City of Mackinac Island
Drinking Water State Revolving Fund
Project Plan Amendment

Project No. 221432
March 23, 2032

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1515 Arboretum Drive, SE
Grand Rapids, Michigan 49546

616.575.3824 | fishbeck.com

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Prepared For:
Department of Public Works
Mackinac Island, Michigan

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Table of Contents

List of Tables

List of Charts

List of Figures

List of Appendices

List of Abbreviations/Acronyms

ADD	average daily demand
CIP	Capital Improvements Plan
City	City of Mackinac Island
DWSRF	Drinking Water State Revolving Fund
EGLE	Michigan Department of Environment, Great Lakes, and Energy
gpm	gallons per minute
ISO	Insurance Service Office
MDD	maximum daily demand
MG	million gallons
mgd	million gallons per day
MOR	monthly operating reports
O&M	operation and maintenance
PHD	peak hour demands
PRV	pressure reducing valve
WTP	water treatment plant

1.0 Introduction

In February 2022, the City of Mackinac Island (City) retained Fishbeck to complete a Drinking Water State Revolving Fund (DWSRF) Project Plan for improvements to the City's drinking water system. The City did not receive enough points through the DWSRF scoring to fund the proposed projects. The projects proposed in the original Project Plan included:

- Replacement of the 6-inch water main along Cadotte Avenue with a 12-inch main to address pressure and redundancy issues within the distribution system.
- Improvements at the Water Treatment Plant (WTP), including closure the underground storage tank (UST) and installing an above-grade fuel tank, equipment improvements, conversion of the disinfection system from chlorine gas to onsite generation of sodium hypochlorite (OSG), expansion of the existing garage, and upgrades to treatment capacity.
- Installation of an 8-inch water main just west of Cadotte Avenue between 6th and 7th Streets.
- Inspection and repair of a suspected leak in the Upper Reservoir of the City's water system.

This report is intended as an amendment to the original proposed project plan. The following changes to the proposed projects are included with this amendment:

- Removal of the inspection and repair of a suspected leak in the Upper Reservoir of the City's water system from the project plan.
- The addition of 5,600 feet of 6-inch water main replacement up Cadotte Road from 5th Street to the airport, and west to the 12-inch water main just northeast of Forest Drive.
- Review of a potential connection to the Silver Birches Development in the northwest part of the Island.
- Rehabilitation of the existing valve pits on Huron Street and at the west end of the Bluffs. This will include some equipment replacement and vault rehabilitation.
- Installation of a mixer in the Lower Reservoir near Fort Mackinac.
- Replacement of all valves and actuators associated with and replacement of the membranes on the existing membranes skids in the WTP.

A map of the water service area for the City's water system is included in Figure 1. A map of the City's water distribution system, including the pressure districts, storage tanks, water mains, and the WTP is provided in Figure 2.

2.0 Project Background

2.1 Delineation of Study Area

The City is situated on Lake Huron in the Straits of Mackinac. The City is 5.6 square miles of which 1.2 square miles is water, and 0.6 square miles is Round Island, which results in 3.8 square miles of land on Mackinac Island. The City's water distribution system supplies water to Mackinac Island. The current water distribution system is shown in Figure 2. The water distribution system stretches from the southeast to the northwest, generally following the coastline along the south and west sides of the island. The northeast part of the island is owned by the State of Michigan and is State Park land. The proposed water system improvements would potentially occur as shown in Figure 3 in the following locations:

- Along Cadotte Avenue from the 16-inch water main past Algonquin Street to 5th Street (from Original Project Plan).
- Installation of an 8-inch water main just west of Cadotte Avenue between 6th and 7th Streets (from Original Project Plan).

- Along Cadotte Road from 5th Street to the airport, and west to the 12-inch water main just northeast of Forest Drive.
- A potential connection to the Silver Birches Development in the northwest part of the Island.
- Rehabilitation of valve pits at Huron Street and the west end of the Bluffs.

Water is provided to the distribution system by the WTP at the southeast end of Mackinac Island. An intake in Lake Huron brings raw water into the WTP, where it is treated then pumped through the distribution system. The proposed WTP improvements in this Project Plan will occur within the WTP site shown in Figure 4.

2.2 Land Use

No changes have been made in Land Use as part of the Project Plan Amendment.

2.3 Population Projections

This section was revised as part of the Project Plan Amendment based on updated projections provided by the City.

Due to the seasonal tourist nature of Mackinac Island, the City experiences a significant fluctuation in population from summer to winter seasons. Population projections for year-round residents were obtained from the US Census Bureau, while population projections for summer tourists were created for the City using the *Wastewater Treatment 2022 Master Plan*.

To determine the potential total population build-out for the summer, the zoning ordinance was reviewed to determine available land area for each zoning district. Areas for each zoning district were estimated and divided among allowable land users. Maximum densities for each land use were multiplied by the area to give a total population. The City assumes that approximately 55% of the potential future development could occur during the 20-year planning period. This equates to an annual increase of approximately 2.75% of the build out population. The starting point for the population projections were estimated by multiplying the 2022 Master Plan population estimates by the annual 2.75% of the potential build out. Aside from the seasonal employees and overnight tourists, the summer seasons also includes day trip tourists. The number of daily tourists was estimated using 3.5% growth per year.

The City's year-round population had remained relatively consistent until 2010 when the population began to increase annually by 1.83%. When looking at the historical growth trend from 1960 to 2020 the growth rate decreases slightly to 1.2% annually. The historical population growth rate was utilized to project the future winter population.

The current and projected population data is included in Table 2-1.

Table 2-1 – City Historical and Projected Population Data

	2022		2028		2043	
Resident Type	Summer*	Winter**	Summer	Winter	Summer	Winter
Island Residents	2,230	586	2,662	592	3,739	610
Hotel/Lodging Guests	3,555		4,378		6,436	
Seasonal Employees	4,214		4,535		5,338	
Total Residential Population	9,999	586	11,575	592	15,513	610
Day Trip Tourists	8,752		10,270		14,065	
Total Design Population	18,751	586	21,845	592	29,578	610

*Data from the Wastewater Treatment 2022 Master Plan

**Data from US Census Bureau 2020

2.4 Water Demand

This section was revised as part of the Project Plan Amendment based on updated projections provided by the City.

2.4.1 Historical Demands

Fishbeck utilized the water pumpage recorded in the City's Water Treatment Plant (WTP) monthly operating reports (MORs) to estimate historical water use for the years of 2010 to 2021. It was assumed that the water pumped from the WTP to the system was equivalent to the water demand in the system. In this manner, losses throughout the distribution system and any lost water, such as that used for hydrant flushing and fire protection, are accounted for in the overall demands.

During the summer months (May through October), the City experiences a large influx of visitors and workers, which corresponds with higher water demands in the system. Summer demands were used for this analysis as that is when water demand is the highest. The population that stays on the Island through the winter months has remained relatively static when compared to the summer population. Any population growth on the island is expected to be seen in additional tourist accommodations and summer homes which would correspond to more water demands in the summer.

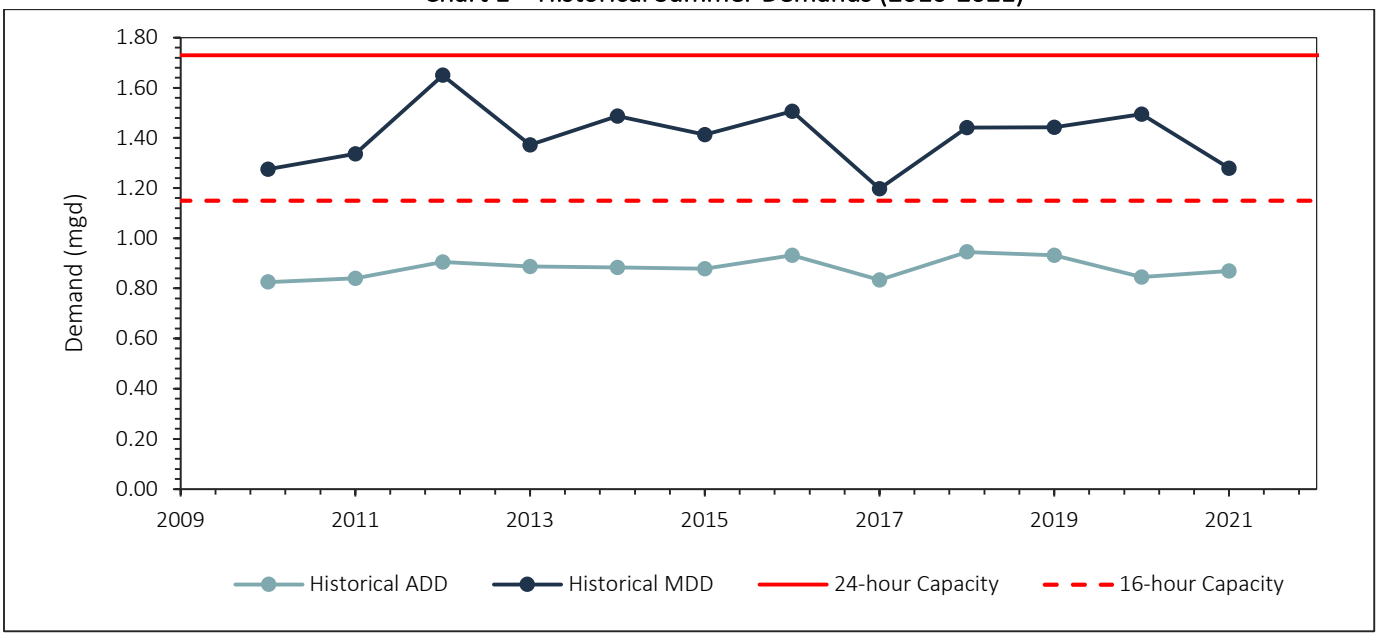
The ADD, or the annual average daily water flow supplied to the system, was determined for each year by dividing the total water treated in that year by the number of days in the year. The MDD, or the maximum daily demand of water flow supplied to the system on a single day in a given year, was also determined for each year. In addition, a MDD:ADD peaking factor, or calculated ratio of the MDD to ADD, was determined for each year. The historical water demands are shown in Table 2-2 and Figure 1, where they are compared to the WTP 24-hour rated firm capacity (1.73 million gallons per day [mgd]) and the 16-hour firm production capacity (1.15 mgd).

An operational day of 16 hours is the normal schedule for the WTP during the summer months. Typically, Michigan Department of Environment, Great Lakes, and Energy (EGLE) recommends water systems begin planning for a WTP expansion when historical demands exceed 80% of the rated capacity of the system. The MDD does exceed 80% of the rated capacity of the system and the City is in the process of implementing WTP improvements that will increase the capacity to handle current and future water demands.

Table 2-2 – Historical Water Demands (Summer 2010 -2021)

Year	Average Daily Demands (mgd)	Maximum Daily Demands (mgd)	Peaking Factor (MDD:ADD)
2010	0.83	1.28	1.54
2011	0.84	1.34	1.56
2012	0.90	1.65	1.82
2013	0.89	1.37	1.55
2014	0.88	1.49	1.68
2015	0.88	1.41	1.61
2016	0.93	1.51	1.62
2017	0.83	1.20	1.44
2018	0.95	1.44	1.52
2019	0.93	1.44	1.55
2020	0.85	1.50	1.77
2021	0.87	1.28	1.47
Average	0.88	1.41	1.60
Maximum	0.95	1.65	1.82
Minimum	0.83	1.20	1.44
Standard Deviation (St Dev)	0.04	0.12	0.11
Average + 1.65 St Dev	0.95	1.12	1.79

Chart 1 – Historical Summer Demands (2010-2021)



2.4.2 Water Demand Projections

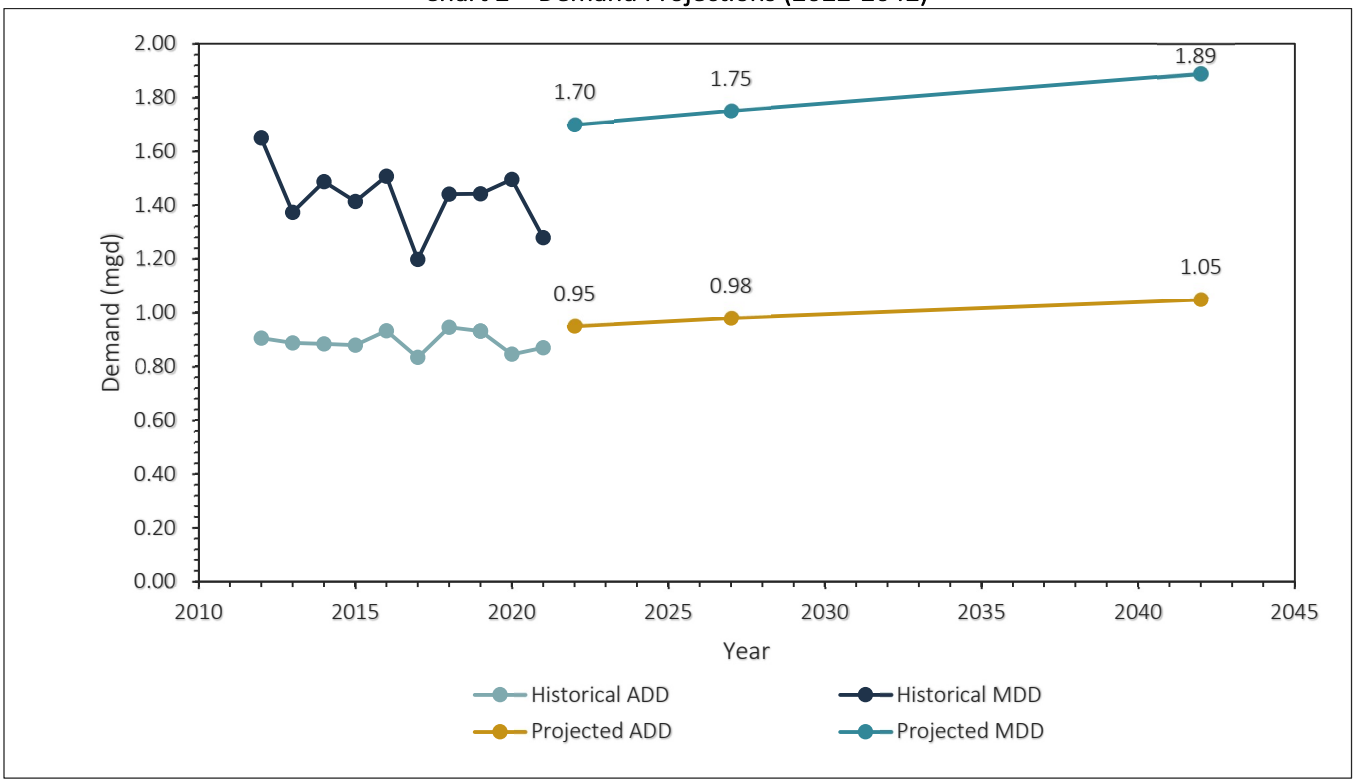
To project future water demands, the starting points for both the ADD and MDD projections were estimated. The starting point for the ADD was estimated using the average ADD plus 1.65 times the standard deviation of the ADD from 2010 to 2021 of 0.95 mgd. Statistically, this value is predicted to be greater than 95% of the probable future values based on the dataset, assuming it has a normal distribution. To estimate the MDD, the average ADD was multiplied by the average peaking factor and 1.65 times the standard deviation of the peaking factor from the years 2010 to 2021. The MDD:ADD peaking factor used was 1.79 resulting in a projected MDD starting point of 1.70 mgd.

The projected ADD for 2027 and 2042 were projected by applying the slight increase (0.55% annually) indicated in the linear trendline fitted to the historical ADD dataset for the years 2010 to 2021. The MDD was found by multiplying the ADD by the peaking factor of 1.79. The peak hour demands were estimated using a typical MDD:PHD peaking factor of 1.5. The projected demand values for the 5-year and 20-year periods are summarized in Table 2-3 and Figure 2.

Table 2-3 – Demand Projections (2022-2042)

Year	Average Daily Demands (mgd)	Maximum Daily Demands (mgd)	Peak Hour Demands (mgd)
2022	0.95	1.70	2.55
2027	0.98	1.75	2.63
2042	1.05	1.89	2.84

Chart 2 – Demand Projections (2022-2042)



2.4.3 20-Year Projected Storage Analysis

Storage capacity for the City's distribution system was evaluated to determine if adequate storage would be provided for the 20-year projected demands and assuming the full capacity of the WTP is utilized. Based on the demand projections (2020–2040), the ADD is approximately 1.05 mgd, and the MDD is approximately 1.89 mgd. An analysis of the storage needed to meet these water demands resulted in a calculated recommended storage volume of 1.53 MG.

The existing system storage totals 1.25 MG which is less than the recommended storage volume. The recommended storage volume can be reduced if the WTP has capacity in excess of the 2042 projected MDD, 1.89 mgd. However, the existing WTP only has a firm capacity of 1.73 mgd. If the WTP capacity is not expanded, an additional 0.3 MG of storage would be needed to make up the shortfall.

If the WTP capacity is expanded as proposed, an excess treatment capacity of 0.92 mgd would be available under standby power. The excess treatment capacity would allow the recommended storage to be reduced to 0.63 MG. The City's existing storage volume, 1.25 MG, exceeds this recommendation.

2.5 Existing Facilities

To see a detailed description of the existing facilities, reference the Original Project Plan.

2.6 Summary of Project Need

A summary of project need was provided for the projects added as part of the Project Plan Amendment. For additional information on the other projects, reference the Original Project Plan.

2.6.1 Current System Needs

2.6.1.1 Cadotte Avenue Water Main Replacement Extension

The 6-inch cast iron main that runs along Cadotte Avenue is more than 50 years old and is the primary pipeline supplying the majority of year-round residents in the winter.

Operation of the water distribution system changes depending on the season. During the summer months, all mains are kept open to allow flow through every part of the system. During the winter months when demand is low, the 10-inch mains on Cupid's Pathway and Algonquin Street are closed to force water through the 6-inch main on Cadotte Avenue. This helps prevent freezing in the 6-inch main, which is only about 3 feet below grade making it susceptible to breaks. Even with this change in operation, the City is forced to require residents downstream of the Cadotte Avenue Main to leave their taps open continuously to force more flow through the main until the cold period passes.

The Original Project Plan proposed replacing the water main along Cadotte Avenue from 16-inch water main past Algonquin Street to 5th Street. As part of the Project Plan Amendment, an additional 5,600 lineal feet is proposed for replacement with a 12-inch water main installed below the frost line (6 feet deep in Michigan). This additional replacement will generally follow Cadotte Avenue up to the airport and southwest to Forest Drive, where it will connect to a 12-inch main. This replacement will provide a large loop for the whole northern part of the water system, as well as, mitigating the potential for main breaks due to freezing during the winter months.

2.6.1.2 Silver Birches Development Water Main Replacement

The Silver Birches Development is in the far northwest part of the Island. It is currently serviced by a single 6-inch water main that runs roughly 2,900 lineal feet from British Landing to the development. British Landing is in turn fed by a single 4-inch water main that runs roughly 3,100 lineal feet from near the intersection of Forest Drive and Towering Oak Court to British Landing.

Available fire flows and pressures to the Silver Birches Development are very limited due to it being fed by a single stretch of small diameter water mains. Flow testing was completed near the development in 2015. Available fire flows were estimated at under 300 gpm, which is well below the Insurances Service Office (ISO) recommendations for available fire flow.

2.6.1.3 Huron Street and West Bluff Valve Pits Rehabilitation

The Huron Street and West Bluff Valve Pits provide a connection between the lower and upper pressure districts in the water system. The Huron Street Valve Pit consists of manual valve connections, which can be opened to allow free flow between the two pressure districts in case of a loss of pressure or other emergency situations in either of the pressure districts. The West Bluff Valve Pit consists of manual valve connections and a hydraulically actuated pressure reducing valve (PRV). Similar to the Huron Street Pit, the manual valve connections within the West Bluff Pit can be opened to allow free flow between the two pressure districts. The PRV allows flow from the upper pressure district to the lower pressure district, but controls the pressure allowed to the low-pressure district by inducing a head loss across the valve; this allows the upper pressure district to feed the lower pressure district without over pressurizing the system.

Both of these valve pits are original to the 1984 construction of the water system. While some intermittent maintenance has been performed on the valves in the vault, no major rehabilitation projects have been completed on the valves within the pits. In particular, the PRV is at the end of its design useful life and needs to be replaced. The other valves need to be assessed and either rebuilt or refurbished.

2.6.1.4 Installation of Mixer in Lower Reservoir

The Lower Reservoir is a critical component in the distribution system. The reservoir has issues with thermal stratification, which leads to icing during the winter months. Ice formation has been observed in these tanks recently, increasing the risk of equipment damage. Icing within storage tanks can significantly damage the tanks, disrupting water supply and forcing expensive repairs.

The Project Plan proposes to install a mixing technology within the tank. The installation of a mixer can mitigate thermal stratification and icing potential. In addition, the mixer can help to reduce sediment build-up that can lead to microbial growth within the tanks.

2.6.1.5 Membrane Skid Equipment Replacement

The WTP was upgraded in 1991 with ultrafiltration skids. The skids have had membranes replaced over time, but the original valves and actuators are still in place. These are beyond their useful design life and need replacement as well as the membranes. The membranes were last replaced in 2016; they typically get replaced every seven to ten years.

The Project Plan proposes to replace the membranes and membrane skid valves and actuators to allow the membrane skids to continue to operate well. In addition, with the installation of an “open” membrane style skid as part of the Plant Expansion, the new membranes can be used with the new membrane skids.

2.6.2 Orders and Enforcement Actions

No court or enforcement orders or written enforcement actions have been issued to the City regarding the water system.

2.6.3 Drinking Water Quality Problems

The aesthetic quality of the water produced by the City’s WTP is generally good; there are no known drinking water problems in the overall distribution system.

2.6.4 Projected Needs for the Next 20 Years

No updated Capital Improvements Plan (CIP) has been produced since the issuance of the Original Project Plan. Said document can be referenced for the current CIP for the City.

3.0 Analysis of Alternatives

3.1 Cadotte Avenue Water Main Extension

3.1.1 No-Action

The no-action alternative would result in continuing the operation of the system as before. This would likely result in further breaks along the Cadotte Avenue water main and would leave the redundancy issues for the water system unresolved. The no-action alternative would not eliminate these problems and therefore is not considered further.

3.1.2 Optimum Performance of Existing Facilities

Water system performance in the project area is optimized. The deficiencies targeted for improvements are a function of pipe age, issues related to maintaining the water main, and redundancy, which would all require capital improvements for correction. Thus, this alternative is eliminated from further consideration.

3.1.3 Regional Alternative

Since the water distribution system is on an island, a regional alternative would be impractical. No further consideration is given to this alternative.

3.1.4 Construction Alternative – New 12-inch Water Main

In this alternative, approximately 5,600 lineal feet of 6-inch water main along Cadotte Avenue to the airport and southwest to Forest Drive would be replaced by a new 12-inch water main below the frost line. This would address the water main break issues due to freezing while providing redundancy to the entire water system. Therefore, this alternative is evaluated further as the principal alternative for Cadotte Avenue Water Main Extension.

3.2 Silver Birches Development Water Main

3.2.1 No-Action

The no-action alternative would result in continuing the operation of the system as before with no installation of any additional water main. While this would be no-action in regard to improvements within the City water system, improvements could be made at the point-of-use at the development. The installation of a water storage tank and pumping system could allow the development to be served. It is expected that this is the most effective and affordable alternative; therefore, this alternative is evaluated further as the principal alternative for Silver Birches Development Water Main.

3.2.2 Optimum Performance of Existing Facilities

Water system performance in the project area is optimized. The deficiencies targeted for improvements are a function of pipe age, issues related to maintaining the water main, and redundancy, which would all require capital improvements for correction. Thus, this alternative is eliminated from further consideration.

3.2.3 Regional Alternative

Since the water distribution system is on an island, a regional alternative would be impractical. No further consideration is given to this alternative.

3.2.4 Construction Alternative – New 8-inch Water Main

In this alternative, approximately 6,000 lineal feet of 8-inch water main would be installed along Forest Drive up to British Landing and continue on up Scott's Cave Road to the Silver Birches Development. This would improve fire flow and performance to some degree but does not provide much benefit for the amount of water main being installed, only serving a single development. This cost verses benefit imbalance leads to this alternative not being recommended.

3.3 Huron Street and West Bluff Valve Pits Rehabilitation

3.3.1 No-Action

If the no-action alternative were to be selected, the valve pits, which have valves that are beyond their useful design life, would continue to degrade, resulting in a reduced reliability and resiliency for the water system. Given the valve pits and the valves therein are almost 40 years old, the pits were deemed to be in need of rehabilitation for continued operation, and this alternative was not considered further.

3.3.2 Optimum Performance of Existing Facilities

The replacement or refurbishment of all the valves in both pits would significantly lengthen the useful life of the water system assets. The vaults could also be examined for structural integrity and repaired if need be. This alternative was deemed necessary for continued operation of the water system, maintaining the reliability and resiliency provided to the system's customers in the past. Therefore, this alternative is evaluated further as the principal alternative for the Huron Street and West Bluff Valve Pits Rehabilitation.

3.3.3 Regional Alternative

Since the WTP and distribution system are located on an island, a regional alternative would be impractical. No further consideration is given to this alternative

3.3.4 Construction Alternatives

The construction alternative evaluated for this project was the replacement of the valve pits themselves and all valving and piping within the structure. The vaults themselves and the piping within are not in poor condition. Replacement of these assets was not deemed necessary. In addition, the installation of new vaults in the areas in question would result in significant disruption to the businesses in the area and would also require patching of asphalt, which is difficult to do on the Island. Because of the limited utility of the construction alternative and difficulties in road work, the construction alternative was not considered further.

3.4 Installation of Mixer in Lower Reservoir

3.4.1 No Action

If the no action alternative were to be selected, the City water system would continue to experience challenges due to ice buildup in the tank in the winter months. This alternative was not considered further.

3.4.2 Optimum Performance of Existing Facilities – Operation Changes

The Lower Reservoir is a critical piece of infrastructure within the system. Due to the nature of the water storage tank (an above-grade ground storage tank), it is believed that no change in operation beyond taking the reservoir out of service would resolve the icing issues. Therefore, this alternative is eliminated from further consideration.

3.4.3 Regional Alternative

Since the WTP and distribution system are located on an island, a regional alternative would be impractical. No further consideration is given to this alternative.

3.4.4 Construction Alternative – Mixer System Installation

In this alternative, a mixing system would be installed in each tank to continuously mix the contents of the tanks. Two mixing system styles were evaluated: a coarse bubbler diffuser mixing system and a mechanical jet mixer. The air mixing system produces sequences of compressed air to generate large bubbles in the inlet pipe or tank bottom that rise and create a circulation pattern to stir and blend the tank. This system does not require mechanical components in the tank, which improves ease of maintenance but requires more energy to run the compressor and bubble the air into the tank or inlet pipe.

The active jet mixer creates a vortex and induces a flow pattern to circulate the full volume of the tank. These small mixers could be easily lowered through an access hatch and would sit on the floor of the tank. For the Lower Reservoir, the active jet mixer can be driven by a 0.5 horsepower motor. Jet mixers have reliable performance and longevity based on past experiences with similar style mixers. Seasonal operation of the mixer only during periods of freeze concern will reduce the magnitude of the energy used. The jet mixer installation alternative is evaluated further as the principal alternative for the Lower Reservoir.

3.5 Membrane Skid Equipment Replacement

3.5.1 No Action

If the no action alternative were to be selected, the membrane skids would begin to see failures of the referenced equipment (membranes and skid valves), which would result in water outages and increased operation and maintenance costs. This alternative was not considered further.

3.5.2 Optimum Performance of Existing Facilities – Operation Changes

Given the age of the equipment in question, there is no optimum performance that will prevent it exceeding its useful design life. The City already runs the membranes at a lower flux rate (treated water produced per unit of area) to lengthen the life of the membranes, but they are still in need of replacement. Therefore, this alternative is eliminated from further consideration.

3.5.3 Regional Alternative

Since the WTP and distribution system are located on an island, a regional alternative would be impractical. No further consideration is given to this alternative.

3.5.4 Construction Alternative – New Membranes and Skid Valves and Actuators

In this alternative, new membranes, skid valves and actuators will be installed. All the equipment is expected to be replacement in-kind, though some investigation will be needed to ensure the relevant manufacturers still make similar units.

The new membranes will be provided by Memcor, who are the current manufacturer of the style of membrane skid in use at the WTP. These new membranes will be functionally the same as the old with the same allowable flux, size, and resistance to chlorine. It is expected that the operation of the skids will remain relatively the same with the installation of the new membranes.

The skid valves and actuators will be replaced with new valves and actuators. The existing actuators are of an older design, with a relay panel near the center of the skid units that is used to actuate the valves. The new actuators will use a more modern design that has all needed controls internal to the actuator rather than relying on an external panel. The valves themselves will be replaced with new based on recommendations from the skid manufacturer.

4.0 Principal Alternatives

Each alternative analysis resulted in one feasible alternative. A deeper analysis of each principal alternative resulting from the initial alternatives analysis is included in this section. Because a principal alternative or no-action was selected for the Silver Birches Development Water Main was selected, no further analysis is included in this report.

4.1 Cadotte Avenue Water Main Replacement Extension

4.1.1 Monetary Evaluation

A monetary analysis was completed for the construction alternative. The project cost summary for the construction alternative is presented in Table 4-1. The cost estimates include the restoration required to complete the improvements.

Table 4-1 – Estimated Project Cost Summary for New 12-inch Water Main

Item	Initial Capital Cost	Salvage Value
New 12-Inch Water Main and Restoration	$3,550,000	$2,840,000
Subtotal	$3,550,000	
Contractor's General Conditions and Profit	$639,000	
Construction Contingency	$838,000	
Total Construction Cost	$5,027,000	
Engineering, Construction Administration, and Legal	$603,000	
Total Project Cost	$5,630,000	

A present worth analysis was completed for the construction alternative and for the no-action alternative, as summarized in Table 4-2. The present worth analysis for the water main construction alternative is included in Appendix 1. The no-action alternative has no associated capital costs, but associated operation and maintenance (O&M) costs were included. Sunk costs are not included in the analysis.

Table 4-2 – 20-Year Present Worth Analysis

	New 12-Inch Water Main		No Action	
	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$5,630,000	$5,630,000	$0	$0
O&M Cost/Year*	$0	$0	$30,000	$576,000
Salvage Value	($2,840,000)	($2,622,000)	$0	$0
Total Worth		$3,008,000		$576,000

*O&M costs shown only account for work related to the water main in question

4.1.2 Environmental Evaluation

4.1.2.1 Cultural Resources

The proposed improvement project will occur within the existing right-of-way along Cadotte Avenue, through pipe bursting across a forested area to the airport (resulting in little to no impact to the area), and over to Forest Drive along the edge of the airport. There is no direct expected historical or archeological impact due to the proposed water main improvements. The historical sites within the City are summarized in the Original Project Plan.

4.1.2.2 Natural Environment

No long-term impacts to the natural environment are anticipated. The only anticipated impacts to the natural environment are a temporary decrease in air quality due to construction and construction noise which could potentially disrupt the local environment and disturb the local population. Where applicable, construction will occur during the typical construction season for underground work.

4.1.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week; this will also help reduce the impact of construction noise on the local population. Appropriate dust and sound control measures will be taken during construction.

4.1.4 Implementability and Public Participation

The public will be provided with opportunities to comment on the project at the Public Meeting. Additional public concerns will be considered whenever possible throughout the design and construction.

The City owns and operates the water distribution system, and the project does not require intermunicipal agreements.

4.1.5 Technical Considerations

The replacement of the 6-inch water main with the 12-inch water main installed below the frost line will mitigate freezing issues in this section of water main during the winter and provide redundancy to the low-pressure district.

A section of the water main, across a forested area, will be installed using pipe bursting. This will reduce cost and impact to the forested areas.

4.1.6 Residuals

This project will have no impact on residuals.

4.1.7 Potential Industrial/Commercial/Institutional Users

There are no potential industrial, commercial, or institutional users anticipated along the water main replacement route, as the area along the route is already developed. The area served by the replaced water main along Cadotte Avenue and at the airport is assumed to serve the same customers it currently serves.

4.1.8 Growth Capacity

The purpose of the proposed project is to better serve existing customers. The water main is not being installed for growth.

4.1.9 Contamination

There are no known contaminated sites in the location of this project. Reference the Original Project Plan for a map of the known contaminated sites on the Island.

4.2 Huron Street and West Bluff Valve Pits Rehabilitation

4.2.1 Monetary Evaluation

A monetary analysis was completed for the principal alternative, which includes the optimum performance of existing facilities alternative, assuming existing valves within the pits will be replaced or refurbished. The project cost summary for the optimum performance alternative is presented in Table 4-3.

Table 4-3 – Estimated Project Cost Summary for Valve Pits Rehabilitation

Item	Initial Capital Cost	Salvage Value
Huron Street Valve Pit Rehabilitation	$200,000	$120,000
West Bluff Valve Pit Rehabilitation	$200,000	$120,000
Subtotal	$400,000	
Contractor's General Conditions and Profit	$72,000	
Construction Contingency	$94,000	
Total Construction Cost	$566,000	
Engineering, Construction Administration, and Legal	$68,000	
Total Project Cost	$634,000	

A present worth analysis was completed for the optimum performance alternative and the no-action alternative. The no-action alternative has no associated capital costs, but associated O&M and equipment replacement costs within the 20-year design life were included. Table 4-4 shows the comparison of the present worth analysis for the alternatives. The present worth analysis for the Valve Pits Rehabilitation is included in Appendix 2.

Table 4-4 – 20-Year Present Worth Analysis

	Valve Pits Rehabilitation		No-Action	
	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$634,000	$634,000	$0	$0
O&M Cost/Year	$5,000	$96,000	$50,000	$960,000
Replacement Cost	$0	$0	$0	$0
Salvage Value	$240,000	($222,000)	$0	$0
Total Present Worth		$508,000		$960,000

4.2.2 Environmental Evaluation

4.2.2.1 Cultural Resources

The work on the valve pits will occur within the pits. There is no direct historical or archeological impact expected. The historical sites within the City are summarized in the Original Project Plan.

4.2.2.2 Natural Environment

The work will occur inside the pits. No long-term impacts to the natural environment are anticipated. The effects on the natural environment are limited to a temporary decrease in air quality due to construction. In addition, there will be a fair amount of construction noise which could potentially disrupt the local environment and disturb the local population.

4.2.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week; this will also help reduce the impact of construction noise on the local population. Appropriate dust and sound control measures will be taken during construction.

4.2.4 Implementability and Public Participation

The public will be provided with opportunities to comment on the project at the Public Meeting. Additional public concerns will be considered whenever possible throughout the design and construction.

The City owns and operates the valve pits, and the project does not require intermunicipal agreements.

4.2.5 Technical Considerations

The valves will be replaced in kind wherever possible with some potential adjustment of piping needed. The valve pits will be evaluated during construction to determine if any patching or injection is needed.

4.2.6 Residuals

The improvements will have no impact on the production of residuals.

4.2.7 Potential Industrial/Commercial/Institutional Users

The valve pits are not related to the water system capacity and will only help to increase the reliability and resiliency of the water system.

4.2.8 Growth Capacity

The valve pits are not related to the water system capacity and will only help to increase the reliability and resiliency of the water system.

4.2.9 Contamination

There are no known contaminated sites in the location of this project. Reference the Original Project Plan for a map of the known contaminated sites on the Island.

4.3 Installation of Mixer in Lower Reservoir

A monetary analysis was completed for the installation of mixer in Lower Reservoir construction alternative. The estimated project cost summary is presented in Table 4-5. These costs are preliminary estimates and will be further refined during the project design phase.

Table 4-5 – Estimated Project Cost Summary for Mixer in Lower Reservoir

Item	Initial Capital Cost	Salvage Value
New Tank Mixer (Jet Mixer)	$75,000	$0*
Subtotal	$75,000	
Contractor's General Conditions and Profit	$14,000	
Construction Contingency	$18,000	
Total Construction Cost	$107,000	
Engineering, Construction Administration, and Legal	$13,000	
Total Project Cost	$120,000	

*Estimated service life of 20 years, no salvage value remaining at end of study period.

A present worth analysis was completed for the construction alternative and the no-action alternative. The no-action alternative has no associated capital costs, but associated O&M and equipment replacement costs within the 20-year design life were included. Table 4-6 shows the comparison of the present worth analysis for the alternatives. The present worth analysis for the Mixer Installation is included in Appendix 3.

Table 4-6 – 20-Year Present Worth Analysis

	Mixer Installation		No-Action	
	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$75,000	$75,000	$0	$0
O&M Cost/Year	$1,000	$20,000	$20,000	$384,000
Replacement Cost	$0	$0	$0	$0
Salvage Value	$0,000	($0,000)	$0	$0
Total Present Worth		$95,000		$384,000

4.3.1 Environmental Evaluation

4.3.1.1 Cultural Resources

The work on the Lower Reservoir will occur within the reservoir itself with no direct historical or archeological impact expected. The historical sites within the City are summarized in the Original Project Plan.

4.3.1.2 Natural Environment

The work will occur inside the Lower Reservoir. No long-term impacts to the natural environment are anticipated.

4.3.2 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week; this will also help reduce the impact of construction noise on the local population. Appropriate dust and sound control measures will be taken during construction.

4.3.3 Implementability and Public Participation

The public will be provided with opportunities to comment on the project at the Public Meeting. Additional public concerns will be considered whenever possible throughout the design and construction.

The City owns and operates the Lower Reservoir, and the project does not require intermunicipal agreements.

4.3.4 Technical Considerations

The mixer will be lowered into the reservoir using a manufacturer provided lifting chain. It will receive power from an existing 120V connection within the enclosure which encompasses the tank.

4.3.5 Residuals

The improvements will have no impact on the production of residuals.

4.3.6 Potential Industrial/Commercial/Institutional Users

The mixer is not related to the capacity of the system but will only help to mitigate icing issues observed in the Lower Reservoir.

4.3.7 Growth Capacity

The mixer is not related to the capacity of the system but will only help to mitigate icing issues observed in the Lower Reservoir.

4.3.8 Contamination

There are no known contaminated sites in the location of this project as it is being installed inside of the existing Lower Reservoir. Reference the Original Project Plan for a map of the known contaminated sites on the Island.

4.4 Membrane Skid Equipment Replacement

A monetary analysis was completed for the membrane skid equipment replacement construction alternative. The estimated project cost summary is presented in Table 4-7. These costs are preliminary estimates and will be further refined during the project design phase.

Table 4-7 – Estimated Project Cost Summary for Membrane Skid Equipment Replacement

Item	Initial Capital Cost	Salvage Value
Membrane Skid Valve and Actuator Replacement	$750,000	$375,000
Membrane Replacement	$500,000	$0*
Subtotal	$1,250,000	
Contractor's General Conditions and Profit	$225,000	
Construction Contingency	$295,000	
Total Construction Cost	$1,770,000	
Engineering, Construction Administration, and Legal	$212,000	
Total Project Cost	$1,982,000	

*Estimated service life of 10 years, no salvage value remaining at end of study period.

A present worth analysis was completed for the construction alternative and the no-action alternative. The no-action alternative has no associated capital costs, but associated O&M and equipment replacement costs within the 20-year design life were included. Table 4-8 shows the comparison of the present worth analysis for the alternatives. The present worth analysis for the Membrane Skid Equipment Replacement is included in Appendix 4.

Table 4-8 – 20-Year Present Worth Analysis

	Membrane Skid Equipment Replacement		No-Action	
	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,250,000	$1,250,000	$0	$0
O&M Cost/Year	$1,000	$20,000	$20,000	$384,000
Replacement Cost	$500,000	$481,000	$0	$0
Salvage Value	$375,000	($346,000)	$0	$0
Total Present Worth		$1,405,000		$384,000

4.4.1 Environmental Evaluation

4.4.1.1 Cultural Resources

The work on the Membrane Skids will occur within the WTP with no direct historical or archeological impact expected. The historical sites within the City are summarized in the Original Project Plan.

4.4.1.2 Natural Environment

The work will occur inside the WTP. No long-term impacts to the natural environment are anticipated.

4.4.2 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week; this will also help reduce the impact of construction noise on the local population. Appropriate dust and sound control measures will be taken during construction.

4.4.3 Implementability and Public Participation

The public will be provided with opportunities to comment on the project at the Public Meeting. Additional public concerns will be considered whenever possible throughout the design and construction.

The City owns and operates the WTP, and the project does not require intermunicipal agreements.

4.4.4 Technical Considerations

The new membranes will be functionally the same as the old with the same allowable flux, size, and resistance to chlorine. It is expected that the operation of the skids will remain relatively the same with the installation of the new membranes.

The skid valves and actuators will be replaced with new valves and actuators. The existing actuators are of an older design, with a relay panel near the center of the skid units that is used to actuate the valves. The new actuators will use a more modern design that has all needed controls internal to the actuator rather than relying on an external panel. The valves themselves will be replaced with new based on recommendations from the skid manufacturer.

4.4.5 Residuals

The improvements will have no impact on the production of residuals.

4.4.6 Potential Industrial/Commercial/Institutional Users

The mixer is not related to the capacity of the system but will only help to mitigate icing issues observed in the Lower Reservoir.

4.4.7 Growth Capacity

The mixer is not related to the capacity of the system but will only help to mitigate icing issues observed in the Lower Reservoir.

4.4.8 Contamination

There are no known contaminated sites in the location of this project as it is being installed inside of the existing Lower Reservoir. Reference the Original Project Plan for a map of the known contaminated sites on the Island.

5.0 Selected Alternatives

5.1 Cadotte Avenue Water Main Extension

The selected water main alternative is the replacement of the existing 6-inch water main along Cadotte Avenue to the airport and southwest to Forest Drive with a new 12-inch water main installed below the frost line. This alternative addresses the three concerns described in the Summary of Project Need: water main age, issues with winter operation and water main breaks, and need for looping of the water system.

5.1.1 Design Parameters

Replacement of approximately 5,600 linear feet of 6-inch water main with a 12-inch water main.

5.1.2 Maps

A map of the selected area for the proposed water main replacement is included in Figure 3.

5.1.3 Schedule for Design and Construction

The project schedule is consistent with the quarterly DWSRF funding deadlines and is provided in Table 5-1. The project is scheduled for DWSRF Funding Quarter 3.5 in Fiscal Year 2024.

Table 5-1 – Cadotte Avenue Water Main Extension Schedule

Task Name	Duration	Tentative Start	Tentative Finish
Design	4 months	October 2023	February 2024
Construction Permit	2 months	February 2024	April 2024
Bidding	1 month	April 2024	May 2024
DWSRF Funding & Project Award	1 month	May 2024	June 2024
Construction Phase 1 (Seasonally Dependent)	2 months	October 2024	December 2024
Construction Phase 2 (Seasonally Dependent)	2 months	March 2024	May 2024

5.1.4 Cost Estimate

The estimated project cost for the selected alternative is included in Table 5-2. The costs are provided in March 2023 dollars.

Table 5-2 – Cadotte Avenue Water Main Extension Summary of Estimated Costs

Project	Estimated Project Start (Bid date)	Total Estimated Project Costs
Cadotte Avenue Water Main Extension	April 2024	$5,630,000
	Total	$5,630,000

The breakdown of costs is shown in Table 5-3.

Table 5-3 – Breakdown of Estimated Water Main Project Costs

Category	Cost
Estimated Capital Cost	$3,550,000
Contractor's General Condition and Profit	$639,000
Construction Contingency	$838,000
Engineering, Construction Administration, and Legal	$603,000
Total Estimated Project Cost	$5,630,000

5.2 Huron Street and West Bluff Valve Pits Rehabilitation

The selected alternative was the optimum performance alternative for the valve pits rehabilitation. This alternative would include the replacement or refurbishment of all the valves in both pits and an examination of the structural integrity of the vaults, which could be repaired if need be.

5.2.1 Design Parameters

Replacement or refurbishment of approximately six isolation valves in the Huron Street Valve Pit and of approximately seven isolation valves and one PRV in the West Bluff Valve Pit. It will also include potential structural repairs to the valve pits, if necessary.

5.2.2 Maps

A map showing the location of the valve pits is included in Figure 3.

5.2.3 Schedule for Design and Construction

The project schedule is consistent with the quarterly DWSRF funding deadlines and is provided in Table 5-4. The project is scheduled for DWSRF Funding Quarter 3.5 in Fiscal Year 2024.

Table 5-4 – Valve Pits Rehabilitation Schedule

Task Name	Duration	Start	Finish
Design	4 months	October 2023	February 2024
Construction Permit	2 months	February 2024	April 2024
Bidding	1 month	April 2024	May 2024
DWSRF Funding & Project Award	1 month	May 2024	June 2024
Construction Phase (Seasonally Dependent)	2 months	October 2024	December 2024

5.2.4 Cost Estimate

The estimated project costs for the selected WTP improvements are presented in Table 5-5. The cost estimates are provided in March 2023 dollars.

Table 5-5 – Valve Pits Rehabilitation Summary of Estimated Costs

Project	Estimated Project Start (Bid date)	Total Estimated Project Costs
Valve Pits Rehabilitation	April 2024	$634,000
	Total	$634,000

The breakdown of costs is shown in Table 5-6.

Table 5-6 – Breakdown of Valve Pits Rehabilitation Costs

Category	Cost
Estimated Capital Cost	$400,000
Contractor's General Condition and Profit	$72,000
Construction Contingency	$94,000
Engineering, Construction Administration, and Legal	$68,000
Total Estimated Project Cost	$634,000

5.3 Installation of Mixer in Lower Reservoir

The selected alternative was the construction alternative of installing a tank mixer to mitigate issues with ice in the Lower Reservoir. This alternative would include the installation of a jet-style tank mixer in the Lower Reservoir.

5.3.1 Design Parameters

Mitigation of icing issues was needed for the 250,000-gallon Lower Reservoir. Single phase 120V power was available to power a tank mixer.

5.3.2 Maps

A map showing the location of the Lower Reservoir is included in Figure 3.

5.3.3 Schedule for Design and Construction

The project schedule is consistent with the quarterly DWSRF funding deadlines and is provided in Table 5-7. The project is scheduled for DWSRF Funding Quarter 3.5 in Fiscal Year 2024.

Table 5-7 – Mixer in Lower Reservoir Schedule

Task Name	Duration	Start	Finish
Design	4 months	October 2023	February 2024
Construction Permit	2 months	February 2024	April 2024
Bidding	1 month	April 2024	May 2024
DWSRF Funding & Project Award	1 month	May 2024	June 2024
Construction Phase (Seasonally Dependent)	2 months	October 2024	December 2024

5.3.4 Cost Estimate

The estimated project costs for the selected WTP improvements are presented in Table 5-8. The cost estimates are provided in March 2023 dollars.

Table 5-8 – Mixer in Lower Reservoir Summary of Estimated Costs

Project	Estimated Project Start (Bid date)	Total Estimated Project Costs
Mixer in Lower Reservoir	April 2024	$120,000
	Total	$120,000

The breakdown of costs is shown in Table 5-9.

Table 5-9 – Breakdown of Mixer in Lower Reservoir Costs

Category	Cost
Estimated Capital Cost	$75,000
Contractor's General Condition and Profit	$14,000
Construction Contingency	$18,000
Engineering, Construction Administration, and Legal	$13,000
Total Estimated Project Cost	$120,000

5.4 Membrane Skid Equipment Replacement

The selected alternative was the construction alternative for the membrane skid equipment replacement. This alternative would include replacing the membranes, skid valves, and skid actuators.

5.4.1 Design Parameters

The membranes need to be replaced every seven to ten years for the skids to maintain their performance. The new membranes will be functionally the same as the old with the same allowable flux, size, and resistance to chlorine. It is expected that the operation of the skids will remain relatively the same with the installation of the new membranes.

The membrane skid valves and actuators are beyond their useful design life. The skid valves and actuators will be replaced with new valves and actuators. The existing actuators are of an older design, with a relay panel near the center of the skid units that is used to actuate the valves. The new actuators will use a more modern design that has all needed controls internal to the actuator rather than relying on an external panel. The valves themselves will be replaced with new based on recommendations from the skid manufacturer.

5.4.2 Maps

A map showing the site plan of the WTP is included in Figure 4.

5.4.3 Schedule for Design and Construction

The project schedule is consistent with the quarterly DWSRF funding deadlines and is provided in Table 5-10. The project is scheduled for DWSRF Funding Quarter 3.5 in Fiscal Year 2024.

Table 5-10 – Membrane Skid Equipment Replacement Schedule

Task Name	Duration	Start	Finish
Design	4 months	October 2023	February 2024
Construction Permit	2 months	February 2024	April 2024
Bidding	1 month	April 2024	May 2024
DWSRF Funding & Project Award	1 month	May 2024	June 2024
Construction Phase (Seasonally Dependent)	2 months	October 2024	December 2024

5.4.4 Cost Estimate

The estimated project costs for the selected WTP improvements are presented in Table 5-11. The cost estimates are provided in March 2023 dollars.

Table 5-11 – Membrane Skid Equipment Replacement Summary of Estimated Costs

Project	Estimated Project Start (Bid date)	Total Estimated Project Costs
Mixer in Lower Reservoir	April 2024	$1,982,000
	Total	$1,982,000

The breakdown of costs is shown in Table 5-12.

Table 5-12 – Breakdown of Membrane Skid Equipment Replacement Costs

Category	Cost
Estimated Capital Cost	$1,250,000
Contractor's General Condition and Profit	$225,000
Construction Contingency	$295,000
Engineering, Construction Administration, and Legal	$212,000
Total Estimated Project Cost	$1,982,000

5.5 Updated Costs for Existing Projects

The costs for the projects submitted in the Original Project Plan needed adjustment due to the current bidding climate and escalating construction material costs. Table 5-13 shows the original project costs, the updated project costs, and the proposed financing quarter to be used for scheduling for each project.

Table 5-13 – Updated Project Costs from Original Project Plan

Project Name	Estimated Project Cost	Adjusted Cost
Cadotte Avenue Water Main Replacement	$1,170,000	$2,750,000
Water Main Between 6th and 7th Streets	$721,000	$1,219,000
Closure of UST and Above grade Fuel Tank	$447,000	$492,000
WTP Equipment Improvements	$347,000	$452,000
Disinfection System Improvements	$964,000	$1,254,000
Garage Expansion	$417,000	$543,000
Treatment Capacity Expansion*	$8,363,000	$10,872,000

* Note, this includes only the portions of the expansion not covered in the other line items.

5.6 Overall Costs

The overall costs associated with the Original Project Plan with the Amendment are shown in Table 5-14.

Table 5-14 – Overall Costs for Project Plan with Amendment

Project Name	Estimated Project Cost
Cadotte Avenue Water Main Replacement	$2,750,000
Water Main Between 6th and 7th Streets	$1,219,000
Closure of UST and Above grade Fuel Tank	$492,000
WTP Equipment Improvements	$452,000
Disinfection System Improvements	$1,254,000
Garage Expansion	$543,000
Treatment Capacity Expansion*	$10,872,000
Cadotte Avenue Water Main Extension	$5,027,000
Huron Street Valve Pit	$283,000
West Bluff Valve Pit	$283,000
Membrane Skid Valve Replacement	$1,062,000
Membrane Replacement	$708,000
Mixer in Lower Reservoir	$106,000
Construction Subtotal	$25,051,000
Planning Costs	$25,000
Design Engineering	$2,955,000
Construction Engineering	$2,510,000
Legal/Financial Fees	$90,000
Bond Counsel Fees	$50,000
Total Estimated Funding Required	$30,681,000

* Note, this includes only the portions of the expansion not covered in the other line items.

5.7 User Costs

The estimated total cost for the selected alternatives is $30,681,000 and the resulting debt retirement will be achieved primarily by user rates. Current water rates include a flat rate based on meter size and a commodity rate based on water usage. For an average residential water customer, the water system improvements are anticipated to increase water rates by $533 per year. Costs to business users may be higher based on meter size and usage.

The City is in the process of completing a rate study to determine an appropriate rate schedule and methodology to increase rates and meet the needs for both sewer and water utility improvements. Existing rates have not been increased for several years and the current utility budgets are underfunded.

Fiscal responsibility is of the utmost importance to the City, and cost saving measures will be explored throughout the design process. The proposed improvements are necessary to continue to provide reliable water service to customers.

5.8 Overburdened Community

The overburdened community qualification is determined for each loan that is applied for by a community. An Overburdened Community Status Determination Worksheet was submitted to EGLE in March of 2023. EGLE has determined the City meets the overburdened community qualifications.

5.9 Ability to Implement the Selected Alternatives

The City owns and operates the water supply, treatment, and distribution system. The proposed improvement projects will occur within the City. All financial and loan-related work will be handled by the City.

6.0 Environmental Evaluation

6.1 Historical/Archeological/Tribal Resources

Reference the original project plan for details on the resources compiled to evaluate the impacts on Historical/Archeological/Tribal Resources in the area of the project.

6.2 Water Quality

The proposed projects will not affect surface water or groundwater quality or quantity.

6.3 Land/Water Interface

The proposed project will not impact any wetlands. Reference the original project plan for details on the resources compiled to evaluate the impacts on Land/Water Interface in the area of the project.

6.4 Endangered Species

The proposed project will not impact endangered species. Reference the original project plan for details on the resources compiled to evaluate the impacts on Endangered Species in the area of the project.

It should be noted that no or little tree removal is expected as part of this project as the portion of the project through a wooded area will be completed via pipe bursting. If any tree removal is identified, consideration will be given to impact on habitat for endangered species in the area.

6.5 Agricultural Land

The proposed project will not impact any prime farmland. Reference the original project plan for details on the resources compiled to evaluate the impacts on Agricultural Land in the area of the project.

6.6 Social/Economic Impact

The proposed water main replacement and the WTP improvements will result in direct cultural and social benefits. Public health and safety will benefit from the increased water system quality and reliability the proposed projects will create.

The construction phase of the projects will create jobs and contribute favorably to the local economy.

6.7 Construction/Operational Impact

6.7.1 Distribution System Improvements

Water main replacement, the rehabilitation of the valve pits, and the installation of the tank mixer are expected to be completed using routine construction practices. No tree removal is anticipated.

Construction hours for projects of this type are generally limited to 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. Saturday. Pedestrian access to all properties will be maintained throughout construction.

6.7.2 WTP Improvements

The WTP Improvements will occur on the WTP site and will not greatly disrupt the area of construction. The area surrounding the WTP is not heavily populated, so construction activity will have minimal disruption. The property has adequate space for staging activities and no significant modifications to the environment are anticipated.

Construction hours for projects of this type are generally limited to 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. Saturday.

6.8 Indirect Impacts

6.8.1 Changes in Development

No significant changes in development are anticipated due to the proposed improvements. However, the proposed projects will enhance the existing water distribution and treatment system.

6.8.2 Changes in Land Use

The proposed projects will not have an impact on existing or future land use as an indirect result.

6.8.3 Changes in Air or Water Quality

The proposed projects will not have any long-term impacts on air or water quality.

6.8.4 Changes to Natural Setting or Sensitive Ecosystems

The proposed projects will not have an impact on the natural setting or sensitive ecosystems.

6.8.5 Changes to Aesthetic Aspects of the Community

The indirect effect of a more reliable, safer WTP and distribution system will be the ability to support economic growth and continue the social and cultural traditions of the City and the region.

6.8.6 Resource Consumption

Resource consumption in the form of building materials and energy will occur over the useful life of the proposed projects.

7.0 Mitigation Measures

7.1 Short-Term Impacts

The short-term impacts associated with the proposed projects are related to the construction work. These impacts will be temporary in nature and will subside at the end of construction.

Measures that will be taken to avoid, eliminate, or mitigate potential short-term environmental impacts include the following:

- Traffic: Use of designated traffic routes for construction traffic, as well as flagmen, warning signs, barricades, and cones.
- Air emissions: Standard construction mitigation treatments including controlling fugitive dust by watering or covering exposed soil/dust areas, maintaining equipment, using emission control devices on construction equipment, and prohibiting idling of inactive equipment or vehicles. Construction activities will result in

increased dust in the vicinity of the construction sites during the length of the proposed construction. Mitigation measures to minimize the negative effect of dust on residents and construction workers will be defined in the project specifications. It is anticipated that dust control will be provided by the application of water and/or dust palliative during dry and dusty periods. The Contractor will be required to control dust in accordance with methods described in the project specifications.

- Noise control: Noise control provisions will include the use of working machinery and equipment with noise suppression devices and other noise and vibration abatement measures. Noise levels will increase temporarily during construction of the proposed projects but will be mitigated by performing the work only during daytime hours and minimizing work on holidays/weekends.
- Soil erosion and sedimentation control: The Contractor will be required to obtain a soil erosion and sedimentation control permit from the local agency prior to the start of the work. It is anticipated that mitigation measures that may be utilized will include silt fence, straw bales, rip rap, geotextile fabric, and other such methods, as appropriate.
- Vegetation protection: An attempt to minimize the removal of existing vegetation and restore areas to their pre-construction appearance to the greatest extent possible will be made. Prior to construction, a plan for protecting existing trees and vegetation that are to remain or could be impacted during construction activity would be developed.
- Restoration: Construction will generally be confined to the existing water main at Cadotte Avenue and the WTP site. Any disturbance to existing pavement, vegetation, and utilities will be repaired or replaced in accordance with the project specifications developed during design.

7.2 Long-Term Impacts

There are no anticipated negative long-term impacts associated with the proposed projects.

Measures that will be taken to avoid, eliminate, or mitigate potential long-term environmental impacts include the following:

- A Soil Erosion Plan for the construction of the proposed projects will be developed and reviewed by the EGLE Land and Water Management Division.
- The contractor will be required to obtain a soil erosion and sedimentation control permit from the local agency prior to the start of the work. It is anticipated that mitigation measures that may be utilized will include silt fence, straw bales, rip rap, geotextile fabric, and other such methods, as appropriate.

7.3 Indirect Environmental Impacts

The proposed projects will not result in any changes in anticipated land use. There are no anticipated indirect impacts due to changes to the natural setting or sensitive ecosystems or jeopardy to any endangered species, wetlands, or coast lines. Construction will occur within previously paved rights-of-way and at the WTP site. Therefore, construction will not cross or impact any streams or habitats of threatened and endangered species.

8.0 Public Participation

8.1 Public Meeting Advertisement

The public meeting was advertised on the City website on March 24, 2023. The advertisement listed the public meeting date, described the availability of the report for viewing, and briefly described the proposed projects and estimated costs. The DWSRF Project Plan Amendment was made available online for public review and comment.

Documentation indicating the Project Plan Amendment is available for review will be included in Appendix 5.

8.2 Public Meeting Contents

A formal public meeting will be held virtually on April 4, 2023. Representatives from the Department of Public Works, board members, and consultants from Fishbeck will be in attendance to explain the Project Plan to the public.

The following information will be presented at the public meeting:

- A description of the DWSRF Project Plan Amendment.
- A brief background of the Mackinac Island drinking water system.
- A description of the drinking water system needs and problems to be addressed by the proposed projects and the principal alternatives that were considered.
- A description of the selected alternatives, including capital costs and a cost breakdown by project component.
- A description of the proposed method of project financing and the proposed annual cost to the typical customer.
- A description of the anticipated social and environmental impacts associated with the selected alternatives and the measures that will be taken to mitigate adverse impacts.

Meeting minutes will be taken and will be provided in Appendix 6.

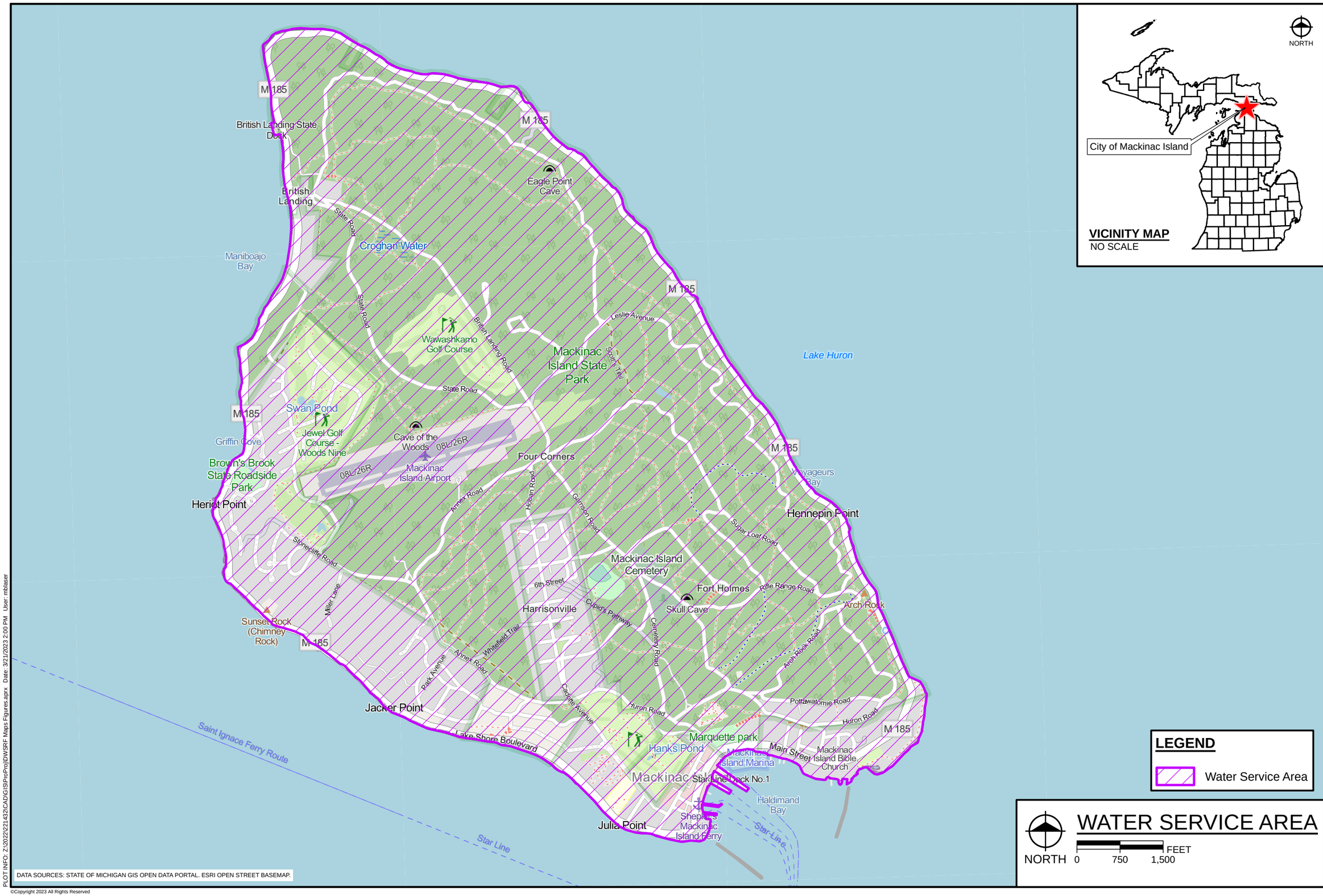
8.3 Comments Received and Answered

Comments will be received at the public meeting and answered.

8.4 Adoption of the Project Plan

The City Council will pass a resolution to adopt the DWSRF Project Plan. The resolution to formally adopt the final Project Plan will be included in Appendix 7.

Figures



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City of Mackinac Island
Mackinac County, Michigan
Drinking Water State Revolving Fund (DWSRF) Project Plan Amendment

PROJECT NO.
221432

FIGURE NO.
1

DATA SOURCES: STATE OF MICHIGAN GIS OPEN DATA PORTAL. ESRI OPEN STREET BASEMAP.

PLOT INFO: Z:\2022\221432\CAD\GIS\ProPro\DWSRF Maps Figures.aprx Date: 3/21/2023 2:00 PM User: mblaser

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City of Mackinac Island
Mackinac County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Project Plan Amendment

PROJECT NO.
221432

FIGURE NO.
2

PLOT INFO: Z:\2022\221432\CAD\GIS\ProjDWSRF Maps Figures.aprx Date: 3/21/2023 2:00 PM User: mblaser

LEGEND

- WTP — Treatment Plant
- Water Tank
- Valve Pit
- Water Main

Water Main Project

- Added with Project Amendment
- From Original Project Plan

NORTH

WATER SYSTEM IMPROVEMENTS

0 750 1,500 FEET

DATA SOURCES: MACKINAC ISLAND GIS. STATE OF MICHIGAN GIS OPEN DATA PORTAL. ESRI OPEN STREET BASEMAP.

fishbeck
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City of Mackinac Island
Mackinac County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Project Plan Amendment

PROJECT NO.
221432

FIGURE NO.
3

PLOT INFO: Z:\2022\221432\CAD\GIS\ProPro\DWSRF Maps Figures.aprx Date: 3/23/2023 7:43 AM User: mblaser

DATA SOURCES: MACKINAC ISLAND GIS. STATE OF MICHIGAN GIS OPEN DATA PORTAL.

LEGEND

- WTP — Treatment Plant
- Hydrant
- Water System Valve
- Distribution Main

NORTH

WATER TREATMENT PLANT SITE PLAN

0 25 50 FEET

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City of Mackinac Island
Mackinac County, Michigan

Drinking Water State Revolving Fund (DWSRF) Project Plan Amendment

PROJECT NO.
221432

FIGURE NO.
4

PLOT INFO: Z:\2022\221432\CAD\GIS\ProPro\DWSRF Maps Figures.aprx Date: 3/21/2023 2:00 PM User: mbtaser

Appendix 1

Present Worth Analysis

Community Name: City of Mackinac Island

Federal Discount Rate for Water Resources Planning (Interest Rate) i = 0.004

Number of Years, n = 20 years

Cadotte Avenue Water Main Extension

Initial Capital Costs =	$5,630,000
Annual Operations & Maintenance Costs =	$0
Future Salvage Value =	$2,840,000
Present Worth of 20 years of O & M =	$0

PW = Annual OM * $\frac{(1+i)^n-1}{i*(1+i)^n}$

Present Worth of 20 yr Salvage Value =	$ (2,622,000)

PW =

FSV* $\frac{1}{(1+i)^n}$

Total Present Worth =	$3,008,000

Appendix 2

Present Worth Analysis

Community Name: City of Mackinac Island

Federal Discount Rate for Water Resources Planning (Interest Rate) i = 0.004

Number of Years, n = 20 years

Huron Street and West Bluff Valve Pits Reabilitation

Initial Capital Costs =	$634,000
Annual Operations & Maintenance Costs =	$5,000
Future Salvage Value =	$240,000
Present Worth of 20 years of O & M =	$96,000

PW = Annual OM * $\frac{(1+i)^n-1}{i*(1+i)^n}$

Present Worth of 20 yr Salvage Value =	$ (222,000)

PW = FSV* $\frac{1}{(1+i)^n}$

Total Present Worth =	$508,000

Appendix 3

Present Worth Analysis

Community Name: City of Mackinac Island

Federal Discount Rate for Water Resources Planning (Interest Rate) i = 0.004

Number of Years, n = 20 years

Installation of Mixer in Lower Reservoir

Initial Capital Costs =		$75,000
Annual Operations & Maintenance Costs =		$1,000
Future Salvage Value =		$0
Present Worth of 20 years of O & M =		$20,000
PW = Annual OM * $\frac{(1+i)^n-1}{i*(1+i)^n}$		
Present Worth of 20 yr Salvage Value =	$	-
PW = FSV* $\frac{1}{(1+i)^n}$		
Total Present Worth =		$95,000

Appendix 4

Present Worth Analysis

Community Name: City of Mackinac Island

Federal Discount Rate for Water Resources Planning (Interest Rate) i = 0.004

Number of Years, n = 20 years

Membrane Skid Equipment Replacement

Initial Capital Costs =	$1,250,000
Annual Operations & Maintenance Costs =	$1,000
Replacement Cost =	$500,000
Future Salvage Value =	$375,000
Present Worth of 20 years of O & M =	$20,000

PW = Annual OM * $\frac{(1+i)^n-1}{i*(1+i)^n}$

Present Worth of Replacement Cost =	$481,000

PW = FSV* $\frac{1}{(1+i)^n}$

Present Worth of 20 yr Salvage Value =	$ (346,000)

PW = FSV* $\frac{1}{(1+i)^n}$

Total Present Worth =	$1,405,000