelt, respectively. These floods would move sediment and build sandbars creating the species' preferred habitat. After the building of the dams, these natural processes were greatly altered along the open sections of river. This is compounded by continually fluctuating reservoir levels behind the dams, which often flood active nesting locations.

The US Fish and Wildlife Service, with assistance from many other federal and state agencies, participate in recovery efforts for these bird species by documenting nesting birds, monitoring them, assisting with moving nests if necessary, and regulating public access in areas of active nests. Sometimes these access restrictions are located in areas of high public use, creating conflicts with recreational uses. To mitigate additional impacts to terns and plovers, the USACE periodically manipulates river flows to ensure that birds are nesting in safer locations.

For the least tern, these management strategies have been rather successful. In 2020, it is anticipated that this species will be removed from the Federal Register. While it may be delisted, there will be a period of time in which monitoring will still take place to ensure strong populations.

Another species that has been negatively affected by the building of mainstem dams on the Missouri River is the pallid sturgeon. The pallid sturgeon is a prehistoric fish species that literally was around when dinosaurs walked the earth. This species survived the landscape and climate changes that were associated with the extinction of the dinosaurs and other prehistoric species. However, dam construction has been devastating for the pallid sturgeon. Dams substantially changed their preferred habitat by reducing the natural river courses to short sections, and taking flowing sediments out of the water. Today, it is estimated that there are only 120-150 wild adult sturgeon in the upper Missouri River Basin.

The pallid sturgeon recovery program has incorporated reintroduction through stocking, modifying river flows, and constructing habitat to improve spawning. However, it seems that one of the biggest issues is the lack of continuous river sections that the pallid sturgeon once relied on in their migration for spawning. Because of this, agencies are working on a fish passage at a low head dam near Glendive, MT on the Yellowstone River. The intention of this is to create a longer river corridor that the fish can use to spawn.

In June 2014, the US Fish and Wildlife Service for the first time, found evidence that natural spawning had occurred in the Powder River, a tributary of the Yellowstone River near Glendive, Montana. This is a significant development because it takes 15 years for a pallid sturgeon to reach sexual maturity, meaning that the fish from the stocking program are finally of age where they can attempt to reproduce in the wild.

To help with the recovery of threatened and endangered species, the Missouri River Recovery Implementation Committee (MRRIC) was formed in 2008 to serve as a basin-wide forum to develop a shared vision and comprehensive plan for Missouri River recovery. Many of the issues that the MRRIC works on deal with proposed modifications to the river or management strategies aimed at aiding in species recovery.

RIPARIAN **DEVELOPMENT**

The Missouri River bottoms provide excellent recreational opportunities. Additionally, residents in towns along the Missouri River have found how enjoyable living along the river can be. This is especially true in the Bismarck-Mandan area.

Prior to the construction of the Garrison Dam, there was little commercial or residential development south of Main Street in Bismarck due to seasonal flooding of the Missouri River. With the completion of the dam came a significant reduction in the threat of flooding. It was at this time that real estate developers took advantage of the opportunity to start parceling out property and building in the Missouri River floodplain.

Beginning in the 1970s, the development of riverfront property in Bismarck-Mandan gained popularity. Fox Island in south Bismarck was one of the first residential developments along the river. Today, there are many other areas that have been developed, including Southport, Misty Waters, and Hogue Island in Burleigh County. In Mandan, areas known as Marina Bay, Borden Harbor, and Lakewood continue to be developed. Many of these areas have private marinas for easy access to the river.

In areas where there is development along the river, one will notice modifications to the riverbank to reduce the amount of erosion. Most often this is done by placing large rocks and boulders, also known as rip-rap, along the banks so they are not damaged or washed away during high flows of the river.

Residential riparian development is very attractive to some people. However, it does not come without cost to the private property owner. There are many permitting requirements and building specifications for construction in a flood prone area. In addition, if you carry a federally backed loan or mortgage for a home in a flood prone area, you must have flood insurance, and flood insurance can be costly.

But, even with the known risks of flooding, it is unlikely that development will stop in these high-risk areas. The attractiveness of living along the river simply outweighs the risks of future floods to many homeowners.

WATER **SUPPLY**

The Missouri River is a tremendous resource for many of North Dakota's municipal, rural, industrial, and agricultural water users. There are currently several water supply intakes along the Missouri River for various purposes in North Dakota, and two of those are large regional water supply systems – The Southwest Pipeline Project and the Western Area Water Supply.

The Southwest Pipeline Project (SWPP) was established in 1986 to provide a reliable and high quality water supply from the Missouri River to a portion of North Dakota south and west of the Missouri River. The SWPP currently serves 56,000 water users, including 7,130 rural customers, 33 communities, and 21 raw water customers. With the population continuing to grow in this region of the state, it is expected that the SWPP will likewise continue to grow.

Established in 2011, the Western Area Water Supply (WAWS) is a domestic water supply project that uses Missouri River water that is treated in Williston, North Dakota to support the municipal, rural, and industrial needs throughout five counties in northwest North Dakota. In 2019, WAWS was serving 71,000 water users, including 4,000 rural connections and 11 communities in the region. The supply system also operates eight water depots that provide industrial water to the oilfield. It is expected that WAWS will continue to grow into the future to supply high quality water to those in need.

In the coming years, the Northwest Area Water Supply (NAWS) project will take water from Snake Creek Pumping Station on the east end of Lake Sakakawea, treat it, and supply it to area municipalities and rural water suppliers. The development of the project had been ongoing at a slow pace since 2002 because of court challenges. However, in May 2019, NAWS was finally able to overcome its 17 year legal battle with the Province of Manitoba and the State of Missouri. Today, NAWS is building out a number of project components to meet its mission. Construction is anticipated to last well into the future and NAWS is projected to deliver water to 81,000 people.

Currently, the Missouri River is being looked at to provide water to the Red River Valley. Over the years, various projects have been proposed to supply Missouri River water to eastern North Dakota. Between 2000-2007, the U.S. Bureau of Reclamation and Garrison Diversion Conservancy District developed plans for a Red River Valley Water Supply Project. An EIS was completed, however, authorities at the federal level never issued a record of decision to allow the project to move forward.

More recently, in 2014, the State of North Dakota and Garrison Diversion Conservancy District started working on studies to evaluate potential intake sites and alignment routes to bring Missouri River water to areas in central and eastern North Dakota. The current version of the project is state and locally sponsored. The water will be carried by pipeline from an intake site near Washburn, and then treated and transported east along Highway 200 by pipeline to the Sheyenne River north of Valley City. When this water supply is complete it will be owned by Lake Agassiz Water Authority. In total, it is anticipated that this project will cost $1.1 billion through 2029 and has the potential to serve 50% of North Dakota's population.

RECREATION

The construction of Garrison Dam in North Dakota and Oahe Dam in South Dakota resulted in a tremendous loss of river bottom land. Combined, the creation of Lake Sakakawea and Lake Oahe flooded 550,000 acres of prime riparian farmland in North Dakota. To compensate North Dakota for lost land and income from a project that was designed to benefit downstream states, the federal government originally promised over 1.2 million acres of irrigation. However, those large irrigation projects never came to fruition.

Since then, North Dakota has adapted to the post- dam landscape along the Missouri River, Lake Sakakawea, and Lake Oahe. The USACE manages federal lands around the entirety of Lake Sakakawea and Lake Oahe. The agency has established many recreational facilities through partnerships with tribal governments, state agencies, county park boards, water resource districts, and local service groups. In total, Lake Sakakawea has 37 recreation areas within USACE boundaries. Lake Oahe has 14 recreation areas within North Dakota. Services that are offered at these recreation facilities range from boating, camping, and picnicking, to swimming and nature trails.

USACE owned public lands along the Missouri River in North Dakota also provide numerous hunting opportunities. Hunting is allowed on all USACE property as well as on sovereign lands, unless posted otherwise. There are many Wildlife Management Areas that are leased and managed by the North Dakota Game and Fish Department throughout the river system as well.

The most popular water-based recreation activity on North Dakota's Missouri River System is fishing, as it supports a destination recreational fishery that is important to the state's economy. During just a 10-week period in 2018, anglers from more than 30 states harvested over 628,000 walleye from Lake Sakakawea. In addition, thousands of sauger, northern pike, chinook salmon, yellow perch and smallmouth bass were also taken. Also, during just a 6-week period in 2018, 107,000 walleye were harvested from North Dakota's portion of Lake Oahe and the Missouri River.

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SEDIMENT DEPOSITION & DELTA FORMATION

The Missouri River dams and their associated reservoirs create areas where water is stored, river current is diminished, and sediment loads have the ability to settle to the river/lake bed. This process provides for better water clarity and overall quality. However, it also creates significant negative impacts, like sediment deposition and delta formation.

For more than six decades since Garrison Dam was closed, sedimentation has been occurring at the upper reaches of Lake Sakakawea, specifically around the Williston, ND area where the headwaters of the reservoir are located. The same process happens south of Bismarck at the headwaters of Lake Oahe.

Sedimentation has a negative impact on flood protection structures such as levees. The city of Williston has an extensive levee system in place to protect from floodwaters of the Missouri River and Lake Sakakawea. Due to the flood of record in 2011, and sedimentation over time, the levees were heightened.

Accumulated sedimentation at the mouth of the river at the upstream reaches of Lake Sakakawea and Lake Oahe have caused the formation of deltas at each location. A delta is an area where widespread sediment has deposited, causing the water to no longer flow through a defined channel. Instead, the river forms braided, meandering, shallow areas. The deltas in the Missouri River have lessened the storage capacity of the reservoirs, and can also contribute to river elevation rises. This can also contribute to ice jams and localized flooding because of restricted river flows.

The USACE has recently conducted studies to identify a variety of alternatives to mitigate this process. Increased flows to clear the channel, and dredging and excavating river channels to increase water velocity are two alternatives. However, most mitigation techniques only provide for temporary relief as sediment builds back up over time.

WATER QUALITY

Prior to the dams being built on the Missouri River it was one of the greatest silt carrying rivers in the world. So much so that it was also known as the Big Muddy. When pioneers were settling along the Missouri River, it was often described as "too thick to drink, but too thin to plow." Silts and sediments were carried from sloughing banks during high flows on the river, as well as from its tributaries.

Starting in 1937, when Fort Peck Dam was closed in Montana, and again in 1953, when Garrison Dam was closed, water quality was drastically improved. Eventually, with the completion of the remaining dams, water quality was improved along the entire Missouri River system. The dams and their associated reservoirs allow sediment loads to settle out and decrease turbidity in river sections. Today, water quality in the Missouri River is among the best in North Dakota for domestic and industrial purposes.

2011 MISSOURI RIVER **FLOOD**

Since the completion of Garrison Dam, the Bismarck-Mandan area experienced very few flood-related impacts. In 1975 and 1997, high spring/summer runoff caused moderate flooding in communities. However, the region had never seen a flood similar to that of the unprecedented flooding in 2011 in the post-dam era.

In 2011, flooding in the Missouri River basin was caused by numerous factors that all happened in sequence. Going into the winter of 2010-2011, much of the upper Missouri River basin had already experienced an unusually high amount of precipitation. This caused soils to be saturated before winter. When the snow did come, it came in record amounts. The northern United States was stuck in a persistent storm track that transported several significant storm events through the region throughout the winter months. For example, locations that average 30 inches of snowfall per year received 108 inches!

With the Missouri River reservoirs drawn down to account for spring runoff as usual, no one anticipated what would happen next. The rain started to fall.

As tremendous rainfall amounts began to accumulate in early summer 2011, the USACE changed their flood projections numerous times and continually increased releases from Garrison Dam. Burleigh and Morton Counties, the cities of Bismarck and Mandan, and private citizens began constructing temporary levees, plugging marina inlets along the river, and sandbagging private residences. Many people were forced to evacuate their homes because of impending floodwater.

On June 1, 2011, the spillway gates at Garrison Dam were opened for the first time in history to release floodwater, and one day later the Missouri River went above flood stage in Bismarck-Mandan and remained above flood stage until August 30.

In spite of the hard work of all parties in the flood fight, it was not possible to provide flood protection for everyone. Many homes were severely damaged or destroyed in the floodwaters.

During the same time that the Bismarck-Mandan area was fighting the flood, there were many other communities that were affected as well. At Fort Yates, along the south shores of Lake Oahe, the USACE worked on a project to strengthen the shoreline so that floodwater would not damage the levees that had been in place for decades. In Williston, boils or leaks formed in the city's permanent levees that had been in place for decades. There was concern that the boils could ultimately cause the levees to fail, which would have jeopardized the city's water supply and sewage treatment facility.

Since the flood of 2011, the Williston levee has been rebuilt and all new monitoring instrumentation has been installed. In all, $20 million was spent over three years to rebuild the system.

In the Bismarck-Mandan area, there was a lot of clean-up and rebuilding that took place after the flood. In some flooded locations, the county bought out homes. Beginning in 2012 through the present, flood protection projects, such as levees and road grade raises have been installed along the river in Bismarck.

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