

Problem Summary

The BBWA Main Canal conveys an average of 400 cfs of water for irrigation and municipal purposes throughout the City of Billings. Portions of the canal are fortified, and in some areas the canal runs upwards of 60 feet above residences and businesses. The canal is notorious for seepage losses due to well drained underlying soils. Seepage of the canal, combined with development and infrastructure cutting into the hillside below the canal, results in weakened slope stability. An embankment failure would likely cause loss of life and a projected \$1 million to \$1 billion in economic damages according to Yellowstone County Disaster and Emergency Services (DES). BBWA has performed multiple lining projects in the past, most recently 1,500 feet in 2018 to prevent seepage, but there is still approximately 12.6 miles of canal within city limits which needs to be addressed (this project seeks to fund approximately ½ mile of this total length). The canal section has been separated into three phases: extreme priority, high priority, and moderate priority. A portion of the area determined to be of extreme priority is the focus of this grant application and encompasses a portion of the canal in which failure of the embankment may occur quickly and without warning, causing injury and/or loss of life. The area identified as high priority has a lesser chance of causing loss of life due to a lower slope elevation where a breach may occur. The moderate priority area has a lesser likelihood of breach, but significant seepage is still occurring, causing foundational issues and stormwater control problems for the city and residents below. These issues ultimately result in significant economic loss. The extreme priority portion of the canal should be completed immediately (or as soon as funds can be secured), as the BBWA consistently finds cracks and slope movement above residences and businesses, indicating a breach of the canal could be imminent. The BBWA continually repairs these areas as they do not have the funding to install the lining. Failure of the canal in one of these areas could be financially insurmountable for the BBWA and leave homeowners, business owners and farmers helpless, along with causing catastrophic property damage and the potential for injury and death.

Project Summary

The proposed canal rehabilitation project provides enormous public health and safety benefits for City of Billings residents, while improving water quality for the Yellowstone River. BBWA's Main Canal experiences severe seepage losses over a 12.6-mile section equating to a loss of approximately 40cfs (9.8 billion gallons) of water annually, which directly contributes to poor slope stability. In the focus area for this application (0.51 mile stretches of extreme priority), it is estimated 1.68cfs or 39.7 million gallons are lost annually. An embankment failure would wash an enormous amount of sediment and contaminants from flooded municipalities (houses, businesses, streets, etc.) into the City of Billings stormwater network. The city's stormwater system is a DEQ MS-4 permitted system which is monitored for water quality at discharge into the Yellowstone River. Embankment failure would cause violations of water quality, and expose wildlife habitat to high concentrations of sediment chemicals, oils and greases, which are extremely toxic. Flooding would also have severe economic implications, causing \$1 million to \$1 billion dollars in estimated damage per Yellowstone County Disaster and Emergency Services. Damage to homes, businesses and vehicles, health and safety hazards, and potential loss of life are all likely to occur should there be an embankment failure. Lining and regrading the canal will minimize seepage losses to improve slope stability. Mitigating seepage along the main canal within city of Billings limits significantly lowers the chances of embankment failure. The goal of the BBWA is to line and regrade the canal in three phases based on level of priority (Extreme, High, and Moderate), and costs for each phase can be found in the attached technical memorandum. This application looks to

address a small portion of the final project by focusing on a portion of the most extreme and concerning stretches of the main canal. The Extreme Priority Phase encompasses approximately 5.1 miles of canal (0.51 miles for this application), and primarily includes areas built well above grade, experiencing high volumes of seepage loss. These areas pose the most immediate threat with extremely high danger to public health and safety. The High Priority Phase includes approximately 3.3 miles, mainly areas built above grade, experiencing high volumes of seepage losses which pose a high risk to citizens. The Moderate Priority Phase, approximately 4.2 miles, primarily includes areas that experience high volumes of seepage loss and moderate risk to citizens. Effectiveness of any project can be measured by multiple methods. First, it can be evaluated on the amount and size of cracks or movement in embankments during annual inspections. Secondly, staff gauges already installed throughout the City of Billings section can be tracked, and past loss measurements can be used for comparison. Finally, the BBWA will continue to monitor how much water is being diverted from the Yellowstone River, comparing the data with prior years to determine the amount of water retained by lining the Main Canal. Rehabilitating the proposed 0.51 mile stretch of canal will increase public safety, improve the quality of water being returned to the Yellowstone River, and decrease the amount of water being introduced to groundwater contaminants (salinity, nitrates, etc.). Furthermore, an estimated 39.7 million gallons of water could be retained by this portion of the project, allowing for a substantial conservancy of water in the natural body, the Yellowstone River.

Project Goal

Address the imminent threat of a breach of the BBWA Main Canal, which could cause extreme damage to homes and businesses, including the potential for injury and loss of life. Provide greater public safety to City of Billings residents by addressing seepage losses which are degrading slope stability in 12.6 miles of the BBWA Main Canal inside Billings City Limits, increasing the chance of embankment or slope failure. Reduce the amount of excess water diverted from the Yellowstone River to compensate for seepage losses, and to reduce the likelihood of sediment loaded water flooding into the city's stormwater system, ultimately flowing into the Yellowstone River. Provide a more consistent availability of irrigation water in drier months to farmers who rely on the BBWA canal for crop cultivation.

Project Objectives

Regrade and line the BBWA Main Canal in the most concerning area within the City of Billings.

Project Effectiveness

Seepage losses will be measured by flow data taken by BBWA staff and compared with flows from historical data, which in turn indicates the water quantity preserved in the canal. Lining effectiveness for public health and safety will be measured by noting slope movements/deterioration during routine inspections.

Total Acreage Affected

17,000

Crops

Alfalfa, barley, corn, grass/hay, sugar beets

Public health or safety threats?

Yellowstone County Disaster and Emergency Services has identified the BBWA Main Canal as a likely disaster location which could cause \$1 million to \$1 billion in economic damages. Additionally, an embankment failure would result in a catastrophic flood event which would lead to numerous injuries and likely loss of life, as well as subject residents and businesses to contaminants (mold, oils, greases) due to flooding.

Receiving water body

The Yellowstone River

Impacts to a waterbody on the State's 303d list

The Yellowstone River is the discharge location for the City of Billings stormwater network. The city network is a DEQ MS-4 permitted system. Embankment failure would wash large quantities of sediment, chemicals, oils, greases and other pollutants into the city's stormwater system, which would result in toxic water being discharged into the Yellowstone River.

Protect public health?

The Main Canal is built up in excess of 60 feet in places, directly above residential and commercial buildings. Currently in 0.51 mile stretches of extreme priority (the focus area for this application), it is estimated 1.68cfs or 39.7 million gallons are lost annually. The seepage of water in addition to newer infrastructure encroaching into embankments below the canal are greatly impacting slope stability. A canal embankment failure will destroy residences and businesses, likely causing injury and loss of human life.

Toxic effects to aquatic life?

A canal breach, like the one which occurred in June of 2021, results in sediments, grease, oil, chemicals and other pollutants discharging into the Yellowstone River through the City of Billings stormwater network. This toxic water has a great impact on the habitat, wildlife and aquatic species such as trout, burbot, paddlefish, walleye, and numerous others. Reducing the risk of a breach would prevent future events like the one which occurred in June. Furthermore, by introducing a seepage abatement measure, the BBWA will be able to provide a more consistent water supply to its users by only modifying intake to the canal during changing water usage periods, rather than having to account for seepage losses. This could preserve up to 9.8 billion gallons of water per year, allowing it to stay in the Yellowstone River. Therefore, it would remain uncontaminated in its natural biome.

Reduce sediment or nutrient loads?

Rehabilitation of the Main Canal would reduce sediment loading to a surface water body in two different ways. The lining project would limit the amount of erosion occurring at turnouts or other key points in the canal. Secondly, lining the canal eliminates the need for the excess flows being diverted into the main canal, which would reduce the amount of runoff flowing into Lake Elmo, Rattlesnake Reservoir and the Yellowstone River. The primary reduction in sediment would be that which occurs during severe flooding events. In the technical memorandum you will find pictures of a major overflow that occurred in June of 2021, where a large amount of sediment was discharged onto the streets of

Billings. All of this sediment ended up in the stormwater network and ultimately in the Yellowstone River.

Improve water use efficiency?

Presently, an excessive amount of water must be diverted into the BBWA from the Yellowstone River to account for seepage losses. An estimated 1.68cfs or 39.7 million gallons of water would be conserved by completing this lining project. The city of Billings is fast approaching a limit on available municipal water, which increases the difficulty of supplying the west end of Billings with potable water. A source of raw water for irrigation of large public spaces in this area could alleviate future issues of water supply to the city, which accounts for 10% of the State of Montana's population. These 39.7 million gallons in water savings can be utilized for further development of irrigable acres west of Billings, increasing crop yields on agricultural areas that are water short during periods of peak demand, or the future development of raw water systems (e.g., parks) west of Billings, which are a taxing water use for a municipality to manage. The loss of water due to seepage in the Main Canal directly affects every water user along the Main Canal within the city of Billings limits.

Enhance wildlife habitat?

Excess water that is currently being diverted from the Yellowstone to compensate for seepage could be remediated by the proposed lining project. Correcting this issue would mean more water could remain in the Yellowstone River habitat, benefiting wildlife and aquatic life. Furthermore, these additional flows encourage erosion, contributing to sediment loaded water discharging into Lake Elmo, Rattlesnake Reservoir and the Yellowstone River. This runoff has a negative impact on wildlife and aquatic life existing in these habitats. A full description of the project and its impacts on wildlife habitats can be found in the attached technical memorandum.

Help meet a TMDL?

The city of Billings stormwater network is DEQ monitored for discharge water quality to the Yellowstone River. As previously mentioned, a canal breach would result in sediments and contaminants entering the city's system causing violations of these standards. Rattlesnake Reservoir is supplied by the BBWA main canal and acts as a domestic supply for a subdivision north of Billings. Therefore, the water is monitored for TMDL, and the proposed project would minimize sediment loaded water entering the reservoir.

Better stormwater management?

The lining project will enhance the city of Billings' ability to meet total maximum daily loads (TMDL) for stormwater and municipal water for the Hidden Lake Subdivision. The Rattlesnake Reservoir, supplied by the BBWA, is utilized for municipal water supply in a subdivision northeast of Billings. Rehabilitating the Main Canal should reduce the turbidity of the water entering the reservoir, which in turns helps the subdivision meet the TMDL required of Rattlesnake Reservoir. The city's stormwater network, which is permitted as an MS-4 by EPA, has TMDL requirements it must meet as their system discharges into the Yellowstone River. Embankment failure releases large amounts of sediments into City streets and the floodwaters pick up toxic foreign substances that ultimately end up in the city's stormwater network. The sediment and substances would cause a violation of the City of Billings stormwater TMDL requirements. The proposed rehabilitation project will limit the chance of canal failure, which keeps

these large quantities of sediment and toxic substances from entering the City of Billings stormwater system and ultimately the Yellowstone River.

Conserve irrigation water?

During peak water usage times, the BBWA must deliver the maximum flow that can be carried through the canal to account for seepage losses prior to irrigable lands northeast of Billings. Because of this issue, no additional irrigated lands can be developed in the upper reaches of the canal. Currently, 2,100 acres of lands are irrigated in the area west of Billings. Further development of irrigable lands must include either an increase in flow capacity of the canal, which would require increasing the flow capacity of nearly 20 miles of canal, or a reduction in seepage of critical loss areas. Some agricultural areas served by the Main Canal become water short during periods of peak demand due to high seepage losses. These shortages often occur during critical growth periods for crops, which reduce crop yields and create financial hardship for the farmers who operate and maintain these lands. The section of the canal proposed to be rehabilitated accounts for an average seepage loss of an estimated 1.68cfs or 39.7 million gallons, which is documented in measurements completed by WWC Engineering and the Bureau of Reclamation.

Irrigation Competitive Grant Requested:

\$500,000

Total Match:

\$120,000 (BBWA)

Total Project Cost:

\$620,000