City of Mackinac Island
Wastewater Treatment Plant

2022 Master Plan

Prepared For:

City of Mackinac Island

Mackinac County, Michigan

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

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847240

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Executive Summary

This Master Plan was completed to identify current issues and provide a long-term plan for the City of Mackinac Island Wastewater Treatment Plant (WWTP). This report includes recommended upgrades to the WWTP that reflect the short-term and long-term needs of the community. The 20-year planning period for this report is from 2022 through 2042.

Since the original construction of the WWTP, several renovations and expansions have been completed to meet the growing needs of the community. The facility is again routinely operating near or above its peak capacity during the summer months. Based on the observed and projected maximum day flows, an expansion of the WWTP is required to provide reliable compliance with the current discharge permit and to meet the demands for planned future growth within the service area.

This report presents the results of the engineering and scientific evaluations performed to determine the need for the project, develop alternatives to remedy identified challenges and to define the scope of the recommended alternatives. Background information on the existing system is also provided along with the rationale used to define alternatives capable of meeting the wastewater treatment needs of the community.

Three principal alternatives were developed to meet the project objectives and serve the long-term needs (20-year planning period) of the City. The principal alternatives were evaluated and compared for their technical and financial feasibility including a full life cycle cost analysis.

The recommended alternative provides the most cost-effective solution to expand the facility and address future summer conditions while also effectively handling the smaller winter flows. Based on Moving Bed Biofilm Reactor (MBBR) technology, the recommended alternative has a relatively small footprint and the organic treatment capacity can be increased by simply adding additional media to the system as constructed. The MBBR system is simple to operate along with minimal mechanical equipment to maintain. The current total project cost forecast for the recommended alternative is $27 million.

The magnitude of the project will require financial planning, including a determination of the best mix of funding alternatives. There are grants and principal forgiveness opportunities with certain programs as well as subsidized loans. Current interest rates for federal and local subsidized funding programs are a near record lows, helping defray the costs of the project over a 20 to 30-year period. Available options for funding this project include municipal bonds, USDA Rural Development grants and loans, Legislative Earmarks, and the Clean Water State Revolving Fund (SRF) loans and principal forgiveness. A municipal financial advisor should be consulted to determine the best source of funding for the project.

I. Introduction

A. Objectives

The purpose of the Master Plan is to evaluate the existing facilities and make recommendations for the short-term and long-term improvements necessary to meet the future wastewater treatment needs of the service area. To accomplish this objective, historical influent data, effluent permit limits, service area population growth, and projected flows and loadings, were reviewed to determine the magnitude of the expansion. An evaluation of the existing facility and future economic and environmental considerations have been used to identify the prioritized needs and improvements necessary at the Wastewater Treatment Plant (WWTP).

B. Wastewater System Background

The wastewater collection system serves a majority of the homes and businesses across Mackinac Island. Wastewater collected into the sanitary sewer system is pumped to the WWTP for treatment. Treated effluent is discharged to Lake Huron. Due to seasonal variation in tourist population and permanent residents, the WWTP experiences a significant fluctuation in flows throughout the year.

The Mackinac Island WWTP is located along Stonecliff Rd. in the City of Mackinac Island. The facility operates under the jurisdiction of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) NPDES permit system, Permit No. MI0026751 (see Appendix A). The permit expires on October 1, 2023.

Properties that are not connected to the collection system utilize septic tanks, which are periodically pumped out and the septage is hauled to the WWTP for further processing.

II. Existing Facilities

A. Pump Stations

The City's wastewater collection system is comprised of over 4 miles of gravity sewer, 5 Pump stations, and approximately 7 miles of forcemain. A map of the collection system is provided in Appendix B.

A summary of the pump stations is provided below in Table 1.

Table 1: Pump Station Summary

Pump Station	Firm Capacity (gpm)
Biddle Point PS*	1,200
Mission Point PS	200
Park Avenue PS*	50
Stonecliffe PS*	250
Stonebrook PS	80
***PS discharges directly to WWTP through common 12" forcemain**	

The Biddle Point Pump Station receives a majority of the City's wastewater from areas served by the gravity sewer system and the Mission Point PS. Wastewater from the Biddle Point PS is pumped directly to the WWTP through a 12" forcemain. An improvement project is currently underway that will provide Biddle Point with a new tri-plex pump station rated for a firm capacity of 1,200 gpm.

The Park Avenue PS serves a portion of the West Bluff area and is tied into the main forcemain to the WWTP. Similarly, Stonecliffe PS is connected to the main forcemain and receives flow pumped from individual simplex grinder pumps, the Solid Waste Handling Facility and the Stonebrook Pump Station.

Three private pump stations serve the Harrisonville village area and discharge to the 12-inch forcemain between the Biddle Point and Park Avenue Pump Stations.

The combined firm capacity of the pump stations discharging to the WWTP is estimated at 1,600 gpm, assuming 100 gpm from the private Harrisonville PS.

B. History of WWTP

The Mackinac Island WWTP was originally constructed in 1970 and included preliminary screening and grit removal, two primary clarifiers, an oxidation tower, two aeration tanks, two final clarifiers, chlorine disinfection, aerobic sludge storage and sludge drying beds. As the service area was expanded and treatment requirements changed, the original WWTP was upgraded to accommodate needs of the City. The following list summarizes important expansions and improvements completed at the WWTP to date:

- In 1982, the plant was expanded to include an additional oxidation tower, and an equalization basin. Mechanical screening equipment was also added to the headworks.
- In 1992, the plant was expanded again to include two additional aeration tanks, two final clarifiers, and a sludge storage tank. A new fine screen and effluent pumps were also installed.
- In 2012, an outdoor summer headworks structure was added to accommodate peak summer flow rates. A process building was constructed to house a new sludge dewatering system, and the sludge drying beds were abandoned.

C. Overview of the Current Treatment Process

To accommodate the large variability in flow between the summer and winter months, the WWTP has two modes of operation. Process Flow Schematics and hydraulic profiles of the existing facility are provided in Appendix B.

Summer Operation

During the summer (mid-May – late October), influent wastewater is pumped to the Summer Headworks Building, where the flow is measured by an electromagnetic flow meter. The wastewater flows through an automatic screen to remove rags and other large inorganic debris prior to treatment. Following screening, the wastewater enters a vortex grit removal chamber to settle out sand and other grit that could damage downstream treatment equipment.

The wastewater flows by gravity through the winter headworks channel to the primary clarifiers where settleable organic matter is removed to reduce the organic loading to secondary biological treatment process.

Secondary treatment pumps lift and split the flow between two oxidation towers before sending the wastewater to the aeration tanks for additional biological treatment. Biological treatment occurs continuously in four aeration tanks.

Effluent from the aeration tanks is divided between four final clarifiers to remove biological solids and phosphorus. Ferric chloride chemical addition is used to aid in phosphorus removal.

From the final clarifiers, treated effluent flows to the chlorine contact chamber for disinfection prior to discharge. Plant effluent flow is measured by an ultrasonic level sensor over the chlorine contact tank weir prior to being pumped to the discharge location in Lake Huron.

Winter Operation

During the winter (November – mid-May), influent wastewater bypasses the summer headworks and enters to the winter headworks. The wastewater passes through the winter mechanical screen to remove rags and other larger debris prior to treatment.

Following screening, flow is measured by an ultrasonic level sensor and transmitted over the 6-inch Parshall flume. Any overflow goes to an equalization tank.

Due to the low influent flow and loadings received during the winter months, the primary clarifiers, two of the aeration tanks, and both oxidation towers can be taken out of service. Biological treatment is accomplished using an extended aeration process in two of the aeration basins. Final clarifier 2 is the only clarifier on-line during the winter months because it is located indoors.

From the final clarifier, the treated effluent flows to the chlorine contact chamber for disinfection prior to discharge.

Solids Handling

Settled sludge from the primary clarifiers is pumped to the two sludge decant tanks. Return activated sludge (RAS) from the final clarifiers is returned upstream of the aeration tanks or wasted to the sludge decant tanks. The scum is pumped out of the final clarifiers, as necessary.

The digested sludge pumps transfer sludge to either the flocculation tank of the rotary screw press or to the biosolids storage tank for temporary storage. The screw press dewaters the sludge to prepare the biosolids for landfill disposal.

The pressate from the screw press is pumped back through the plant, to either the primary clarifiers or the winter headworks channel after the Parshall flume.

Due to the low volumes of sludge produced during the winter months, the sludge dewatering unit is typically taken offline. Waste sludge is stored in the decant tanks and biosolids storage tank until spring.

III. Design Criteria

A. Development of Design Criteria

Design criteria were developed for the WWTP to evaluate the existing facilities and understand the extent of the improvements required at the WWTP. Population and development projections were used to estimate future flows and loadings to the WWTP during the 20-year planning period.

Multiple review meetings were held with City staff to evaluate the potential for future growth on the Island. There is currently a large portion of the Island that remains natural and undeveloped. The City indicated that there is a desire to grow and expand development on the Island, but it is not anticipated that 100% of the available future development will occur in the next 20-year planning period.

B. Population Projections

Due to the seasonal tourist nature of Mackinac Island, the City experiences a significant fluctuation in population from summer to winter seasons. The WWTP must be designed to accommodate the large variability in flow. For this reason, the future population projections were separated into summer and winter.

Summer Population

Future summer population was estimated using the 2018 Master Plan and 2017 Zoning Ordinance. 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 uses. Maximum densities for each land use were multiplied by the area to give a total population. This was assumed to be a ultimate future build out. A summary of this information is provided in Appendix C.

The City estimates that approximately 55% of the potential future development could occur in the 20-year planning period. It is also assumed the Village of Harrisonville will be added to the collection system in the future due to failing septic systems.

In addition to overnight tourists and residents on the Island, there are daily tourists. The number of daily tourists was estimated using 3.5% growth per year, as referenced in the 2018 Master Plan.

Winter Population

Future winter population was determined as approximately 25% of the summer population, per the year-round housing estimate in the 2018 Master Plan.

Table 2 compares the current population to the 20-year population projection and the ultimate buildout population.

Table 2: Population Projections						
	Current*		20-year		Ultimate	
	Summer	Winter	Summer	Winter	Summer	Winter
Island Residents	1,943	492	3,380	860	5,520	1,655
Hotel/Lodging Guests	3,006		5,750		10,460	
Seasonal Employees	4,000		5,070		8,420	
Total Residential Population	8,949	492	14,200	860	24,400	1,655
Day Trip Tourists	7,740	0	12,800	0	17,100	0
Total Design Population	**16,689**	**492**	**27,000**	**860**	**41,500**	**1,655**

*Data source: 2018 Master Plan Table 2-2.

C. Wastewater Characteristics

1. Existing Wastewater Volumes

The existing WWTP Basis of Design indicated that the facility is rated to treat 0.96 million gallons per day (MGD). Based on the seasonal variations in flow the plant has two modes of operation that are designed to accommodate an average daily flow of 0.54 MGD and a maximum daily flow of 0.96 MGD in the summer (May – October) and an average daily flow of 0.13 MGD and maximum daily flow of 0.52 MGD in the winter (November – April).

Influent flow data from September 2017 - January 2021 was reviewed and compared to the original design. Table 3 and Figure 1 present the rated hydraulic capacity, as well as the average and maximum flow observed during the roughly three-year period of review.

Table 3: Current Hydraulic Loading				
	Existing Basis of Design (Summer)	2017 - 2021 (Summer)	Existing Basis of Design (Winter)	2017 - 2020 (Winter)
Average Daily Flow (MGD)	0.54	0.61	0.13	0.10
Maximum Flow (MGD)	0.96	0.99	0.52	0.40

*NPDES Permit Rated flow capacity: 0.96 MGD

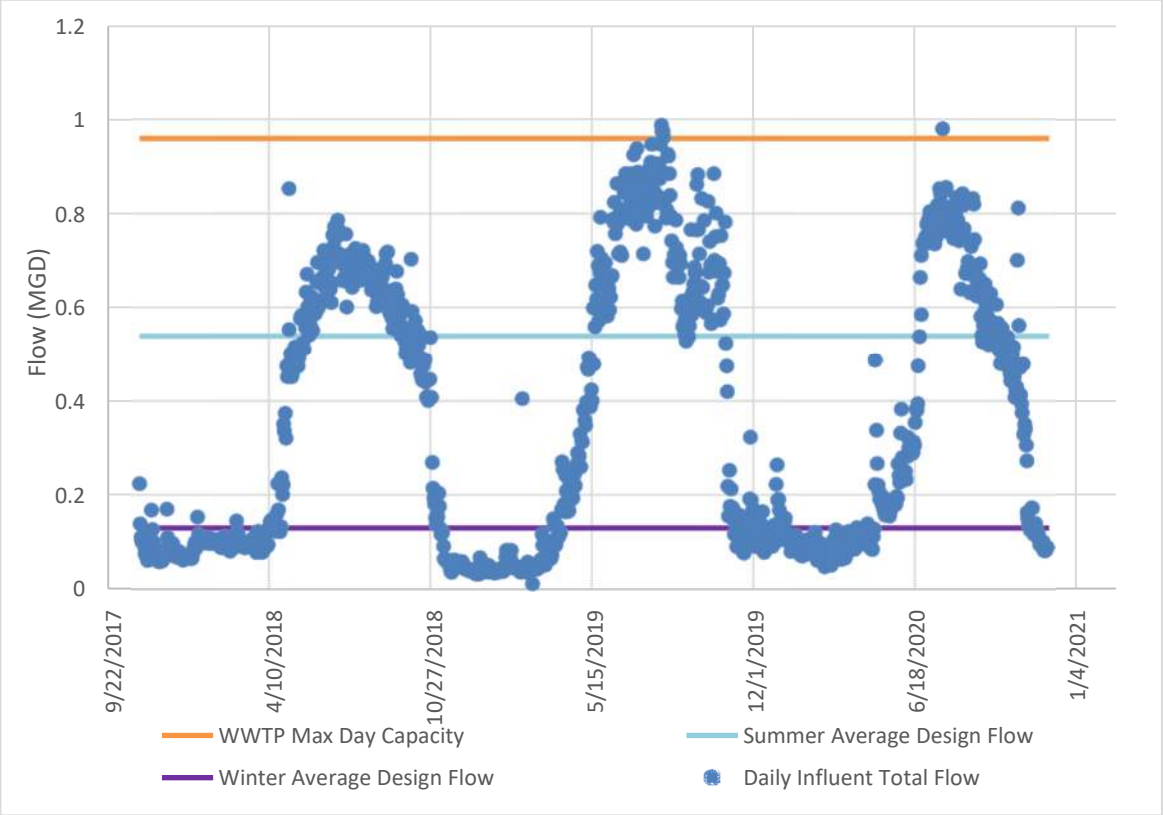


Figure 1: Current Hydraulic Loading

The figure above demonstrates the wide range of seasonal flows received at the WWTP. Peak summer months are routinely approaching the maximum design capacity of the WWTP. Additionally, peak hour flow rates for both the summer and winter were reported above the intended design capacity.

2. Inflow and Infiltration

In October 2020, Fleis & VandenBrink (F&V) completed an Inflow & Infiltration (I/I) Analysis Flow Monitoring Report for the Biddle Point Pump Station Service Area. Based primarily on the flow responses observed during the April 29, 2020, 3.1-inch storm event, the 25-year 24-hour design storm I/I flows are projected to be approximately 0.75 MG during that 24-hour period (equivalent to 0.75 MGD), plus 0.06 MGD from constant groundwater infiltration. The peak hourly flow rate of I/I alone is projected to be 1,000 gpm.

Many buildings served by the sewer system, particularly those in the downtown area, appear to have sump pumps connected to the sanitary sewer system. F&V conducted a detailed evaluation and field investigation in Spring/Fall 2021 to determine the potential impact of the sump pumps and feasibility to reduce I/I. Based on the results of the study it was determined that existing sump pumps could be contributing approximately 60,000 gpd during dry weather and up to 325,000 gpm during wet weather events. A complete detailed report outlining the suspected sump connections to the sanitary sewer system has been provided to the City.

3. Design Wastewater Volumes

The population projections and I/I Analysis described above were utilized to estimate a 20-year design flow that will serve as the basis for the 2022 WWTP Master Plan evaluation. Multiple per capita wastewater production rates were considered during the development of the estimated design flow:

1. U.S. Department of Agriculture & Rural Development (USDA RD) *Bulletin 1780-2* – recommends a usage rate of 70 gallons per capita per day (gpcd).
2. *2004 Recommend Standards for Wastewater Facilities (Ten States Standards)* - Recommends a per capita usage rate of 100 gpcd.
3. *Part 41 Michigan Department of Environmental Quality (MDEQ) Permit application for Wastewater Systems Improvements 2011 (2013 Mackinac Island WWTP Improvements). A usage rate of 110 gallons gpcd was estimated.*

Considering the average value of the sources discussed above, and the actual flows observed at the WWTP, a per capita usage rate of 80 gpcd was assigned to residents (including overnight tourists). It was assumed that day trip tourists would contribute approximately one-third the flow of residential user or 26.7 gpcd.

Table 4 summarizes the proposed future design flow. Based on the seasonal usage patterns of the system, it is recommended that the WWTP be designed to accommodate the maximum month average daily flow. As shown below, the design value is 1.538 MGD. This would account for the peak tourist population and allow for maximum number of residents on the island. Design and operational flexibility should be considered to provide plant turn down during periods of low flow.

Table 4: Proposed 20-Year Design Hydraulic Loading

	Summer (Max Month)	**Winter**
Overnight Tourist/ Resident Population	14,200	860
Tourist Population	12,800	0
	Hydraulic Loading	
	Summer	**Winter**
Overnight Tourist/ Resident Usage (gpd)	1,136,000	68,000
Tourist Usage (gpd)	342,000	0
Groundwater Infiltration (gpd)	60,000	60,000
25-year 24-hour design storm I/I flows	750,000	750,000
Max Month Avg. Daily Flow (gpd)[1]	1,538,000	128,000
Maximum Daily Flow (gpd)[2]	2,288,000	878,000
Peak Hour Flow (gpm)[3,4]	2,600	1,200

[1]Max Month average day demand is based on total resident and tourist usage plus ground water infiltration.
[2]Maximum Daily Flow is based on the average daily flow plus Inflow from the 25-year 24-hour storm.
[3] Summer Peak Hour Flow equals residential and tourist flow multiplied by Ten States Standards peaking factor (2.52) plus groundwater infiltration.
[4] Winter Peak Hour Flow equals residential and tourist flow multiplied by Ten States Standards peaking factor (3.84) plus groundwater infiltration, plus 1,000 gpm for peak I/I. Assuming EQ basin is offline during the winter months.

It should be noted that the design peak hour flow of 2,600 gpm exceeds the current firm capacity of the pump stations (1,600 gpm). Based on the population projections and potential I/I discussed above, planning for the long-term upgrade of the pump stations and WWTP influent and effluent forcemains may be required as the service area is expanded. The timing of this upgrade will be dependent on areas of development and the level of I/I removal that can be achieved.

4. Existing Wastewater Quality

Daily monitoring reports from September 2017 – January 2021 were summarized and compared to the original WWTP design loadings to evaluate the current organic and nutrient loading at the WWTP . These values are summarized in Table 5 below.

Table 5: Current Nutrient Loading

	Existing Basis of Design*		2017 – 2021 maximum day		Current Summer Max Month Average		Current Winter Average	
	Concentration (mg/L)	Loading (lb/d)	Concentration (mg/L)	Loading (lb/d)	Concentration (mg/L)	Loading (lb/d)	Concentration (mg/L)	Loading (lb/d)
BOD_5	750	6,003	755	4,471	633	3,500	82	67
Suspended Solids	650	5,202	588	3,544	335	1,867	64	51
NH_3-N	30	240	-	-	-	-	-	-
Phosphorus (Total P)	6.2	50	9.28	38.4	4.6	24	3.27	2.65

**Basis of Design Information Reference: pg 140 Wastewater Treatment Plant Operation and Maintenance Manual*

It is important to note that the organic loading is higher than typical domestic wastewater to account for receiving high strength waste from restaurants and business, as well as septic tanks from across the Island.

The current winter influent concentrations are substantially lower than typical domestic concentrations due to the small population of year-round residents and observed inflow and infiltration throughout the collection system. The dilute concentrations present a challenge for complying with percent removal requirements on the City's NDPES permit.

5. Design Organic Loading

Based on the max month average day flow projections presented above and the influent concentrations presented in the 2013 basis of design, Table 6 summarizes the 20-year design organic and nutrient loading.

Table 6: Design Nutrient Loading

	Concentration (mg/L)	Loading (lb/d)
BOD_5	750	9,600
Suspended Solids	650	8,300
NH_3-N	30	385
Phosphorus (Total P)	6.2	80

D. Effluent Requirements

1. Current Limits

The City of Mackinac Island WWTP operates under NPDES permit MI0026751. The current permitted effluent limitations are summarized in Table 7.

Table 7: NPDES Effluent Permit Limits

Parameter	Effluent Limit
Biological Oxygen Demand (BOD5)	30 mg/L (monthly) 45 mg/L (7-day)
Total Suspended Solids (TSS)	30 mg/L (monthly) 45 mg/L (7-day)
Total Phosphorous (as P)	1.0 mg/L (monthly)
Fecal Coliform Bacteria	200 cts/100 mL (monthly) 400 cts/100 mL (7-day)
Total Residual Chlorine	0.50 mg/L (daily)
BOD5 Minimum % Removal	85% (minimum monthly)
TSS Minimum % Removal	85% (minimum monthly)
pH	6.5 (daily minimum) 9.0 (daily maximum)
Dissolved Oxygen	4.0 (daily minimum)

2. NPDES Permit

The existing NPDES Permit is rated for a plant discharge of 0.96 MGD. A preliminary meeting with EGLE was held on February 18th, 2021 to review the current permit conditions and discuss future expansion of the facility. Based on the projected hydraulic loading of greater than 1.0 MGD, the NPDES permit classification for the WWTP would change. A major permit modification request would be required for any modifications to the facility that would increase the capacity above 1.0 MGD. EGLE staff recommend the modification request be submitted well in advance of any anticipated construction project to allow sufficient time for the permits department to complete their review. EGLE indicated the following potential changes to the current permit conditions:

- Additional potential monitoring requirements for a WWTP rated above 1 MGD are as follows:
- The annual fee would increase to $5,500.
- There would be increased annual sampling requirements for metals, VOCs, and PFAS.
- There is a possibility for a stricter mercury limit.
- A Stormwater Pollution Prevention Plan (SWPPP) may be required.

IV. Evaluation of Existing WWTP

F&V completed an evaluation of each unit process to determine the condition of equipment, evaluate any inconsistencies with current design standards, identify issues that should be addressed, and develop a timeline for resolving the issues. A complete asset inventory is provided in Appendix D.

A. Influent Screening

Summer Operation

1. Process Description

An automatic mechanical screen prevents inorganic debris greater than ¼-inch from entering the plant. Solids are collected and screened from the raw wastewater in the screening basket. As the basket fills, the screenings are compacted, dewatered, and sent to the collection bin to be landfilled. Table 8 provides equipment details of the mechanical screen.

Figure 2: Summer Mechanical Screen

Table 8: Summer Mechanical Screen Details	
Year Installed:	2012
Equipment Manufacturer:	WesTech
Capacity:	2.2 MGD peak flow
Drive motor:	1 hp

2. Capacity Evaluation

The automatic screen was designed to handle a peak flow of 2.2 MGD. The current firm capacity of pump stations is 1.6 MGD so under high flow conditions there is a potential for the screen's capacity to be exceeded. The 20-year peak hourly flow is anticipated to be equivalent to 3.74 MGD. The existing screen has marginal capacity for the current flows and does not have sufficient capacity for the projected 20-year flow rate.

3. Identified Issues

- There is no by-pass channel with manual bar screen to provide coarse screening in the event of a mechanical screen failure.
- The septage receiving station has no rock trap or preliminary screening mechanism. This allows for a high concentration of solids and debris to be added to the waste stream upstream of the automatic screen which creates the potential to clog or damage the unit.
- There is no flow meter at the septage receiving station, so there is no way to accurately measure the amount of septage entering the WWTP.
- The equipment is exposed to the elements. This causes the summer headworks to be unusable during the winter months. It also creates a higher potential for odors.

4. Recommendations

To accommodate the future capacity of the WWTP, it is recommended that the influent screen be replaced and relocated indoors so the equipment could be utilized year-round. The existing outdoor screening area could be retrofitted to accommodate a septage receiving station with a flow meter, rock trap, and robust screening unit.

Winter Operation

1. Process Description

A mechanical screen, located in the control building, is used during the winter months. A small equalization basin (3,500 gallons) provides bypass and buffer capacity for the existing screen. Table 9 summarizes the design information for the mechanical screen.

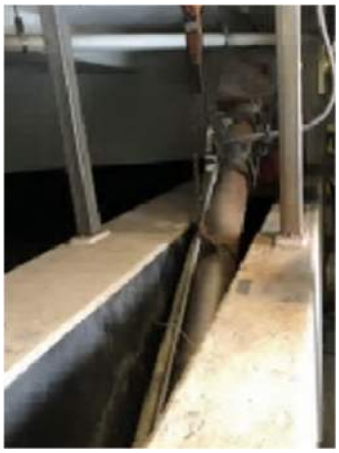


Figure 3: Winter Influent Screen

Table 9: Winter Mechanical Screen Details	
Year Installed:	2013
Equipment Manufacturer:	WesTech
Design Peak Flow:	1.13 MGD
Type:	Auger Screen
Drive motor:	1 hp

2. Capacity Evaluation

The winter mechanical screen was designed to handle a peak flow of 1.13 MGD. The 20-year peak hourly flow is anticipated to be equivalent to approximately 1.8 MGD. The existing screen does not have the capacity for the projected 20- year peak flow rates.

3. Identified Issues

- The existing equalization tank is too small. Winter overflows have occurred during snow melt and heavy rain events.
- The equipment remains in fair condition, but some evidence of corrosion was observed.
- The HVAC system is starting to corrode, and additional ventilation is required to meet NFPA 820 and provide a safe working environment.

4. Recommendations

It is recommended that the existing winter headworks building be abandoned, and a new indoor headworks facility be constructed that could be utilized year-round.

B. Grit Removal

Summer Operation

1. Process Description

The screened wastewater is routed to a vortex grit removal system that allows heavier inorganic material to settle out of the wastewater and helps prevent highly abrasive grit from damaging or interfering with the operation of downstream equipment.

The grit chamber contains a grit tank paddle, grit pump, cyclone separator, and grit washer. The grit pump transfers the grit from the bottom of the grit chamber to the grit washer. Grit is carried from the grit washer to a trash bin by a screw auger. Details of the grit removal equipment are provided in Table 10.

Figure 4: Grit Removal Equipment

Table 10: Grit Removal Details	
Year Installed:	2013
Equipment Manufacturer:	WesTech
Grit Pump Manufacturer:	Gorman-Rupp Company
Capacity	
Grit Pump:	22 gpm @ 27 ft TDH
Grit Washer:	14 cft/hr
Cyclone Separator:	225 gpm @ 5.75 psi
Vortex Grit Tank motor:	0.5 HP

2. Capacity Evaluation

Available design information indicates that the existing vortex grit system was designed to handle influent flows up to 2.2 MGD. The current firm capacity of the pump stations is 1.6 MGD. Therefore, under peak flow conditions there is a potential for the grit system's capacity to be exceeded. The 20-year peak hourly flow is anticipated to be equivalent to 3.74 MGD. The existing grit removal system has marginal capacity for the current flows and does not have sufficient capacity for the projected 20-year flow rate.

3. Identified Issues

- The equipment is exposed to the elements. This causes the summer headworks to beunusable during the winter months. It also allows for a higher potential for odors.

4. Recommendations

It is recommended that the grit removal system be upgraded and relocated indoors so the equipment could be utilized year-round.

Grit Removal - Winter

1. Process Description

The winter headworks building contains an abandoned grit removal system. Screened wastewater is routed through an aerated grit chamber, but all of the grit removal equipment has been abandoned and the system is not functional.

2. Capacity Evaluation

The winter aerated grit unit is anticipated to have insufficient capacity during the next 20-year planning period.

3. Identified Issues

- The aerated grit system mechanical equipment is 28 years old and is no longer in operation.
- During peak spring flows there is a hydraulic bottleneck between the existing winter grit chamber and the aeration tanks that has caused overflows in the past.

4. Recommendations

It is recommended that the existing winter headworks building be abandoned and a new indoor headworks facility be constructed that could be utilized year-round.

C. Primary Clarifiers

1. Process Description

The WWTP contains two circular primary clarifiers. The primary clarifiers are designed to remove a large portion of the settleable organic solids from the wastewater during peak summertime flows. The primary clarifiers are necessary to reduce the organic loading to the secondary biological process and provide a thicker waste sludge to the decant tanks. Scum and floating solids are collected with a rotating skimmer. Sludge settles on the bottom of the clarifiers, and two arms direct sludge from the bottom of the tank to the center hopper of the clarifiers. The primary sludge pumps transfer the sludge to the decant tanks. Details of the primary clarifiers and primary sludge pumps are provided in Table 11 and Table 12.

Figure 5: Primary Clarifier Mechanism

Table 11: Primary Clarifier Details	
Tank Design	
Qty:	2
Diameter:	24 ft
Side Water Depth (SWD):	8 ft
Volume:	100,346 gals, each
Drive Motor:	0.75 HP
Sludge Pump Design	
Type:	Submersible
Motor:	5 Hp

Figure 6: Primary Sludge Pump

Table 12: Primary Sludge Pump Details	
Year Installed:	1971, 2007
Equipment Manufacturer:	Carter
Quantity:	2
Design Conditions Flow: Head:	 150 gpm 67 ft TDH
Motor:	5 HP

2. Capacity Evaluation

Surface Overflow Rate

The design standard for peak hourly overflow rate for primary clarifiers that do not receive waste active sludge is 2,000 gallons per day per square foot of surface area (gpd/sf). The clarifiers are each 24 feet in diameter for a combined surface area of 905 sf. The total rated capacity for the primary clarifier process is therefore: 2,000 gpd/sf x 905 sf = 1.80 MGD.

Peak hourly influent flow data was not readily available; however, it can be estimated using population and average daily flow data, in accordance with the method given in Ten States Standards. For the year 2020, the peaking factor is estimated at 2.75, corresponding to a peak flow of 2.16 MGD. For the 20-year design, the peaking factor is estimated at 2.52, corresponding to a peak flow of 3.74 MGD.

The existing clarifiers do not have sufficient capacity to handle the current or projected peak flows.

Weir Loading

The allowable peak hourly weir loading for plants sized at less than 1.0 MGD is 20,000 gallons per day per foot of weir length (gpd/ft). The total weir length is approximately 148 ft. The weir loading capacity is therefore 20,000 gpd/ft x 148 ft = 2.96 MGD. The existing clarifiers have adequate weir length to handle the current flows, but not the projected flows.

3. Identified Issues

- The existing clarifiers are undersized and do not meet the minimum Ten States Standard of 10 foot side water depth (SWD).
- Clarifier mechanisms have begun to exhibit surface corrosion.
- The treatment process lacks redundancy, both clarifiers must be operational to hydraulically pass the design flows. If a clarifier is taken out of service, all flow must pass through a single 8-inch pipe and there is a potential for the winter headworks to back up and overflow.
- The sludge pumps are aging and operating past their expected useful life.
- There are no safety guards on the sludge pumps.

4. Recommendations

To accommodate the future design conditions of the WWTP it is recommended that the primary clarifiers and sludge pumps be replaced.

D. Secondary Treatment Pump Station

1. Process Description

Effluent from the primary clarifiers flows by gravity to the secondary treatment pump station where it is pumped up to the oxidation towers. The wet well is located directly below the electrical room and the access hatch is inside the building. Table 13 provides details for the secondary treatment pumps.

Figure 7: Secondary Treatment Pumps

Table 13: Secondary Treatment Pump Details	
Year Installed:	2013
Equipment Manufacturer:	Fairbanks Morse
Quantity:	2
Design Conditions	
Flow:	1,250 gpm
Head:	64 ft TDH
Motor:	30 Hp

2. Capacity Evaluation

The existing secondary treatment pumps have a firm capacity of 1.8 MGD. The current firm capacity of the pump stations is 1.6 MGD. Therefore, under peak flow conditions there is a potential for the secondary treatment PS to be overloaded. The secondary pumps do not have sufficient capacity for the current or projected flows

3. Identified Issues

- The wet well is located in the control room near the pump electrical gear. The location of the wet well hatch in relation to the electrical gear is not in compliance with current NFPA 820 standards.
- The WWTP experiences intermittent power supply surges which can cause the secondary pump VFDs to trip on a fault. The VFDs do not automatically reset on fault and must be manually resetby an operator or the pumps will not restart.
- The small wet well provides minimal storage capacity in the event of a mechanical or electrical fault in the pumps. If the wet well overflows it will flood the control building basement and could potentially damage a majority of the process equipment and electrical gear.

4. Recommendations

It is recommended that the existing secondary treatment pump station be abandoned as part of the proposed WWTP expansion.

E. Oxidation Towers

1. Process Description

Two oxidation towers are used during summer operation to reduce the organic loading to the activated sludge process. Wastewater is pumped from the primary clarifiers to the top of the oxidation towers by the secondary treatment pumps. A rotary distributor with four arms evenly disperses the wastewater across a column of plastic media housed within the towers. The plastic media is part of a fixed film biological process in which microorganisms grow on the surface of the plastic and consume the organic matter as the wastewater percolates through the towers. Details for the oxidation towers are presented in Table 14.

Figure 8: Oxidation Towers

Table 14: Oxidation Towers Details	
Tank Dimensions	
Qty:	2
Diameter:	20 ft
Media Depth:	21.5 ft
Working Volume:	50,000 gal, each
Media Manufacturer	
Tank 1:	B.F. Goodrich
Tank 2:	American Surfpac
Year Media Installed	
Tank 1:	1973
Tank 2:	1986
Total Media per Tower:	7,200 cubic feet

2. Capacity Evaluation

Hydraulic Loading

The oxidation towers were designed to hydraulically pass 0.89 gal/sf/min across a combined area of 670 ft. At the current maximum month design flow of 0.96 MGD (670 gpm), the loading rate is 1 gal/sf/min. Additionally, the secondary treatment pumps are rated at 1,250 gpm, therefore during periods of high flow there is a potential for the oxidation towers to be hydraulically overloaded.

Organic Loading

The oxidation towers were designed to handle an organic loading rate of 150 lb BOD/1000cf/day. The current design organic loading capacity of the WWTP is 6000 lb BOD/day. Assuming the primary clarifiers remove 30% of the influent loading, the organic loading to the oxidation towers is 4200 lbs/day. The towers have a total combined volume of 14,362 cf which equates to a loading rate of 292 lbs/1000cf/day. Under the maximum month design conditions, there is a potential for the oxidation towers to be organically overloaded.

The oxidation towers do not have sufficient capacity to accommodate the 20-year flow projections.

3. Identified Issues

- The oxidation towers are undersized to provide the needed biological treatment.
- There are significant structural concerns with the wooden structures and ladders so there is noway for operators to safely access the towers to inspect the media.

- The towers are operating well past their anticipated useful life and should be evaluated for replacement.
- There is a potential for seasonal odors from the operation of the oxidation towers

4. Recommendations

As part of the proposed WWTP expansions, it is recommended that the existing oxidation towers be abandoned, and replaced with an alternative biological treatment technology.

F. Aeration Tanks

1. Process Description

The aeration tanks are designed to provide biological treatment of wastewater through a conventional activated sludge process. The activated sludge process is an aerobic process in which microorganisms consume dissolved organic matter. The active mass of microorganisms is settled in the final clarifiers and either returned to the aeration basins as mixed liquor or wasted to the decant tanks. The mixed liquor supplies a healthy population of microorganisms to continue the treatment process in the aeration basins. All four aeration tanks are in service during the summer operation, and only Tanks 1A and 1B are used in the winter months. Three centrifugal blowers supply air to a diffused aeration grid which provides the mixing energy and oxygen transfer necessary for treatment. Details for the Aeration Tanks and Blowers are provided in Table 15 and Table 16.

Figure 9: Aeration Tanks

Table 15: Aeration Tank Specifications	
Tank Dimensions	
1A:	
Width:	19 ft
Length:	45 ft
Depth:	12 ft SWD
1B:	
Width:	19 ft
Length:	28 ft
Depth:	12 ft SWD
2A & B:	
Width:	19 ft
Length:	38 ft
Depth:	12 ft SWD
Working Volume:	64,807 gal, each
Diffuser Type:	Coarse Bubble
Aeration Grid Manufacturer:	Walker Process

Figure 10: Low-Capacity Blowers

Figure 11: High-Capacity Blower

Table 16: Secondary Treatment Blower Details	
Blower Type:	Centrifugal
No. of Blowers:	Three
Motor	
Blowers 1 & 2:	40 Hp
Blower 3:	50 Hp
Air Flow per Blower	
Blowers 1 & 2:	736 cfm
Blower 3:	930 cfm
Discharge Pressure	
Blowers 1 & 2:	5.75 psig
Blower 3:	5.50 psig
Age of Blowers	
Blowers 1 & 2:	Refurbished in 1990s (installed in 1971)
Blower 3:	2000

2. Capacity Evaluation

Ten States Standards lists the maximum permissible organic loading for a conventional activated sludge process as 40 pounds of BOD_5 per day per 1,000 cubic feet (cf) of aeration tank volume. The total tank volume is approximately 34,000 cf during summer operation, which equates to an allowable BOD_5 loading of 1,400 pounds per day. During the current maximum month design conditions, the organic loading rate to the primary clarifiers is approximately 2,100 pounds per day. This assumes 30% BOD removal in the primary clarifiers and an additional 50% removal in the oxidation towers. The projected 20-year BOD loading is estimated at 3,400 lb/day.

3. Identified Issues

- Existing aeration tanks are undersized to provide the needed biological treatment.
- The blowers were installed in 1970 and 2000. The typical useful life of a blower is 25 years. The low-capacity blowers are past their useful life and the high-capacity blower is approaching the end of its useful life.
- Based on the approximate age of the aeration diffusers it is likely that the diffuser membranes are due for replacement.

4. Recommendations

It is recommended that alternatives for the biological treatment process be evaluated. Further discussion is provided in Section V of this report.

G. Final Clarifiers

Summer Operation

1. Process Description

The final clarifiers are designed to remove suspended solids from the treated wastewater. Each clarifier has a rapid mix chamber that is used to blend ferric chloride with the wastewater to aid in phosphorus precipitation and removal. The clarified effluent overflows a perimeter weir and discharges to the chlorine disinfection process. Settled sludge from the bottom of each clarifier is directed toward the center of the tank with a rotating scraper arm. The sludge is pumped from the clarifiers using the Return Activated Sludge (RAS) pumps and either returned to the aeration tanks or wasted to the decant tanks. Scum and floating solids are collected with a rotating skimmer arm that directs the floatable material into the sludge hoppers where they can be pumped to the decant tanks. Table 17 and Table 18 provide details for the final clarifiers and RAS pumps.

Figure 12: Final Clarifiers

Table 17: Final Clarifier Details	
Tank Dimensions	
1 & 2	
Diameter:	24 ft
Depth:	8 ft SWD
Working Volume:	27,409 gal, each
3 & 4	
Diameter:	30 ft
Depth:	12 ft SWD
Working Volume:	65,034 gal, each
Equipment Age:	
1:	2012
2:	1971
3 & 4:	1994
Drive Motor:	
1:	0.75 Hp
2:	0.5 Hp
3 & 4:	0.5 Hp

Figure 13: RAS Pump

Table 18: RAS Pump Details		
Year Installed:	2012	
Equipment Manufacturer:	Wemco	
Quantity:	4	
Design Conditions	RAS – 1,2	RAS – 3,4
Flow:	140 gpm	185 gpm
Head:	8 ft TDH	14 ft TDH

2. Capacity Evaluation

Surface Overflow

The design standard for peak hourly overflow rate in activated sludge plants using ferric chloride for phosphorus removal is 900 gallons per day per square foot of surface area (gpd/sf). The clarifiers have a combined surface area of 2,320 sf during summer operation. The total rated capacity for the final clarifier process is therefore: 900 gpd/sf x 2,320 sf = 2.09 MGD.

The projected 20-year peak hour flow is 3.74 MGD. The existing clarifiers do not have the capacity to accommodate the projected peak hour flows.

Solids loading

The allowable peak solids loading rate for activated sludge plants is 40 lbs per square foot of surface area per day(lb/day/sf). Typical Mixed Liquor Suspended Solids (MLSS) concentrations at the WWTP are 2,000 – 5,000 mg/L. Based on the existing total surface area of 2,320 sf during summer operation, the rated capacity of the clarifiers is 2.2 MGD.

Weir Loading

The allowable peak hourly weir loading for plants sized at less than 1.0 MGD is 20,000 gallons per day per foot of weir length (gpd/ft). The total weir length during the summer months is approximately 332 ft. The existing clarifiers have adequate weir length to handle the current and 20-year peak flows if all four clarifiers are in operation.

3. Identified Issues

- The existing clarifiers are undersized and clarifier 1 and 2 do not meet the minimum Ten States Standard of 12 foot side water depth (SWD).
- Clarifier mechanisms have begun to exhibit surface corrosion.
- The treatment process lacks redundancy. All clarifiers need to be operational to hydraulically pass the design flows.
- The different tank geometries could lead to unbalanced flow splitting and decreased settling performance at peak flows.
- The current pump configuration limits the operator's ability to waste sludge out of final clarifiers 3 and 4.

4. Recommendations

Additional Secondary Clarifiers will be required to handle the 20-year projected design flows and improve flow splitting between the different sized clarifiers. Further details are provided in the Section V of this report.

Winter Operation

1. Process Description

Final clarifier 2, located inside the control building, is the only clarifier than can be operated during the winter season. Final clarifier 1 has a metal cover to be used as a backup during the winter months, but it does not provide sufficient insulation and freezing is common. Details for Final clarifier 2 are provided in Table 18 and 19.

Figure 14: Final Clarifier 2 (Winter Use)

Table 19: Final Clarifier 2 Scum Pump Details	
Scum Pump Design	
Type:	Submersible 5
Motor:	Hp

2. Capacity Evaluation

Surface Overflow

Final clarifier 2 has a surface area of 452 sf. The total rated capacity for the final clarifier process is therefore: 900 gpd/sf x 452 sf = 0.41 MGD. This is sufficient for current winter operation, but leaves the facility with no reliable alternative if Clarifier 2 needs to be taken out of service. The projected 20-year peak hour winter flow is equivalent to 1.73 MGD and max daily flow is 0.866 MGD. The existing clarifier used during the winter months does not have the capacity to handle the projected peak hour or max daily flows.

Weir Loading

The allowable peak hourly weir loading for plants sized at less than 1.0 MGD is 20,000 gallons per day per foot of weir length (gpd/ft). During the winter months, the total weir length is approximately 74 ft. The existing clarifier used has adequate weir length to handle both the current and 20-year peak flows.

3. Identified Issues

- There is no reliable redundancy for final clarifier 2.
- The mechanism for final clarifier 2 was installed in 1972 and is the oldest final clarifier at the plant. Since it is located inside a building, replacing the mechanism would involve removing and replacing the roof.
- The cover of final clarifier No.1 does not provide sufficient insulation and the tank is prone to freezing if it must be used during the winter months.

4. Recommendations

As part of the recommended WWTP expansion, the final clarification process for winter operation should be upgraded to provide new equipment and enhanced system redundancy.

H. Disinfection System

1. Process Description

The WWTP utilizes a gas chlorination disinfection system to inactivate pathogenic organisms before discharging to Lake Huron. Clarified effluent from the final clarifiers flows over a weir into the chlorine contact tank, and gas chlorine is injected. Because of the hazardous nature of chlorine gas, a gas monitoring system is used in the chlorine room. Details of the chlorination system are provided in Table 20.

Figure 15: Gas Chlorination System

Table 20: Chlorination System Details	
Year Installed:	1971
Chlorinator:	2013
Chlorinator Size:	500 ppd
Tank Dimensions	
Length:	33.5 ft
Width:	13 ft
Weir Height:	6.58 ft
Weir Length:	3.0 ft
Volume:	19,380 gal

2. Capacity Evaluation

Ten States Standards recommends a dosage of 8 mg/L for activated sludge plants. For the current design flow of 0.96 MGD this equates to 65 lbs per day. The existing chlorinator module is rated at 500 lbs per day maximum capacity; however, internal components such as the rotameter limit the system capacity to 100 lbs per day, which is adequate for the current flows. Upgrades would be required to accommodate the 20-year design flow.

At peak hour flow, there should be a minimum detention time of 15 minutes. At the projected 20-year peak hour flow of 3.74 MGD, the detention time is less than 15 minutes.

3. Identified Issues

- Based on the 20-year design flows, there is not enough contact time to meet Ten States Standards.
- Transporting hazardous chlorine gas to the WWTP is a safety concern both on the Island and on the ferry to the Island.
- The plant experiences control issues with the chlorinator.
- The piping from the secondary treatment wet well to the oxidation towers runs through the chlorine contact tank. If this piping failed, raw primary effluent would be flowing into final effluent.

4. Recommendations

Alternate disinfection methods should be considered to provide sufficient contact time and increase operator control. Alternative disinfection methods such as UV disinfection eliminate the need to transport and store hazardous chlorine gas. Further details are provided in Section V of the report.

I. Effluent Pump Station and Gravity Sewer

1. Process Description

Final effluent is pumped from the WWTP, to a 10-inch gravity sewer approximately 7,800 feet in length, to the discharge point, 500 feet into Lake Huron. Two centrifugal pumps are operated on variable frequency drives (VFDs) controlled by the effluent flow meter. The effluent flow meter receives a redundant signal from two ultrasonic level sensors, one on the chlorine contact weir and one on the effluent weir. Specifications for the final effluent pumps are provided in Table 21.

Figure 16: Effluent Pumps

Table 21: Final Effluent Pump Specifications	
Year Installed:	2013
Equipment Manufacturer:	Fairbanks Morse
Type:	Duplex, Non-clog centrifugal
Quantity:	2
Design Conditions	
Flow:	1,250 gpm
Head:	56 ft TDH
HP:	25

2. Capacity Evaluation

The final effluent pumps have the same capacity as the Secondary Pump Station, and therefore face similar capacity concerns. The current firm capacity of the pump stations is 1,600 gpm. Under peak flow conditions there is a potential for the Effluent Pump Station to be overloaded. The effluent pumps do not have sufficient capacity for the current or projected 20-year peak hour flows.

The effluent forcemain is a 10” diameter pressure sewer. Under current peak flow conditions, the hydraulic grade line through the sewer is elevated such that overflows have occurred. Converting the effluent gravity sewer to a pressure sewer has been proposed to increase capacity. The maximum capacity of a 10” pressure sewer is 1,900 gpm (2.4 MGD) based on Ten States Standard maximum recommended velocity of 8 ft/s. This is sufficient for the maximum day flow, but provisions for ultimate design peak hour should be considered.

3. Identified Issues

- The small effluent wet well and rapid changes in flow make responding to and controlling pump discharge rates problematic.
- When there are power surges, the VFD will trip out and does not automatically restart. The fault must be manually cleared before the pumps can be restarted.

- The small wet well provides minimal storage capacity in the event of a mechanical or electrical fault in the pumps. If the wet well overflows it will flood the control building basement and could potentially damage a majority of the process equipment and electrical gear.
- The effluent discharge gravity sewer does not have the capacity to handle the summer peak flows.
- The effluent sewer is 50 years old and should be inspected to confirm its current condition and evaluate the need to for additional repairs or replacement.

4. Recommendations

It is recommended that the final effluent pumps be replaced to match or exceed the capacity of the influent pump stations.

A forcemain evaluation was completed by Fishbeck to address sanitary sewer overflows of the effluent sewer in April 2021. A max design condition of 2.5 MGD was used to evaluate the effluent sewer.

Future recommended improvements to the effluent sewer include the installation of air/vacuum relief valves, modifying the open effluent sewer to an enclosed pressure sewer, and ultimately the replacement of the effluent sewer to provide a redundant effluent sewer and additional capacity.

J. Chemical Feed System

1. Process Description

Ferric chloride is used at the WWTP to aid in phosphorous removal and the settling of solids. The ferric chloride system includes two fiberglass reinforced plastic (FRP) bulk storage tanks, each 800 gallons, one 300-gallon day tank, two transfer pumps, and one metering pump. Table 22 provides details for the ferric chloride system.

Figure 17: Ferric Chloride System

Table 22: Ferric Chloride System Details

Year Installed:	2012
Type	
Transfer Pump 1:	Peristaltic Hose
Transfer Pump 2:	Magnetic Drive
Metering Pump:	Positive Displacement
Capacity	
Transfer Pump 1:	25 gpm @ 78 rpm
Transfer Pump 2:	35 gpm @ 14 ft TDH
Metering Pump:	10 gph @ 80 psi

2. Identified Issues

- The control system should be upgraded and integrated into the WWTP alarm system. There are no alarms if there are issues with the feed system.
- The chemical must be transported to the treatment plant by horse and dray.

3. Recommendations

Along with future WWTP SCADA upgrades, a leak detection alarm should be provided.

K. Solids Treatment and Disposal

1. Process Description

Primary Sludge and Waste Activated Sludge (WAS) are pumped to the decant tanks. The decant tanks use gravity thickening to reduce the volume of sludge to be dewatered. The liquid that is drawn off the top of the decant tanks is pumped back to the winter headworks channel. Final solids processing and dewatering is primarily done during the summer months. During the winter months, most sludge is recycled as RAS or held in the decant tank throughout the winter. Any additional biosolids are sent to the biosolids storage tank. Details for the decant sludge tanks are provided in Table 23.

Figure 18: Sludge Decant Tank

Table 23: Decant Sludge Tank Details	
Year Installed	
Tank 1:	1971
Tank 2:	1992
Quantity:	2
Dimensions	
Tank 1:	16 ft x 19 ft
Tank 2:	8 ft x 38 ft
Total Volume:	55,000 gal (27,500 gal each)

One rotary lobe pump and two vertical centrifugal sludge transfer pumps are located in the basement of the Control Building. The sludge transfer pumps draw suction from the decant tanks and transfer waste sludge to the sludge dewatering screw press or biosolids storage tank. The rotary lobe pump is the primary sludge feed pump to the screw press. A fourth sludge transfer pump, a hose pump, is located in the Sludge Handling Room of the Process Service Building and serves as a backup sludge feed pump to the screw press. The centrifugal pumps are used to transfer sludge to the biosolids storage tank. Details for the sludge feed and transfer pumps are provided in Table 24 and Table 25.

Figure 19 and Figure 20: Sludge Feed Pumps

Table 24: Sludge Feed Pump Details	
Year Installed:	2013
Manufacturer	
Primary:	Börger
Backup:	Verder
Type	
Primary:	Rotary Lobe
Backup:	Hose
Capacity	
Primary:	100 gpm @ 10 psi
Backup:	50 gpm @ 15 ft TDH
Motor	
Primary:	5 Hp
Backup:	7.5 Hp

Figure 21: Sludge Transfer Pump

Table 25: Sludge Transfer Pump Details	
Year Installed:	1994
Manufacturer:	ITT-AC
Quantity:	2
Motor:	5 Hp

The biosolids storage tank is used as needed in the winter to provide additional sludge storage if Decant Tank 2 no longer has capacity. Both the decant tank and the storage tank are emptied during the summer season when the biosolids are processed. The biosolids are pumped out of the decant tank by the digested sludge pumps. Table 26 provides details for the sludge storage tank.

Figure 22: Biosolids Storage Tank

Table 26: Biosolids Storage Tank Details	
Year Installed:	1994
Volume:	55,000 gal
Dimensions:	25 ft diameter x 15 ft SWD

Polymer is added to the sludge feed to condition the sludge and improve dewatering performance. The sludge and polymer are mechanically mixed in the flocculation tank upstream of the rotary screw press. Details of the polymer feed system are provided in Table 27.

Figure 23: Polymer Feed Skid

Table 27: Polymer Skid & Pump	
Year Installed:	2012
Manufacturer Skid: Pump:	 Fluid Dynamics LMI
Pump Type:	Diaphragm
Pump Capacity:	2.5 gph

Sludge dewatering at the WWTP is accomplished by a spiral screw press system. The screw press system extracts water from the waste sludge to produce a drier, more biologically stable solid. Cake solids are transferred from the screw press out of the building by a screw conveyor to a covered wagon. The dewatered biosolids are transported to the Solid Waste Handling Facility, and ultimately transported off the island for landfill disposal. Table 28 and Table 29 provide details for the Screw Press System.

Figure 24: Rotary Screw Press

Table 28: Rotary Screw Press Details	
Year Installed:	2012
Equipment Manufacturer:	FKC
Capacity:	670 dry tons/hr
Motor:	5 Hp

Figure 25: Screw Conveyor

Table 29: Screw Conveyor Details	
Year Installed:	2012
Dimensions:	12-inch diameter x 9-inch pitch x 20-inch long
Model:	30-degree incline screw conveyor
Motor:	3 Hp
Manufacturer:	Austin Mac Inc.
Capacity:	25 cf/hr @ 20% soilds

2. Capacity Evaluation

Screw Press

The screw press has a processing capacity of 8 dry tons per 24 hours. The capacity exceeds the 20 year design.

Sludge Storage

The two decant tanks have a combined 55,000 gallon capacity and the biosolids storage tank has an additional 55,000 gallons. As plant flows and solids production increases over the 20-year design period, additional sludge storage may be required to allow for additional decant volume and increased operational flexibility of the screw press.

3. Identified Issues

- Some of the sludge piping is undersized and could be prone to plugging.
- Solids can only be processed and hauled off the Island in the summer months

4. Recommendations

It is recommended that the WAS pumps and piping be upgraded to facilitate automatic wasting cycles, and increase operational flexibility.

L. Recycle Flows – Summer/Winter

1. Process Description

Many processes throughout the treatment plant allow for recycle flow back to the head of the plant. These include: the aerated grit chamber, primary clarifiers, chlorine contact tank, final effluent wet well, pressate from sludge dewatering processes, and various floor drains. The drain wet well, located in the Process Service Building, collects the return water from the decant tank, biosolids handling, and drains. This wastewater is routed to either the basement sump or the primary clarifier influent.

The basement sump is located in the basement of the control building. The sump is where the recycle flows are collected and are pumped by sump pumps back to the winter headworks channel. Table 30 provides additional details for the basement sump pump.

Figure 26: Basement Sump Pump

Table 30: Sump Pump Details	
Year Installed:	1987
Quantity:	2
Design Conditions	
Flow:	120 gpm
Head:	21 feet
Motor:	2 Hp

2. Identified Issues

- The basement pumps and cover have significant corrosion.
- If the sump pumps fail, the basement will flood.

3. Recommendations

It is recommended that the sump pumps and cover be replaced in the 20 year planning period.

M. Ancillary Equipment

Electrical System

1. Process Description

The WWTP electrical system is fed by a single utility source. The main motor control center (MCC) for the plant was replaced in 2012 and is located in the Process building. The main MCC feeds additional MCCs in the summer headworks building and control building.

2. Identified Issues

- The MCCs in the Control Building have exceeded their expected useful life and should be replaced for future reliable use.
- Upon power failure, critical equipment fails to restart automatically. Operations staff must manually clear faults and restart equipment.

Standby Generator

1. Process Description

The WWTP has one 800 kW standby generator, which was installed in 2012 to provide electrical service should utility electrical power to the WWTP be interrupted.

2. Identified Issues

No issues with the existing generator have been identified.

3. Recommendations

There are no recommended improvements at this time. The sizing of the existing generator should be confirmed through the detailed design of the WWTP expansion.

SCADA System

The WWTP currently uses a telephone dialer system to remotely monitor the facility. The dialer system provides limited capabilities for operators to monitor the WWTP operation and respond to alarms. It is recommended that a plant wide SCADA system be implemented as part of the WWTP expansion. The SCADA system would allow for remote process monitoring and detailed alarm information.

N. Building Conditions

The treatment plant contains five buildings: the Control Building, Headworks Building, Process Building, Storage Building and the Garage.

1. Control Building

The Control Building functions as the Lab and Administration Building on the main level, and the basement houses a majority of the process pumps and process equipment. The lab was redone in 2012 and remains in good condition. Generally, the rest of building has limited space and amenities for WWTP Staff. Renovations are recommended as part of any large-scale improvement project.

2. Headworks Building

The Headworks Building was constructed in 2012 and remains in good condition. Currently the small building houses the electrical gear for the screening and grit removal equipment.

3. Process Building

The Process Building was constructed in 2012 to house the biosolids handling process. The main electrical switch gear and MCC are also located in the process building

4. Maintenance and Equipment Storage Building

The existing Maintenance and Equipment Storage Buildings are utilized for spare parts storage and a shop for equipment maintenance. The buildings do not have sufficient space for secure indoor storage of equipment. Additional garage storage and workshop area should be considered as part of a large scale WWTP improvement project.

V. Analysis of Alternatives

A. Identification of Potential Alternatives

The evaluation in Section IV revealed that a majority of the unit processes at the WWTP are in need of significant improvements to accommodate the proposed WWTP expansion. The recommended improvements for certain unit processes had only one feasible alternative. However, alternatives for the biological treatment process were developed and evaluated based on their ability to meet the WWTP objectives while remaining within financial, regulatory, and technical constraints.

Project objectives include:

1. Provide facilities capable of delivering consistent reliable service and continued compliance with regulatory and permit requirements.
2. Plan for future growth within the City and corresponding treatment capacity.
3. Minimize operating costs through improved treatment methods.
4. Rehabilitate/repair high priority areas of existing wastewater infrastructure.
5. Minimize financial burden to the sewer system users.
6. Minimize environmental impact during construction of the improvements project.
7. Minimize environmental impact of WWTP operations and discharge.

The alternatives are described in detail in the following subsections. Each alternative was initially screened based on effectiveness, ability to implement, and financial requirements. Feasible alternatives were then subjected to a comprehensive evaluation with attention to detailed economic, technical, environmental, and public concerns. A conceptual site plan for each principal alternative is included in Appendix E.

B. Biological Treatment – Alternatives Evaluation

Five alternatives were developed for biological treatment system. The alternatives are described in the following sections.

1. Alternative 1 – No Action

The “No-Action” Alternative is typically required to be evaluated by most funding agencies. No improvements would be implemented with this alternative. The “No Action” alternative would maintain current system operations.

The issues with the current biological treatment process, including inoperable equipment, biological and hydraulic capacity issues, and structural defects in the oxidation towers would not be addressed. Aging equipment would continue to deteriorate until ultimate failure, which could result in compliance problems in the future.

Leaving these problems unaddressed poses a serious risk of process failure and potential sanitary sewer overflows.

There is a cost associated with the “No Action” alternative, although it is difficult to quantify that cost currently.

The “No Action” alternative does not meet the project objectives and will not be evaluated further as a principal alternative.

2. Alternative 2 – Expansion with Upgrades to the Existing Facilities

Alternative 2 includes rehabilitating and expanding the existing biological treatment system.

Repairing the existing oxidation towers and expanding the aeration basins will not improve the hydraulics throughout of the current system. The WWTP will continue to be hydraulically overloaded and frequent bypasses will be necessary.

The existing oxidation towers require the use of the secondary pump station which has historically been a reliability concern due to its small size and location within the facility. The compact footprint of the existing facility leaves no room for the feasible expansion of the secondary pump station or oxidation towers and aeration basins. Additionally, the seasonal odors generated by the oxidation towers would continue.

Without the oxidation towers, a significant expansion of the existing aeration basins would be required to convert the plant to a conventional activated sludge plant. Additionally, the current hydraulic profile does not allow for influent to flow by gravity from the primary clarifiers to the aeration basins.

The control building basement that houses the mechanical equipment and process piping has undergone many renovations in the past and there is minimal space available for additional equipment.

Alternative 2 does not meet the primary project objective and will not be evaluated further as a principal alternative.

3. Alternative 3 – Expansion with Moving Bed Bioreactors (MBBRs)

Alternative 3 includes the addition of a Moving Bed Bioreactor (MBBR) biological treatment system. A MBBR would consists of four concrete aerated basins, partially filled with plastic carrier media, typically below 50% of the total tank volume in the beginning of the MBBR operation, though the total media volume can be increased to accommodate higher flows/loadings from population growth or new commercial and industrial users. The carrier media provides a surface for the formation of biofilms, or bacterial “colonies” that treat the wastewater similar to bacteria found in Conventional Activated Sludge systems.

<u>Advantages</u>

The primary advantage of Alternative 3 is that the MBBR system can accomplish a high degree of treatment in a reduced footprint, and the secondary pump station could be eliminated. Given that this approach will utilize attached growth processes, it is also resilient to shock loading and variable influent rates observed on the Island.

Another significant advantage of the MBBR process is that RAS is not required, eliminating the need for RAS pumping. Due to the nature of biologic growth in MBBR systems, all of the bacteria needed for treatment are sustained on the carrier media, and do not need to be replenished by return sludge. This provides significant OM&R savings, as well as capital costs for the eventual replacement of the RAS pumps.

The biofilm growth process also promotes the formation of large floc, due to the way in which biomass sloughing occurs. With proper coagulation and flocculation, sloughed biomass readily settles within the final clarifiers. All biomass collected at the bottom of the clarifiers can be wasted, requiring regular use of WAS pumps only.

Further advantages offered by an MBBR system are that MBBRs are generally well suited for preventing excessive filamentous bacterial growth, given the nature of biomass growth on the carrier media and the system’s relative buffering capabilities, further improving settling. Attached growth process may also

develop advanced microbial communities, as they generally can support a greater concentration of higher order life forms, typically found in sludge with a higher solids retention time (SRT). These organisms can further oxidize biomass grown on the media, providing a marginal decrease in realized sludge yield. As a result, the volume of sludge wasted should be less than or equal to current volumes, improving overall sludge storage needs.

A MBBR system also provides the most flexibility for future expansion. Should future population growth exceed current projections, additional media could be added to the existing tanks to increase the process capacity. This flexibility would allow the process to be designed to handle the current design flow and loading initially and allow for expansion as flows increase by simply adding media to the reactors. As the maximum media capacity is reached within the existing tanks, an additional MBBR train could be added to provide further treatment capacity.

Regarding ease of operation, a MBBR system provides the most “hands off” operational approach of the alternatives discussed herein, largely due to the lack of recycle flows. It also provides the opportunity for zone isolation for routine maintenance. Scheduled maintenance should be planned for seasonal low flow periods to minimize process disturbance.

Disadvantages

MBBRs are not typically designed to provide complete biological nutrient removal (BNR). The BNR process is designed to remove CBOD5, ammonia (NH3-N), as well as total nitrogen, and phosphorus below permit limits without the addition of chemicals. This MBBR system would not provide biological phosphorus removal or denitrification. Phosphorus removal will continue to be achieved with chemical precipitation of phosphorus.

Implementation

The proposed MBBR system involves the construction of an influent flow control structure, two reactors with two basins in each reactor. During the summer season, the reactors will operate in series, with one reactor as the lead and the other as the lag. These reactors will be alternated throughout the season to promote equal biofilm growth. During the winter season, the primary clarifiers would be bypassed and the reactors will operate in parallel to provide a continuous food supply to the micro-organisms in each reactor to preserve biomass growth during periods of low flow. Bypass piping and gates would be provided to allow for tank isolation and maintenance. Effluent from the MBBR system would be distributed to the final clarifiers through a new splitter box.

A site plan showing the proposed layout for Alternative 3 – Expansion with MBBR can be found in Appendix E.

4. Alternative 4 – Expansion with Oxidation Ditches

Alternative 4 includes replacing the existing biological treatment system with an Oxidation Ditch. Oxidation ditches utilize a modified activated sludge process that allows for long solids retention times. Typical oxidation ditch treatment systems consist of a large ring or oval shaped concrete tank with multichannel configuration. Horizontally mounted aerators provide circulation, oxygen transfer, and aeration in the ditch. The mixing process entrains oxygen into the mixed liquor to foster microbial growth and the circular velocity ensures contact of microorganisms with the incoming wastewater. The aeration sharply increases the dissolved oxygen (DO) concentration, but decreases as biomass uptake oxygen as the mixed liquor travels through the ditch. Solids are maintained in suspension as the mixed liquor circulates around the ditch.

Advantages

The primary advantage of Alternative 4 is that the process has significant turndown capacity. Individual rings can be shut down during periods of low flow to conserve energy. Also, due to the large tank volume, the oxidation ditch has a long hydraulic retention time and complete mixing helps minimize the impact of a shock load or hydraulic surge.

If design solids retention times (SRTs) are selected for nitrification, a high degree of nitrification is possible. Oxidation ditch effluent is usually settled in a separate secondary clarifier. An anaerobic tank could be added prior to the ditch to enhance biological phosphorus removal and limit the amount of chemical used.

Disadvantages

Oxidation ditches require recycle flow from the final clarifiers, similar to an activated sludge process. New RAS pumps, piping, valves, and controls would be required to operate the system. The oxidation ditch also requires additional operator input and control of recycle flows to adjust for variable influent loading. Oxidation ditches require significantly larger tank volumes compared to other biological processes. The additional earthwork and concrete costs could significantly add to the capital costs of the project based on the unique project location and soil types.

Future expansion of the oxidation ditch treatment system is more complex and typically requires the construction of additional tank volume and mechanical equipment.

Implementation

Alternative 4 includes constructing a new oxidation ditch for biological treatment to meet the 20-year design flows and loadings. The preliminary oxidation ditch process design includes three “rings” or process channels operating in series during the summer months. Similar to Alternative 3, the primary clarifiers would be bypassed in the winter months and only one oxidation channel would be required to accomplish the winter treatment objectives. Disc aerators would be utilized to provide the necessary oxygen and mixing. Effluent from the oxidation ditch will discharge to the final clarifiers. New RAS pumps, piping, valves, and controls would also be included with this alternative.

A site plan showing the proposed layout for Alternative 4 – Expansion with Oxidation Ditches can be found in Appendix E.

5. Alternative 5 – Expansion with Membrane Bioreactors (MBRs)

Alternative 5 involves expanding the facility using Membrane Bioreactors (MBRs) downstream of conventional aerated treatment basins. MBRs have the advantage of combining a suspended growth biological reactor with solids removal via filtration. Membrane filtration involves the flow of water containing pollutants across a membrane. Water permeates through the membrane into a separate channel for recovery. The water passing through the membrane is called the permeate, while the water with the more-concentrated materials is called the concentrate or retentate. The requirement is that the membranes prevent passage of particles the size of microorganisms, or about 1 micron, so that they remain in the system. This means that MBR systems are good for removing solid material, but the removal of dissolved wastewater components must be facilitated by using additional treatment steps.

The membrane filtration system in effect replaces the secondary clarifiers in a typical activated sludge treatment system. Membrane filtration allows a higher biomass concentration to be maintained, thereby allowing smaller bioreactors to be used. With the use of MBRs, a smaller opening fine screen is required for primary treatment to protect the hollow fiber membrane system.

Primary clarification and aeration basins are still required to treat the biological loading to the WWTP. The requirements used are similar to the aeration tank capacities needed for a conventional activated sludge plant. The existing tanks do not have sufficient capacity to provide the necessary aeration so additional tanks would need to be added.

Sludge from the MBR process is either returned to the aeration tanks as RAS or wasted from the process, just like in a conventional active sludge system.

The MBR system will require new pumps, blowers, solids handling equipment, and control system.

Advantages

The membranes can be designed for operation in small spaces and provide high removal efficiency of contaminants such as nitrogen, phosphorus, bacteria, biochemical oxygen demand, and total suspended solids.

The primary advantage of Alternative 5 is that MBRs tend to have higher quality effluent than other biological treatment systems, and the land requirement for future expansion would be less than the other alternatives discussed. With the use of MBRs, the existing final clarifiers could be eliminated.

Disadvantages

The primary disadvantage of MBR systems is the higher capital and operating costs than conventional systems for the same throughput. O&M costs include chemical membrane cleaning and fouling control, and eventual membrane replacement. Energy costs are also higher because of the need for air scouring to control bacterial growth on the membranes.

Implementation

A new micro screen would be installed in the proposed headworks building, additional biological treatment volume would be added downstream of the proposed primary clarifiers and a new MBR process building would be constructed. The MBR would need to be located indoors in a climate-controlled environment to prevent freezing during the winter months.

The conceptual preliminary design of the MBR system includes 4 trains for summer operation. Only 1 train would be required during the winter months.

A site plan showing the proposed layout for Alternative 5 – Expansion with MBR can be found in Appendix E.

C. Wastewater Treatment Plant Expansion

Each alternative discussed above includes the construction of an equalization basin, new headworks facility, new primary clarifiers, a biological treatment system, UV disinfection, a Storage Garage, and Control Building improvements. Alternative 3 and 4 also include improvements to the final clarifiers. The existing solids handling process and dewatering system for biosolids disposal would remain.

To provide for the expanded WWTP capacity, the following improvements are recommended:

1. Equalization

The proposed WWTP expansion would be designed to accommodate the projected peak hour from the current lift stations. However, the limiting factor for the WWTP would be the effluent sewer. Utilizing the existing 250,000 gallon aeration basins as an Equalization Basin could reduce the peak hour demands of the effluent pump station.

Depending on the level of I/I removal that can be achieved, the equalization basin may need to be expanded in the future as the service area grows.

2. Headworks

The existing configuration of separate winter and summer headworks is not capable of handling the future design flow rates. To address the current hydraulic challenges with the winter headworks and accommodate the WWTP expansion, it is recommended that a new headworks building be constructed.

The new building would be climate controlled and suitable for year-round use. The building would be designed in accordance with NFPA-820 guidelines, and the HVAC system design could be designed to accommodate the addition of a future odor control system.

Two screening channels would be constructed, to allow for a redundant influent screen in the event of mechanical failure or blockage of the primary unit. The existing summer mechanical screen will be relocated to the bypass channel and a new mechanical screen will be installed to handle the peak flow rates. Alternative 5 requires slightly larger channels and two microscreens to protect the membrane bioreactors

Influent screening would be followed by a vortex grit removal system, similar to the current summer headworks technology. It is possible that a portion of the existing summer headworks grit removal equipment could be relocated to the new headworks building for re-use.

The existing winter headworks would be abandoned, and the summer headworks could be repurposed as a septage receiving station.

3. Septage Receiving Station

A severe duty screen with rock trap would be installed at the existing summer headworks to effectively handle the heavy debris and solids associated with septage hauling. A dedicated septage flow meter would be provided to allow for enhanced monitoring of the septage loading to the WWTP.

4. Primary Clarifiers

It is not feasible to expand the existing primary clarifiers to meet the projected needs of the WWTP. In addition to the deficiencies identified in Section IV, the primary clarifiers cannot flow by gravity to the aeration basins if the secondary pump station and oxidation towers are abandoned as discussed below.

It is recommended that existing primary clarifiers be replaced with three new rectangular primary clarifiers and a primary flow splitter. Rectangular clarifiers allow for a reduced footprint using shared wall construction, and three units provide the necessary redundancy. The proposed configuration allows for simple expansion in the future. New primary sludge pumps, piping, and valves would also be included.

5. Final Clarifiers

In order to address the deficiencies identified with the existing final clarifiers it is recommended that the clarifiers be replaced. Three new 45-ft diameter clarifiers would be designed and constructed in accordance with Ten States Standards recommended parameters for side water depth, surface overflow rate and solids loading rate. Two of the clarifiers would be provided with covers to allow for winter operation.

New sludge piping and waste pumps would be provided to improve clarifier wasting and control.

Due to the filtering capabilities of MBRs, secondary clarifiers would not be necessary with Alternative 5.

6. Disinfection System

The existing chlorine contact chamber is undersized for the projected flows and expansion is not feasible within the existing footprint. Additionally, the transportation of chlorine gas to the WWTP is a safety hazard. It is recommended that an a Ultraviolet (UV) disinfection system be installed to provide reliable disinfection, reduce chemical usage, and improve overall site safety.

7. Effluent Pump Station Modifications

To address the capacity and hydraulic issues with the effluent pump station the following improvements are recommended: installation of air/vacuum relief valves and replacement of WWTP effluent pumps.

8. Plant Automation

Along with the WWTP upgrades discussed above, a Supervisory Control and Data Acquisition (SCADA) system is recommended. A WWTP SCADA system would provide operators with a real-time status of each plant operation including alarm status, and remote monitoring and control.

9. Storage & Control Building Improvements

The WWTP currently has a small storage building and workshop. The space is not adequate for the needs of the plant. Construction of a larger facility (approximately 5,000 sf) would allow for additional storage of spare parts and vehicles as well as a climate-controlled area for maintenance.

The existing control building could also be renovated to provide amenities for operations staff such as a locker room and dedicated break room.

10. Influent and Effluent Forcemain

During the original construction of the WWTP a 12” influent forcemain and 10” effluent sewer were placed in the same trench from Biddle Point up to the WWTP. Both pipes are approximately 50 years old and approaching their maximum capacity.

To address the immediate overflow concerns with the effluent sewer, it is recommended that the open gravity sewer be converted to a closed pressure sewer and air/vacuum relief valves be installed.

It is recommended that planning for the replacement of both forcemains be considered in the long term capital improvements plan.

D. Analysis of Principal Alternatives

Three principal alternatives were identified that met the project objectives. These alternatives were analyzed further as summarized in the following sections.

1. Alternative 3 – Expansion with MBBR
2. Alternative 4 – Expansion with Oxidation Ditches
3. Alternative 5 – Expansion with MBRs

1. **Monetary Evaluation**

The monetary evaluation includes a present worth analysis for the three principal alternatives. The analysis does not identify the source of funds but compares cost uniformly for each alternative over the 20-year planning period. The present worth is the sum which, if invested now at a given interest rate, would provide the funds required to pay projected costs over the 20-year planning period. The total present worth, used to compare the alternatives, is the sum of the initial capital cost, plus the present worth of Operation,

Maintenance, and Replacement (OM&R) costs, minus the present worth of the salvage value at the end of the 20-year planning period.

The salvage value is calculated at the end of 20 years where portions of the project structures or equipment may have a salvage value, which is determined by using straight-line depreciation. EGLE guidance documents establish the estimated life for the project structures and equipment to assess salvage values at the 20-year planning period. In general, concrete structures, earthwork basins, and piping have useful lives of 30-50 years and equipment has a useful life of 10-20 years.

The cost of labor, equipment and materials are not escalated over the 20-year life since it is assumed that any increase in these costs will apply equally to all alternatives. The interest charge during construction (capitalized interest) would not significantly influence the comparison of alternatives and was not included in the cost-effectiveness analysis.

To ensure uniformity of the cost comparisons, the following cost comparison details were specifically addressed and were applied in the present worth analysis as per the EGLE guidance.

- Capital costs were included for all identified improvements.
- Sunk costs were excluded from the present worth cost. Sunk costs for the project include existing land, existing waterworks facilities, and outstanding bond indebtedness.
- Operation, Maintenance, and Replacement, (OM&R) costs were included in the present worth cost. The operation costs were compared relative to treating the design flow and loading over the 20-year planning period assuming a 60/40 split between summer and winter operation.
- The economic comparison is based on a 20-year planning period and a discount rate of 1.5%, per EGLE/EPA guidance for FY2021.
- Salvage values were included in the present worth cost.
- Energy cost escalation was assumed equal between the alternatives and therefore was not adjusted over the 20-year period.

A detailed breakdown of all identified project costs is included in Appendix F for each alternative. Table 31 compares the costs for the principal alternatives.

Table 31: Summary of Present Worth Cost Analysis

Alternative	Project Cost	Annual OM&R Cost	Net Present Worth of OM&R Cost	Salvage Value	Net Present Worth
Alternative 3 - WWTP Expansion with MBBR	$27,110,000	$180,000	$3,090,000	$3,990,000	$26,210,000
Alternative 4 - WWTP Expansion with Oxidation Ditches	$29,820,000	$220,000	$3,780,000	$4,510,000	$29,090,000
Alternative 5 - WWTP Expansion Membrane Bioreactor (MBR)	$28,870,000	$350,000	$6,010,000	$3,420,000	$31,460,000

Note: This table represents budgetary estimates for planning purposes. Further definition of the scope of the projects through preliminary and final design will provide details necessary to improve the accuracy of the cost estimates.

As shown in the table above, Alternative 3 has the lowest capital costs and O&M cost over the planning period resulting in the lowest net present worth. The financial analysis in conjunction with the technical advantages of the treatment system make Alternative 3 the recommended alternative.

VI. Recommendations

A. Recommended WWTP Expansion

The following section outlines the recommended WWTP Expansion Plan identified in previous sections. The total project cost and proposed year of implementation are included in Table 32 below. The project costs were estimated based on 2021 construction costs and are inflated at an annual rate of 3% to the anticipated year of implementation.

Table 32: Proposed WWTP Expansion w/ MBBR Opinion of Probable Costs

Project	Anticipated Year of Replacement	Project Budget (2021 Dollars)	Budget Project Year (2023 Dollars)
General Construction Costs	2023		
Contractors General Conditions OH&P		$2,720,000	$2,890,000
Site Development		$300,000	$320,000
Site Utilities		$330,000	$350,000
Demolish Existing Facilities		$800,000	$850,000
WWTP Process Equipment and Structures	2023		
Headworks		$1,600,000	$1,700,000
Equalization		$520,000	$550,000
Septage Receiving		$610,000	$650,000
Primary Clarifiers		$1,740,000	$1,850,000
MBBR Equipment		$3,770,000	$4,000,000
Final Clarifiers		$5,180,000	$5,500,000
Disinfection		$1,164,000	$1,230,000
Effluent Pump Station Modifications		$470,000	$500,000
Electrical, Controls, and SCADA	2023		
Plant Automation		$250,000	$270,000
Motor Control Centers/Electrical Gear		$250,000	$270,000
Building Improvements	2023		
Control Building Renovation		$650,000	$690,000
Storage Garage		$500,000	$530,000
		Subtotal Construction	**$22,150,000**
		Engineering & Administration:	$4,430,000
		Contingency:	$2,220,000
		Estimated Project Total	**$28,800,000**

B. Project Financing

Available options for funding this project include municipal bonds, USDA Rural Development, and the Clean Water State Revolving Fund (SRF). A municipal financial advisor should be consulted to determine the best source of funding for the project.

Issuing municipal bonds is one option to finance wastewater system projects. The municipal bond rate is dependent on the loan term and the Authority's credit rating. Financing the project with municipal bonds does not put restrictions on project schedule, project delivery methods, or bidding requirements. However, the interest rate may be higher than funding with the SRF program.

Financing through the SRF program is another option. The SRF program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. The current interest rate for SRF loans is 1.875% for 20-year loans in fiscal year 2022. Financing the project through the SRF program requires a project plan to be completed to qualify for funding. The Master Plan can be used as a basis for the project plan. The SRF program requires following a quarterly schedule for design and bidding of projects and limits project delivery methods. The SRF program also requires compliance with Davis-Bacon prevailing wage rates for labor and compliance with American Iron and Steel requirements which may increase construction costs.

Appendix A

PERMIT NO. MI0026751

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, 33 U.S.C., Section 1251 *et seq*., as amended; Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

City of Mackinac Island
Market Street
PO Box 455
Mackinac Island, MI 49757

is authorized to discharge from the **Mackinac Island WWTP** located at

3134 Stonecliff Rd.
Mackinac Island, MI 49757

designated as **Mackinac Island WWTP**

to the receiving water named Lake Huron in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on March 29, 2016, as amended through December 16, 2016.

This permit takes effect on December 1, 2018. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date, this permit shall supersede National Pollutant Discharge Elimination System (NPDES) Permit No. MI0026751 expiring October 1, 2016.

This permit and the authorization to discharge shall expire at midnight on **October 1, 2023**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application that contains such information, forms, and fees as are required by the Michigan Department of Environmental Quality (Department) by **April 4, 2023**.

Issued: November 29, 2018.

Original signed by Christine Alexander
Christine Alexander, Manager
Permits Section
Water Resources Division

PERMIT FEE REQUIREMENTS

In accordance with Section 324.3120 of the NREPA, the permittee shall make payment of an annual permit fee to the Department for each October 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by January 15 for notices mailed by December 1. The fee is due no later than 45 days after receiving the notice for notices mailed after December 1.

Annual Permit Fee Classification: Municipal Minor, less than 1 MGD (Individual Permit)

In accordance with Section 324.3132 of the NREPA, the permittee shall make payment of an annual biosolids land application fee to the Department if the permittee land applies biosolids. In response to the Department's annual notice, the permittee shall submit the fee, which shall be postmarked no later than January 31 of each year.

CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Upper Peninsula District Office of the Water Resources Division. The Upper Peninsula District Office is located at 1504 West Washington Street, Marquette, MI 49855, Telephone: 906-228-4853, Fax: 906-228-4940.

CONTESTED CASE INFORMATION

Any person who is aggrieved by this permit may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

PART I

Section A. Limitations and Monitoring Requirements

1. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001. Outfall 001 discharges to Lake Huron. Such discharge shall be limited and monitored by the permittee as specified below.

	Maximum Limits for Quantity or Loading				Maximum Limits for Quality or Concentration				Monitoring	Sample
Parameter	**Monthly**	**7-Day**	**Daily**	**Units**	**Monthly**	**7-Day**	**Daily**	**Units**	**Frequency**	**Type**
Flow	(report)		(report)	MGD	---		---	---	Daily	Report Total Daily Flow
Biochemical Oxygen Demand (BOD5)	240	360	(report)	lbs/day	30	45	(report)	mg/l	5X Weekly	24-Hr Composite
Total Suspended Solids (TSS)	240	360	(report)	lbs/day	30	45	(report)	mg/l	5X Weekly	24-Hr Composite
Total Phosphorus (as P)	8.0	---	(report)	lbs/day	1.0	---	(report)	mg/l	5X Weekly	24-Hr Composite
Fecal Coliform Bacteria	---	---	---	---	200	400	(report)	cts/100 ml	5X Weekly	Grab
Total Residual Chlorine	---	---	---	---	---	---	0.50	mg/l	5X Weekly	Grab
Total Mercury Apr – Nov										
Corrected	(report)		(report)	lbs/day	(report)		(report)	ng/l	Monthly	Calculation
Uncorrected	---		---	---	---		(report)	ng/l	Monthly	Grab
Field Duplicate	---		---	---	---		(report)	ng/l	Monthly	Grab
Field Blank	---		---	---	---		(report)	ng/l	Monthly	Preparation
Laboratory Method Blank	---		---	---	---		(report)	ng/l	Monthly	Preparation
	12-Month Rolling Avg				**12-Month Rolling Avg**					
Total Mercury Apr – Nov	0.000075	---	---	lbs/day	9.0	---	---	ng/l	Monthly	Grab
					Minimum % Monthly		**Minimum % Daily**			
BOD5 Minimum % Removal	---	---	---	---	85	---	(report)	%	Monthly	Calculation
TSS Minimum % Removal	---	---	---	---	85	---	(report)	%	Monthly	Calculation
					Minimum Daily		**Maximum Daily**			
pH	---	---	---	---	6.5	---	9.0	S.U.	5X Weekly	Grab
Dissolved Oxygen	---	---	---	---	4.0	---	---	mg/l	5X Weekly	Grab

The following design flow was used in determining the above limitations but is not to be considered a limitation or actual capacity: 0.96 MGD.

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

b. Sampling Locations
Samples for BOD5, Total Suspended Solids, and Total Phosphorus shall be taken prior to disinfection. Samples for Fecal Coliform Bacteria, Total Residual Chlorine, Total Mercury, pH, and Dissolved Oxygen shall be taken after disinfection. The Department may approve alternate sampling locations that are demonstrated by the permittee to be representative of the effluent.

c. Total Residual Chlorine (TRC)
Compliance with the TRC limit shall be determined on the basis of one or more grab samples. If more than one (1) sample per day is taken, the additional samples shall be collected in near equal intervals over at least eight (8) hours. The samples shall be analyzed immediately upon collection and the average reported as the daily concentration. Samples shall be analyzed in accordance with Part II.B.2. of this permit.

d. Percent Removal Requirements
These requirements shall be calculated based on the monthly (30-day) effluent BOD5 and TSS concentrations and the monthly influent concentrations for approximately the same period.

e. Final Effluent Limitation for Total Mercury
The final limit for total mercury is the Discharge Specific Level Currently Achievable (LCA) based on a multiple discharger variance from the WQBEL of 1.3 ng/l, pursuant to Rule 1103(9) of the Water Quality Standards. Compliance with the LCA shall be determined as a 12-month rolling average, the calculation of which may be done using blank-corrected sample results. The 12-month rolling average shall be determined by adding the present monthly average result to the preceding 7 monthly average results then dividing the sum by 8. For facilities with quarterly monitoring requirements for total mercury, quarterly monitoring shall be equivalent to three (3) months of monitoring in calculating the 12-month rolling average. Facilities that monitor more frequently than monthly for total mercury must determine the monthly average result, which is the sum of the results of all data obtained in a given month divided by the total number of samples taken, in order to calculate the 12-month rolling average. If the 12-month rolling average for any month is less than or equal to the LCA, the permittee will be considered to be in compliance for total mercury for that month, provided the permittee is also in full compliance with the Pollutant Minimization Program for Total Mercury, set forth in Part I.A.3. of this permit.

After a minimum of 8 monthly data points have been collected, the permittee may request a reduction in the monitoring frequency for total mercury. This request shall contain an explanation as to why the reduced monitoring is appropriate and shall be submitted to the Department. Upon receipt of written approval and consistent with such approval, the permittee may reduce the monitoring frequency for total mercury indicated in Part I.A.3. of this permit. The Department may revoke the approval for reduced monitoring at any time upon notification to the permittee.

f. Total Mercury Testing and Additional Reporting Requirements
The analytical protocol for total mercury shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry." The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

The use of clean technique sampling procedures is required unless the permittee can demonstrate to the Department that an alternate sampling procedure is representative of the discharge. Guidance for clean technique sampling is contained in EPA Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance), EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

In order to demonstrate compliance with EPA Method 1631E and EPA Method 1669, the permittee shall report, on the daily sheet, the analytical results of all field blanks and field duplicates collected in conjunction with each sampling event, as well as laboratory method blanks when used for blank correction. The permittee shall collect at least one (1) field blank and at least one (1) field duplicate per sampling event. If more than ten (10) samples are collected during a sampling event, the permittee shall collect at least one (1) additional field blank AND field duplicate for every ten (10) samples collected. Only field blanks or laboratory method blanks may be used to calculate a concentration lower than the actual sample analytical results (i.e., a blank correction). Only one (1) blank (field OR laboratory method) may be used for blank correction of a given sample result, and only if the blank meets the quality control acceptance criteria. If blank correction is not performed on a given sample analytical result, the permittee shall report under "Total Mercury – Corrected" the same value reported under "Total Mercury – Uncorrected." The field duplicate is for quality control purposes only; its analytical result shall not be averaged with the sample result.

2. Quantification Levels and Analytical Methods for Selected Parameters

Quantification levels (QLs) are specified for selected parameters in the table below. These QLs shall be considered the maximum acceptable unless a higher QL is appropriate because of sample matrix interference. Justification for higher QLs shall be submitted to the Department within 30 days of such determination. Where necessary to help ensure that the QLs specified can be achieved, analytical methods may also be specified in the table below. The sampling procedures, preservation and handling, and analytical protocol for all monitoring conducted in compliance with this permit, including monitoring conducted to meet the requirements of the application for permit reissuance, shall be in accordance with the methods specified in the table below, or in accordance with Part II.B.2. of this permit if no method is specified in the table below, unless an alternate method is approved by the Department. With the exception of total mercury, all units are in ug/l. The table is continued on the following page:

Parameter	QL	Units	Analytical Method
1,2-Diphenylhydrazine (as Azobenzene)	3.0	ug/l	
2,4,6-Trichlorophenol	5.0	ug/l	
2,4-Dinitrophenol	19	ug/l	
3,3'-Dichlorobenzidine	1.5	ug/l	EPA Method 605
4,4'-DDD	0.05	ug/l	EPA Method 608
4,4'-DDE	0.01	ug/l	EPA Method 608
4,4'-DDT	0.01	ug/l	EPA Method 608
Acrylonitrile	1.0	ug/l	
Aldrin	0.01	ug/l	EPA Method 608
Alpha-Hexachlorocyclohexane	0.01	ug/l	EPA Method 608
Antimony, Total	1	ug/l	
Arsenic, Total	1	ug/l	
Barium, Total	5	ug/l	
Benzidine	0.1	ug/l	EPA Method 605
Beryllium, Total	1	ug/l	
Beta-Hexachlorocyclohexane	0.01	ug/l	EPA Method 608
Bis (2-Chloroethyl) Ether	1.0	ug/l	
Boron, Total	20	ug/l	
Cadmium, Total	0.2	ug/l	
Chlordane	0.01	ug/l	EPA Method 608
Chromium, Hexavalent	5	ug/l	
Chromium, Total	10	ug/l	
Copper, Total	1	ug/l	
Cyanide, Available	2	ug/l	EPA Method OIA 1677
Cyanide, Total	5	ug/l	

Parameter	QL	Units	Analytical Method
Delta-Hexachlorocyclohexane	0.01	ug/l	EPA Method 608
Dieldrin	0.01	ug/l	EPA Method 608
Di-N-Butyl Phthalate	9.0	ug/l	
Endosulfan I	0.01	ug/l	EPA Method 608
Endosulfan II	0.01	ug/l	EPA Method 608
Endosulfan Sulfate	0.01	ug/l	EPA Method 608
Endrin	0.01	ug/l	EPA Method 608
Endrin Aldehyde	0.01	ug/l	EPA Method 608
Fluoranthene	1.0	ug/l	
Heptachlor	0.01	ug/l	EPA Method 608
Heptachlor Epoxide	0.01	ug/l	EPA Method 608
Hexachlorobenzene	0.01	ug/l	EPA Method 612
Hexachlorobutadiene	0.01	ug/l	EPA Method 612
Hexachlorocyclopentadiene	0.01	ug/l	EPA Method 612
Hexachloroethane	5.0	ug/l	
Lead, Total	1	ug/l	
Lindane	0.01	ug/l	EPA Method 608
Lithium, Total	10	ug/l	
Mercury, Total	0.5	**ng/l**	EPA Method 1631E
Nickel, Total	5	ug/l	
PCB-1016	0.1	ug/l	EPA Method 608
PCB-1221	0.1	ug/l	EPA Method 608
PCB-1232	0.1	ug/l	EPA Method 608
PCB-1242	0.1	ug/l	EPA Method 608
PCB-1248	0.1	ug/l	EPA Method 608
PCB-1254	0.1	ug/l	EPA Method 608
PCB-1260	0.1	ug/l	EPA Method 608
Pentachlorophenol	1.8	ug/l	
Phenanthrene	1.0	ug/l	
Selenium, Total	1.0	ug/l	
Silver, Total	0.5	ug/l	
Strontium, Total	1000	ug/l	
Sulfides, Dissolved	20	ug/l	
Thallium, Total	1	ug/l	
Toxaphene	0.1	ug/l	EPA Method 608
Vinyl Chloride	0.25	ug/l	
Zinc, Total	10	ug/l	

3. Pollutant Minimization Program for Total Mercury

The goal of the Pollutant Minimization Program is to maintain the effluent concentration of total mercury at or below 1.3 ng/l. The permittee shall develop and implement a Pollutant Minimization Program in accordance with the following schedule.

On or before April 1, 2019, the permittee shall submit to the Department an approvable Pollutant Minimization Program for mercury designed to proceed toward the goal. The Pollutant Minimization Program shall include the following:

a. an annual review and semi-annual monitoring of potential sources of mercury entering the wastewater collection system;

b. a program for quarterly monitoring of influent and periodic monitoring of sludge for mercury; and

c. implementation of reasonable cost-effective control measures when sources of mercury are discovered. Factors to be considered include significance of sources, economic considerations, and technical and treatability considerations.

The Pollutant Minimization Program shall be implemented upon approval by the Department.

On or before March 31 of each year following approval of the Pollutant Minimization Program, the permittee shall submit a status report for the previous calendar year to the Department that includes 1) the monitoring results for the previous year, 2) an updated list of potential mercury sources, and 3) a summary of all actions taken to reduce or eliminate identified sources of mercury.

Any information generated as a result of the Pollutant Minimization Program set forth in this permit may be used to support a request to modify the approved program or to demonstrate that the Pollutant Minimization Program requirement has been completed satisfactorily.

A request for modification of the approved program and supporting documentation shall be submitted in writing to the Department for review and approval. The Department may approve modifications to the approved program (approval of a program modification does not require a permit modification), including a reduction in the frequency of the requirements under items a. and b.

This permit may be modified in accordance with applicable laws and rules to include additional mercury conditions and/or limitations as necessary.

4. Short Term Waste Characterization Study

As a condition of this permit, the permittee shall monitor the discharge from monitoring point 001A for the constituents listed below. This is due to previous data being provided with quantification levels used by the laboratory that were not sufficiently sensitive to determine if these parameters were being discharged at levels below Michigan water quality standards. Sampling shall take place when the facility is actively processing leachate and "summer commercial" nondomestic wastewater. By March 29, 2019, the permittee shall submit to the Department for review and approval, a sampling plan designed to ensure the samples will be taken during such a time. The sampling shall be a onetime event during this permit cycle and be consistent with the Department approved plan. The sampling results shall be submitted to the Department in a report that also includes the date, time, and approximate amount of leachate and septage received by the plant during the 24-hour period prior to the time of sampling. Grab samples shall be collected for available cyanide, total phenols, and the Volatile Organic Compounds identified below. For all other parameters, 24-hour composite samples shall be collected. Upon written request, an alternate schedule may be approved by the Department.

Metals (Total Recoverable), Cyanide and Total Phenols

antimony	arsenic	available cyanide	barium
beryllium	boron	cadmium	chromium
copper	lead	nickel	selenium
silver	thallium	zinc	
total phenolic compounds			

Volatile Organic Compounds

acrolein	acrylonitrile	benzene	bromoform
carbon tetrachloride	chlorobenzene	chlorodibromomethane	chloroethane
2-chloroethylvinyl ether	chloroform	dichlorobromomethane	1,1-dichloroethane
1,2-dichloroethane	trans-1,2-dichloroethylene	1,1-dichloroethylene	1,2-dichloropropane
1,3-dichloropropylene	ethylbenzene	methyl bromide	methyl chloride
methylene chloride	1,1,2,2,-tetrachloroethane	tetrachloroethylene	toluene
1,1,1-trichloroethane	1,1,2-trichloroethane	trichloroethylene	vinyl chloride

Acid-Extractable Compounds

p-chloro-m-cresol	2-chlorophenol	2,4-dichlorophenol	2,4-dimethylphenol
4,6-dinitro-o-cresol	2,4-dinitrophenol	2-nitrophenol	4-nitrophenol
Pentachlorophenol	phenol	2,4,6-trichloropheno	

Base/Neutral Compounds

acenaphthene	acenaphthylene	anthracene	benzidine
benzo(a)anthracene	benzo(a)pyrene	3,4-benzofluoranthene	benzo(ghi)perylene
benzo(k)fluoranthene	bis(2-chloroethoxy)methane	bis(2-chloroethyl)ether	bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate	4-bromophenyl phenyl ether	butyl benzyl phthalate	2-chloronaphthalene
4-chlorophenyl phenyl ether	chrysene	di-n-butyl phthalate	di-n-octyl phthalate
dibenzo(a,h)anthracene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene
3,3'-dichlorobenzidine	diethyl phthalate	dimethyl phthalate	2,4-dinitrotoluene
2,6-dinitrotoluene	1,2-diphenylhydrazine	fluoranthene	fluorene
Hexachlorobenzene	hexachlorobutadiene	hexachlorocyclo-pentadiene	hexachloroethane
indeno(1,2,3-cd)pyrene	isophorone	naphthalene	nitrobenzene
n-nitrosodi-n-propylamine	n-nitrosodimethylamine	n-nitrosodiphenylamine	phenanthrene
pyrene	1,2,4-trichlorobenzene		

The results of the analysis shall be submitted to the department within 30 days of the date on which the sample was collected. If, upon review of the analysis, it is determined that any of the materials or constituents require limiting to protect the receiving waters in accordance with applicable water quality standards, the permit may then be modified by the Department in accordance with applicable laws and rules.

5. Untreated or Partially Treated Sewage Discharge Reporting and Testing Requirements

In accordance with Section 324.3112a of the NREPA, if untreated sewage, including sanitary sewer overflows (SSO) and combined sewer overflows (CSO), or partially treated sewage is directly or indirectly discharged from a sewer system onto land or into the waters of the state, the entity responsible for the sewer system shall immediately, but not more than 24 hours after the discharge begins, notify, by telephone, the Department, local health departments, a daily newspaper of general circulation in the county in which the permittee is located, and a daily newspaper of general circulation in the county or counties in which the municipalities whose waters may be affected by the discharge are located that the discharge is occurring.

The permittee shall also annually contact municipalities, including the superintendent of a public drinking water supply with potentially affected intakes, whose waters may be affected by the permittee's discharge of combined sewage, and if those municipalities wish to be notified in the same manner as specified above, the permittee shall provide such notification. Such notification shall also include a daily newspaper in the county of the affected municipality.

At the conclusion of the discharge, written notification shall be submitted in accordance with and on the “Report of Discharge Form” available via the internet at: http://www.deq.state.mi.us/csosso/ , or, alternatively for combined sewer overflow discharges, in accordance with notification procedures approved by the Department.

In addition, in accordance with Section 324.3112a of the NREPA, each time a discharge of untreated sewage or partially treated sewage occurs, the permittee shall test the affected waters for *Escherichia coli* to assess the risk to the public health as a result of the discharge and shall provide the test results to the affected local county health departments and to the Department. The testing shall be done at locations specified by each affected

local county health department but shall not exceed 10 tests for each separate discharge event. The affected local county health department may waive this testing requirement, if it determines that such testing is not needed to assess the risk to the public health as a result of the discharge event. The results of this testing shall be submitted with the written notification required above, or, if the results are not yet available, submit them as soon as they become available. This testing is not required, if the testing has been waived by the local health department, or if the discharge(s) did not affect surface waters.

Permittees accepting sanitary or municipal sewage from other sewage collection systems are encouraged to notify the owners of those systems of the above reporting and testing requirements.

6. Facility Contact

The "Facility Contact" was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing within 10 days after replacement (including the name, address and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
- for a corporation, a principal executive officer of at least the level of vice president; or a designated representative if the representative is responsible for the overall operation of the facility from which the discharge originates, as described in the permit application or other NPDES form,
- for a partnership, a general partner,
- for a sole proprietorship, the proprietor, or
- for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager or other duly authorized employee.

b. A person is a duly authorized representative only if:
- the authorization is made in writing to the Department by a person described in paragraph a. of this section; and
- the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section releases the permittee from properly submitting reports and forms as required by law.

7. Monthly Operating Reports

Part 41 of Act 451 of 1994 as amended, specifically Section 324.4106 and associated R 299.2953, requires that the permittee file with the Department, on forms prescribed by the Department, operating reports showing the effectiveness of the treatment facility operation and the quantity and quality of liquid wastes discharged into waters of the state.

Within 30 days of the effective date of this permit, the permittee shall submit to the Department a revised treatment facility monitoring program to address monitoring requirement changes reflected in this permit, or submit justification explaining why monitoring requirement changes reflected in this permit do not necessitate revisions to the treatment facility monitoring program. The permittee shall implement the revised treatment facility monitoring program upon approval from the Department. Applicable forms and guidance are available on the Department's web site at http://www.michigan.gov/deq/0,1607,7-135-3313_44117---,00.html. The permittee may use alternate forms if they are consistent with the approved treatment facility monitoring program. Unless the Department provides written notification to the permittee that monthly submittal of operating reports is required, operating reports that result from implementation of the approved treatment facility monitoring program shall be maintained on site for a minimum of three (3) years and shall be made available to the Department for review upon request.

PART I

Section B. Storm Water Pollution Prevention

This section (Section B: Storm Water Pollution Prevention) is not needed for this permit.

PART I

Section C. Industrial Waste Pretreatment Program

1. Industrial Waste Pretreatment Program

It is understood that the permittee does not receive the discharge of any type or quantity of substance which may cause interference with the operation of the treatment works; and, therefore, the permittee is not required to immediately develop an industrial pretreatment program in accordance with Section 307 of the Federal Water Pollution Control Act. The permittee is required to comply with Section 307 of the Federal Water Pollution Control Act upon accepting any such discharge for treatment. The permittee is required to notify the Department within thirty (30) days if any user discharges or proposes to discharge such wastes to the permittee for treatment.

Under no circumstances shall the permittee allow introduction of the following wastes into the waste treatment system:

a. pollutants which cause pass-through or interference;

b. pollutants which create a fire hazard or explosion hazard in the sewerage system, including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21;

c. pollutants which will cause corrosive structural damage to the sewerage system; but in no case, discharges with pH less than 5.0, unless the works is specifically designed to accommodate such discharges;

d. solid or viscous pollutants in amounts which will cause obstruction to the flow in the sewerage system resulting in interference;

e. any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the treatment plant;

f. heat in amounts which will inhibit biological activity in the treatment plant resulting in interference; but in no case, heat in such quantities that the temperature at the treatment plant exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless the Department, upon request of the permittee, approves alternate temperature limits;

g. pollutants which result in the presence of toxic gases, vapors or fumes within the sewerage system in a quantity that may cause acute worker health and safety problems; and

h. any trucked or hauled pollutants, except at discharge points designated by the permittee.

If information is gained by the Department that the permittee receives or is about to receive industrial wastes, then this permit may be modified in accordance with applicable laws and rules to incorporate the requirements of Section 307 of the Federal Water Pollution Control Act.

PART I

Section D. Residuals Management Program

1. Residuals Management Program for Land Application of Biosolids

A permittee seeking authorization to land-apply bulk biosolids or prepare bulk biosolids for land application shall develop and submit a Residuals Management Program (RMP) to the Department (see Part I.D.1.e) for approval. Effective upon Department approval of the permittee's RMP, the permittee is authorized to land-apply bulk biosolids or prepare bulk biosolids for land application in accordance with the requirements established in R 323.2401 through R 323.2418 of the Michigan Administrative Code (Part 24 Rules) which can be obtained via the internet (http://www.michigan.gov/deq/ and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids, then click on Biosolids Laws and Rules Information which is under the Laws & Rules banner in the center of the screen). The permittee's approved RMP, and any approved modifications thereto, are enforceable requirements of this permit. Incineration, landfilling and other residual disposal activities shall be conducted in accordance with Part II.D.7. of this permit.

a. RMP Approval and Implementation
A permittee seeking approval of an RMP shall submit the RMP to the Department (see Part I.D.1.e) at least 180 days prior to the land application of biosolids. The permittee may utilize the RMP Electronic Form which can be obtained via the internet (http://www.michigan.gov/biosolids then click on RMP Electronic Form which is under the Downloads banner in the center of the screen) or obtain detailed requirements from the Department. The RMP shall become effective and shall be implemented by the permittee upon written approval by the Department.

b. Annual Report
On or before October 30 of each year, the permittee shall submit an annual report to the Department for the previous fiscal year of October 1 through September 30. The report shall be submitted electronically via the Department's MiWaters system at https://miwaters.deq.state.mi.us. At a minimum, the report shall contain:

1) a certification that current residuals management practices are in accordance with the approved RMP, or a proposal for modification to the approved RMP; and

2) a completed Biosolids Annual Report Form, available at https://miwaters.deq.state.mi.us.

c. Modifications to the Approved RMP
Prior to implementation of modifications to the RMP, the permittee shall submit proposed modifications to the Department (see Part I.D.1.e.) for approval. The approved modification shall become effective upon the date of approval. Upon written notification, the Department may impose additional requirements and/or limitations to the approved RMP as necessary to protect public health and the environment from any adverse effect of a pollutant in the biosolids.

d. Record Keeping
Records required by the Part 24 Rules shall be kept for a minimum of five years. However, the records documenting cumulative loading for sites subject to cumulative pollutant loading rates shall be kept as long as the site receives biosolids.

e. Contact Information
RMP-related submittals shall be made to the Department.

PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

Section A. Definitions

Acute toxic unit (TU_A) means $100/LC_{50}$ where the LC_{50} is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

Annual monitoring frequency refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Authorized public agency means a state, local, or county agency that is designated pursuant to the provisions of section 9110 of Part 91 of the NREPA to implement soil erosion and sedimentation control requirements with regard to construction activities undertaken by that agency.

Best management practices (BMPs) means structural devices or nonstructural practices that are designed to prevent pollutants from entering into storm water, to direct the flow of storm water, or to treat polluted storm water.

Bioaccumulative chemical of concern (BCC) means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

Biosolids are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

Bulk biosolids means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

Certificate of Coverage (COC) is a document, issued by the Department, which authorizes a discharge under a general permit.

Chronic toxic unit (TU_C) means 100/MATC or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and IC_{25} are expressed as a percent effluent in the test medium.

Class B biosolids refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Combined sewer system is a sewer system in which storm water runoff is combined with sanitary wastes.

Daily concentration is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any *individual* sample taken during the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs and the minimum value of any *individual* sample taken during the month in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. For dissolved oxygen, report the minimum concentration of any *individual* sample in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Daily loading is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

Daily monitoring frequency refers to a 24-hour day. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Department means the Michigan Department of Environmental Quality.

Detection level means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Discharge means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

EC_{50} means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

Fecal coliform bacteria monthly
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a discharge event. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the calculated monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a reporting month. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

Fecal coliform bacteria 7-day
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean value for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the 7-day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days in a reporting month. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. The first calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

Flow-proportioned sample is a composite sample with the sample volume proportional to the effluent flow.

General permit means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

Geometric mean is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

Grab sample is a single sample taken at neither a set time nor flow.

IC_{25} means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

Illicit connection means a physical connection to a municipal separate storm sewer system that primarily conveys non-storm water discharges other than uncontaminated groundwater into the storm sewer; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

Illicit discharge means any discharge to, or seepage into, a municipal separate storm sewer system that is not composed entirely of storm water or uncontaminated groundwater. Illicit discharges include non-storm water discharges through pipes or other physical connections; dumping of motor vehicle fluids, household hazardous wastes, domestic animal wastes, or litter; collection and intentional dumping of grass clippings or leaf litter; or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-storm water waste directly into a separate storm sewer.

Individual permit means a site-specific NPDES permit.

Inlet means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

Interference is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference].

Land application means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

LC_{50} means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

Maximum acceptable toxicant concentration (MATC) means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

Maximum extent practicable means implementation of best management practices by a public body to comply with an approved storm water management program as required by a national permit for a municipal separate storm sewer system, in a manner that is environmentally beneficial, technically feasible, and within the public body's legal authority.

MGD means million gallons per day.

Monthly concentration is the sum of the daily concentrations determined during a reporting period divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Monthly loading is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a reporting period. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR.

Monthly monitoring frequency refers to a calendar month. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Municipal separate storm sewer means a conveyance or system of conveyances designed or used for collecting or conveying storm water which is not a combined sewer and which is not part of a publicly-owned treatment works as defined in the Code of Federal Regulations at 40 CFR 122.2.

Municipal separate storm sewer system (MS4) means all separate storm sewers that are owned or operated by the United States, a state, city, village, township, county, district, association, or other public body created by or pursuant to state law, having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law, such as a sewer district, flood control district, or drainage district, or similar entity, or a designated or approved management agency under Section 208 of the Federal Act that discharges to the waters of the state. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

National Pretreatment Standards are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

No observed adverse effect level (NOAEL) means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

Noncontact cooling water is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

Nondomestic user is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

Outfall is the location at which a point source discharge enters the surface waters of the state.

Part 91 agency means an agency that is designated by a county board of commissioners pursuant to the provisions of section 9105 of Part 91 of the NREPA; an agency that is designated by a city, village, or township in accordance with the provisions of section 9106 of Part 91 of the NREPA; or the Department for soil erosion and sedimentation activities under Part 615, Part 631, or Part 632 pursuant to the provisions of section 9115 of Part 91 of the NREPA.

Part 91 permit means a soil erosion and sedimentation control permit issued by a Part 91 agency pursuant to the provisions of Part 91 of the NREPA.

Partially treated sewage is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

Point of discharge is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

Point source discharge means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Changing the surface of land or establishing grading patterns on land will result in a point source discharge where the runoff from the site is ultimately discharged to waters of the state.

Polluting material means any material, in solid or liquid form, identified as a polluting material under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

POTW is a publicly owned treatment work.

Pretreatment is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

Public (as used in the MS4 individual permit) means all persons who potentially could affect the authorized storm water discharges, including, but not limited to, residents, visitors to the area, public employees, businesses, industries, and construction contractors and developers.

Public body means the United States; the state of Michigan; a city, village, township, county, school district, public college or university, or single-purpose governmental agency; or any other body which is created by federal or state statute or law.

Qualified Personnel means an individual who meets qualifications acceptable to the Department and who is authorized by an Industrial Storm Water Certified Operator to collect the storm water sample.

Qualifying storm event means a storm event causing greater than 0.1 inch of rainfall and occurring at least 72 hours after the previous measurable storm event that also caused greater than 0.1 inch of rainfall. Upon request, the Department may approve an alternate definition meeting the condition of a qualifying storm event.

Quantification level means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

Quarterly monitoring frequency refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Regional Administrator is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

Regulated area means the permittee's urbanized area, where urbanized area is defined as a place and its adjacent densely-populated territory that together have a minimum population of 50,000 people as defined by the United States Bureau of the Census and as determined by the latest available decennial census.

Secondary containment structure means a unit, other than the primary container, in which significant materials are packaged or held, which is required by State or Federal law to prevent the escape of significant materials by gravity into sewers, drains, or otherwise directly or indirectly into any sewer system or to the surface or ground waters of this state.

Separate storm sewer system means a system of drainage, including, but not limited to, roads, catch basins, curbs, gutters, parking lots, ditches, conduits, pumping devices, or man-made channels, which is not a combined sewer where storm water mixes with sanitary wastes, and is not part of a POTW.

Significant industrial user is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process waste stream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

Significant materials Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the NREPA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant spills and significant leaks means any release of a polluting material reportable under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

Special-use area means secondary containment structures required by state or federal law; lands on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and/or areas with other activities that may contribute pollutants to the storm water for which the Department determines monitoring is needed.

Stoichiometric means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

Storm water means storm water runoff, snow melt runoff, surface runoff and drainage, and non-storm water included under the conditions of this permit.

Storm water discharge point is the location where the point source discharge of storm water is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including *outfalls* which discharge directly to surface waters of the state, and *points of discharge* which discharge directly into separate storm sewer systems.

SWPPP means the Storm Water Pollution Prevention Plan prepared in accordance with this permit.

Tier I value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

Tier II value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

Total maximum daily loads (TMDLs) are required by the Federal Act for waterbodies that do not meet water quality standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet water quality standards, and an allocation of that load among point sources, nonpoint sources, and a margin of safety.

Toxicity reduction evaluation (TRE) means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

Water Quality Standards means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of the NREPA, being R 323.1041 through R 323.1117 of the Michigan Administrative Code.

Weekly monitoring frequency refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

WWSL is a wastewater stabilization lagoon.

WWSL discharge event is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

3-portion composite sample is a sample consisting of three equal-volume grab samples collected at equal intervals over an 8-hour period.

7-day concentration

FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily concentrations determined. If the number of daily concentrations determined during the WWSL discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the WWSL discharge event in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days in a reporting month divided by the number of daily concentrations determined. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations in the reporting month. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

7-day loading

FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily loadings determined. If the number of daily loadings determined during the WWSL discharge event is less than 7 days, the number of actual daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the WWSL discharge event in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days in a reporting month divided by the number of daily loadings determined. If the number of daily loadings determined is less than 7, the actual number of daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations in the reporting month. When required by the permit, report the maximum calculated 7-day loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

24-hour composite sample is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

PART II

Section B. Monitoring Procedures

1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. **Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations**. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Manager of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan, 48909-7958. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

PART II

Section C. Reporting Requirements

1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

2. Submittal Requirements for Self-Monitoring Data

Part 31 of the NREPA (specifically Section 324.3110(7)); and R 323.2155(2) of Part 21, Wastewater Discharge Permits, promulgated under Part 31 of the NREPA, allow the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring," the permittee shall submit self-monitoring data via the Department's MiWaters system.

The permittee shall utilize the information provided on the MiWaters website, located at https://miwaters.deq.state.mi.us, to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the 20th day of the month following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page (or otherwise authorized by the Department in accordance with the provisions of this permit) to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Department. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th (April 1st for animal feeding operation facilities) of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

Retained self-monitoring may be denied to a permittee by notification in writing from the Department. In such cases, the permittee shall submit self-monitoring data in accordance with Part II.C.2., above. Such a denial may be rescinded by the Department upon written notification to the permittee. Reissuance or modification of this permit or reissuance or modification of an individual permittee's authorization to discharge shall not affect previous approval or denial for retained self-monitoring unless the Department provides notification in writing to the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Department.

5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a *written* notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-Hour Reporting
Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. Other Reporting
The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit (or, if this is a general permit, on the COC); or, if the notice is provided after regular working hours, call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from **out-of-state** dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventive measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

9. Bypass Prohibition and Notification

a. Bypass Prohibition
Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass
If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass
The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

d. Written Report of Bypass
A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations
The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of R 323.1098 and R 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit, for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under R 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit or, if applicable, the facility's COC may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

14. Operations and Maintenance Manual

For wastewater treatment facilities that serve the public (and are thus subject to Part 41 of the NREPA), Section 4104 of Part 41 and associated Rule 2957 of the Michigan Administrative Code allow the Department to require an Operations and Maintenance (O&M) Manual from the facility. An up-to-date copy of the O&M Manual shall be kept at the facility and shall be provided to the Department upon request. The Department may review the O&M Manual in whole or in part at its discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M Manual shall include the following information: permit standards; descriptions and operation information for all equipment; staffing information; laboratory requirements; record keeping requirements; a maintenance plan for equipment; an emergency operating plan; safety program information; and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the O&M Manual shall be submitted to the Department at least sixty days prior to start-up of a new wastewater treatment facility. Recertification shall be submitted sixty days prior to start-up of any substantial improvements or modifications made to an existing wastewater treatment facility.

15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit and that require a signature shall be signed and certified as described in the Federal Act and the NREPA.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The NREPA (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit, COC, or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or COC or in a notice or report required by the terms and conditions of an issued permit or COC, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, permit, or COC of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit, on forms provided by the Department.

PART II

Section D. Management Responsibilities

1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit, more frequently than, or at a level in excess of, that authorized, shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the NREPA and/or the Federal Act and constitutes grounds for enforcement action; for permit or Certificate of Coverage (COC) termination, revocation and reissuance, or modification; or denial of an application for permit or COC renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the NREPA.

3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department, or the Regional Administrator, upon the presentation of credentials and, for animal feeding operation facilities, following appropriate biosecurity protocols:

a. to enter upon the permittee's premises where an effluent source is located or any place in which records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (R 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit, shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the NREPA.

10. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or the facility's COC, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

Section E. Activities Not Authorized by This Permit

1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the NREPA.

2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW shall be by permit issued under Part 41 of the NREPA.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

Appendix B

Figure B-1

WASTEWATER COLLECTION SYSTEM

NORTH

0 300 600 1,200 FEET

LEGEND

- City Owned Pump Station
- Treatment Plant
- Private Pump Station
- Private Valve Vault
- Clean Out
- Sewer Fitting
- Reducer
- Air Release Valve
- Combination Valve
- Discharge Point

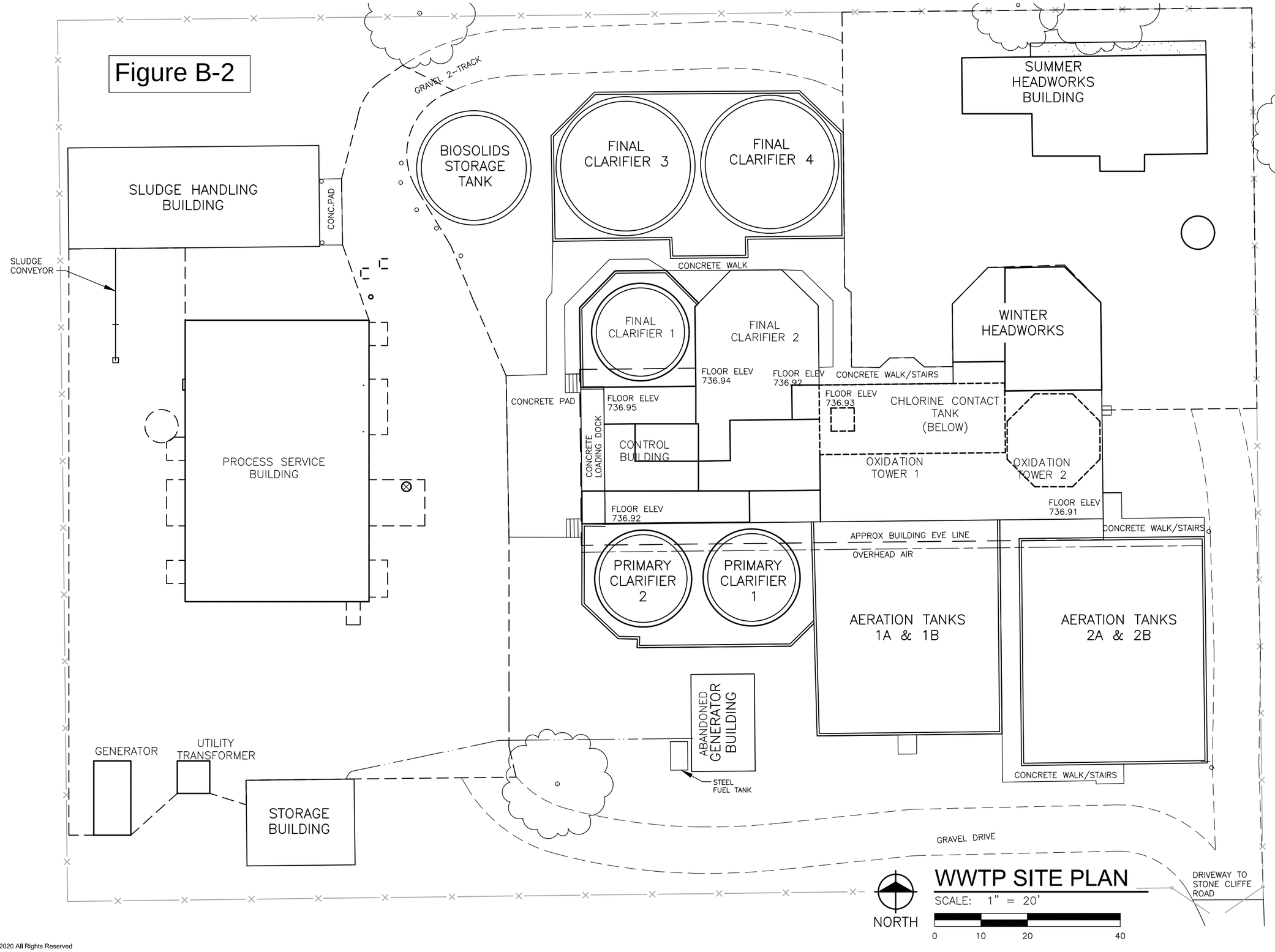
Manhole - Owned By
- Mackinac Island
- Private
- State of Michigan

Gravity Main - Owned By
- Mackinac Island
- Private
- State of Michigan

Force Main - Owned By
- Mackinac Island
- Private
- City Limit

DATA SOURCES: BASEMAP SUPPLIED BY MACKINAC COUNTY GIS, 2015.

Figure B-2



WWTP SITE PLAN

SCALE: 1" = 20'

PLOT INFO: Z:\2019\190714\CAD_FIGURES\FIG02-WWTP SITE PLAN.DWG LAYOUT: FIG02-WWTP SITE PLAN DATE: 5/15/2020 TIME: 7:06:06 AM USER: RSECORD

fishbeck
Engineers | Architects | Scientists | Constructors

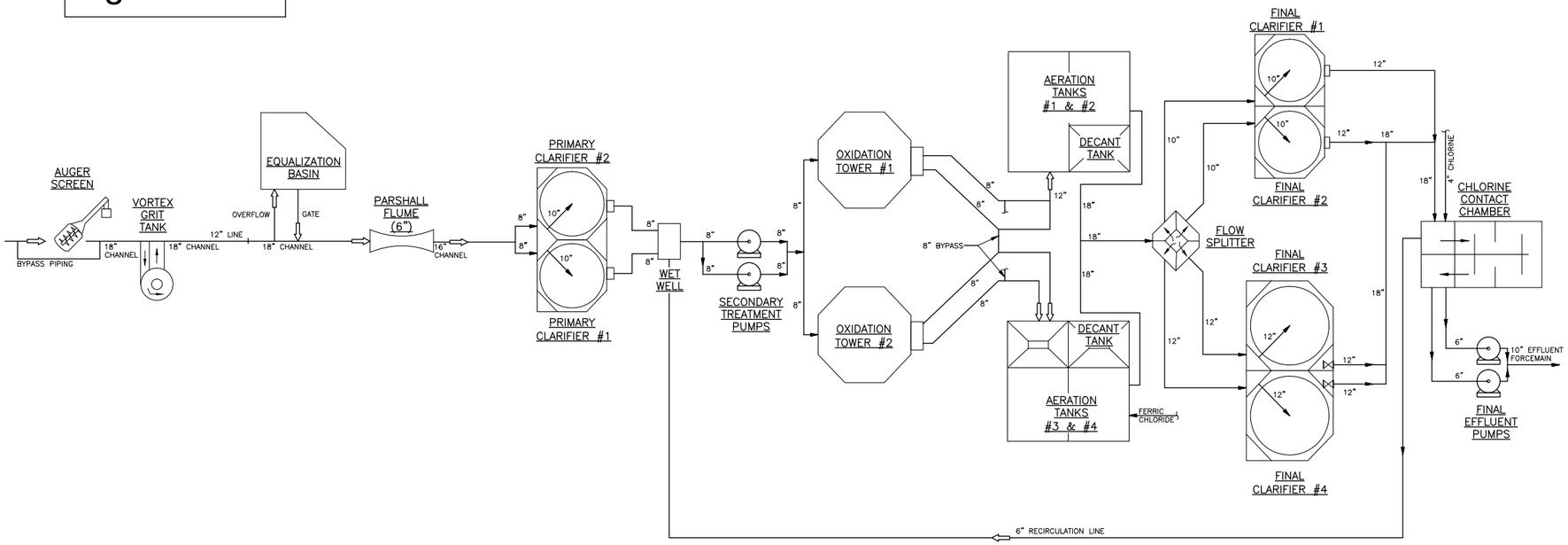
Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

City of Mackinac Island
Mackinac County, Michigan
Wastewater Treatment Plant
Operation and Maintenance Manual

PROJECT NO.
190714

FIGURE NO.
2

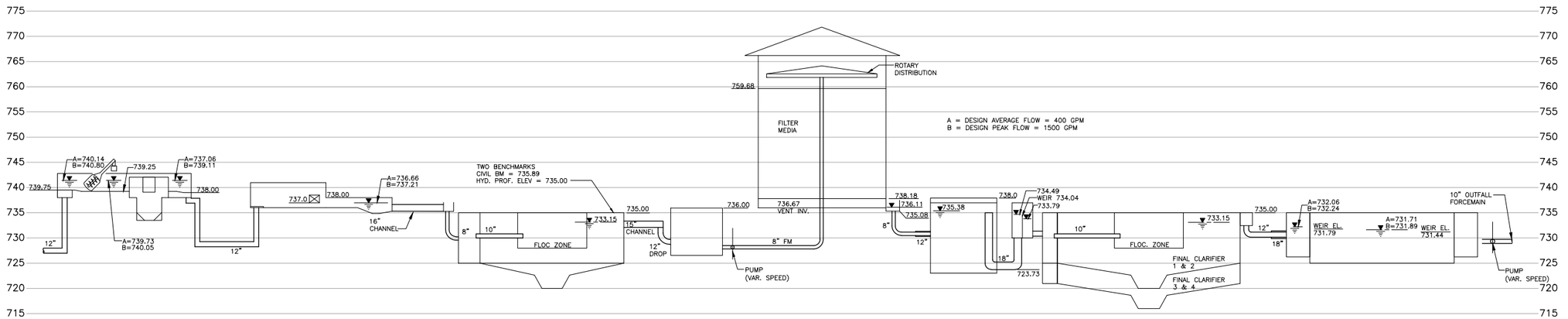
Figure B-3



SUMMER FLOW SCHEMATIC
NO SCALE

NOTES

1. SEE 500 SERIES SHEETS FOR P&ID OF WINTER HEADWORKS.
2. SCHEMATIC IS DEPICTED WITH ALL ALTERNATES INCLUDED.



SUMMER HYDRAULIC PROFILE
SCALE: 3/32" = 1'-0"
0 6 12 24

RECORD DRAWINGS
Constructed by: DAVIS CONSTRUCTION, INC.
Inspected by: FTCH
Date: DECEMBER, 2013

ftch
engineers
scientists
architects
constructors
fishbeck, thompson, carr & huber, inc.

City of Mackinac Island
Mackinac Island, Mackinac County, Michigan
Wastewater Treatment Plant Improvements

12/2013	REVISED IN ACCORDANCE WITH CONST. RECORDS
Drawn By	RS2
Designer	JJF/EHS
Reviewer	WEL
Manager	JCR

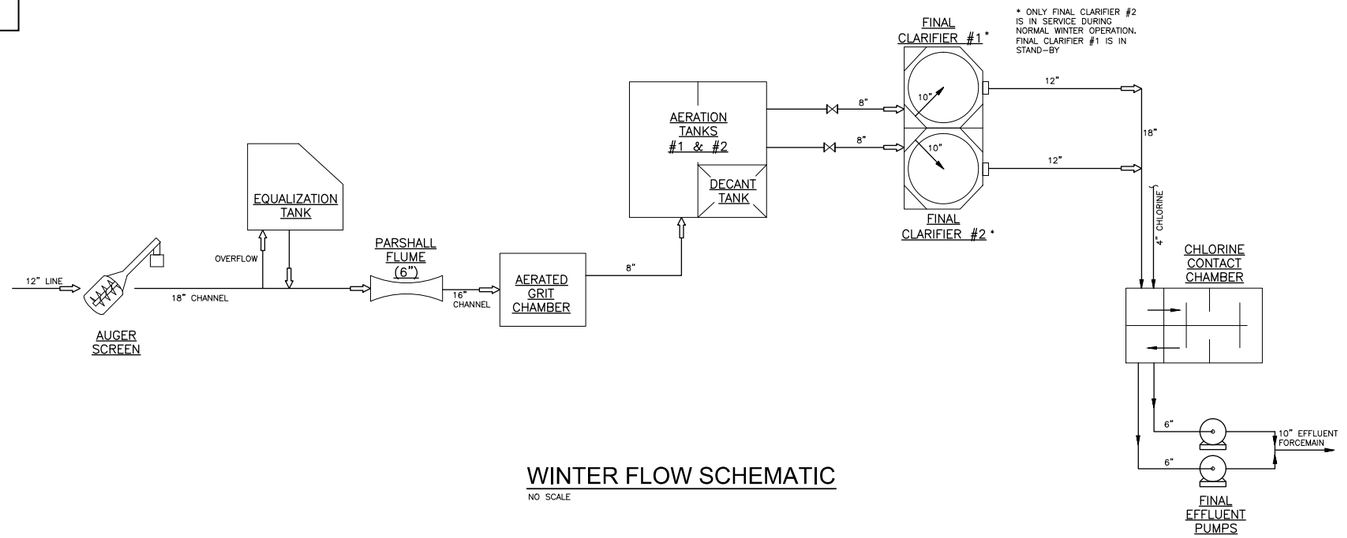
Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
G080509CD

SHEET NO.
134

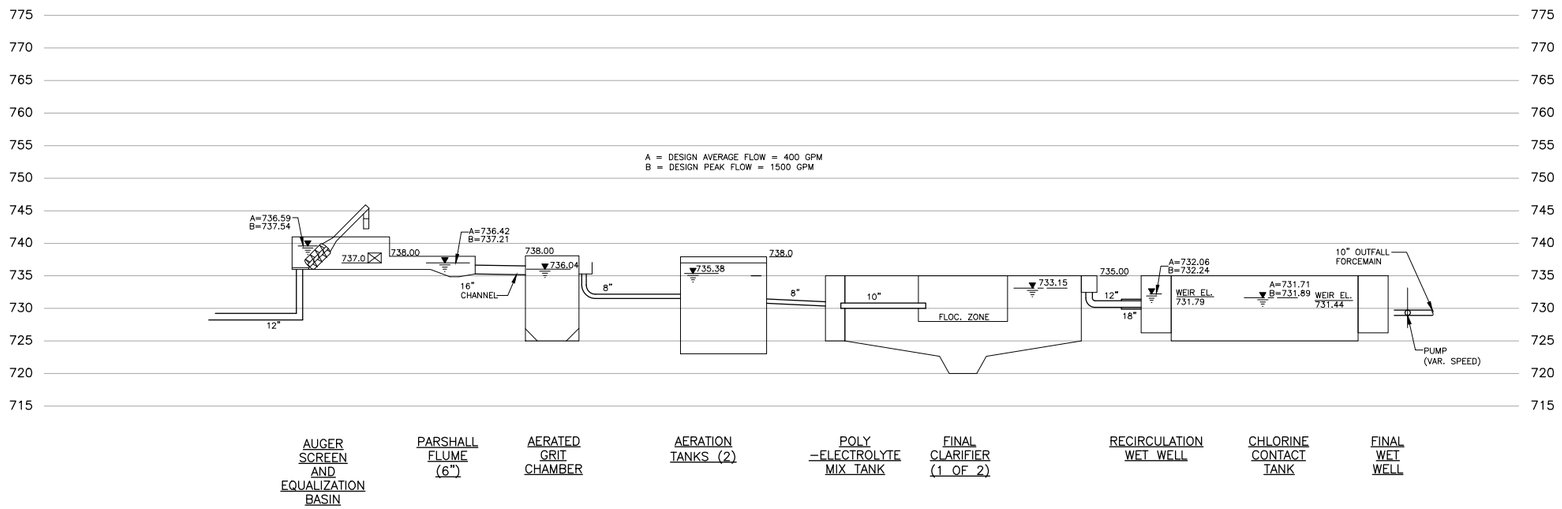
PLOT INFO: Z:\2008\080509CD\CAD\CD\134-080509CD.DWG LAYOUT: 134 DATE: 2/20/2014 TIME: 10:17:22 AM USER: RS2

Figure B-4



WINTER FLOW SCHEMATIC

NO SCALE



WINTER HYDRAULIC PROFILE

SCALE: 3/32" = 1'-0"

0 6 12 24

*EXCEPT WHERE INDICATED OTHERWISE, ELEVATIONS ON THIS SHEET ARE BASED ON CURRENT PLANT DATUM AND DO NOT REFLECT ELEVATIONS USED ON EXISTING RECORD DRAWINGS

NOTES

1. SEE 400 SERIES SHEET FOR P&ID OF SUMMER HEADWORKS.
2. SCHEMATIC IS DEPICTED WITH ALL ALTERNATES INCLUDED.

RECORD DRAWINGS

Constructed by: DAVIS CONSTRUCTION, INC.

Inspected by: FTCH

Date: DECEMBER, 2013

fTCh

engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

City of Mackinac Island

Mackinac Island, Mackinac County, Michigan

Wastewater Treatment Plant Improvements

12/2013 REVISED IN ACCORDANCE WITH CONST. RECORDS

Drawn By	RS2
Designer	JJF/EHS
Reviewer	WEL
Manager	JCR

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.

G080509CD

SHEET NO.

135

PLOT INFO: Z:\2008\080509CD\CAD\CD\135-080509CD.DWG LAYOUT: 135 DATE: 2/18/2014 TIME: 8:45:08 AM USER: RS2

Appendix C

Figure C-1

Figure 7-1

Future Land Use Map

N

Feet
0 250 500 1,000

British Landing State Dock
Scott's Cave Rd
Scott's Shore Rd
Carver Pond
185
Maniboajo Bay
Mackinac Island State Park
Solid Waste Treatment Facility
Wawashkamo Golf Course
British Landings Rd
Towering Oak Ct
Maple Ridge St
Fir Ct
Forest Driveway
Pine Brook St
Pine Cove Ln
Ironwood Ln
Birchway Ln
Spruceview Ln
Jewel Golf Course "Woods Nine"
Mackinac Island Equestrian Center
Crooked Tree Rd
Leslie Ave
Mackinac Island Airport
Annex Rd
Voyageur's Bay
Green Shed Ln
Hert's Trl
Eckel Dr
Wastewater Treatment Facility
Protestant Cemetery
Fort Holmes Rd
Sugar Loaf Rd
Garrison Rd
Trillium Dr
7th St
6th St
5th St
4th St
3rd St
2nd St
Cadotte Ave
Great Turtle Park
Upper Reservoir
Post Cemetery
Rifle Range Rd
Stonecliffe Rd
The Inn at Stonecliffe
Cupid's Pathway
Whitefield Rd
Louisignon Trl
Hedgecliff Rd
Park Ave
Grand Ave
Carriage Rd
Carriage Barns
St. Anne's Catholic Cemetery
Custer Rd
Arch Rock Rd
Lake Shore Rd
Lakeview Blvd
Algonquin St
Lower Reservoir
Fort Mackinac
Huron Rd
Water Filtration Intake
Mission Point Resort
Pottawatomie Rd
Marquette Park
Spring St
Fort St
West Bluff Rd
185
Jewel Golf Course "Grand Nine"
Hanks Pond
Grand Hotel
Bogan Ln
Church St
Truscott St
Mission St
Main St
Civic Offices
Market St
Cloban St
French Ln
Mackinac Island State Harbor
The Greens of Mackinac
Mackinac Island School
Mahoney Ave
Haldimand Bay
Lake Huron
Library/ Pump Station

City of
Mackinac Island
Mackinac County, Michigan

Master Plan

Future Land Use Categories

- Conservation/Park
- Recreation/Open Space
- Shoreline Residential
- Cottage Residential
- Mixed Residential
- Single Family Residential
- Hotel/Resort
- Market Street
- Commercial

- State Highway
- Improved (Asphalt) Roads
- Unimproved (Gravel) Roads
- Property Lines
- Water Bodies

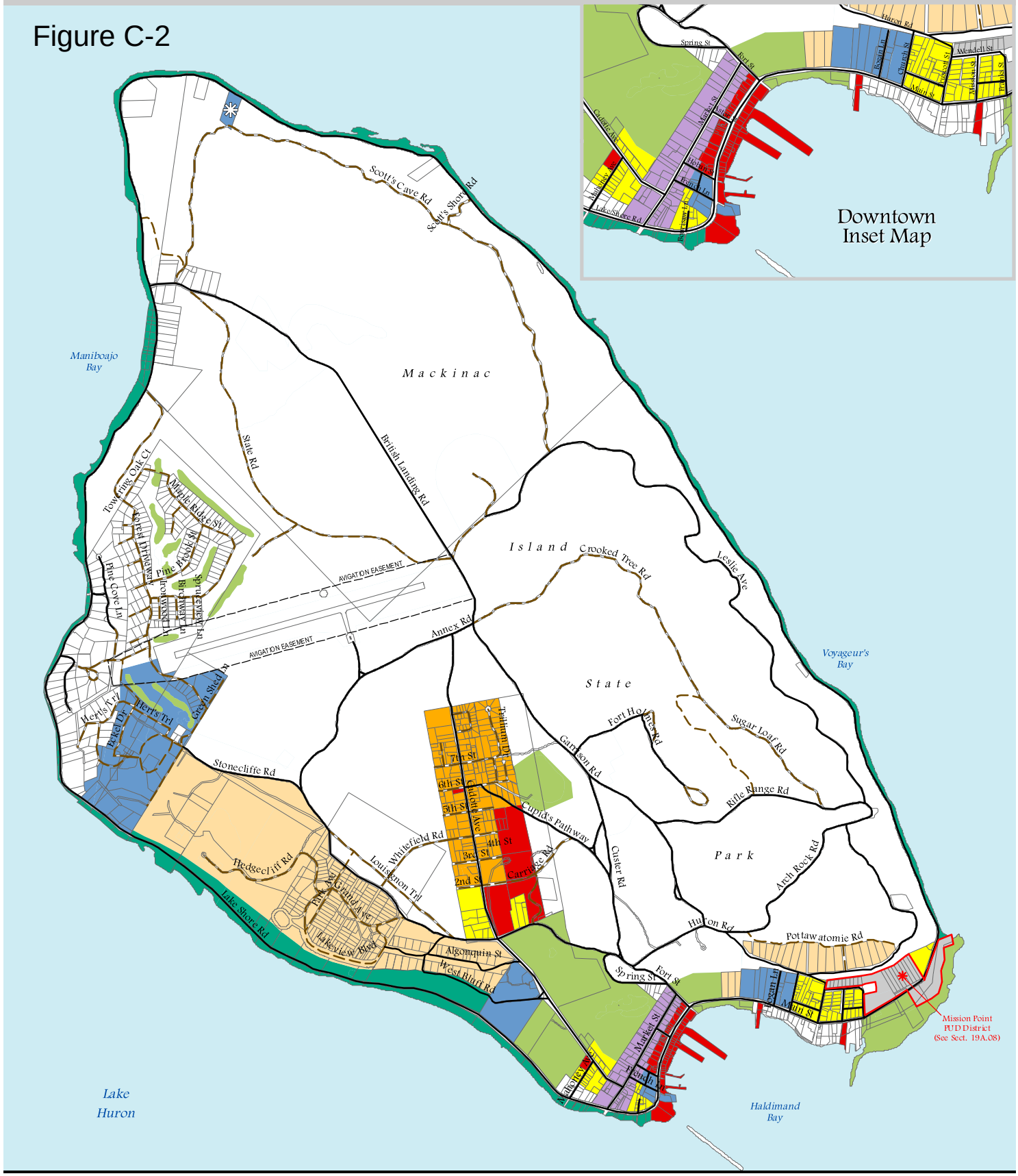
Property Line Source: Mackinac County Equalization;

Adopted by the Mackinac Island Planning Commission on October 9, 2018

WADE TRIM
271 West McCoy Rd
Gaylord, MI 49735
www.WadeTrim.com

\\dtdata\projects\MCK2009\01d\GIS-data\Projects\Future Land Use Map.mxd

Figure C-2



Zoning Map

City of
Mackinac Island
Mackinac County, Michigan

- R-1 Low Density Residential
- R-3 High Density Residential
- R-4 Harrisonville Residential
- HB Hotel/Boardinghouse
- C Commercial
- MD Market
- CD Cottage
- ROS Recreation/Open Space
- RS Shoreline Residential
- Indicates that the property was rezoned with a statement of conditions

- Improved (Asphalt) Roads
- Unimproved (Gravel) Roads
- Property Lines

Property Line Source: Mackinac County Equalization

Adopted October 16, 2013
Effective November 12, 2013
Amended Through May, 2017

N

0 250 500 1,000 Feet

WADETRIM
271 West McCoy Rd
Gaylord, MI 49735
www.WadeTrim.com

Mackinac Island Estimated Ultimate Population Breakdown

Figure C-3

Zoning District		Allowable Land Use	Area		%	Area		Maximum Density				Ultimate Summer	%	Ultimate Winter
			Acre	sf	Allocation	Acre	sf					Population	Year round	Population
R-1	Low Denisty Residential	State Park	1,646.0	71,699,760	100%	1,646.0	71,699,760	0	DU/ac	2.5	ppl/DU	-	0%	
R-1	Low Denisty Residential	Residential	189.2	8,241,552	100%	189.2	8,241,552	3	DU/ac	2.5	ppl/DU	1,419	30%	425
R-3	High Density Residential	Residential	25.7	1,119,492	60%	15.4	671,695	20	DU/ac	2.5	ppl/DU	771	30%	231
		Boarding House	25.7	1,119,492	40%	10.3	447,797	500	sf/person			895	0%	-
R-4	Harrisonville	Residential	51.0	2,221,560	60%	30.6	1,332,936	10	DU/ac	2.5	ppl/DU	765	30%	229
		Boarding House	51.0	2,221,560	40%	20.4	888,624	500	sf/person			1,777	0	-
R-4	Mission Point PUD	Residential	13.8	601,128	40%	5.5	240,451	10	DU/ac	2.5	ppl/DU	138	30%	41
		Boarding House	13.8	601,128	60%	8.3	360,677	500	sf/person			721	0	-
HB	Hotel/Boarding	Residential	71.8	3,127,608	10%	7.2	312,761	20	DU/ac	2.5	ppl/DU	359	30%	107
		Boarding House	71.8	3,127,608	30%	21.5	938,282	300	sf/person			3,127	0	-
		Hotel	71.8	3,127,608	60%	43.1	1,876,565	60	BR/ac	2	ppl/BR	5,169	0	-
C	Commercial	Residential	26.3	1,145,628	33%	8.7	378,057	30	DU/ac	2.5	ppl/DU	650	30%	195
		Boarding House	26.3	1,145,628	33%	8.7	378,057	250	sf/person			1,512	0	-
		Hotel	26.3	1,145,628	33%	8.7	378,057	230	sf/room	2	ppl/rm	3,992	0	-
MD	Market	Residential	14.4	627,264	60%	8.6	376,358	7	DU/ac	2.5	ppl/DU	151	30%	45
		Boarding House	14.4	627,264	30%	4.3	188,179	500	sf/person			376	0	-
		Hotel	14.4	627,264	10%	1.4	62,726	450	sf/room	2	ppl/rm	1,296	0	-
CD	Cottage	Residential	154.1	6,712,596	100%	154.1	6,712,596	1	DU/ac	2.5	ppl/DU	385	30%	115
ROS	Recreational/Open Space	N/A	102.5	4,464,900	100%	102.5	4,464,900	0					0	-
RS	Shoreline Residential	Residential	87.8	3,824,568	100%	87.8	3,824,568	4	DU/ac	2.5	ppl/DU	878	30%	267
		Total:	2,416.0								**Total:**	24,381		1,655

Ultimate Population Breakdown	
Year-round residents	1,655
Seasonal Residents	3,861
Hotel/lodging guests	10,457
Seasonal Employees	8,408

Figure C-4

Mackinac Island Estimated Ultimate Population Breakdown

Zoning District		Allowable Land Use	Ultimate Summer Population	% Year round	Ultimate Winter Population	% of Ultimate Development	Current Summer population	% Year round	Current Winter Population	% of Ultimate Development	Design Summer population	% Year round	Design Winter Population
			Ultimate Population			**Current Population**				**Design Population**			
R-1	Low Denisty Residential	State Park	-	0%		35%	-	0	-	55%	-	0%	-
R-1	Low Denisty Residential	Residential	1,419	30%	425	35%	501	25%	127	55%	780	25%	198
R-3	High Density Residential	Residential	771	30%	231	35%	272	25%	69	55%	424	25%	108
		Boarding House	895	0%	-	35%	313	0%	-	55%	492	0%	-
R-4	Harrisonville	Residential	765	30%	229	35%	270	25%	68	100%	765	25%	195
		Boarding House	1,777	0	-	35%	622	0%	-	80%	1,422	0	-
R-4	Mission Point PUD	Residential	138	30%	41	35%	49	25%	12	55%	76	25%	20
		Boarding House	721	0	-	35%	252	0%	-	55%	397	0	-
HB	Hotel/Boarding	Residential	359	30%	107	35%	126	25%	32	55%	197	25%	50
		Boarding House	3,127	0	-	35%	1,094	0%	-	55%	1,720	0	-
		Hotel	5,169	0	-	35%	1,809	0%	-	55%	2,843	0	-
C	Commercial	Residential	650	30%	195	35%	229	25%	58	55%	359	25%	91
		Boarding House	1,512	0	-	35%	529	0%	-	55%	832	0	-
		Hotel	3,992	0	-	35%	1,397	0%	-	55%	2,196	0	-
MD	Market	Residential	151	30%	45	35%	53	25%	13	55%	83	25%	21
		Boarding House	376	0	-	35%	132	0%	-	55%	208	0	-
		Hotel	1,296	0	-	35%	454	0%	-	55%	712	0	-
CD	Cottage	Residential	385	30%	115	35%	136	25%	34	55%	213	25%	55
ROS	Recreational/Open Space	N/A		0	-	35%	-	0%	-	55%	-	0	-
RS	Shoreline Residential	Residential	878	30%	267	35%	307	25%	78	55%	483	25%	122
		Total:	24,381		1,655	**Total:**	8,546	**Total:**	492	**Total:**	14,200	**Total:**	860

Ultimate Population Breakdown	
Year-round residents	1,655
Seasonal Residents	3,861
Hotel/lodging guests	10,457
Seasonal Employees	8,408

Current Population Breakdown	
Year-round residents	492
Seasonal Residents	1,451
Hotel/lodging guests	3,660
Seasonal Employees	2,943

Design Population Breakdown	
Year-round residents	860
Seasonal Residents	2,520
Hotel/lodging guests	5,750
Seasonal Employees	5,070

Appendix D

City of Mackinac Island WWTP
Asset Inventory

	Asset	Capacity/Size	Summer	Winter	Location	Year installed	Condition
Headworks							
	Summer Headworks Building		x		Summer Headworks Building	2012	good
	Automatic Screen	2.2 MGD	x		Summer Headworks Building	2013	good
	Vortex Grit System	2.2 MGD	x		Summer Headworks Building	2013	good
	Grit Pump	22 gpm @ 27 ft TDH, 4x4 inch	x		Summer Headworks Building	2013	good
	Cyclone Separator	225 gpm @ 5.75 psi	x		Summer Headworks Building	2013	good
	Grit Washer	14 cft/hr	x		Summer Headworks Building	2013	good
	Mag Meter	10"	x		Upstream Summer Headworks	2013	good
	Septage Receiving		x		Summer Headworks Building	2012	good
	Automatic Screen Controls		x		Summer Headworks Building	2012	good
	Grit CP		x		Summer Headworks Building	2012	good
	MCC-CA		x		Summer Headworks Building	2012	good
	MCC-CB				Summer Headworks Building	2012	good
	Mechanical Screen	1.13 MGD		x	Control Building - East Upper	2013	fair
	Grit Washer				Control Building - East Upper	1992	very poor
	Aerated Grit Unit	6' x 6' x 9'9" SWD			Control Building - East Upper	1992	very poor
	Parshall Flume	6" Width, 24" Depth	x	x	Control Building - East Upper	1992	very poor
	EQ Tank	24'x17'x1'	x	x	Control Building - East Upper	1987	very poor
	Aerated Grit Chamber Blower			x	Control Building - East Upper	1992	very poor
Primary Clarifiers							
	Primary Clarifier 1 - Tank	24' diam x 11'-8" (8' SWD)	x		South Yard	1971	fair
	Primary Clarifier 2 - Tank	24' diam x 11'-8" (8' SWD)	x		South Yard	1971	fair
	Rapid Mix Chamber 1	600 gal	x		South Yard	1971	fair
	Rapid Mix Chamber 2	600 gal	x		South Yard	1971	fair
	Primary Clarifier Mechanism 1	24' Diam	x		Primary Clarifier	2012	fair
	Primary Clarifier Mechanism 2	24' Diam	x		Primary Clarifier	2012	fair
	Primary Clarifier 1 Weir/Baffles		x		Primary Clarifier	2012	fair
	Primary Clarifier 2 Weir/Baffles		x		Primary Clarifier	2012	fair
	Primary Clarifier 1 Scum Trough/Tank		x		Primary Clarifier	1971	fair
	Primary Clarifier 2 Scum Trough/Tank		x		Primary Clarifier	1971	fair
	Primary Clarifier Splitter Box		x		Primary Clarifier	1971	fair

City of Mackinac Island WWTP
Asset Inventory

	Asset	Capacity/Size	Summer	Winter	Location	Year installed	Condition
Oxidation Towers							
	Secondary Treatment Pump 1	30 hp, 1250 gpm @ 64' TDH	x		Control Building Basement	2013	good
	Secondary Treatment Pump 2	30 hp, 1250 gpm @ 64' TDH	x		Control Building Basement	2013	good
	Secondary Pump Electrical Gear		x		Control Building - Break Room	2012	poor
	Secondary Treatment Wet Well	8' x 3'4" x 10'	x		Control Building Basement	1971	poor
	Oxidation Tower 1 - West	20' Dia x 21.5' Media Depth	x		East Yard	1971	very poor
	Oxidation Tower 2 - East	20' Dia x 21.5' Media Depth	x		East Yard	1987	very poor
	Oxidation Tower 1 Media	7200 cft	x		East Yard	1973	unknown
	Oxidation Tower 2 Media	7200 cft	x		East Yard	1986	unknown
	Oxidation Tower 1 Rotary Distributor		x		East Yard	2012	unknown
	Oxidation Tower 2 Rotary Distributor		x		East Yard	2012	unknown
Aeration							
	Aeration Tank 1	45'x19'x12' SWD	x	x	South Yard	1971	fair
	Aeration Tank 2	28'x19'x12' SWD	x	x	South Yard	1971	fair
	Aeration Tank 3	38'x19'x12' SWD	x		South Yard	1992	fair
	Aeration Tank 4	38'x19'x12' SWD	x		South Yard	1992	fair
	Secondary Treatment Blower 1	40 hp, 736 cfm @5.75 psi	x	x	Control Building Basement	1971	poor
	Secondary Treatment Blower 2	40 hp, 736 cfm @5.75 psi	x		Control Building Basement	1971	poor
	Secondary Treatment Blower 3	50 hp	x		Control Building Basement	2000	poor
	Aeration Tank 1 Diffusers	Coarse Bubble	x	x	Aeration Tank 1	1992	poor
	Aeration Tank 2 Diffusers	Coarse Bubble	x	x	Aeration Tank 2	1992	poor
	Aeration Tank 3 Diffusers	Coarse Bubble	x		Aeration Tank 3	1992	poor
	Aeration Tank 4 Diffusers	Coarse Bubble	x		Aeration Tank 4	1992	poor

City of Mackinac Island WWTP
Asset Inventory

	Asset	Capacity/Size	Summer	Winter	Location	Year installed	Condition
Final Clarifiers							
	Clarifier Cover				Final Clarifier 1	2012	poor
	Final Clarifier 1	24' dia x 8' SWD	x		North Yard	1971	poor
	Final Clarifier 2	24' dia x 8' SWD	x	x	North Yard	1971	poor
	Final Clarifier 3	30' dia x 12' SWD	x		North Yard	1992	fair
	Final Clarifier 4	30' dia x 12' SWD	x		North Yard	1992	fair
	Final Clarifier 1 Mechanism	24' diameter	x		Final Clarifier 1	2012	good
	Final Clarifier 2 Mechanism	24' diameter	x	x	Final Clarifier 2	1971	very poor
	Final Clarifier 3 Mechanism	30' diameter	x		Final Clarifier 3	1994	poor
	Final Clarifier 4 Mechanism	30' diameter	x		Final Clarifier 4	1994	poor
	Final Clarifier 1 Weir/Baffles		x		Final Clarifier 1	2012	good
	Final Clarifier 2 Weir/Baffles		x	x	Final Clarifier 2	1971	poor
	Final Clarifier 3 Weir/Baffles		x		Final Clarifier 3	1994	fair
	Final Clarifier 4 Weir/Baffles		x		Final Clarifier 4	1994	fair
	Final Clarifier Splitter Box		x	x		1994	fair
	Final Clarifier 1 Rapid Mix Chamber	600 gal	x			1971	fair
	Final Clarifier 2 Rapid Mix Chamber	600 gal	x	x		1971	fair
	Final Clarifier 3 Rapid Mix Chamber	1400 gal	x			1994	fair
	Final Clarifier 4 Rapid Mix Chamber	1400 gal	x			1994	fair
Disinfection							
	Gas Monitoring System		x	x	Control Building - Chlorine Room	2012	good
	Chlorinator	70 lbs/day	x	x		2013	good
	Chlorine Contact Tank	33' x 13' x 6.58' (19380 gal)	x	x		1971	poor
Effluent							
	Effluent Pump 1	25 hp, 1250 gpm @ 56' TDH	x	x	Control Building - Basement	2013	good
	Effluent Pump 2	26 hp, 1250 gpm @ 56' TDH	x	x	Control Building - Basement	2013	good
	Effluent Pump CP		x	x	Control Building - Break Room	2013	good
	Effluent Flow Meter 1		x	x	Chlorine Contact Tank (influent weir)	2013	good
	Effluent Flow Meter 2		x	x	Chlorine Contact Tank (effluent weir)	2013	good
	Effluent Composite Sampler		x	x	Effluent Piping		good

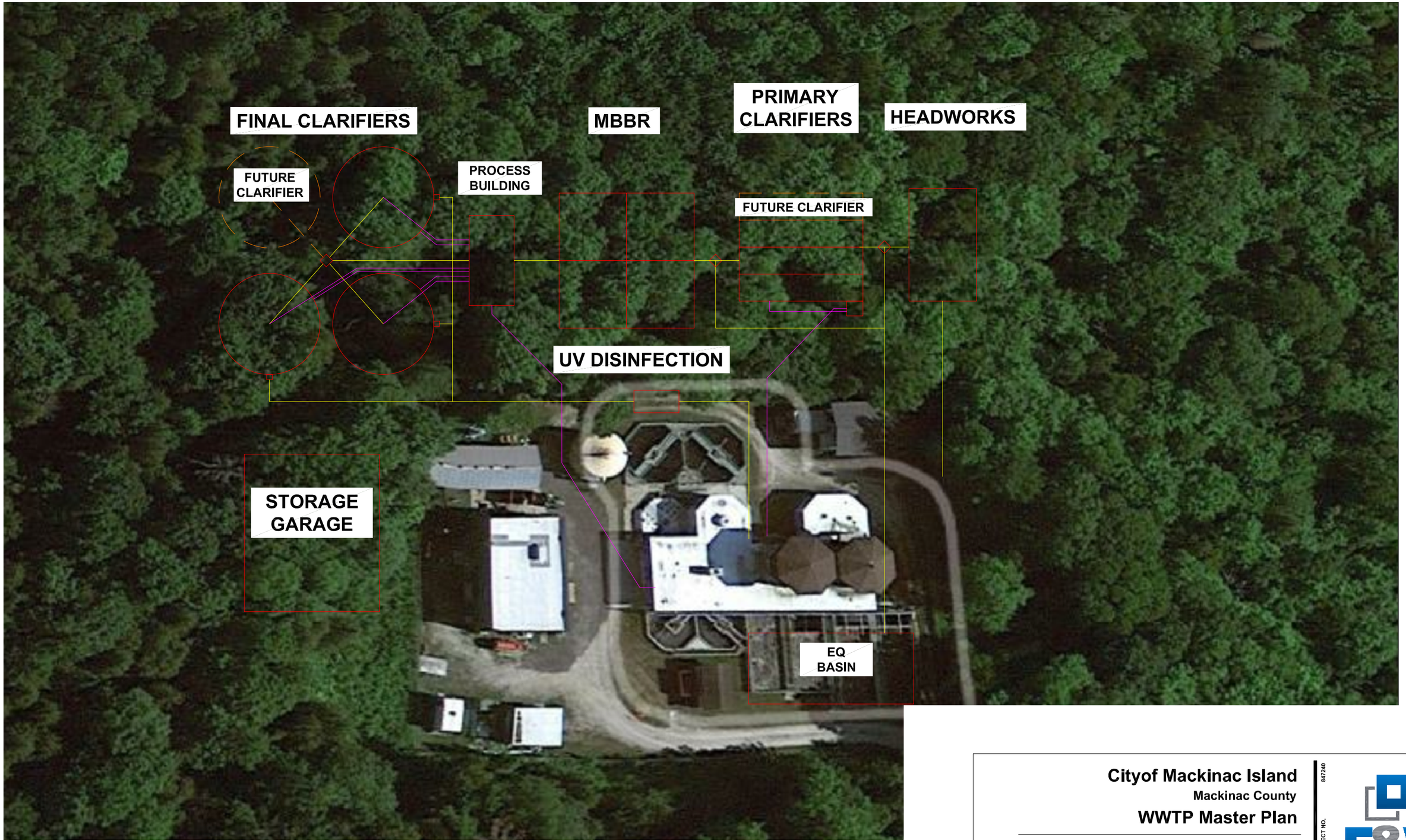
City of Mackinac Island WWTP
Asset Inventory

	Asset	Capacity/Size	Summer	Winter	Location	Year installed	Condition
Solids Handling							
	Rotary Screw Press	5 HP, 37 gpm	x		Process Service Building	2012	good
	Screw Conveyor	5 HP, 12" dia	x		Process Service Building	2012	good
	Sludge Press Control Panel		x		Process Service Building	2012	good
	Belt Filter Press				Process Service Building	1982	poor
	Flocculation Tank	38" diameter x 94"	x		Process Service Building	2012	good
	Flocculator		x		Process Service Building	2012	good
	Polymer Metering Pump 1		x		Process Service Building	2012	good
	Polymer Metering Pump 2		x		Process Service Building	2012	good
	Polymer Blending System	2.5 gph	x		Process Service Building	2012	good
	Rotary LobeSludge Feed Pump 1	100 gpm @ 23 ft TDH	x		Control Building Basement	2013	good
	Hose Sludge Feed Pump 2	50 gpm @ 15 ft TDH	x		Process Service Building	2013	good
	Sludge Transfer Pump	5 HP	x		Control Building Basement	1994	poor
	Vactor Truck				Process Service Building		good
	RAS Pump 1	140 gpm @ 8 ft TDH	x	x	Control Building Basement	2012	fair
	RAS Pump 2	140 gpm @ 8 ft TDH	x	x	Control Building Basement	2012	fair
	RAS Pump 3	185 gpm @ 14 ft TDH	x	x	Control Building Basement	2012	fair
	RAS Pump 4	185 gpm @ 14 ft TDH	x	x	Control Building Basement	2012	fair
	Primary Sludge Pump 1	150 gpm @ 67 ft TDH	x		Control Building Basement	1971	poor
	Primary Sludge Pump 2	150 gpm @ 67 ft TDH	x		Control Building Basement	2007	poor
	Biosolids Storage Tank	25' dia x 15'		x	West Yard	1994	poor
	Digested Sludge Pump 1	5 HP	x		Control Building Basement	1994	fair
	Digested Sludge Pump 2	5 HP	x		Control Building Basement	1994	fair
	Decant Sludge Tank 1	16' x 19' x 12' SWD	x		East Yard	1971	poor
	Decant Sludge Tank 2	8' x 38' x 12' SWD	x	x	East Yard	1992	fair

City of Mackinac Island WWTP
Asset Inventory

	Asset	Capacity/Size	Summer	Winter	Location	Year installed	Condition
Ferric Room							
	Ferric Bulk Tank	5' diameter x 6' - 800 gal	x	x	Process Service Building	2012	good
	Ferric Bulk Tank	5' diameter x 6' - 800 gal	x	x	Process Service Building	2012	good
	Ferric Day Tank	3' diameter x 6' - 300 gal	x	x	Process Service Building	2012	good
	Transfer Pump 1	3 HP	x	x	Process Service Building	2012	good
	Transfer Pump 2	0.5 HP	x	x	Process Service Building	2012	good
	Chemical Metering Pump	.25 HP			Process Service Building	2012	good
	Chemical Metering Pump	.25 HP			Process Service Building	2012	good
	Chemical Metering Pump	10 gph @ 80 psi	x	x	Process Service Building	2019	good
Sludge Drain PS							
	Return Pump 1	1 HP	x	x	Process Service Building	2013	good
	Return Pump 2	1 HP	x	x	Process Service Building	2013	good
Electrical							
	MCC-A		x	x	Process Service Building	2012	good
	MCC-B		x	x	Process Service Building	2012	good
	Control Bldg. MCC A		x	x	Control Building Main Level	1971	poor
	Control Bldg. MCC B		x	x	Control Building Main Level	1971	poor
	Generator - diesel	800 kW	x	x		2012	good
Support							
	Laboratory		x	x	Control Building	2012	good
	Sump Pump 1	2 HP	x	x	Control Building Basement	1987	poor
	Sump Pump 2	2 HP	x	x	Control Building Basement	1987	poor
	Sump		x	x	Control Building Basement	1971	poor

Appendix E



Cityof Mackinac Island
Mackinac County
WWTP Master Plan

ALTERNATIVE 3 - MBBR EXPANSION

F&V PROJECT NO. 847240

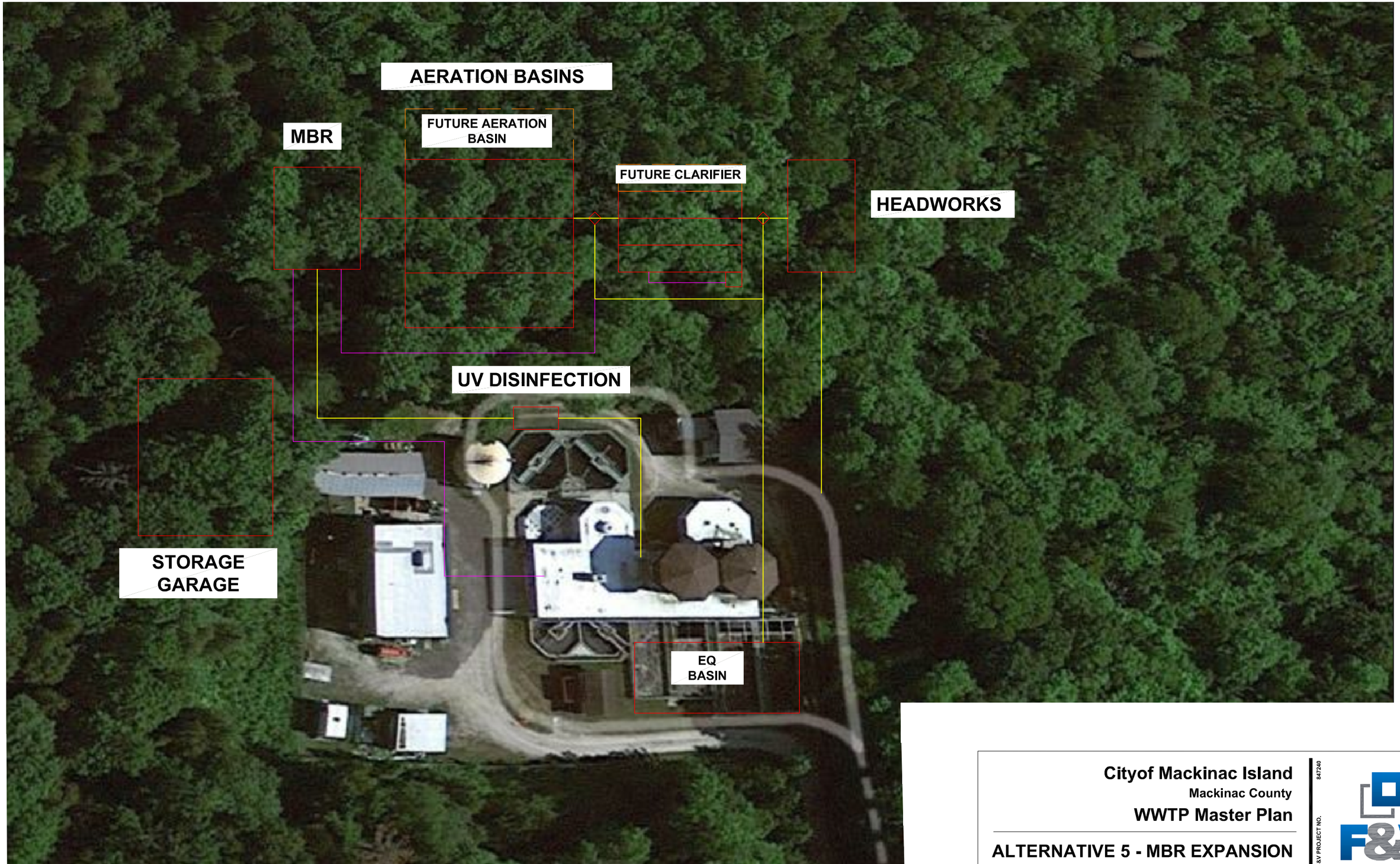
F&V

CITY OF MACKINAC ISLAND
MACKINAC COUNTY
WWTP MASTER PLAN

ALTERNATIVE 4 - OXIDATION DITCH EXPANSION

F&V PROJECT NO. 847240

F&V



Cityof Mackinac Island
Mackinac County
WWTP Master Plan

ALTERNATIVE 5 - MBR EXPANSION

F&V PROJECT NO. 847240

F&V

Appendix F

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Cost
Mackinac Island WWTP Master Plan

Client: City of Mackinac Island
Project Mackinac Island WWTP Master Plan
Project No. 847240
Date: December-21

Alternative 3 - WWTP Expansion w/ MBBR

Item	Item Description	Unit	Qty	Estimated Unit Price	Total Cost
General Construction Costs					**$4,150,000**
1	Contractors General Conditions and OH&P	LS	1	$2,720,000	$2,720,000
2	Site Development (clearing, grading, driveway, and parking)	LS	1	$300,000	$300,000
3	Site Piping/Utilities (well, water, sanitary, and process)	LS	1	$330,000	$330,000
4	Demolish Existing Facilities	LS	1	$800,000	$800,000
WWTP Process Equipment and Structures					**$15,054,000**
1	Headworks	LS	1	$1,600,000	$1,600,000
2	Equalization	LS	1	$520,000	$520,000
3	Septage Receiving	LS	1	$610,000	$610,000
4	Primary Clarifiers	LS	1	$1,740,000	$1,740,000
5	Biological Treatment - MBBR	LS	1	$3,770,000	$3,770,000
6	Final Clarifiers	LS	1	$5,180,000	$5,180,000
7	Disinfection	LS	1	$1,164,000	$1,164,000
8	Effluent Pump Station Modifications	LS	1	$470,000	$470,000
Electrical/Controls/SCADA					**$500,000**
1	Plant Automation	LS	1	$250,000	$250,000
2	Motor Control Centers/Electrical Gear	LS	1	$250,000	$250,000
Building Improvements					**$1,150,000**
1	Control Building Renovation	LS	1	$650,000	$650,000
2	Storage Garage	LS	1	$500,000	$500,000
				Subtotal, Construction:	**$20,854,000**
				Engineering, Administration & Legal:	$4,170,000
				Contingency:	$2,090,000
		Total Estimated Project Cost 2021 Dollars:			**$27,110,000**

Notes:
This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Cost
Mackinac Island WWTP Master Plan

Client: City of Mackinac Island
Project Mackinac Island WWTP Master Plan
Project No. 847240
Date: December-21

Alternative 4 - WWTP Expansion w/ Oxidation Ditch

Item	Item Description	Unit	Qty	Estimated Unit Price	Total Cost
General Construction Costs					**$4,420,000**
1	Contractors General Conditions and OH&P	LS	1	$2,990,000	$2,990,000
2	Site Development (clearing, grading, drainage, driveway, and parking)	LS	1	$300,000	$300,000
3	Site Piping/Utilities (well, water, sanitary, and process)	LS	1	$330,000	$330,000
4	Demolish Existing Facilities	LS	1	$800,000	$800,000
Equipment					**$16,844,000**
1	Headworks	LS	1	$1,600,000	$1,600,000
2	Equalization	LS	1	$520,000	$520,000
3	Septage Receiving	LS	1	$610,000	$610,000
4	Primary Clarifiers	LS	1	$1,740,000	$1,740,000
5	Biological Treatment - Oxidation Ditch	LS	1	$4,940,000	$4,940,000
6	Final Clarifiers	LS	1	$5,800,000	$5,800,000
7	Disinfection	LS	1	$1,164,000	$1,164,000
8	Effluent Pump Station Modifications	LS	1	$470,000	$470,000
Electrical/Controls/SCADA					**$530,000**
1	Plant Automation	LS	1	$280,000	$280,000
2	Motor Control Centers/Electrical Gear	LS	1	$250,000	$250,000
Building Improvements					**$1,150,000**
1	Control Building Renovation	LS	1	$650,000	$650,000
2	Storage Garage	LS	1	$500,000	$500,000
				Subtotal, Construction:	**$22,944,000**
				Engineering, Administration & Legal:	$4,590,000
				Contingency:	$2,290,000
		Total Estimated Project Cost 2021 Dollars:			**$29,820,000**

Notes:
This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
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Engineer's Opinion of Probable Cost
Mackinac Island WWTP Master Plan

Client: City of Mackinac Island
Project Mackinac Island WWTP Master Plan
Project No. 847240
Date: December-21

Alternative 5 - WWTP Expansion w/ MBR

Item	Item Description	Unit	Qty	Estimated Unit Price	Total Cost
General Construction Costs					**$4,506,000**
1	Contractors General Conditions and OH&P	LS	1	$2,900,000	$2,900,000
2	Site Development (clearing, grading, drainage, driveway, and parking)	LS	1	$476,000	$476,000
3	Site Piping/Utilities (well, water, sanitary, and process)	LS	1	$330,000	$330,000
4	Demolish Existing Facilities	LS	1	$800,000	$800,000
Equipment					**$15,974,000**
1	Headworks	LS	1	$2,130,000	$2,130,000
2	Equalization	LS	1	$520,000	$520,000
3	Septage Receiving	LS	1	$610,000	$610,000
4	Primary Clarifiers	LS	1	$1,740,000	$1,740,000
5	Biological Treatment and MBR	LS	1	$9,340,000	$9,340,000
6	Disinfection	LS	1	$1,164,000	$1,164,000
7	Effluent Pump Station Modifications	LS	1	$470,000	$470,000
Electrical/Controls/SCADA					**$575,000**
1	Plant Automation	LS	1	$300,000	$300,000
2	Motor Control Centers/Electrical Gear	LS	1	$275,000	$275,000
Building Improvements					**$1,150,000**
1	Control Building Renovation	LS	1	$650,000	$650,000
2	Storage Garage	LS	1	$500,000	$500,000
				Subtotal, Construction:	$22,205,000
				Engineering, Administration & Legal:	$4,440,000
				Contingency:	$2,220,000
		Total Estimated Project Cost 2021 Dollars:			**$28,870,000**

Notes:
This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Site Development**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Building					
1	Clearing and Grubbing	ac	1.5	$15,000	$ 23,000
2	Site Prep and Grading	ac	1.5	$20,000	$ 30,000
3	Driveway within WWTP fence	SFT	5000	$ 15	$ 75,000
4	Sidewalk	LS	1800	$ 10	$ 18,000
5	Chainlink Fence, 6 ft	LF	2000	$ 30	$ 60,000
6	Site Restoration	ac	1	$ 10,000	$ 10,000
7	Entrance Gate	LS	1	$ 25,000	$ 25,000
8	Silt Fence	LS	1	$ 20,000	$ 20,000
9	Undeveloped Details		15%	$ 39,000	$ 39,000
				Sub-Total:	**$ 300,000**
10	Contingency		10%		$ 30,000
11	Engineering, Legal, & Administration				$ 60,000
				Total Project Cost:	**$ 390,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Site Utilities**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Building					
1	Water Supply lines	LS	1	$ 50,000	$ 50,000
2	Building Drains - sanitary plumbing	LS	1	$ 80,000	$ 80,000
3	Storm sewer drain structures	LS	1	$ 75,000	$ 75,000
4	Site Lighting	LS	1	$ 80,000	$ 80,000
5	Undeveloped Details		15%	$ 43,000	$ 43,000
				Sub-Total:	**$ 330,000**
6	Contingency		10%		$ 33,000
7	Engineering, Legal, & Administration				$ 66,000
				Total Project Cost:	**$ 430,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Headworks - MBBR/Ditch**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Building					
1	Insulated Precast Wall Panels (by Exterior SFt)	SFT	2400	$80	$ 192,000
2	Precast Roof Panels	SFT	1600	$ 55	$ 88,000
3	Roof System	SFT	1600	$ 25	$ 40,000
4	Concrete	CYD	165	$ 1,200	$ 199,000
5	Excavation	CYD	420	$ 18	$ 8,000
6	Backfill	CYD	300	$ 15	$ 5,000
5	Coating Systems - walls, floor, pipe and valves	LS	1	$ 80,000	$ 80,000
6	Gas Detection System	LS	1	$ 25,000	$ 25,000
7	Doors	LS	1	$ 20,000	$ 20,000
8	Grating	LS	1	$ 20,000	$ 20,000
9	Misc. Metals	LS	1	$ 20,000	$ 20,000
10	HVAC	LS	1	$ 100,000	$ 100,000
					$ -
Process Equipment					$ -
11	Mechanical Screen	LS	1	$ 117,000	$ 117,000
12	Redundant Mechanical Screen install	LS	1	$ 15,000	$ 15,000
13	Grit System - Vortex Grit, Grit Pump, Classifier	LS	1	$ 235,000	$ 235,000
14	Parsall Flume and Transducer	LS	1	$ 15,000	$ 15,000
15	Stop Plates	EA	8	$ 5,000	$ 40,000
16	Process Piping & Valves	LS	1	$ 80,000	$ 80,000
17	Electrical and Controls	LS	1	$ 166,000	$ 166,000
18	Equipment Installation			$ 134,000	$ 134,000
19	Undeveloped Details		15%	$ 240,000	$ 240,000
				Sub-Total:	**$ 1,600,000**
19	Contingency				$ 160,000
20	Engineering, Legal, & Administration				$ 320,000
				Total Project Cost:	**$ 2,080,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Headworks - MBR**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Building					
1	Insulated Precast Wall Panels (by Exterior SFt)	SFT	2400	$ 80	$ 192,000
2	Precast Roof Panels	SFT	1600	$ 55	$ 88,000
3	Roof System	SFT	1600	$ 25	$ 40,000
4	Concrete	CYD	165	$ 1,200	$ 199,000
5	Excavation	CYD	420	$ 18	$ 8,000
6	Backfill	CYD	300	$ 15	$ 5,000
7	Coating Systems - walls, floor, pipe and valves	LS	1	$ 80,000	$ 80,000
8	Gas Detection System	LS	1	$ 25,000	$ 25,000
9	Doors	LS	1	$ 20,000	$ 20,000
10	Grating	LS	1	$ 20,000	$ 20,000
11	Misc. Metals	LS	1	$ 20,000	$ 20,000
12	HVAC	LS	1	$ 100,000	$ 100,000
Process Equipment					
13	Fine Screen x2 - MBR	LS	1	$ 286,000	$ 286,000
14	Grit System - Vortex Grit, Grit Pump, Classifier	LS	1	$ 235,000	$ 235,000
15	Parsall Flume and Transducer	LS	1	$ 15,000	$ 15,000
16	Stop Plates	EA	8	$ 5,000	$ 40,000
17	Process Piping & Valves	LS	1	$ 80,000	$ 80,000
18	Electrical and Controls	LS	1	$ 197,000	$ 197,000
19	Equipment Installation		35%	$ 202,000	$ 202,000
20	Undeveloped Details		15%	$ 278,000	$ 278,000
				Sub-Total:	**$ 2,130,000**
20	Contingency		10%		$ 213,000
21	Engineering & Administration				$ 426,000
				Total Project Cost:	**$ 2,770,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Septage Receiving Station**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Septage Receiving Station				
1	Septage Receiving Screening Equipment	EA	1	$ 296,000	$ 296,000
2	Yard Piping and valves	LF	200	$ 200	$ 40,000
3	Ex Headworks Modifications - submersible pump station	LS	1	$ 60,000	$ 60,000
4	Electrical	LS	1	$ 40,000	$ 40,000
5	Equipment Installation			$ 104,000	$ 104,000
6	Undeveloped Details		15%	$ 65,000	$ 65,000
				Sub-Total:	**$ 610,000**
7	Contingency		10%		$ 61,000
8	Engineering, Legal, & Administration				$ 122,000
				Total Project Cost:	**$ 800,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Equalization Basin**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Influent Equalization				
1	Existing Aeration Tank Modifications	LS	1	$ 50,000	$ 50,000
2	Site Piping	LS	1	$ 100,000	$ 100,000
3	EQ Pump Station	LS	1	$ 200,000	$ 200,000
4	Electrical	LS	1	$ 40,000	$ 40,000
5	Equipment Installation			$ 70,000	$ 70,000
6	Undeveloped Details		15%	$ 59,000	$ 59,000
				Sub-Total:	**$ 520,000**
7	Contingency				$ 52,000
8	Engineering, Legal, & Administration				$ 104,000
				Total Project Cost:	**$ 680,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Primary Clarifiers**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Primary Clarifiers				
1	Concrete	CYD	250	$ 1,200	$ 300,000
2	Excavation	CYD	1520	$ 18	$ 27,000
3	Backfill	CYD	720	$ 15	$ 11,000
4	Influent Splitter Box	LS	1	$ 75,000	$ 75,000
5	Handrail	LF	250	$ 90	$ 23,000
6	FRP Covers	LS	1	$ 100,000	$ 100,000
7	Primary Clarifier Equipment	EA	3	$ 110,000	$ 330,000
8	Stop Plates	EA	4	$ 8,000	$ 32,000
9	Weirs and Baffles	LS	1	$ 60,000	$ 60,000
10	Valves	EA	10	$ 10,000	$ 100,000
11	18" Influent, bypass, effluent piping	LF	175	$ 300	$ 53,000
12	6" Sludge Piping	LF	400	$ 250	$ 100,000
13	Primary Sludge Pumps	EA	2	$ 25,000	$ 50,000
14	Electrical/Controls	LS	1	$ 76,000	$ 76,000
15	Equipment Installation			$ 200,000	$ 200,000
16	Undeveloped Details		15%	$ 201,000	$ 201,000
				Sub-Total:	**$ 1,740,000**
17	Contingency		10%		$ 174,000
18	Engineering, Legal, & Administration				$ 348,000
				Total Project Cost:	**$ 2,270,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**MBBR Treatment Process**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Process Building					
1	Insulated Precast Wall Panels (by Exterior SFt)	SFT	1440	$ 80	$ 115,000
2	Precast Roof Panels	SFT	800	$ 55	$ 44,000
3	Roof System	SFT	800	$ 25	$ 20,000
4	Concrete	CYD	150	$ 1,200	$ 180,000
5	Excavation	CYD	260	$ 18	$ 5,000
6	Backfill	CYD	110	$ 15	$ 2,000
7	Coating Systems - walls, floor, pipe and valves	LS	1	$ 40,000	$ 40,000
8	Doors	LS	1	$ 10,000	$ 10,000
9	Misc. Metals	LS	1	$ 20,000	$ 20,000
10	HVAC	LS	1	$ 20,000	$ 20,000
MBBR					
11	Concrete	CYD	350	$ 1,200	$ 420,000
12	Excavation	CYD	1190	$ 18	$ 21,000
13	Backfill	CYD	320	$ 15	$ 5,000
14	Influent Piping	LF	40	$ 300	$ 12,000
15	Influent Flow Channel	LS	1	$ 50,000	$ 50,000
16	Air Piping Piping	LS	1	$ 100,000	$ 100,000
17	Process Valves	LS	1	$ 100,000	$ 100,000
18	MBBR Process Equipment	LS	1	$ 1,320,000	$ 1,320,000
	Blowers				
	Media				
	Aeration Grids				
	Knife Diffuser Assemblies				
	Controls				
	Wedgewire Screens				
19	Slide Gates	LS	4	$ 25,000	$ 100,000
20	Electrical	LS	1	$ 291,000	$ 291,000
21	Equipment Installation			$ 462,000	$ 462,000
22	Undeveloped Details		15%	$ 431,000	$ 431,000
				Sub-Total:	**$ 3,770,000**
23	Contingency				$ 377,000
24	Engineering, Legal, & Administration				$ 754,000
				Total Project Cost:	**$ 4,910,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Oxidation Ditches**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Process Building					
1	Insulated Precast Wall Panels (by Exterior SFt)	SFT	1440	$ 80	$ 115,000
2	Precast Roof Panels	SFT	800	$ 55	$ 44,000
3	Roof System	SFT	800	$ 25	$ 20,000
4	Concrete	CYD	150	$ 1,200	$ 180,000
5	Excavation	CYD	260	$ 18	$ 5,000
6	Backfill	CYD	110	$ 15	$ 2,000
7	Coating Systems - walls, floor, pipe and valves	LS	1	$ 40,000	$ 40,000
8	Doors	LS	1	$ 10,000	$ 10,000
9	Misc. Metals	LS	1	$ 20,000	$ 20,000
10	HVAC	LS	1	$ 20,000	$ 20,000
Oxidation Ditch					
11	Concrete	CYD	1150	$ 1,200	$ 1,380,000
12	Excavation	CYD	7650	$ 18	$ 138,000
13	Backfill	CYD	1530	$ 15	$ 23,000
14	Oxidation Ditch Equipment	LS	1	$ 600,000	$ 600,000
	3-75 HP drives and motors				
	3-30 HP drives and motors				
	177-66" discs				
	9 shafts				
	18 shaft bearings				
	3 shaft couplings				
	12 automatic bearing lubricators				
	9 flat weatherhood assemblies				
15	Smart BNR Lite	LS	1	$ 600,000	$ 600,000
16	VFDs	EA	6	$ 20,000	$ 120,000
17	Influent Piping	LF	80	$ 300	$ 24,000
18	Gates	EA	6	$ 35,000	$ 210,000
19	Handrail	LF	500	$ 90	$ 45,000
21	Electrical and Controls	LS	1	$291,000	$ 291,000
20	Equipment Installation			$ 462,000	$ 462,000
22	Undeveloped Design Details		15%	$ 583,000	$ 583,000
				Sub-Total:	**$4,940,000**
23	Contingency		10%		$500,000
24	Engineering, Legal, & Administration				$ 990,000
				Total Project Cost:	**$6,500,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**MBR Treatment Process**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
Building/MBR Tank					
1	Insulated Precast Wall Panels (by Exterior SFt)	SFT	3600	$80	$ 288,000
2	Precast Roof Panels	SFT	1800	$ 55	$ 99,000
3	Roof System	SFT	1800	$ 25	$ 45,000
4	Concrete	CYD	320	$ 1,200	$ 384,000
5	Excavation	CYD	2700	$ 18	$ 49,000
6	Backfill	CYD	1269	$ 15	$ 19,000
7	Coating Systems - walls, floor, pipe and valves	LS	1	$ 75,000	$ 75,000
8	Doors	LS	1	$ 20,000	$ 20,000
9	Misc. Metals	LS	1	$ 20,000	$ 20,000
10	HVAC	LS	1	$ 80,000	$ 80,000
	Aeration Tanks				
11	Concrete	CYD	918	$ 1,200	$ 1,101,000
12	Excavation	CYD	4500	$ 18	$ 81,000
13	Backfill	CYD	1700	$ 15	$ 26,000
14	Aeration Blowers	EA	3	$ 150,000	$ 450,000
15	Aeration Diffusers	LS	1	$ 300,000	$ 300,000
16	Process Piping	LF	1	$ 200,000	$ 200,000
17	Process Valves	EA	1	$ 150,000	$ 150,000
18	Gates	EA	6	$ 35,000	$ 210,000
19	VFDs	EA	3	$ 20,000	$ 60,000
20	Electrical and Controls	LS	1	$ 102,000	$ 102,000
	MBR				
21	MBR Package	LS	1	$ 2,275,000	$ 2,275,000
22	Gates	EA	8	$ 35,000	$ 280,000
23	Process Piping	LS	1	$ 350,000	$ 350,000
24	Valves	LS	1	$ 200,000	$ 200,000
25	Recirc Flow Control Structures	LS	1	$ 100,000	$ 100,000
26	Electrical and Controls	LS	1	$ 234,000	$ 234,000
26	Equipment Installation			$ 1,059,000	$ 1,059,000
27	Undeveloped Design Details		15%	$ 1,080,000	$ 1,080,000
				Sub-Total:	**$ 9,340,000**
28	Contingency				$ 934,000
29	Engineering, Legal, & Administration				$ 1,868,000
				Total Project Cost:	**$ 12,150,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Final Clarifiers - MBBR**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Final Clarifiers - New				
1	Flow Splitting Structure	LS	1	$ 50,000	$ 50,000
2	Final Clarifier Tank	LS	3	$ 808,000	$ 2,424,000
3	PRVs	EA	12	$ 1,500	$ 18,000
4	Clarifier Mechanism and Bridge	EA	3	$ 150,000	$ 450,000
5	Clarifier Covers	EA	2	$ 250,000	$ 500,000
6	Isolation Gates	EA	3	$ 10,000	$ 30,000
7	Influent and Effluent Piping	LF	300	$ 300	$ 90,000
8	8-in Drain Piping	LS	300	$ 150	$ 45,000
9	Sludge and Scum Piping	LS	700	$ 200	$ 140,000
10	WAS Pumps	EA	2	$ 30,000	$ 60,000
11	Process Piping	LS	1	$ 100,000	$ 100,000
12	Process Valves	LS	1	$ 50,000	$ 50,000
13	Weirs and Baffles	LF	424	$ 200	$ 85,000
14	Handrail	LF	424	$ 90	$ 38,000
15	Electrical and Controls	LS	1	$102,000	$ 102,000
16	Equipment Installation				$364,000
17	Undeveloped Details		15%		$ 627,000
				Sub-Total:	**$5,180,000**
18	Contingency		10%		$520,000
19	Engineering, Legal, & Administration				$ 1,040,000
				Total Project Cost:	**$6,800,000**

Notes:

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FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Final Clarifiers - Oxidation Ditch**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Final Clarifiers - New				
1	Flow Splitting Structure	LS	1	$ 50,000	$ 50,000
2	Final Clarifier Tank	LS	3	$ 808,000	$ 2,424,000
3	PRVs	EA	12	$ 1,500	$ 18,000
4	Clarifier Mechanism and Bridge	EA	3	$ 150,000	$ 450,000
5	Clarifier Covers	EA	2	$ 250,000	$ 500,000
6	Isolation Gates	EA	3	$ 10,000	$ 30,000
7	Influent and Effluent Piping	LF	600	$ 300	$ 180,000
8	8-in Drain Piping	LF	450	$ 150	$ 68,000
9	Sludge and Scum Piping	LS	1200	$ 200	$ 240,000
10	RAS Piping	LS	400	$ 200	$ 80,000
11	WAS Pumps	EA	2	$ 30,000	$ 60,000
12	RAS Pumps	EA	2	$ 30,000	$ 60,000
13	Process Piping	LS	1	$ 150,000	$ 150,000
14	Process Valves	LS	1	$ 100,000	$ 100,000
15	Weirs and Baffles	LF	424	$ 120	$ 51,000
16	Handrail	LF	424	$ 90	$ 38,000
17	Electrical and Controls	LS	1	$ 114,000	$ 114,000
18	Equipment Installation				$490,000
19	Undeveloped Details		15%		$ 692,000
				Sub-Total:	**$5,800,000**
20	Contingency		10%		$580,000
21	Engineering & Administration				$ 1,160,000
				Total Project Cost:	**$7,600,000**

Notes:

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FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**UV Disinfection**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	UV Disinfection				
1	Concrete Channels	LS	1	$ 100,000	$ 100,000
2	UV System Equipment	LS	1	$ 250,000	$ 250,000
3	UV System Building	SF	900	$ 325	$ 293,000
4	Grating and Covers	SF	150	$ 100	$ 15,000
5	Painting	LS	1	$ 20,000	$ 20,000
6	Mechanical / HVAC	LS	1	$ 30,000	$ 30,000
7	Site Piping	LS	1	$ 100,000	$ 100,000
8	Electrical and Controls	LS	1	$ 115,000	$ 115,000
9	Equipment Installation			$ 103,000	$103,000
10	Undeveloped details		15%	$ 138,000	$138,000
				Sub-Total:	**$1,164,000**
11	Contingency		10%		$117,000
12	Engineering & Administration				$233,000
				Total Project Cost:	**$1,514,000**

Notes:

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FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Effluent Pump Station**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Effluent Pump Station				
1	Pumps	EA	2	$ 65,000	$ 130,000
2	Chlorine Contact / Effluent Wet Well mods	LS	1	$ 50,000	$ 50,000
3	Effluent Sewer Modifications	LS	1	$ 150,000	$ 150,000
4	Electrical and Controls	LS	1	$ 33,000	$ 33,000
5	Equipment Installation				$ 46,000
6	Undeveloped Design Details		15%		$ 54,000
				Sub-Total:	**$ 470,000**
7	Contingency		10%		$ 47,000
8	Engineering & Administration				$ 94,000
				Total Project Cost:	**$ 620,000**

Notes:

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FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Control Building Remodel**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Control Building Remodel				
1	Demolition	LS	1	$ 50,000	$ 50,000
2	Renovate ex. Building	SF	1200	$ 200	$ 240,000
3	HVAC	LS	1	$ 50,000	$ 50,000
4	Electrical	LS	1	$ 50,000	$ 50,000
5	Plumbing	LS	1	$ 50,000	$ 50,000
6	Painting	LS	1	$ 80,000	$ 80,000
7	Undeveloped Design Details		25%		$ 130,000
					$ 650,000
8	Contingency		10%		$ 65,000
9	Engineering & Administration				$ 130,000
				Total Project Cost:	**$ 980,000**

Notes:

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FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Engineer's Opinion of Probable Project Cost [1]

Project:	Mackinac Island WWTP Master Plan	*Project No.*	847240
Basis for Estimate:	[X] Conceptual [ ] Basis of Design [ ] Final	*Estimator:*	SFH
Work:	**Storage Facility**	*Date:*	Dec-21

Item	Description	Unit	Qty.	Unit Price	Amount
	Storage Facility				
1	Building and doors	LS	1	$ 250,000	$ 250,000
2	Concrete	LS	1	$ 60,000	$ 60,000
3	Plumbing	LS	1	$ 10,000	$ 10,000
4	Mechanical	LS	1	$ 20,000	$ 20,000
5	Electrical	LS	1	$ 15,000	$ 15,000
6	Fire supression	LS	1	$ 20,000	$ 20,000
7	Earthwork	LS	1	$ 20,000	$ 20,000
8	Undeveloped Design Details		25%		$ 99,000
				Sub-Total:	**$ 500,000**
9	Contingency		10%		$ 50,000
10	Engineering & Administration				$ 100,000
				Total Project Cost:	**$ 650,000**

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

Appendix G

1

YOUR TEAM

Brian Rowley, PE
Traverse City Regional Manager

David Harvey, PE
Project Manager

Scott Hall, PE
Project Engineer

2

AGENDA

- Introduction / Purpose of Master Plan
- Background and Planning
- WWTP Evaluation
- Recommended Improvements
- Project Costs
- Funding
- Next Steps
- Questions

3

INTRODUCTION/PURPOSE

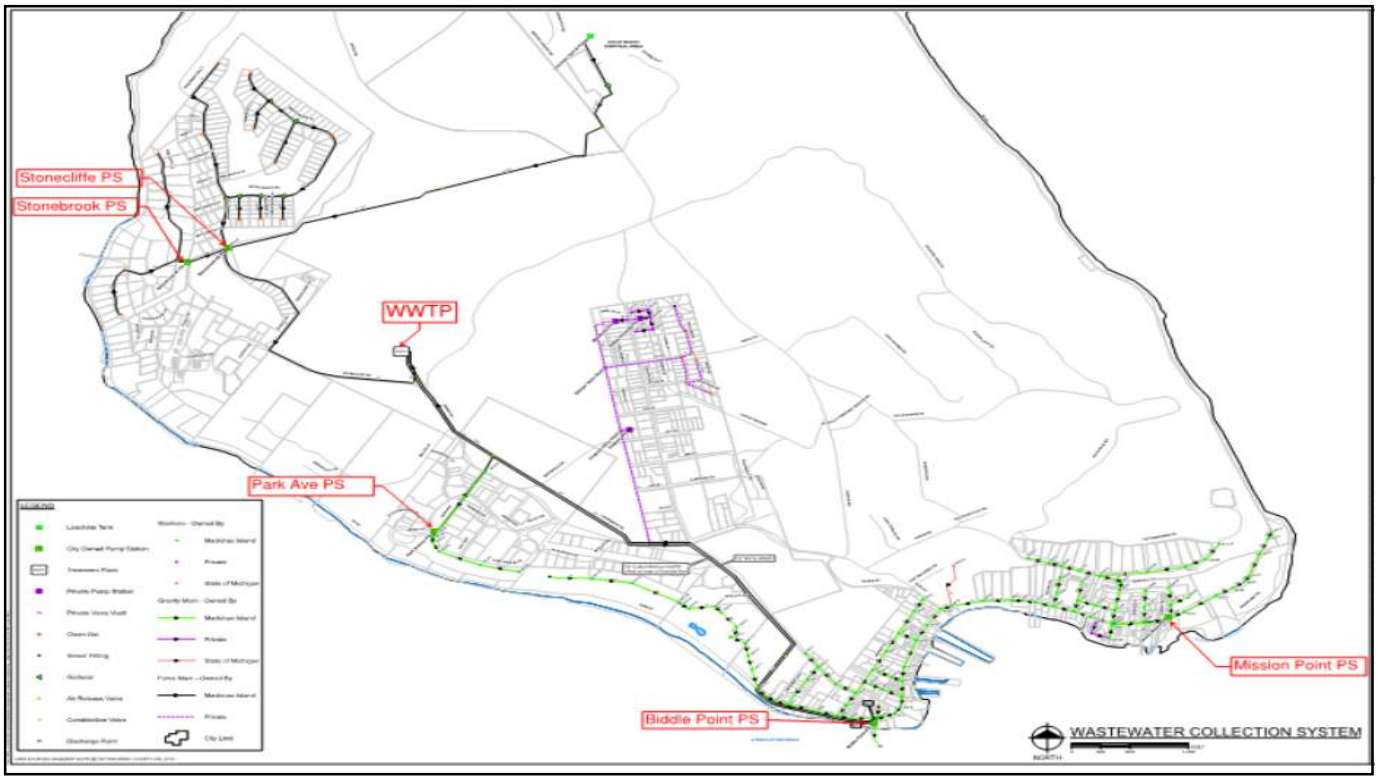
- Evaluate Existing WWTP Facilities
  - » Age, Condition, Capacity and Performance, Operation, Reliability
- Develop 20-year Wastewater Flow and Loading Projections
- Identify Short-Term and Long-Term Needs
- Provide Recommendations for Improvements

4

BACKGROUND

- The City's wastewater collection system is comprised of over 4 miles of gravity sewer, 5 Pump stations, and approximately 7 miles of forcemain.
- The WWTP was originally constructed in 1970, with expansions/upgrades in 1982,1992, and 2012.

5



6

POPULATION PROJECTIONS

	Current*	
	Summer	**Winter**
Island Residents	1,943	492
Hotel/Lodging Guests	3,006	
Seasonal Employees	4,000	
Total Residential Population	**8,949**	**492**
Day Trip Tourists	7,740	0
Total Design Population	**16,689**	**492**

**Resource 2018 Master Plan*

Approach

- Master Plan Zoning Districts
- Allowable Density
- Estimated Development

7

POPULATION PROJECTIONS

	Current*		20-year		100% Development	
	Summer	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**
Island Residents	1,943	492	3,380	860	5,520	1,655
Hotel/Lodging Guests	3,006		5,750		10,460	
Seasonal Employees	4,000		5,070		8,420	
Total Residential Population	**8,949**	**492**	**14,200**	**860**	**24,400**	**1,655**
Day Trip Tourists	7,740	0	12,800	0	17,100	0
Total Population	**16,689**	**492**	**27,000**	**860**	**41,500**	**1,655**

**Resource 2018 Master Plan*

8

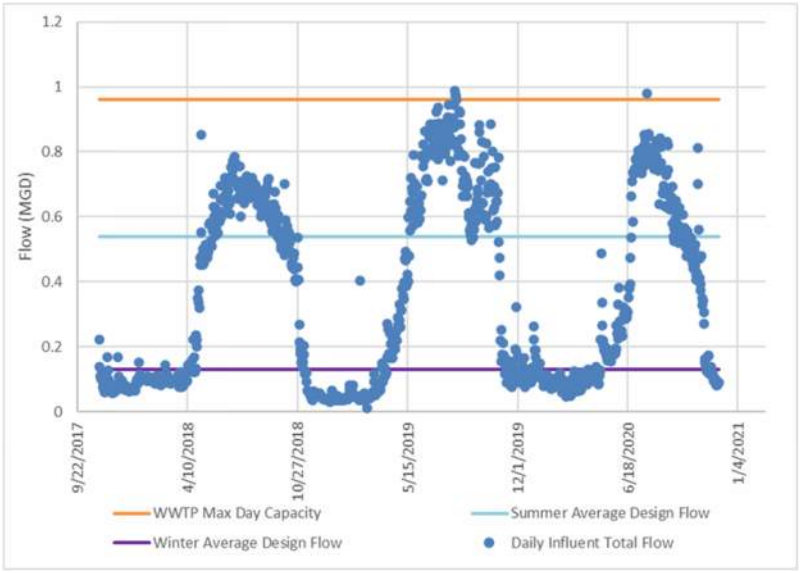
CURRENT WASTEWATER FLOWS

	Existing Basis of Design (Summer)	2017 - 2021 (Summer)	Existing Basis of Design (Winter)	2017 - 2020 (Winter)
Average Daily Flow (MGD)	0.54	0.61	0.13	0.10
Maximum Flow (MGD)	0.96	0.99	0.52	0.40

**NPDES Permit Rated flow capacity: 0.96 MGD*

9

CURRENT WASTEWATER FLOWS



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DESIGN WASTEWATER FLOWS

	Summer (Max Month)	Winter
Overnight Tourist/ Resident Population	14,200	860
Tourist Population	12,800	0
Hydraulic Loading		
	Summer	**Winter**
Overnight Tourist/ Resident Usage (gpd)	1,136,000	68,000
Tourist Usage (gpd)	342,000	0
Groundwater Infiltration (gpd)	60,000	60,000
25-year 24-hour design storm I/I flows	750,000	750,000
Max Month Avg. Daily Flow (gpd)	1,538,000	128,000
Maximum Daily Flow (gpd)	2,288,000	878,000
Peak Hour Flow (gpm)[3]	2,600	1,200

- Overnight Tourists/Residents usage: 80 gallons/person/day
- Tourist Usage (1/3 of Residential): 26.7 gallons/person/day

11

POPULATION PROJECTIONS

	Existing Basis of Design*		2017 – 2021 maximum day		Current Summer Max Month Average		Current Winter Average	
	Concentration (mg/L)	Loading (lb/d)	Concentration (mg/L)	Loading (lb/d)	Concentration (mg/L)	Loading (lb/d)	Concentration (mg/L)	Loading (lb/d)
BOD_5	750	6,003	755	4,471	633	3,500	82	67
Suspended Solids	650	5,202	588	3,544	335	1,867	64	51
NH_3-N	30	240	-	-	-	-	-	-
Phosphorus (Total P)	6.2	50	9.28	38.4	4.6	24	3.27	2.65

Design Nutrient Loading		
	Concentration (mg/L)	Loading (lb/d)
BOD_5	750	9,600
Suspended Solids	650	8,300
NH_3-N	30	385
Phosphorus (Total P)	6.2	80

12

PERMITTING

- Preliminary Meeting w/ EGLE February 18, 2021
- >1.0 MGD Capacity
- Updated NPDES Permit required
  - Major vs Minor Facility
  - Annual fee increases from $1,950 to $5,500.
  - Increased annual sampling requirements for metals, VOCs, and PFAS.
  - There is a possibility for a stricter mercury limit.
  - A Stormwater Pollution Prevention Plan (SWPPP) may be required.
  - Operator license (Class C) requirements are not expected to change.
- Part 41 Construction Permit

13

WASTEWATER TREATMENT PLANT EVALUATION

14

SUMMARY OF EXISTING WWTP EVALUATION

In general, the condition of the WWTP was fair to poor

- Limited Capacity
- Aging infrastructure
- Limited footprint for Expansion
- Code Compliance

Typical "lifespan" reflects components:

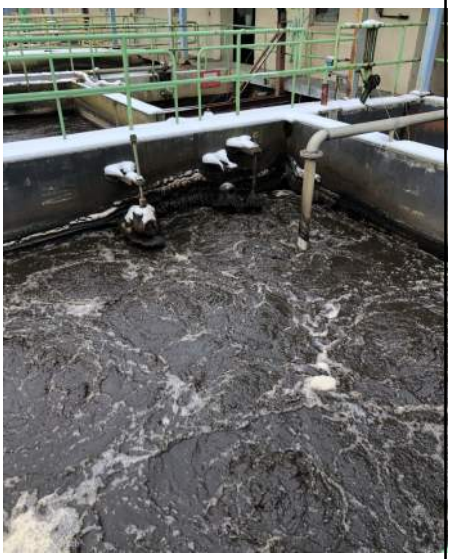
- Pumps – 10-15yrs
- Treatment Equip – 15-20yrs
- Controls – 10-15yrs
- Structures – 50+yrs (concrete)
- Pipe/Valves – 25-50yrs

15

EXISTING FACILITIES

16

EXISTING FACILITIES

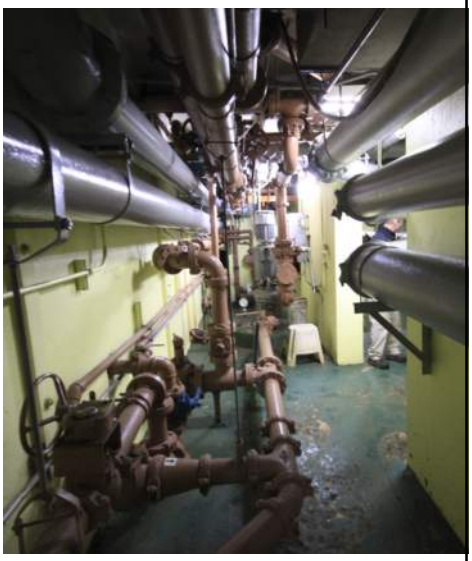


17

EXISTING FACILITIES

18

EXISTING FACILITIES



19

EXISTING FACILITIES

20

EXISTING FACILITIES

21

ALTERNATIVES EVALUATION

- Developed alternatives to address project needs.
- Each alternative reviewed for:
  - » Operational and Design Flexibility
  - » Technical and Financial Feasibility
  - » Net Present Worth Evaluation

22

ALTERNATIVES CONSIDERED

1. No Action
   - » No changes to existing facility
   - » Capacity and mechanical concerns continue
2. Improve Existing Facility
   - » Maintain current operation and treatment technology
   - » Expand existing processes
3. Moving Bed Bioreactor - MBBR
4. Oxidation Ditch
5. Membrane Bioreactor - MBR

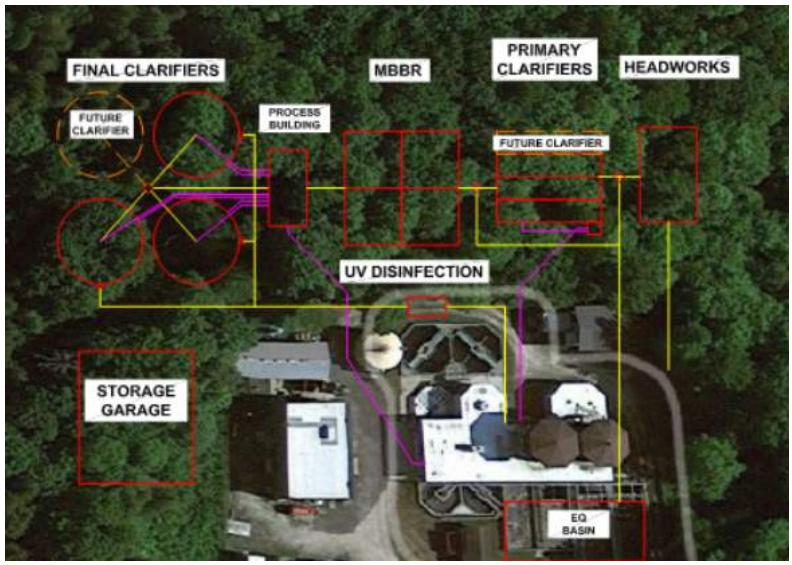
23

RECOMMENDED IMPROVEMENTS

- Headworks
- Primary Clarifiers
- Biological Treatment
- Final Clarifiers
- Disinfection
- Biosolids Handling
- Influent/Effluent Forcemains

24

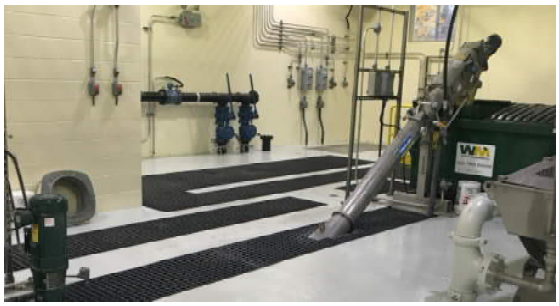
RECOMMENDED ALTERNATIVE - MBBR



25

HEADWORKS

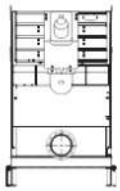
- New headworks sized for projected flows
- Indoor facilities to be used year round
- Design in accordance with NFPA 820

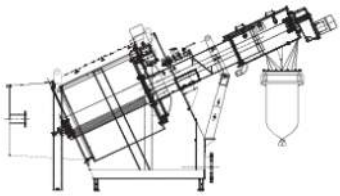


26

SEPTAGE RECEIVING

**Stock photo of JWC septage receiving station*





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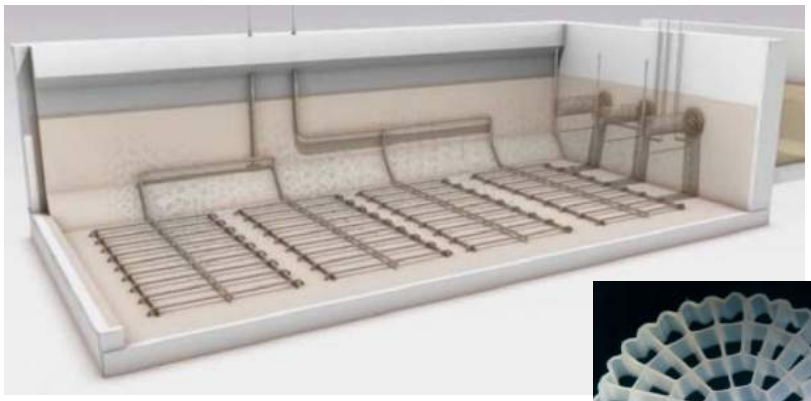
PRIMARY CLARIFIERS

28

MBBR



29

FINAL CLARIFICATION

30

UV DISINFECTION

Figure 1: Operation During Periods of High Flow

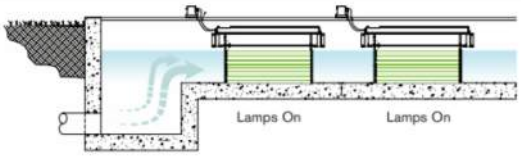
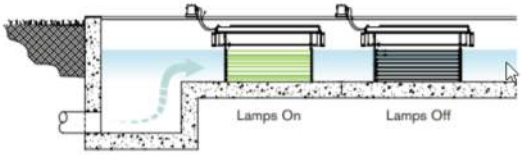


Figure 2: Operation During Periods of Low Flow



31

STORAGE GARAGE & CONTROL BUILDING RENOVATION

32

OPINION OF PROBABLE COST

Engineers Opinion of Probable Cost	
Contractors General Conditions OH&P	$2,890,000
Site Development	$1,520,000
Headworks	$1,700,000
Equalization	$550,000
Septage Receiving	$650,000
Primary Clarifiers	$1,850,000
MBBR Equipment	$4,000,000
Final Clarifiers	$5,500,000
Disinfection	$1,230,000
Effluent Pump Station Modifications	$500,000
Electrical, Controls, and SCADA	$540,000
Building Improvements	$1,220,000
Engineering and Administration	$4,430,000
Construction Contingency	$2,220,000
Estimated Project Total (2023 Dollars)	$28,800,000

33

FUNDING OPPORTUNITIES

- Clean Water SRF
  - » 20-30 year loan term available
  - » Low rates
    - 1.875% for 20-year loan
    - 2.125% for 30-year loan
- USDA RD
  - » 40-year loan term available
  - » Low rates, based on Median Household Income (MHI)
    - 1.25% for Poverty communities
    - 1.75% for Intermediate (City of Mackinac Island)
    - 2.125% for Market
- Legislative Earmarks/grants

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NEXT STEPS

- Clean Water SRF
  - » Intent to Apply – 1.31.22
  - » ITA Meeting with EGLE
  - » Disadvantage Community Determination
  - » SRF Project Plan – 6.1.22
- USDA RD
  - » Applications accepted all year
- Legislative Earmarks/grants

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POTENTIAL PROJECT TIMELINE

- Secure Project Funding – Summer/Fall 2022
- DNR Land acquisition/Site investigation – Fall 2022
- Engineering Design– Fall 2022 – Winter 2023.
- Construction 2023 – 2025

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CONVENTIONAL DESIGN-BID-BUILD APPROACH

- Owner consulted during design phase
- Independent oversight of Builder
- Open to Owner involvement during design and construction
- Pricing is not known until the design process is complete
- Contractor is selected based on low bid

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FVC – PROGRESSIVE DESIGN- BUILD

- Collaborative effort:
  - » Control construction cost
  - » Construction Sequencing
  - » Owner has greater involvement during design, bidding, and construction
  - » Milestone design meetings with EGLE and City staff.
- No finger pointing - one firm responsible for design, construction, schedule, quality and warranty.
- Open book pricing to Owner
  - » Trade bids are opened publicly with Owner
  - » Opportunity to adjust pricing with open book cost data

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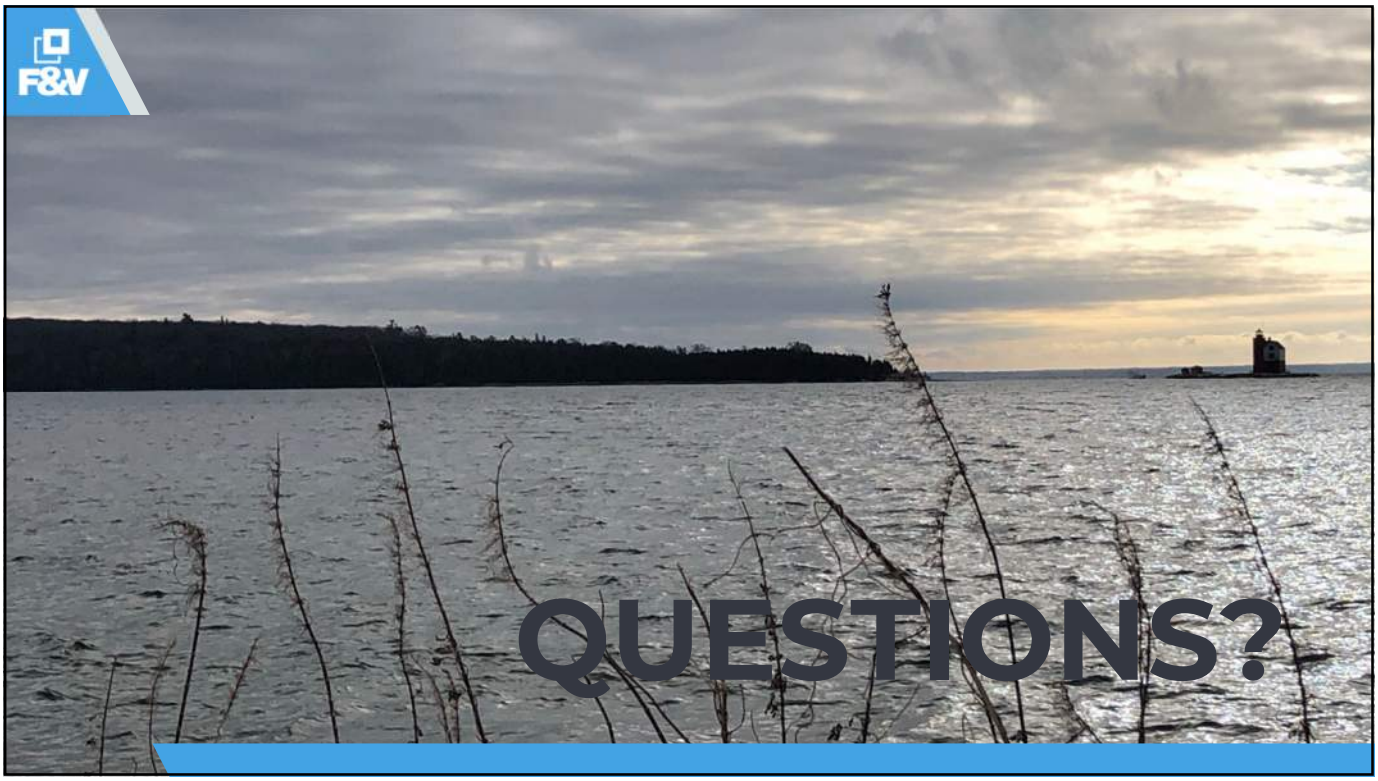

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