SRF Project Plan

City of Gladstone
Wastewater Treatment Plant Improvements
Vol. 1 (Report Body Only)

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c2ae
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AC	Acre		NEPA	National Environmental Policy Act
AMP	Asset Management Plan		NH_3-N	Ammonia Nitrogen
ASCE	American Society Of Civil Engineers		NPDES	National Pollutant Discharge Elimination System
AWWA	American Waterworks Association		NPV	Net Present Value
BOD	Biological Oxygen Demand		NRWA	National Rural Water Association
BRF	Business Risk Factor		O&M	Operation and Maintenance
BWF	Base Wastewater Flow		OMB	US Office Of Management And Budget
CB	Storm Water Catch Basin		OTE	Oxygen Transfer Efficiency
CFM	Cubic Feet per Minute		P	Phosphorus
			PFAS	Per- and polyfluoroalkyl substances
CFS	Cubic Feet Per Second		POF	Probability of Failure
Cl	Chlorine		POSA	Plan Of Study Area
CMAS	Complete Mix Activated Sludge		POTW	Publically Owned Treatment Works
COMB	Combined Sanitary and Storm Sewer		PPB	Parts per Billion
CSO	Combined Sewer Overflow		PPD	Pounds Per Day
CUPPAD	Central U.P. Planning and Devel. Reg. Commission		PPM	Parts Per Million
DO	Dissolved Oxygen		PSI	Pounds Per Square Inch
DWF	Dry Weather Flow		PVC	Polyvinyl Chloride (Pipe)
DWSRF	Michigan Drinking Water Revolving Fund		RDII	Rainfall Derived Infiltration And Inflow
EGLE	Mich. Dept. of Environment, Great Lakes, & Energy		RRI	Repair, Replacement, and Improvements (Fund)
EPA	US Environmental Protection Agency		RUS	Rural Utility Service (USDA-RD)
EPDM	Ethylene Propylene Diene Terpolymer		SAN	Sanitary Sewer
EUPPDR	Eastern U.P. Planning and Devel. Reg. Commission		SAW	Michigan Stormwater And Wastewater funding
FSP	Fiscal Sustainability Plan		SCADA	Supervisory Control And Data Acquisition
GPCD	Gallons Per Capita Per Day		SCFM	Standard Cubic Feet per Minute
GPD	Gallons Per Day		SF	Square Foot
GPD/IN-MI	Gallons Per Day Per Inch Diameter Mile		SS	Suspended Solids
GPM	Gallons Per Minute		STO	Storm Sewer
GWI	Groundwater Infiltration		SRF	Michigan State Revolving Loan Fund
HP	Horsepower		SRT	Solids Retention Time
HSIA	Hydraulically Significant Impervious Area		SS	Suspended Solids
HVAC	Heating, Ventilation, and Air Conditioning (System)		SSES	Sewer System Evaluation Survey
I	Rainfall Intensity		SSO	Sanitary Sewer Overflow
I/I	Infiltration/Inflow		SSOAP	Sanitary Sewer Overflow Analysis And Planning
IN/HR	Inches Per Hour (Rainfall)		SWD	Side Wall Depth

MBBR	Moving Bed Bio-Reactors		SWMM	EPA Storm Water Management Model
MBR	Membrane Bio-Reactor		USACE	US Army Corps Of Engineers
MDNR	Michigan Department of Natural Resources		USDA-RD	US Dept. Of Agriculture - Rural Development
MG	Million Gallons		UV	Ultra Violet
MGD	Million Gallons Per Day		VCP	Vitrified Clay Pipe
MG/L	Milligrams Per Liter		VFD	Variable Frequency Drive
MH	Access Manhole		VSS	Volatile Suspended Solids
ML	Milliliter		WERF	Water Environment Research Foundation
MLSS	Mixed Liquor Suspended Solids		WPA	Works Progress Administration (early public works construction program)
MPN	Most Probable Number		WRC	Michigan Water Resources Commission
NASSCO	National Association of Sewer Service Companies		WTP	Water Treatment Plant
NEMA	National Electrical Manufacturers Association		WUPPDR	Western U.P. Planning and Devel. Reg. Commission
			WWTF	Wastewater Treatment Facility
			WWTP	Wastewater Treatment Plant

SUMMARY

Background

Authorization and Purpose

This study (Project Plan) was originally authorized by the City of Gladstone via execution of a letter proposal on February 17, 2018. A draft of the Project Plan was submitted to EGLE to meet requirements for SAW on May 20, 2020 and to allow for a pilot study at the WWTP to be completed prior to the final submittal of the Project Plan. The proposal for an updated Project Plan (this document) was executed February 9, 2021.

Study Area

Gladstone is located in southwestern Delta County on the west shore of Lake Michigan's (and Green Bay's) Little Bay De Noc, in the south central region of Michigan's Upper Peninsula. The existing sanitary sewer service includes the entire City of Gladstone. Also served are several homes in the Kipling area of Brampton Township and the community of Rapid River in Masonville Township, both North of the City.

Environmental Setting

The area in and around Gladstone has numerous environmental and cultural resources. The status of the resources and impact on them relative to the City's wastewater system was reviewed as part of this study. The primary goal of wastewater treatment is to protect the quality of the waters of the State of Michigan and to protect public health. Ultimately, the driving force for this study and the potential construction of the recommended improvements is the protection and enhancement of the quality of the WWTP effluent discharged to Little Bay de Noc.

Population

Gladstone's population is approximately 4,900 while the wastewater system service area population is approximately 5,400 which includes customers in Rapid River and Kipling.

Economics

The economic conditions of the Gladstone area are primarily influenced by the major industry (a paper mill in the nearby Escanaba/Wells Townships), tourism, recreation, and a few smaller forestry/manufacturing/service commercial enterprises in the City. The City's waterfront provides for boating, fishing, and other water related services.

Existing Facilities

Gladstone began providing municipal sewer service to its residents in the early 1900s with the first iteration of the current WWTP constructed in 1954. A major upgrade to RBC treatment came in 1972 to 1974.

Gladstone's wastewater collection system (City owned portion) consists of 32 miles of 8 to 30-inch gravity sewer and 10 pump stations ranging in capacity from 40 to 400 gpm.

The wastewater treatment plant (WWTP) equipment/processes include raw sewage screening and pumping, flow measurement, grit removal, primary settling, rotating biological contactor secondary treatment, chlorination, outfall to Little Bay de Noc, and digesters for biosolids management.

Evaluations of the Gladstone WWTP and its processes have been prepared for a peak 25-year, 24-hour instantaneous wet weather flow of 4.2 MGD based on the system hydraulic model created for the SAW Asset Management Plan. The proposed maximum hour hydraulic flow is 3.5 MGD based on historic records and with an allowance for future tributary flows. This compares to an original maximum hour hydraulic flow of 2.5 MGD. The existing average annual flow is 0.66 MGD (prior to 2019) compared to an original design capacity of 1.0 MGD. Because Gladstone exceeds maximum I/I guidelines of the State of Michigan, it was necessary to complete an I/I Study (see Appendix A for summary). Average annual flow in 2018 and 2019 have increased with very high groundwater levels created by the record Great Lakes levels. The annual average flow in 2018 was 0.67 MGD, and in 2019, the annual average flow was 0.94 MGD.

Fiscal Sustainability

Through historic established practices and programming developed via the State SAW funded asset management planning, the City has addressed asset inventory, asset evaluation, water/energy conservation, and asset maintenance/funding

Need for the project

Gladstone's WWTP generally operates in compliance with its NPDES permit. The system is well operated and maintained; however, it is moderately old and has not received major capital investment in several decades.

An EGLE Enforcement Notification, with a Draft Administrative Consent Order (ACO) attached, was delivered to Gladstone in February 2021. This is precipitated by excessive I/I in the collection system along with WWTP needed improvements. It will be required by the State to address excessive I/I issues while improvements to the WWTP will be approved in conjunction with execution of the ACO.

The ACO will allow for WWTP upgrades to move ahead prior to eliminating the excess I/I. The ACO will mandate collection system improvement.

The WWTP was upgraded in 1974 to treat an annual average flow of 1.0 MGD and a maximum sustained rate through secondary treatment of 2.5 MGD. Evaluations under the SAW program proposed a future peak design flow of 3.5 MGD to include increased infiltration in aging pipes and to reflect potential growth in Masonville, Kipling, and North Bluff areas (4.2 MGD peak to account for calculated 25-year, 24-hour precipitation event).

The goal is to protect State surface and ground water quality and public health. Ability to reliably meet these goals moving forward would be adversely affected without the project. The project will improve treatment reliability and efficiency.

Analysis of Alternatives

Potential Alternatives

A number of potential alternatives were reviewed and/or evaluated and were found lacking under current conditions, including the following:

- No Action – would not address problems/issues and not considered a responsible method of asset management and providing utility system service to its customers
- Optimum Performance of Existing Facilities – currently occurring limited by current equipment
- Water and Energy Efficiency – part of recommended improvements and also limited by current equipment
- Regional Alternatives – not currently considered cost effective nor politically achievable.
- New WWTP facility

Principal Alternatives

Alternative 1: Existing Process Upgrade

To upgrade the existing WWTP to accept a treatable design flow of 3.5 MGD (4.2 MGD peak hydraulic rate) involves generally upgrading the existing treatment process as outlined in prior studies. Alternate 1 includes a new automatic Fine Screening and Grit Removal process along with a new Administration Building and major upgrades to Primary

Treatment, Secondary Treatment, and Digestion. Biosolids handling is by means of Anaerobic Digestion and Agricultural Land Application. This alternative Includes many improvements aimed at long term reliability and facility sustainability, many of which are common to all alternatives.

Alternative 2: RBF Primary Treatment and RBC Secondary Treatment

This alternative involves replacement of the current Primary Settling process with a new innovative Rotating Belt Filters (RBF) primary process and upgrade of the existing Rotating Biological Contactor (RBC) Secondary Treatment. Biosolids Handling is by means of Anaerobic or Aerobic Digestion and Land Application. Many common improvements are to be included under this alternative.

Alternative 3: Oxidation Ditch

Alternative 3 is the replacement of the existing Primary/Secondary fixed film treatment with Extended Aeration (Oxidation Ditches). New Oxidation Ditch installation would involve abandonment of the existing Primary Settling and RBC secondary process, and construction of two new oxidation ditches to provide secondary treatment by means of extended aeration. This option avoids the need for existing or new primary settling tanks, but requires that sludge digestion be by means of the aerobic process. This requires conversion of the Anaerobic Digesters to Aerobic Digesters. Biosolids disposal is by land application.

Alternative 4: RBF Primary Treatment and Moving Bed Bioreactor Secondary Treatment

Alternative 4 utilizes Rotating Belt Filter (RBF) Primary Treatment as a cost effective substitute to conventional Primary Settling (as in Alternate 2). Moving Bed Bioreactors (MBBRs) are used as an upcoming fixed film secondary process to reduce mechanical maintenance requirements potentially associated with RBCs. MBBR treatment is relatively new, but this process is recently approved in Michigan by EGLE. With MBBR treatment, it will be possible to install RBF units in the space currently occupied by RBCs within the existing building. It is proposed that RBF with a conventional headworks system be installed adjacent to the existing headworks area. Under this option, Biosolids handling will use Aerobic Digestion with full Land Application of waste solids. Common facility improvements are also included.

Alternative 5: Primary Clarifier with Moving Bed Bioreactor Secondary Treatment

Alternative 5 combines components from Alternatives 1 and 4, combining expanded traditional Primary Treatment (presented in Alternative 1) while replacing the aging RBC units with MBBR secondary treatment (presented in Alternative 4). Upgrades would also consist of conventional Headworks system with upgraded Raw Sewage pumping; including new automatic fine screening and vortex grit removal. Additional Final Clarifier tankage, along with Biosolids

Handling is by means of Anaerobic Digestion. However, C2AE is continually researching Class A biosolids option for the City. A sludge dehumidification system may be implemented for somewhat less cost effective on a capital and present worth basis, but it offers several strong benefits including: flexibility to handle future regulations, land application of Class A, marketability of biosolids, landfill in emergency situations, and other reasons presented in the Biosolids Handling section below. Common facility improvements are also included with this Alternative.

Future collection system improvements will be required by the Administrative Consent Order. The City intends to partition the total collection system needs into numerous construction phases over the next several decades; this will enable improvements within the limited financing capability of the service district.

Selected Alternative

Description and Design Parameters

The Selected Alternative is Alternative 5, Conventional Primary Treatment and Moving Bed Bioreactor (MBBR) secondary treatment, with Anaerobic Digestion and Land Application of Biosolids. A complete list of improvements under the Selected Alternative is provided on Table 19 on Page 92 and is summarized below.

- New Administration Building
- Existing Service Building Modification for Proposed Treatment
- Raw Sewage Pumping Improvements
- Additional Primary Clarifier to North of Existing
- MBBR Tanks and Treatment Equipment
- Secondary Sludge Pumping
- Final Clarifier Improvements (Add Third Settling Tank and Piping)
- Secondary Treatment Pumps
- Hydraulic Capacity Improvements
- Electrical Service Upgrade
- SCADA Control and Monitoring System
- HVAC Rehabilitation Asset Upgrade
- Facility Piping and Valves
- Facility Surface Restoration (Concrete, Masonry, Painting)
- Site Improvements
- Digester Improvements

- Anaerobic Digester Mixing and Rehabilitation
- Digester Gas Boiler and Heat Exchanger
- Digester Gas Handling Equipment
- Digester Gas Piping and Valves
- Secondary Digester Rehabilitation

- Chlorine Contact Rehabilitation Asset Upgrade
- Roof Replacement Asset Upgrade
- Select Window and Door Asset Upgrade

A flow schematic for the selected alternative is provide in Figure 14 on Page 94. A proposed site plan is presented in Figure 12 on Page 89.

Project Cost Summary

Table 1 below is a summary of anticipated project costs. Greater detail is provided under the selected alternative section of this report and in Appendix D. Note that the subtotal value presented in the table below, is comprised of engineering total plus administration and legal with construction dollars included.

Table 1: Summary of Proposed Project Costs

Description	Amount
Construction Total	**$13,728,000**
Administration, Legal, and Bonding	$145,000
RBF Pilot Study	$30,000*
I & I Work plan and Project Plan Amendment	$23,000*
Sewer System Evaluation Survey	$45,000*
Total Preliminary Engineering (Planning)	**$98,000***
Design Engineering	$1,243,000
Bidding (Basic Services)	$35,000
Additional Services	$184,000
Construction General Engineering (Basic Services)	$323,000
Resident Project Representative	$378,000
Post Construction (Basic Services)	$17,000
Engineering Total	**$2,180,000**
Subtotal	**$16,053,000**
Contingency	**$964,000**
Project Total	**$17,017,000**

*Note: *Costs are included within the Construction Total*

Project Location

The initial project will be located on the site of the existing WWTP which sits on the southerly side of Minneapolis Avenue between 4th and 5th Streets adjacent to Little Bay de Noc. Future collection system work will concentrate on older sewers within the City proper.

Controlling Factors

- Planning and design will be in accordance with applicable industry standards including, EGLE standards, WEF MOP 8 Manual of Practice, Ten States Standards for Wastewater, and normal practice
- EGLE and USACE Permitting Requirements
- OSHA and MiOSHA Requirements
- SHPO and THPO Requirements
- Regional Utility Standards

Special Assessment

No special assessments are planned to aid in financing any of the alternatives.

Sensitive Features

Work will take place on treatment facility grounds and be isolated from any potential sensitive environmental locations. It will be necessary to protect the waters of the Little Bay De Noc during construction. I/I related sewer construction, when it occurs, will be in previously disturbed City street right-of-way.

Schedule

The proposed project schedule is aimed at a complete SRF funding application submittal in June of 2021, design in 2021 and early 2022, and construction planned for 2022 to 2024. A detailed schedule can be found in Table 21 on Page 108 of this report.

Authority to Implement

The City of Gladstone has undertaken numerous public works projects in the past. It has the municipal authority and demonstrated ability to administer the current proposed undertaking.

User Costs

User rates impacts from the proposed project are noted in detail later in this report. Potential rate increases have already been indicted. Up to an estimated $29.25, which is already covered under rate increases enacted by the council.

Disadvantaged Community

Disadvantaged community determination status submittals will be made during the Project Planning and CWRF application process.

Useful Life

Remaining Useful Life of all wastewater assets is available in the 2019 to 2020 SAW Asset Management Plan process evaluation and asset rating lists (see Appendix A).

Evaluation of Environmental Impacts

Summary of Impacts

The anticipated environmental impacts resulting from implementation of the selected alternative can include beneficial and detrimental, short and long term, and irreversible or irretrievable impacts.

Impacts of the recommended plan are primarily beneficial, but some short-term construction related negative impacts do exist.

The short-term adverse impacts associated with construction activities would be minimal in comparison to the long-term continued benefits to the area through improved infrastructure. The project segments are not expected to have adverse effects relative to limiting the range of future land and water use options. Fossil fuels, human labor, construction materials, and wear on equipment, would be utilized during construction. Financial resources of Gladstone and the State of Michigan would also be committed.

Analysis of Impacts

No disturbance is planned of significant natural or manmade features or vegetation. No significant impact is expected on floodplain, wetlands, shorelands, or streams. Where applicable, contract documents will require construction methods and disturbed areas to be minimized regarding their impact to the site and neighboring areas.

The project should have no impact on endangered species, significant plant communities, natural features, or prime and unique agricultural land. Any required mitigation measures would be coordinated with EGLE during the design and permitting process.

Construction of the Gladstone WWTP improvements is not anticipated to have any adverse effect on historical, archaeological, geological or recreational areas. All construction will take place on City of Gladstone WWTP property. Excavation in previously unexcavated areas is very limited.

No long term adverse indirect nor cumulative impacts are anticipated and further discussion can be found in the body of the report.

Mitigation

Short Term Impacts

Construction impacts anticipated include groundwater control and areas of inferior structural/pipe bedding and backfill soil material. These are normal occurrences with construction in the area and prior planning/design will create a situation where these problems will pose no significant difficulties for qualified contractors. Construction traffic will be regulated by the Construction documents and City ordinance/policy.

Long Term Impacts

The City does not expect any long-term impacts from the general construction activities. Long-term operational issues will not be adversely changed by the projects; rather, operations should be enhanced through new more reliable equipment installations and treatment processes.

Indirect Impacts

Long range planning by the City of Gladstone identified the project segments evaluated in this report and all impacts take place within the WWTP property or developed City streets and would have no effect on planning and zoning in the community. Costs and less tangible impacts such as construction traffic would have no disproportionate impact any area group. Impacts are spread evenly amongst community collection system users.

Public Participation

Public Meetings

Wastewater collection system needs and potential fixes have been openly noted during several City Commission meetings over the past several years. This includes a council meeting that presented the SAW findings by C2AE in December of 2020; a council meeting that approved a resolution to submit the I & I to EGLE and authorize the Notice of Intent in December of 2019; and during a rate review presentation by UFS in November 2019.

Public Hearing

A formal public hearing on this Project Plan was advertised on __tentative April 12___, 2021 and held on ___ tentative May 17 _, 2021 during a regular City Commission meeting. A verbatim transcript of minutes is included with this Project Plan.

Plan Adoption

The Gladstone City Commission formally adopted this project Plan on ___ tentative May 17____, 2021.

BACKGROUND

Authorization and Purpose

This study (Project Plan) was authorized originally by the City of Gladstone, Michigan, via execution of a letter proposal on February 17, 2018 (part of the City's SAW Asset Management Program). A draft of the Project Plan was submitted to EGLE to meet requirements for SAW on May 20, 2020 and to allow for a pilot study at the WWTP to be completed prior to the final submittal of the Project Plan. The proposal for an updated Project Plan executed February 9, 2021. The purpose of the Project Plan is to investigate the Gladstone wastewater collection and treatment systems and to evaluate alternatives to address needs where appropriate.

The City of Gladstone is the responsible governing entity for the municipal wastewater systems serving the City. The facilities are owned and operated by the City. The WWTP is located east of Highway (US-2-41/M-35) along Minneapolis Avenue in the City.

Delineation of the Study Area

<u>Geographic Area</u>

Gladstone is located in the southwestern area of Delta County on the west shore of Little Bay De Noc (part of Green Bay and Lake Michigan) in the south central region of Michigan's Upper Peninsula. The City itself covers approximately 8 sq. mi.

The study area includes the entire sanitary sewer service district served by the WWTP.

The sanitary sewer service district is located in the southern portion of Delta County at the center of Michigan's Upper Peninsula. The plan of study areas includes the City of Gladstone, in Township 40N, and Range 22W, Sections 10, 15 to 17, 20 to 22, and 28 to 29 of Delta County, Michigan. The WWTP effluent discharge is to the Little Bay de Noc. The WWTP is located in Section 28.

A location map is provided as Figure 1 on Page 13. A service area and USGS topographic map are provided as Figure 2 on Page 14.

Political Boundaries

The existing sanitary sewer service includes the entire City of Gladstone. Also served are several homes in the Kipling area of Brampton Township and the community of Rapid River in Masonville Township, both north of the City. The City is bordered on the west and south by unserved Escanaba Township.

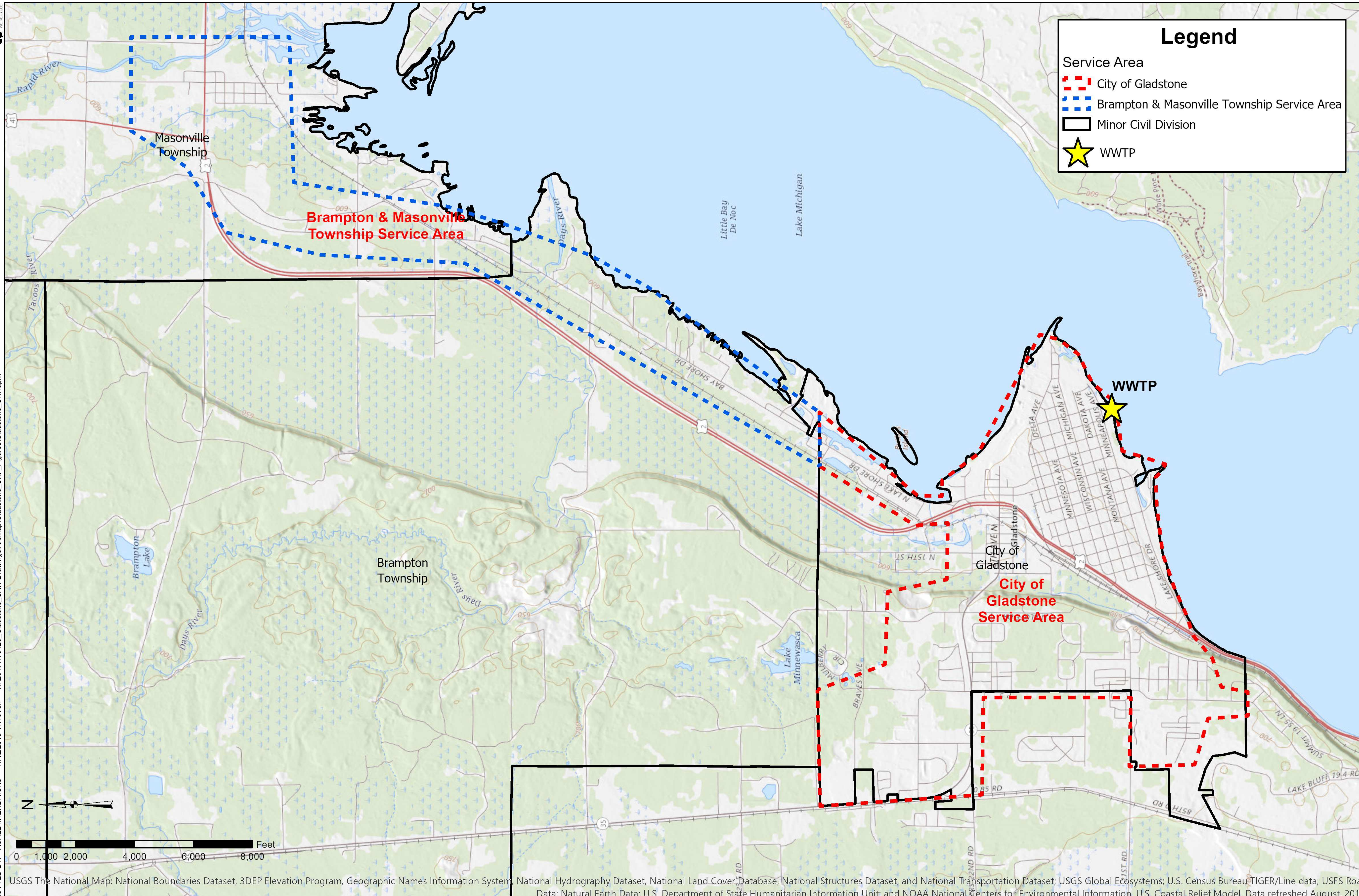
Existing and Potential Facility Sites

The existing WWTP lies near the shore of Little Bay De Noc on the City's northeast side. A WWTP has been at the site since the 1930s. There is room for reasonable expansion if needed. Due to the extensive infrastructure already in place leading to the site, relocation to other potential sites is not being considered.

Current and Future Service Area

The current service area includes the City of Gladstone, several homes in the Kipling area of Brampton Township, and the developed community of Rapid River in Masonville Township. Service area expansion is not currently being considered but potential exists for more residences in the Kipling area and residential/commercial in Escanaba Township. The City itself also has tracts of undeveloped land should economics improve to the point where development would be viable.

Figure 1: Location Map



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CITY OF GLADSTONE
SRF PROJECT PLAN
DELTA COUNTY, MICHIGAN

FIGURE 2: STUDY & SERVICE AREA

Environmental Setting

The area in and around Gladstone has numerous environmental and cultural resources. The status of the resources and impact on them relative to the City's wastewater system was reviewed as part of this study. Cultural and environmental comment requests and responses are contained in Appendix C.

Cultural Resources

- Historic/Archaeological Sites: No known historic sites of are near the WWTP. Proposed work to the WWTP will be confined within the existing site. Subsequent potential future phases of work to address I/I and collection system deficiencies would be limited to replacement or rehabilitation of existing collection system components within long developed and disturbed rights-of-way. Refer to Appendix C, Part 2 – Archeological and Historic Resources and Part 3 – Tribal Historic Preservation Officers.

Natural Environment

- Air Quality: Project area air quality can be described as good to excellent. The area has minimal large industrial or power producing facilities which can adversely affect air quality. Limited population also means limited transportation system initiated air quality impacts. Refer to Appendix C, Part 1 – Air Quality.

- Wetlands: Wetlands make up almost a quarter of the undeveloped land cover within the Gladstone City Limits. They are defined by the US Fish and Wildlife Service as:

  "…lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of the year."

  Wetlands are one of the most biologically productive ecosystems in the world, and therefore, perform a variety of functions. They provide fish and wildlife habitat, control storm water and flooding, improve water quality, provide water recharge areas, aid in shoreline erosion control, nutrient recycling and retention, and support a diverse biological ecosystem. Protection of these significant ecosystems falls under the Goemaere-Anderson Wetlands Act of 1979. The State of Michigan oversees regulation and permitting of wetland uses. Refer to Appendix C, Part 16C - Land-Water Interface: Wetlands.

- Coastal Zones: The WWTP is located within the Michigan Coastal Zone Management Area of Little Bay De Noc. The EGLE Great Lakes Shoreland Protection agent has been contacted regarding this project and requested to provide comment. Refer to Appendix C, Part 16D - Land-Water Interface: Great Lakes Shoreland Protect.

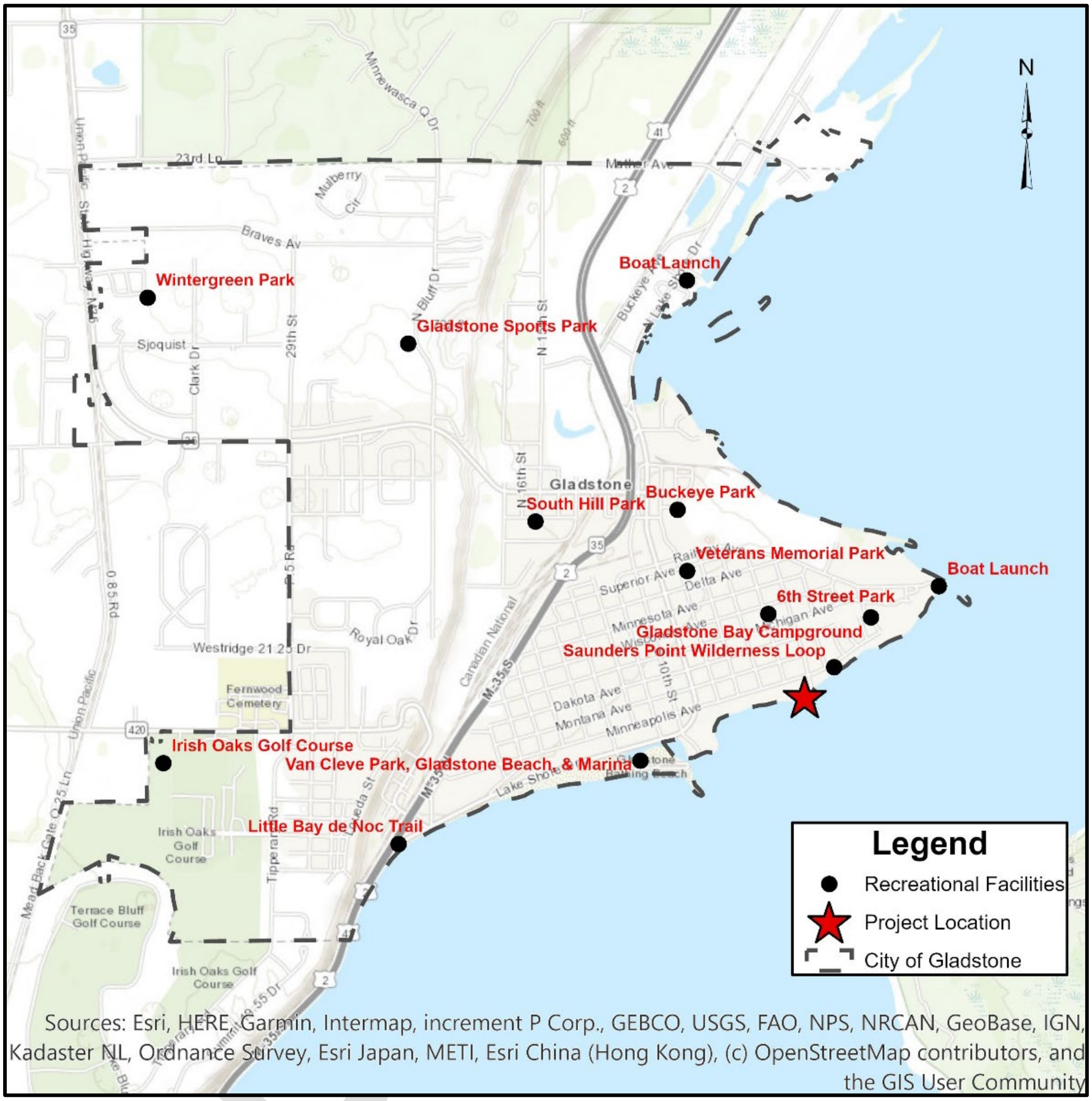
- Floodplains: Localized floodplains exist along the shore of Little Bay de Noc. The floodplains are generally not developed. The existing WWTP site is within the 100-year floodplain. EGLE has provided a 100-yr floodplain elevation of 585.0 ft; ground elevations at the WWTP site run 583 to 587 ft. Refer to Appendix C, Part 16B - Land-Water Interface: Floodplains. Building code may take precedence.

- Natural or Wild and Scenic Rivers: The City is approximately seven to ten miles south of the Whitefish and Rapid Rivers and approximately three miles north of the Escanaba River. There are no Designated Natural or Wild and Scenic Rivers within the planning area. Refer to Appendix C, Part 14.

- Surface Waters: Little Bay de Noc is located in the most northwestern portion of Lake Michigan, in Green Bay. Gladstone is located on the western shore. There are no rivers or major streams located within the City. Little Bay de Noc is one of the top walleye sport fisheries in the world, along with the nearby Big Bay de Noc. Water temperatures, depth, spawning habitat, and forage facilitate an ecosystem that supports the growth of large walleye populations, and other Great Lakes fish species. Combined with all of the tributaries, Little Bay de Noc provides Gladstone residents with a unique freshwater resource that is strongly appreciated by the community as well as visitors. Preservation of and access to this hydrological resource is a community concern and should be a major consideration for future planning. The WWTP discharges to Little Bay de Noc approximately 800 ft offshore from the WWTP. At this time, no portion of effluent is diverted for agricultural, industrial, or public water supply uses.

- Recreational Facilities: Seven City parks, totaling 500 acres including the Sports Park with a downhill ski hill and tube run and chalet (see Figure 3). The waterfront of the city is the Van Cleve Park, Gladstone Harbor and the Gladstone Beach. A non-motorized trail and marina are situated within the City of Gladstone. There are privately owned golf courses west and north of the City.

Figure 3: Recreational Facilities

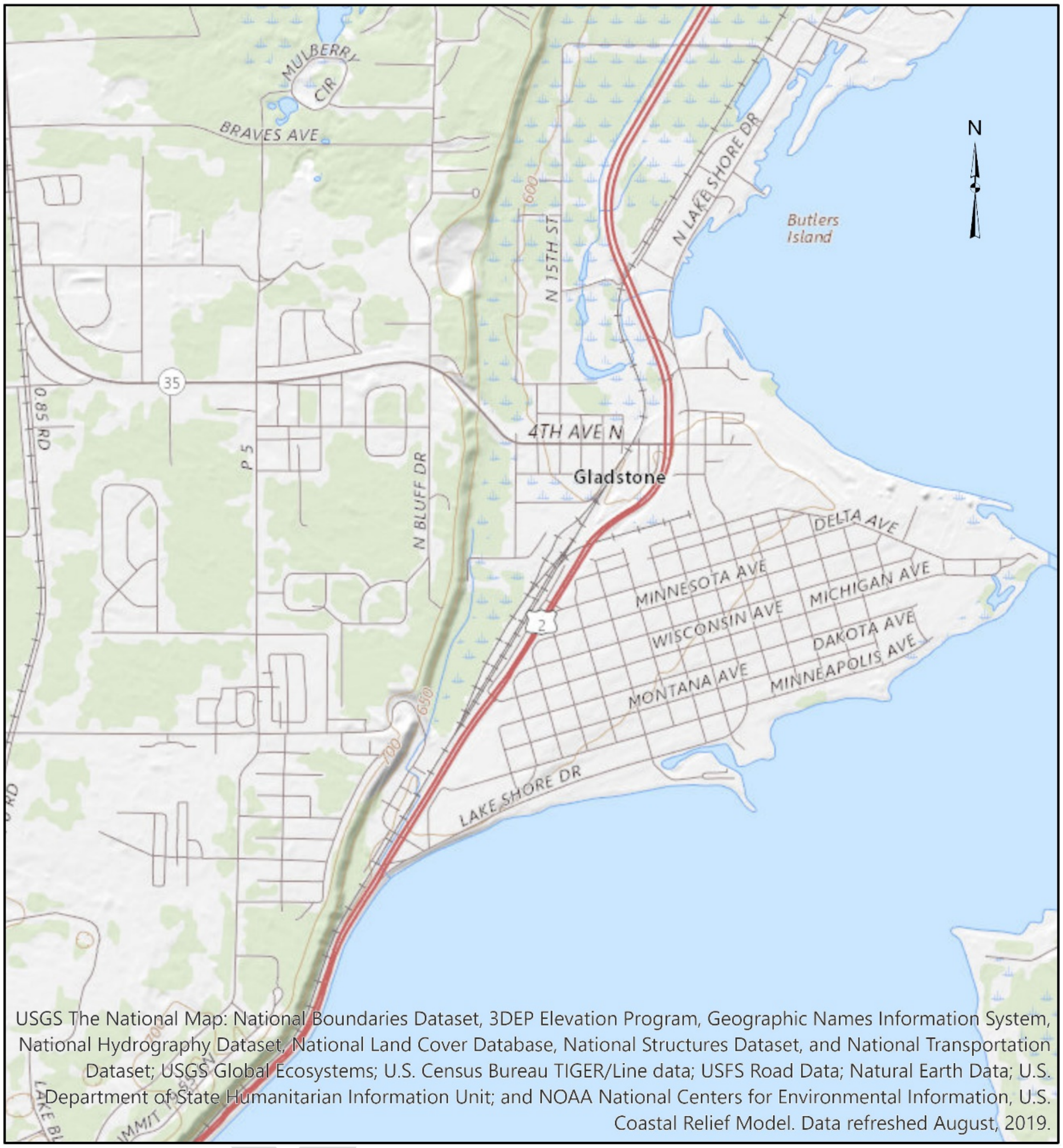


- Topography: As with the rest of the Upper Peninsula, Gladstone was shaped by glacial activity and the Great Lakes. Gladstone drains toward Lake Michigan and the downtown area is situated in a low-lying area with minor elevation change. Further north and west, a 100 ft bluff roughly divides the City limits in half. Overall, except for the bluff edge, Gladstone has a gentle elevation increase moving toward the inland regions. Refer to Figure 4 on the following page for a topographic map of the area.

- Geology: The bedrock surface of Delta County is formed by Paleozoic rocks of Ordovician and Silurian age. A glacial drift of varying thickness was deposited on the bedrock during the Pleistocene era. Many of the physical features of the County were formed during this era. Rocks from this era include limestone, dolomite, shale, sandstone, and gypsum deposited by shallow seas. In the northeastern part of the County, glacial deposits form areas of higher elevation. The Gladstone area was once covered by an early glacial lake, as seen from the plains, beaches, and dunes of the area. The period of glaciation was followed by a period of erosion. The uplift of land after the last ice age formed the present shoreline of the area.

  There are several alvar landscapes within Delta County and Gladstone that were formed during the late Ordovician and early Silurian periods when Michigan was covered in inland seas. Limestone was formed into flat, horizontal layers of rock, which can be seen very clearly on the banks of the Escanaba River where the soil has eroded to expose the bare rock. This type of landscape has thin to no soil and, as a result, sparse grassland vegetation. Often flooded in the spring, and affected by drought in the summer, alvars support a distinctive group of prairie-like plants. This stressed habitat can support a community of rare plants and animals, including species more commonly found on prairie grassland. Lichens and mosses are common while trees and shrubs are absent or severely stunted.

Figure 4: Topographic Map



- Soils: USDA Natural Resource Conservation Service (NRCS) published their Soil Survey of Delta County. General soil classifications and estimated percentage of the service over which they survey show their dominance are:
    - Onaway-Ossineke fine sandy loams, moraine, 1 to 6 percent slopes. (2.5%)
    - Onaway-Ossineke fine sandy loams, drumline, 1 to 6 percent slopes. (1.1%)
    - Alluvial land. (1.3%)
    - Au Gres sand, 0 to 3 percent slopes. (2.0%)

- Carbondale, Lupton, and Rifle soils. (8.3%)
- Cathro and Tacoosh mucks. (5.2%)
- Charlevoix sandy loam 0 to 4 percent slopes. (7.3%)
- Croswell sand, 0 to 3 percent slopes. (1.8%)
- Dawson and Greenwood peats. (3.1%)
- Ensley muck, 0 to 2 percent slopes. (6.2%)
- Kalkaska sandy, 0 to 6 percent slopes. (4.0%)
- Kalkaska sandy, 6 to 15 percent slopes. (3.8%)
- Karlin sandy loam, 0 to 6 percent slopes. (1.2%)
- Kiva sandy loam, 0 to 6 percent slopes. (1.2%)
- Limestone rock land. (2.1%)
- Longrie sandy loam, 2 to 6 percent slopes. (1.8%)
- Nahma muck. (2.4%)
- Roscommon mucky loam sandy, 0 to 2 percent slopes. (4.5%)
- Rubicon sandy, 6 to 15 percent slopes. (2.0%)
- Summerville fine sandy loam, 0 to 4 percent slopes. (2.3%)
- Sundell fine sandy loam, 0 to 4 percent slopes. (1.8%)
- Tawas muck. (7.3%)
- Trenary fine sandy loam, 2 to 6 percent slopes. (4.5%)

- Agricultural Resources: There is no designated farmland within the City. Refer to Appendix C, Part 5 – Agricultural Resources.

- Fauna and Flora: Limits of the proposed project areas are confined to the WWTP property which includes grass cover. In Appendix C, Part 10 - Michigan Natural Features Inventory states that although several rare species have been documented within 1.5 mi of the proposed activity, the occurrences are well away from the project site.

- Climate: Gladstone has a humid continental climate, described as an area with large seasonal temperature swings, warm and humid summers and cold to frigid winters with precipitation occurring somewhat regularly throughout the year. The climate in and around the City of Gladstone is heavily influenced by the proximity of

Lake Michigan. Gladstone is situated in a region with long, cold winters and relatively cool summers. The lakes help to keep summer temperatures cool and winter temperatures warmer than inland areas. The proximity of the lake also creates lake effect snow, although not as much as the northern part of the region due to both temperature differences and prevailing wind direction. The lake effect snow results from cool air masses moving over the relatively warm waters of the lake. When these air masses reach the cooler land areas, the moisture picked up from the lake is deposited as snow. The average annual temperature is 42°F. The average high and low temperatures range from 25°F and 7°F in January, to 76°F and 57°F in July. The City receives approximately 28.51 in. of rain per year, with the wettest month in September and the driest month in February.

Land Use

Several types of land use are found within the City of Gladstone. Residential land use is generally single family dwellings with only occasional multiple units and mobile home park type settings. Commercial land use is concentrated in the Delta Avenue corridor and 9th Street corridor in the City with typical small town other scattered commercial uses. Light industrial/manufacturing is located in an industrial park in the bluff area on the east side of Highway M-35, west of the City.

Gladstone's downtown business area is its primary retail district and oldest area of the City. The older residential area is below the bluff surrounding the downtown. The main commercial districts are downtown and along the highway corridors. The bluff area contains newer neighborhoods. Gladstone's eastern waterfront area is primarily a mix of residential and park/recreational land. A large area of waterfront northeast of downtown is undeveloped. Gladstone's light industrial areas include the industrial park on the bluff, the railroad corridor below the bluff, and along the northern shore.

Delta County has approximately 1,173 square mi of area, 211 mi of Great Lakes shoreline, 514 mi of rivers/streams, nearly 6,000 acres of inland lakes and ponds, and nearly 310,000 acres of public recreation land. The vast majority of the land areas in Delta County are forested. Land use in the study area is a mixture of residential, commercial, industrial, open space district, civic/institutional, and transportation.

Airways and Airports: The Delta County Airport is 9.2 mi away from the Gladstone WWTP.
The existing land use patterns are expected to remain stable, with development over the 20-year planning period generally following the City's 2015 Master Plan Update (see Figure 5 and Figure 6).

Figure 5: Land Use

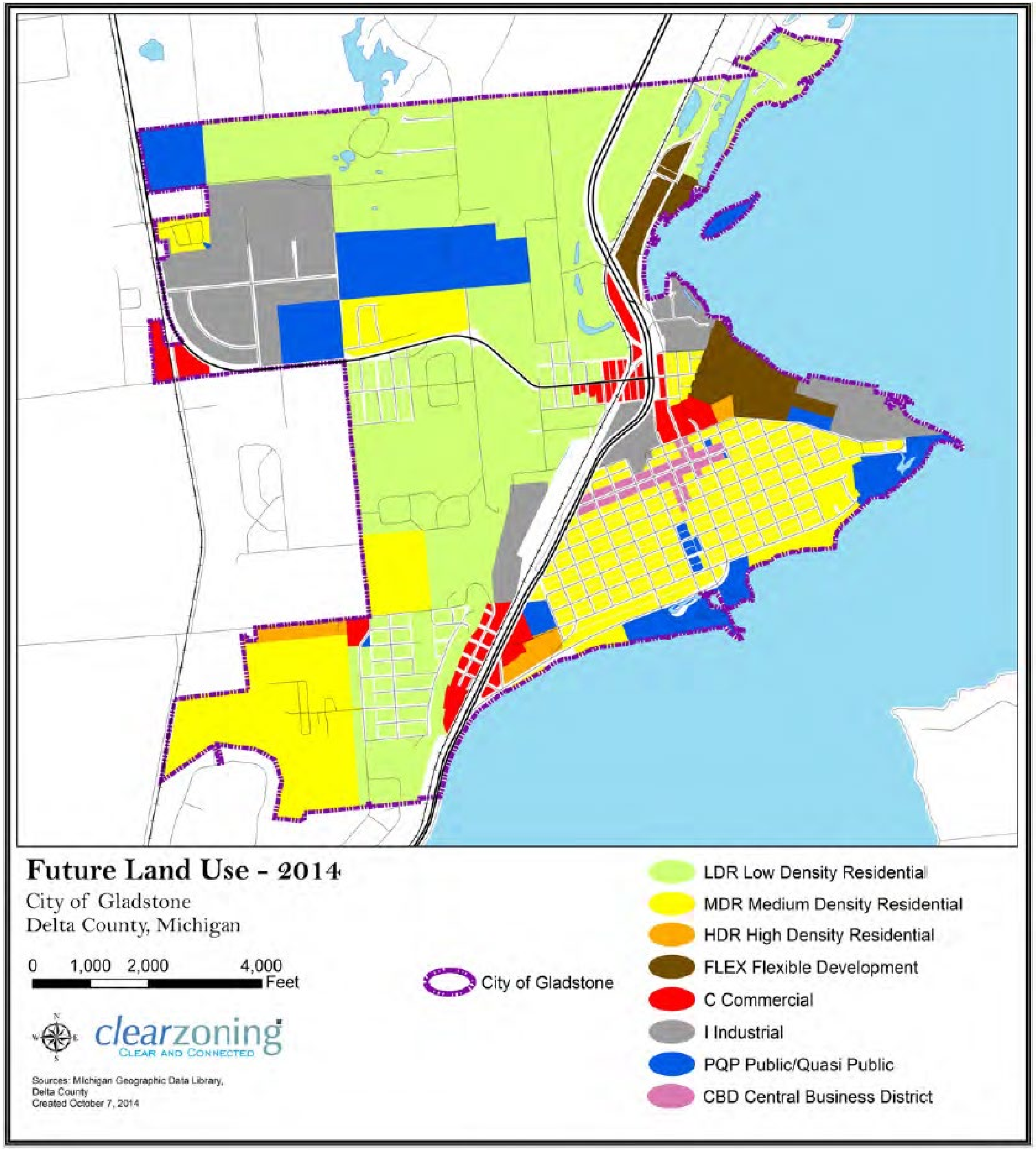
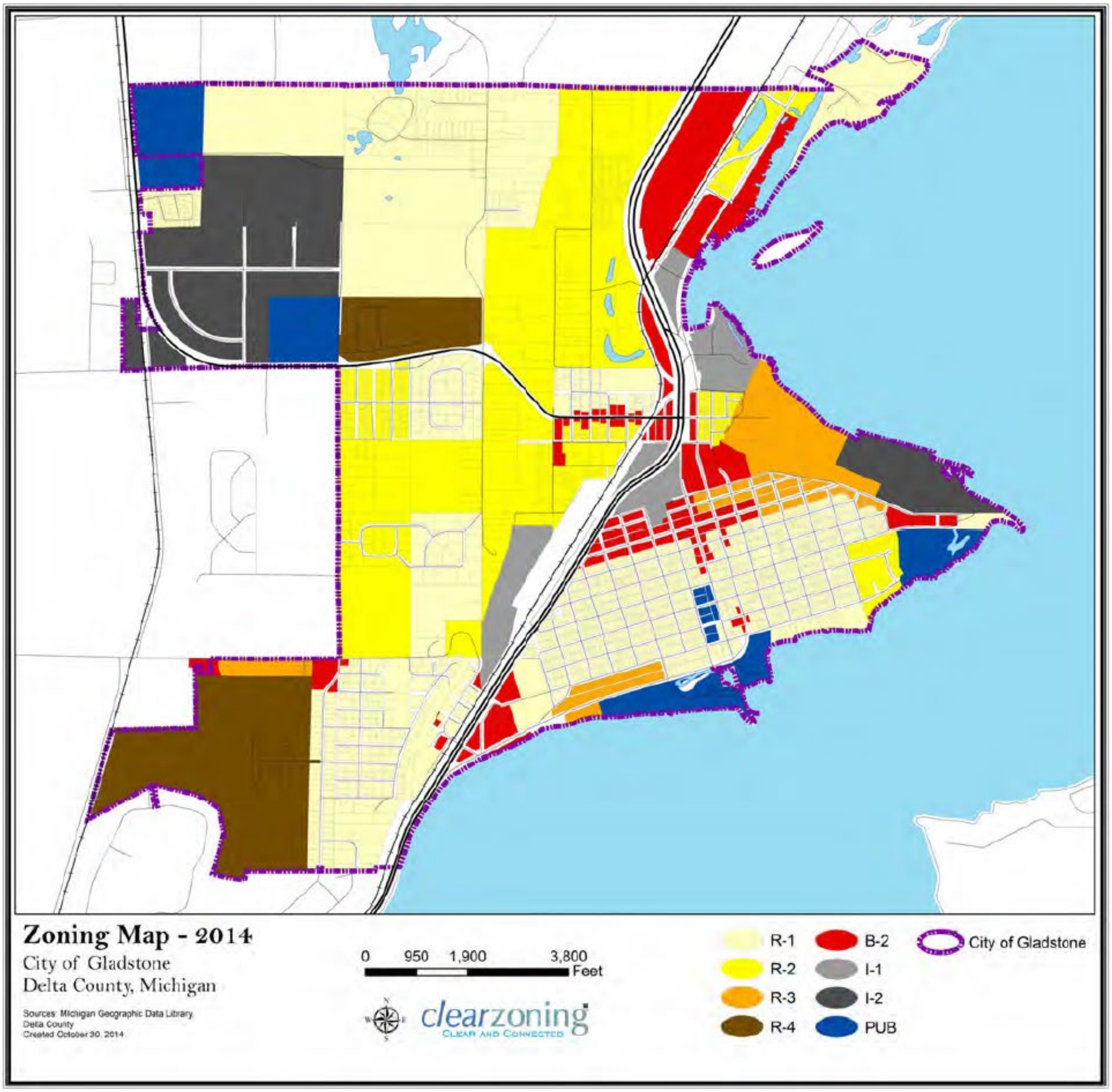


Figure 6: Zoning



Population

For purposes of this study/report and effects on the City's wastewater system size, operation, reliability, and capacity, population in the service area is projected to stabilize or slightly decrease (see Table 2). This assumes the local economy does not experience significant changes and is based apparent census trending since 2010.

Table 2: Population

Area	1970 (a)	1980 (a)	1990 (a)	2000 (a)	2010 (a)	2020 (b)	2030 (b)	2040 (b)
City of Gladstone	5,237	4,533	4,565	5,042	4,973	4,860	4,850	4,840
Masonville Township				1,877	1,734	1,730	1,720	1,710
Brampton Township	377	1,113	1,142	1,090	1,050	1,050	1,040	1,040
Escanaba Township	1,948	3,229	3,340	3,587	3,482	3,470	3,460	3,450
Wells Township	4,003	5,181	5,159	5,044	4,885	4,870	4,860	4,850
Delta County	35,924	38,947	37,780	38,520	37,069	36,960	36,850	36,740
(a) – US Census for 1970 to 2010								
(b) – Estimated Approx. 0.3% drop per decade based on CUPPAD 2016 "Escanaba Master Plan" estimated 0.6% drop in Delta County from 2010 to 2040								

Economic Characteristics

The economic conditions of the study area are primarily influenced by the paper processing industry (a paper mill in the nearby Escanaba/Wells Township), tourism, and recreation. The area as a whole is ideally suited for these industries because of the Gladstone being centrally located in the Upper Peninsula and its shoreline. The waterfront provides for boating, fishing, and other water related services.

Gladstone's extensive lakeshore includes a modern marina and large public park areas. Trunklines US-2/41 and M-35 pass through the west-central portion of the City. The Canadian National railroad owns a major switching yard in the City limits and provides service within the City.

The area's major employers and their approximate number of employees is listed in Table 3 which follows.

Table 3: Major Employers

Employer	# of Employees
Gladstone Schools	148
Canadian National RR	82
VanAire, Inc.	73
Besse Forest Products Group	60
US Forest Service	50
First Bank	49
City of Gladstone	36
Lakeview (Seniors)	29
Marble Arms	26
Bay Bank	24
Independent Machine	23
Pardon Industries	18
USDA Service Center	18
Alger Delta Electric Co-Op	13

Existing Facilities

Treatment Facilities

Gladstone began providing municipal sewer service to its residents in the early 1900s with the first iteration of the current treatment plant constructed in 1954. A major upgrade to RBC Secondary treatment came in 1972.

The wastewater system serves approximately 2,222 customers (2,050 City and 172 Masonville Township). The current service area covers approximately 4.1 square miles (3.0 City of Gladstone and 1.1 Masonville Twp.).

A diagram of the existing WWTP facility site can be found in Figure 7 on the following page.

Figure 7: Existing WWTP Facility Site

The WWTP processes are summarized in Table 4 which follows, while detailed process descriptions and a construction history follow.

Major treatment unit process design and operating criteria were evaluated and compared to standard industry references and recommended design criteria. Comparisons included 2014 Ten State Standards for Wastewater and Water Environment Federation Manual of Practice MOP-8. The Process Evaluation Spreadsheet is included with this report as Appendix A.

Table 4: Wastewater Treatment Plant

Process	Summary Description
Design Flow	1.0 MGD average day 2.8 MGD maximum day flow 3.0 MGD existing, 3.5 MGD future peak hour flow, 4.2 MGD 25-Year, 24-hour peak hydraulic rate
Screening	One manually raked bar screen
Raw Sewage Pumping	Three 1,000 gpm non-clog centrifugal sewage pumps (2.5 MGD firm capacity)
Flow Measurement	6" Parshall Flume
Grit Removal	Single channel, manually cleaned grit system Tank is 19' W x 22' L x 2' operating depth
Primary Settling	Single clarifier at 14' W x 68' L x 11' D
Secondary Treatment	Six rotating biological contactors and two 14'W x 58'8"L x 10'D Final Settling Tanks
Chlorination	Chlorine gas with 22' W x 31'10" L x 6'2" D contact tank
Chemical Feed	Alum and polymer for phosphorus removal
Outfall/Discharge	800' of 16" gravity sewer
SCADA	Active but aging relay based analog SCADA system
Biosolids Management	One primary digester (35' diameter x 17'6" depth), one secondary digester (35' diameter x 17'6" depth), and one storage tank (500,000 gal)

Process	Additional Narrative Summary
Peak Flow to the WWTP	Evaluations of the Gladstone WWTP and its processes have prepared for a maximum hour wet weather flow of 3.5 MGD based on historic records and with an allowance for future tributary flows. The 25-year, 24-hour flow is 4.2 MGD
Screening	Raw Sewage is screened of larger solids by one manually raked bar screen at the inlet point of the 16-inch interceptor sewer.
Raw Sewage Pumping	Sewage to the WWTP passes through a coarse manual bars screen and enters the wet well for the Raw Sewage Pumps (Previously named the Primary Influent Pumps).
Flow Measurement	Existing 6-inch Parshall Flume.
Grit Removal	The Existing manually cleaned, constant velocity grit removal channel.
Primary Settling	Only one primary settling tank serves the WWTP.
Rotating Biological Contactors (RBCs)	The existing RBC system performs well under current conditions. The average flow and loading during the 2014 to 2018 period of record analyzed for this study had an average flow of 0.66 MGD, with an average influent BOD concentration of 156 mg/L. The original Basis of Design used 1.0 MGD with 210 mg/L BOD. Under these more stringent conditions, and at winter time wastewater temperature conditions, an additional train of RBCs would be recommended to ensure consistently reliable treatment.
Chlorination	Evaluations within this report recommend that continued feed of chlorine gas is the most reliable and cost effective means of effluent disinfection.
Chemical Feed	Existing facilities for feeding alum and polymer for phosphorus removal continue to provide good service however significant improvements are needed to incorporate modern feed technology and metering accuracy.
Primary Effluent Pumps	Two Primary Effluent Pumps receive flow from the RBC process and pump to the Final Settling Tanks. Replacement of the Pumps due to age is recommended.
Electrical Upgrade	The WWTP Secondary 480 Volt, Three Phase feed with MCC-A and MCC-B is located adjacent to the current lab. This area will be isolated from the Primary/RBC tank area and upgrade to provide sufficient service capacity for WWTP improvements.

Process	Additional Narrative Summary
Digester Gas Dual Fired Boiler	Methane gas formed in the anaerobic digester is burned to provide heating energy for the digestion process.
SCADA	The existing WWTP has a relay based analogue control and monitoring system.
Primary Digester Mixing	The existing digester gas draft-tube mixing system will require complete rehabilitation or replacement because of age.
Digester Gas Dual Fired Boiler	Methane gas formed in the anaerobic digester is burned to provide heating energy for the digestion process.
Secondary Digester Floating Cover Replacement	Methane gas formed in the primary anaerobic sludge digester is captured and stored by the floating cover on the secondary digester.
Normal Asset Upgrades	Recommended maintenance and potential improvements to these existing assets will be included in the final asset field inventory under the SAW asset management program.

Peak Flow to the WWTP:

Evaluations of the Gladstone WWTP and its processes have prepared for a peak 25yr/24hr wet weather hydraulic flow of 4.2 MGD based on historic records, modeling, and with an allowance for future tributary flows. This compares to an original peak design flow of 2.5 MGD. The existing average annual flow is 0.66 MGD compared to an original design capacity of 1.0 MGD. Because Gladstone exceeds maximum I/I guidelines of the State of Michigan, it was necessary to complete an I/I Study and perhaps a future Sewer System Evaluation Study (SSES) to make a final recommendation as to design peak flows. It will ultimately be necessary for the facility to accept and treat the 25-year, 24-hour hydraulic peak of 4.2 MGD as developed in the Gladstone I/I Report completed in 2019.

Screening:

Raw Sewage entering the plant is first routed through a coarse, manually raked bar screen. The bar screen has one-inch clear spacing and is designed to overflow the sides if the upstream water level surcharges approximately 18 in. above the top of the influent sewer pipe. Gladstone is not aware of basement flooding resulting from surcharging of the screen.

Raw Sewage Pumps:

Screened sewage enters the wet well and is lifted by three, 1000 gpm vertical, non-clog centrifugal sewage pumps. All were installed in 1972 and have received as-needed maintenance and rehabilitation. Normal maintenance has been performed and pumps are old but in reliable condition. Variable speed drives were installed in 2017. It is estimated that the firm pumping capacity of the Raw Sewage Pumps is 2.5 MGD which is below the proposed future peak of 4.2 MGD.

The raw sewage pumping system has required regular maintenance to remove rags and foreign objects which have lodged in the pump volute. In addition, the motors are located below grade along with the VFDs. Potential improvements to upgrade screening are discussed in another section of this report. The suggested upgrade will be to install fine screening after the Raw Sewage Pumps. Replacement of the exiting pumps with high quality dry pit submersible, grinder type pumps with variable frequency drives is recommended based on the age, location, circumstances of the existing pumping system. Potential installation of new variable speed drives above grade will be considered during design. Other types (i.e. – chopper style) of raw sewage pumping shall also be evaluated during the project planning phase.

Flow Measurement:

The existing 6-inch Parshall Flume will be abandoned with construction of the new processes. A new magnetic flow meter will be installed in the Raw Sewage Discharge Piping.

Grit Removal:

Raw Sewage Pumps discharge to open flow channels which contain constant velocity type grit removal, Parshall Flume metering, and raw sewage grinding. Grit removal is accomplished in one constant velocity channel with a bypass channel. Separated grit is removed manually.

Primary Settling Tanks:

From the Existing Grit/Grinder Channel sewage flows by gravity through piping to the single rectangular primary settling tank. This process allows heavier inert and organic solids to settle out and be removed from the tank as raw sludge. Grease and scum is also removed by floatation in the primary tank. The settling tank is 13 ft wide by 58 ft long with an 11.0 ft side water depth, and is housed in a heated building. Surface settling rates in the single tank are 875 GPD/sf at present average flow and 4,632 GPD/sf at future maximum hydraulic flows. Ten State Standards recommends a maximum of 1,000 at average and 1,500 to 2,000 GPD/sf at peak hydraulic flows. The existing primary settling process is significantly undersized per Ten State Standard and lacks the important reliability function of the dual tank system, which allows for one tank to remain in service while maintenance is performed the other tank. A second primary settling tank was recommended in the 1998 McNamee study, and redundant primary separation remains an important need today.

Rotating Biological Contractors (RBCs):

Organic matter in the wastewater that is not removed by Primary Settling is treated by Rotating Biological Contactors (RBCs). The slowly rotating plastic media discs promote the growth of an attached biomass coating that absorbs then oxidizes pollutants, effectively removing them from the flow stream.

The NPDES Permit requires that 30-day average Effluent CBOD to be less than 25 mg/L, and that the average for any consecutive seven-day period be less than 40 mg/L. In addition, the Permit requires the plant to achieve minimum percentage BOD removals of 85% year round.

The design of RBCs is based upon the surface area provided for biomass growth. The amount of surface area required is a function of the concentration of soluble BOD to be removed, the temperature of the incoming sewage, and the flow rate per square foot of media surface. Empirical graphical design tools, based upon bench scale experiments and full scale experience, are available from the manufacturers of these devices. The current system has approximately 540,000 sf of surface area.

Chlorination:

The disinfection process at Gladstone utilizes chlorine gas stored in 150 pound cylinders with a single 22’ by 32’ by 6’ 2” SWD Chlorine Contact Tank. The chlorine contact tank is divided to facilitate maintenance and is baffled at a Length/Width ratio of approximately six to one. Contact time in the tank alone is approximately 70 minutes at present average flow and 13 minutes at a future peak hourly flow of 3.5 MGD. The chlorine contact tank was constructed in 1974. The existing outfall pipe is 16-inch in diameter and approximately 950 ft long extending 800 ft into Little Bay de Noc. Including the outfall pipe contact times, 90 and 17-minute total contact time are provided at average and future peak hourly flows respectively.

The available disinfection contact times in Gladstone are well above recommended minimum values of 15 minutes listed in Ten State Standards at all but proposed future peak flows.

Final Settling Tanks

A principal design consideration for settling tanks is the surface overflow rate (total flow divided by total surface area). The Ten State Standards as well as other standard reference texts suggest that surface overflow rates not exceed 1200 gallons per day per square foot (GPD/sf) at peak flows for Settling Tanks following fixed growth treatment units like RBCs. The maximum allowable flow through the two existing 60 ft long and 14 ft wide rectangular Final Settling Tanks based upon this restriction is slightly more than 2.0 MGD. The overflow rate at the original Design Peak of 2.5 MGD would be 1488 GPD/sf. At the proposed Peak Hourly Rate of 3.5 MGD, it would be 2083 GPD/sf.

An additional consideration with the Final Settling Tanks is the performance of the effluent weir. Design standards recommend limiting the overflow rate for clarifiers following RBCs to 20,000 GPD/lf. The existing weir arrangement provides approximately 184 lf of weir in each tank. Overflow rate at 3.5 MGD (Peak Hourly) would be 19,022 GPD/lf.

In addition to the Ten State Standards, designs of municipal WWTPs are subject to Reliability Criteria published by United States Environmental Protection Agency (USEPA). For Gladstone's WWTP, because the design flow is 1.0 MGD or less, and it discharge directly into Lake Michigan, the requirement is only that it must accommodate at least 50% of the design Peak Flow with one clarifier or one train of RBCs out of service.

Chemical Feed:

Existing facilities for feeding alum and polymer for phosphorus removal continue to provide good service however significant improvements are needed to incorporate modern feed technology and metering accuracy.

Primary Effluent Pumps:

Two Primary Effluent Pumps receive flow from the RBC process and pump to the Final Settling Tanks. Replacement of the Pumps due to age is recommended.

Electrical Upgrade:

The WWTP Secondary 480 Volt, three phase feed with MCC-A and MCC-B is located adjacent to the current lab. This area should be isolated from the Primary/RBC tank area and upgraded to provide sufficient service capacity for WWTP improvements.

SCADA:

The existing WWTP has a relay based analogue control and monitoring system dating to 1974. New digital based Supervisory Control and Data Acquisition (SCADA) system have completely replaced relay technology and far superior a monitoring and control the increasing complexity of today's WWTPs. A new personal computer based SCADA system is recommended along with other plant improvements.

Primary Digester Mixing:

The existing digester gas draft-tube mixing system will require complete rehabilitation or replacement because of age. A cost analysis on similar sized digesters, completed previously, suggests that a Mechanical Pump and Nozzle mixing system can require less initial capital costs and result in improved maintenance. It is recommended that the existing system be replace with a new pumped sludge nozzle mixing system.

Digester Gas Dual Fired Boiler:

The existing dual fired (digester gas or natural gas) boiler is 45 years old and is now inefficient and difficult to maintain. It is recommended that a new replacement dual fired boiler with separate spiral heat exchanger be furnished. This results in less capital cost and potentially improved burning efficiency. An alternative boiler and backup power cogeneration unit is to be reviewed.

Secondary Digester Floating Cover Replacement:

The existing cover is 45 years old with prior repairs performed and in need of replacement. Complete rehabilitation is proposed to replace protective coatings and make necessary repairs.

Normal Asset Upgrades:

There are other equipment items and structures in addition to the major treatment processes and equipment itemized above. Recommended maintenance and potential improvements to these existing assets will be included in the final asset field inventory under the SAW asset management program. These repair and maintenance based, lesser capital improvements, will be described in the Wastewater Asset Management Plan (WAMP) field inventory process and will be reviewed with the City in the future.

History:

The Gladstone WWTP was initially constructed in 1938 as a primary treatment plant and was expanded under several contracts as noted below.

- 1938 – Initial Construction, Primary Settling, Disinfection, and Anaerobic Sludge Digestion
- 1972 – Modified current preliminary treatment and added Rotating Biological Contactor (RBC) Secondary Biological Treatment. Improvements to Anaerobic Sludge Digestion, including the dual fired boiler, were constructed at this time.
- 1994 – two Complete RBC shafts and media were replaced

<u>Sludge Handling</u>

Waste biosolids from the Primary Settling Tank and Final Settling Tank are stabilized prior to ultimate disposal using Anaerobic Digestion. This process places the biosolids into one Primary Digester that is mixed and heated to maintain an operating temperature of approximately 95°F. Raw sludge is fed to Digester No. 1 and then allowed to overflow to Digester No. 2. Inside the primary digester tank, microbes consume about half of the volatile portion of the biosolids, producing a combustible mixture of methane gas and carbon dioxide. Air is excluded from the tank because the desired microorganisms thrive in anaerobic conditions. Note that air in the tank would also create a potentially highly explosive mixture with the methane produced. Excess sludge solids in Digester No. 2 is sent to the sludge storage tank, supernatant is decanted from the sludge storage tank and redirected back to the raw sewage pumps wet well.

After treatment in Primary Digesters No. 1 and Secondary Digester No. 2, the biosolids are directed to rectangular Sludge Storage Tanks No. 3 and 4 (halves of one tank) where further decanting and gravity thickening occurs. Gladstone disposes of sludge on City land, utilizing WWTP staff and equipment, under an EGLE approved Residuals Management Plan (RMP).

The Secondary Digester is equipped with floating, gas-holding cover installed in 1974. The floating cover is designed to provide a volume for the gas to be stored at a constant pressure as it is produced so it can be used as boiler fuel to maintain the required temperature in the Primary Digester and for other purposes such as building heating.

The Primary Digester is mixed with internal gas lances in a center mounted eductor tube, and recirculated digester gas. Equipment was installed in 1974 and is in need of major rehabilitation or replacement.

The existing digesters and storage tanks are generally performing well and have adequate treatment capacity to accept future design average flow.

Collection System

The City of Gladstone owns and operates its water and wastewater utilities serving approximately 5,400 residents in the City of Gladstone and Masonville Township 2019. The wastewater system consists of the following:

- 32 miles of 8-to 30-inch collector sewer (plus 2.7 miles in Masonville Township).
- Ten major pump (lift) stations ranging from 40 to 400 gpm firm capacities.

Gladstone's wastewater collection system serves slightly over four square miles of residential, commercial, and light manufacturing customers (3.0 City of Gladstone and 1.1 Masonville Twp.). Most of the collector sewers are located on developed City street or alley rights-of-way with interceptor sewers more typically cross-country.

Gladstone owns a separated wastewater collection system which has historically delivered low to moderate levels of clean water infiltration and inflow to the WWTP. Rising groundwater tables due to higher lake levels and increased precipitation periods has resulted in abnormally high peak flows in the last one to three years. These conditions have pointed out that the collection system has begun to allow excess clean water into the system again following corrective work in the early 1980s. Because of the generally sound collection system performance under low lake levels, the need to study, understand, and improve the collection system has been minimized over the last two decades. Review of current WWTP flow records, the 1980 MPS I/I Study, 1982 MPS SSES Study, 2005 Wilcox I/I Study, 2018 SAW flow monitoring, 2019 I/I Study, sewer televising, and physical inspections of the manholes contributes to the thinking that clean water flows are mainly due to infiltration through joints in the pipe, footing drains connections, and sump pump discharges. Collection system makeup is summarized in Table 5 on the following page.

Table 5: Collection System

GRAVITY SEWER						
Size	**Footage**	**Inch-Miles**		**Size**	**Footage**	**Inch-Miles**
30”	398’	2.3		10”	19,182’	43.6
24”	1,465’	6.7		8”	103,757’	157.2
21”	2,141’	8.1		**City Total (a)**	**156,947**	**287**
18”	4,637’	15.8		**4”-6” Svc (b)**	**111,100**	**105**
15”	5,048’	14.2				
12”	19,182’	43.6		Masonville 8”	14,354’	22
				Masonville 6”	9,700’	9
(a) Does NOT Include Masonville Township sewers (however included in later table for I/I calculations but they are not owned by the City) *(b) = Number of customers x 50’ (30’-35’ in ROW & 15’-20’ in private property)(used 2,050 Gladstone and 172 Masonville customers)*						
FORCE MAIN						
Size	**Footage**		**Size**	**Footage**		
8”	217’		4”	2,634’		
6”	4,372’		2”	239’		
MAJOR PUMP STATIONS						
Name		**Location**		**Pumps**		**Force Main**
Underpass		411 4^{th} Ave N (M35)		2 ea @ 400 gpm		2,367’- 6”
Industrial Park		Rains Dr.		2 ea @ 225 gpm		465’ – 6”
North Bluff		Clark Dr. at M35		2 ea @ 75 gpm		599’ – 6”
State Police		917 Minneapolis Ave		2 ea @ 150 gpm		13’ – 4”
High School		3506 Braves Ave		2 ea @ 140 gpm		1,099’ – 4”
WWTP Pump Station		413 Minneapolis Ave		2 ea @ 300 gpm		20’ - 6”
East End		201 Michigan Ave		2 ea @ 100 gpm		920’ – 6”
Lakeshore		1501 Lakeshore Dr.		2 ea @ 90 gpm		224’ – 8”
South Bluff		22 Oakbluff Hts		2 ea @ 80 gpm		1,516’ – 4”
Oakwood		35 Sandy Lane		2 ea @ 40 gpm		24’ – 2”

Note: footage totals may vary from those listed in the City’s Asset Management Plan (AMP) depending on when the AMP data is downloaded & totaled, as it is a tool that changes as knowledge of, and changes to, the system occur.

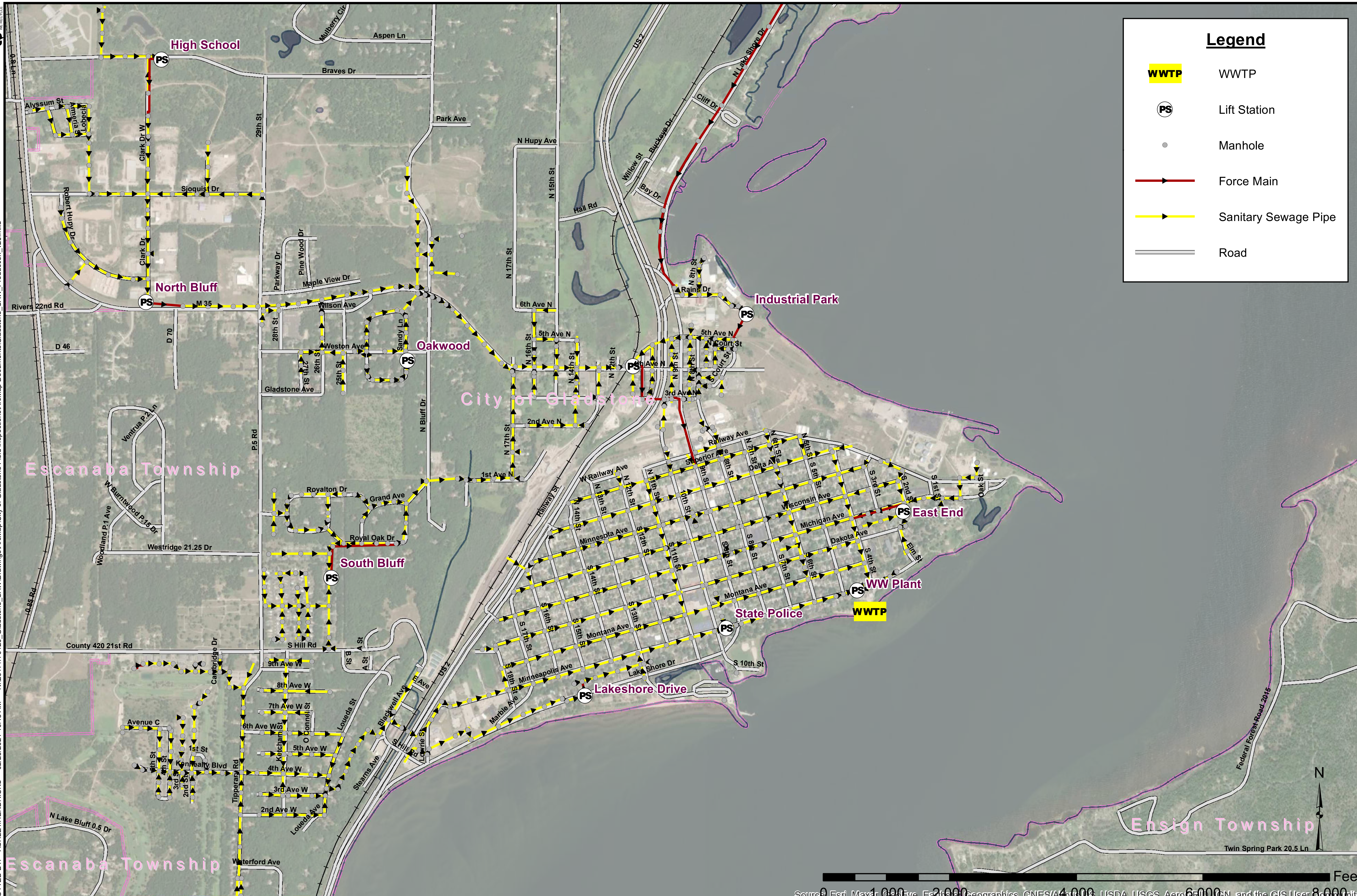
The downtown business area and surrounding residential areas have sewers aged 75 to 100+ years old totaling approximately 13.5 mi of the collection system. Other older residential areas are 50 to 75 years old totaling approximately 2.0 mi of the system. Collection system total is 32 mi within the City of Gladstone and 2.7 mi in Masonville Township.

Service laterals in the collection system are largely four-inch vitrified clay pipe (VCP) with polyvinyl chloride pipe (PVC) coming into general use in the last few decades and during most mainline sewer replacements and extensions (PVC typical in North and South Bluff areas and Masonville Township). The older VCP laterals are considered a source of infiltration, especially those on private property, which are generally not replaced during sewer upgrades.

During the asset inventory/evaluation phase of the City's SAW funded asset management program, 35 manholes were identified as being structurally deficient and in need of replacement. They, along with those sewer segments identified as being at risk, have been incorporated into annual maintenance and capital spending budget planning under the SAW asset management program.

System Component Locations

The City of Gladstone owns and operates its water and wastewater systems serving approximately 2,050 customers within the City and 172 Township customers. The City provides water and wastewater service to residential and commercial customers within the City limits and wastewater service to the developed Rapid River area of Masonville Township. Several residences in the Kipling area of Brampton Township are also served. The wastewater service area is shown in Figure 2 on Page 14 while a collection system map with locations of the WWTP and pump stations can be found as Figure 8 on the following page. Larger scale maps can be found in the rear pocket of this report, Appendix F.



CITY OF GLADSTONE
PROJECT: 21-0088
DELTA COUNTY, MICHIGAN

FIGURE 8: COLLECTION SYSTEM AND FACILITY LOCATIONS

c2ae architecture + engineering

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System Capacity, Flows, and Waste Characteristics

The present WWTP provides manual coarse screening and grit removal, single vessel primary settling, two trains of RBC secondary biological treatment, two rectangular final clarifiers, and disinfection prior to discharging to Lake Michigan under National Pollutant Discharge Elimination System (NPDES) Permit MI0057676. In 1998, an evaluation of the Gladstone WWTP was conducted by McNamee, Porter, and Seeley of Escanaba. The finding of this report has been used as guidance in preparation of the Process and Facilities Overall Evaluation Report.

The 1972 WWTP expansion was designed for an annual average flow of 1.0 MGD and a peak sustained flow through secondary treatment of 3.0 MGD. Normal average flows are in the range of 60% of design and peak hydraulic flows have been below 3.0 MGD. Flow during wet weather months has reached 1.13 MGD average.

It is recommended that the design peak hydraulic raw sewage flow from the existing service district be 4.2 MGD for purposes of this Project Plan evaluation and report based on recent flow monitoring. A 25-year, 24-hour peak hydraulic flow in conformance with EPA guidelines has been separately estimated at 4.2 MGD (see Appendix A for memo summarizing modeling efforts).

In the Table 6 below, are current (2014 to 2020) annual flows and annual average loading values:

Table 6: WWTP Flow and Waste Characteristics

Item	Current Masonville	Current Total
Annual Average (MGD)	0.029	0.74
Maximum Month (MGD)	0.033	1.48
Maximum Day (MGD)		2.82
Peak Hydraulic (MGD)		3.24
Ex. Biochemical Oxygen Demand (BOD_5,mg/L)		147
Design BOD_5		210
Ex. Total Suspended Solids, (TSS, mg/L)		146
Design Total Suspended Solids, (TSS, mg/L)		250
Total Phosphorus, TP (mg/L)		3.2

Gladstone's treated wastewater discharge limits are noted in their NPDES Permit, found in Appendix B.

Septage

The Gladstone WWTP does not presently accept septage from the surrounding area. Septage handling gets mixed reviews. On one hand, it can provide a revenue stream to help defray the costs of plant operation and maintenance. On the other, it can present challenges to the treatment process due to its high strength and to the Biosolids handling system from the additional solid matter and grit it contains, and care must be taken to avoid generating objectionable odors.

Our assessment of the secondary treatment capacity indicates that some could be available for this purpose if desired. Prior to a final decision, a more thorough analysis using actual projections of proposed loading would be advisable. This is also true of the Anaerobic Digesters. In some locations, septage is introduced directly to the digesters rather than into the wastewater treatment process.

If at some time in the future it is determined to be advantageous or necessary to allow septage haulers to discharge at the plant, a dedicated Septage Receiving Station with controlled access using a card reader or other similar security device and an automatic valve to prevent unauthorized discharges is recommended. The installed cost of such systems depends heavily on the volume to be received and the degrees of automation and security desired. Actual system components should be located in an enclosed area and include equipment to remove grit and large objects prior to allowing the residual material to be processed. A large enough containment to provide equalization and capture a load while some initial testing is performed is also frequently included.

Industrial Discharges

The City has no major industrial dischargers, but several small manufacturers and commercial users. No users operate under a formal Industrial Pretreatment Program.

Dry and Wet Weather Flows

WWTP flow data was reviewed for 2015 to 2019 as a preliminary I/I evaluation to gauge whether additional data generation and analysis would be appropriate. Results are summarized in the infiltration/inflow discussion which follows with related previous study data included in Appendix A. The full report is available can be provided if requested.

Infiltration and Inflow

ASCE/EPA Guidance

In 2004, the American Society of Civil Engineers (ASCE) and EPA published additional compiled measures to assist in defining excessive and non-excessive I/I that rely more on the makeup of the sewer pipe being studied and less on the arbitrary assigning of service area population. These were generally developed in the 1980s and 1990s to assist in EPA Grants administration. See additional details in Appendix A, summarizing the I/I Study.

The excessive/non-excessive breakpoint is based on gallons per day (GPD) per inch-diameter x miles of sewer. Allowance is also made for service district size.

Non-excessive I/I Allowance	Length of Sewer
2,000 – 3,000 GPD/in-mi	>100,000 lf
3,000 – 6,000 GPD/in-mi	10,000 – 100,000 lf
5,000 – 10,000 GPD/in-mi	<10,000 lf

The 2004 published criteria also noted factors used in current Michigan SRF Program Project Planning (per capita based criteria):

Non-excessive Infiltration

- Preceding year's 7 to 14-day high groundwater wastewater flow < 120 gpcd

Non-excessive Inflow

- Total daily average storm flow <275 gpcd
- No operational problems in collection and WWTP

EGLE Project Plan Guidance

EGLE's Project Plan preparation guidance (current as of May 2016) provides additional guidance on when to monitor flows for their per capita based criteria as shown below. See additional details in Appendix A.

- < 120 gpcd – high groundwater – March/April/May and September/October/November
- < 275 gpcd – storm data – six largest precipitation days from April 1st to October 31st – extrapolate data to the 25-year, 24-hour storm event as needed
- No backup problems, overflows, or poor treatment due to hydraulic issues

The following is quoted from the EGLE Project Planning guidance (underlining added):

*"An evaluation of I/I should be completed for each existing collector system in the study area. Both private and public sources of I/I must be included in this evaluation. If **any** of the following conditions exist, then an I/I analysis **must** be performed during project planning:*

1. *Wastewater flow during high groundwater conditions is greater than 120 gallons per capita per day (gpcd). For a calculation of this threshold number, look at the metering data for the spring months of March/April/May and the fall months of September/October/November (non-precipitation days);*
2. *Wastewater flow during the design storm event or when any smaller storm event is greater than 275 gpcd. For a calculation of inflow from the WWTP records, use flow metering data for the period April 1 through October 31. Select at least six of the largest storm events for analysis. Extrapolate the data to the recommended remedial design standard (25-year/24-hour storm event during growth conditions and normal soil moisture) using the longer duration storms; or*
3. *Storm events cause backup problems, overflows, or poor treatment performance due to hydraulic overloading"*

Overall System Flows Review

Four years of WWTP influent flow and precipitation records were compiled and evaluated in early 2019. Total system flow during high groundwater periods (infiltration impacted) topped the 120 gpcd infiltration guidance figure several times, however gpd/in-mi data which considered sewer size and length was very reasonable (all under 2,300 GPD/in-mi).

Flow during the largest precipitation periods (inflow impacted) has reached 1.13 MGD average and exceeded the 275 gpcd guideline three times in 2017 and 2018. Numerous overflows occurred in April and May 2019. The gpm/in-mi guidance was also exceeded on those days.

2018 Flow Monitoring

As part of the City's SAW Asset Management Plan (AMP) development, four flow monitors were installed in the wastewater collection system from September 7 to December 4, 2018. Tributary Area #01 connects downtown business and residential areas to the WWTP. Water collected in tributary Area #04 (North and South Bluff) flows into Area #03 (between Downtown and Kipling) and then into meter Area #01. Tributary Area #02 reaches west from the WWTP to 21st Road on the Bluff.

The location of the collection system flow monitoring and pump stations can be found in Figure 9 and Figure 10 on the following pages.

Table 7 on page 46 details the I/I evaluation data. Dry weather infiltration produced the highest per capita flows in Tributary Area #1, which includes 75 to 100-year-old pipe in the oldest area of the City, downtown business district and residential. Many of the sewers are also downstream and deeper, with greater groundwater impact potential. Areas #2 and #3 are a mixture of approximately 50% older (75 to 100-year-old pipe) made up of primarily residential customers and 50% of moderate age (50-year-old pipe) with a mix of commercial and residential. North and South Bluff residential areas generally have newer construction (within 40 years). "Older" also typically means short length clay pipe with often inadequate or less reliable joints.

Wet weather flows indicated concerns in Area #1 again, the only area with events exceeding the 275 gpcd guideline.

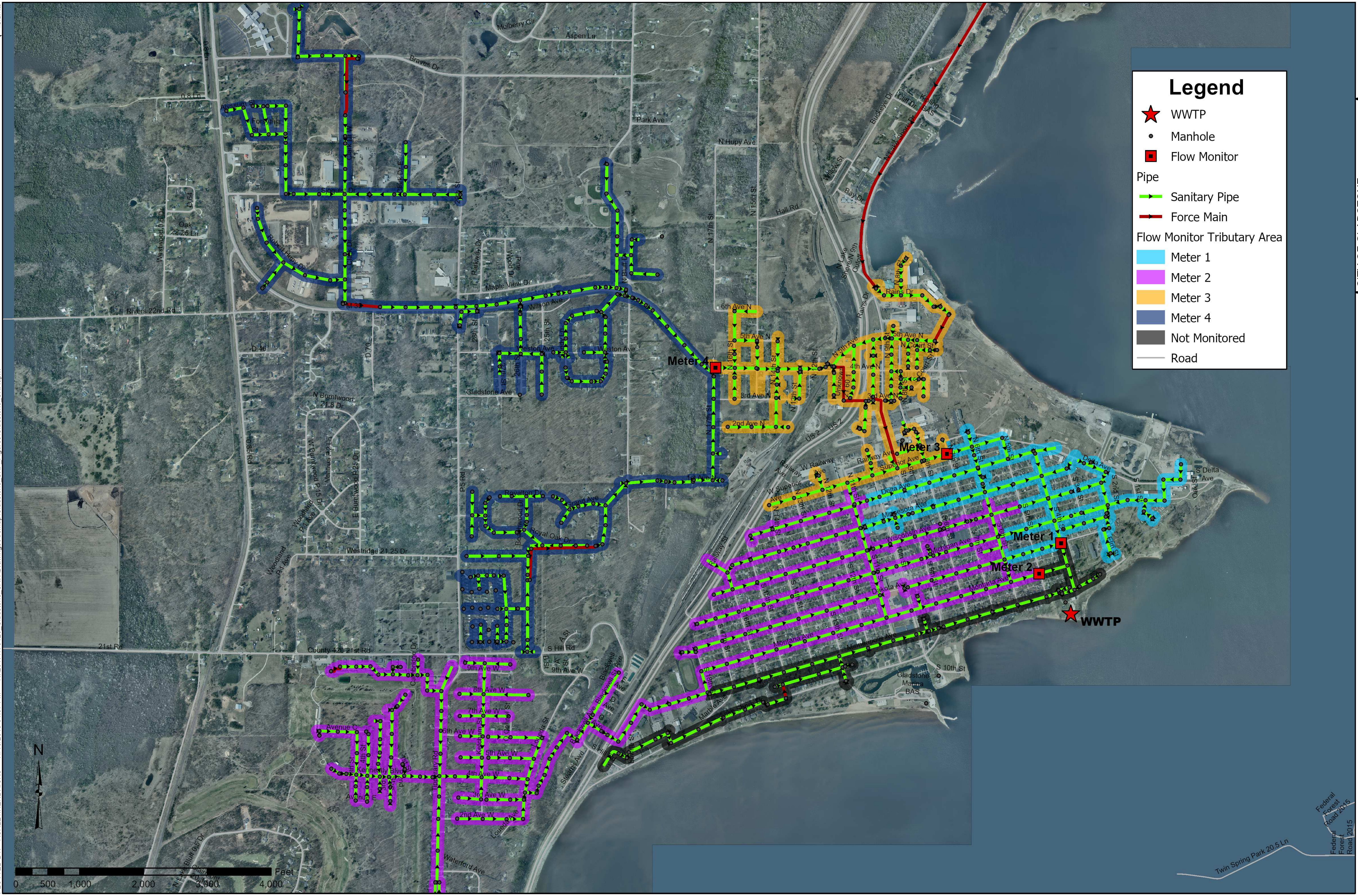

FIGURE 9: FLOW MONITORING TRIBUTARY AREAS

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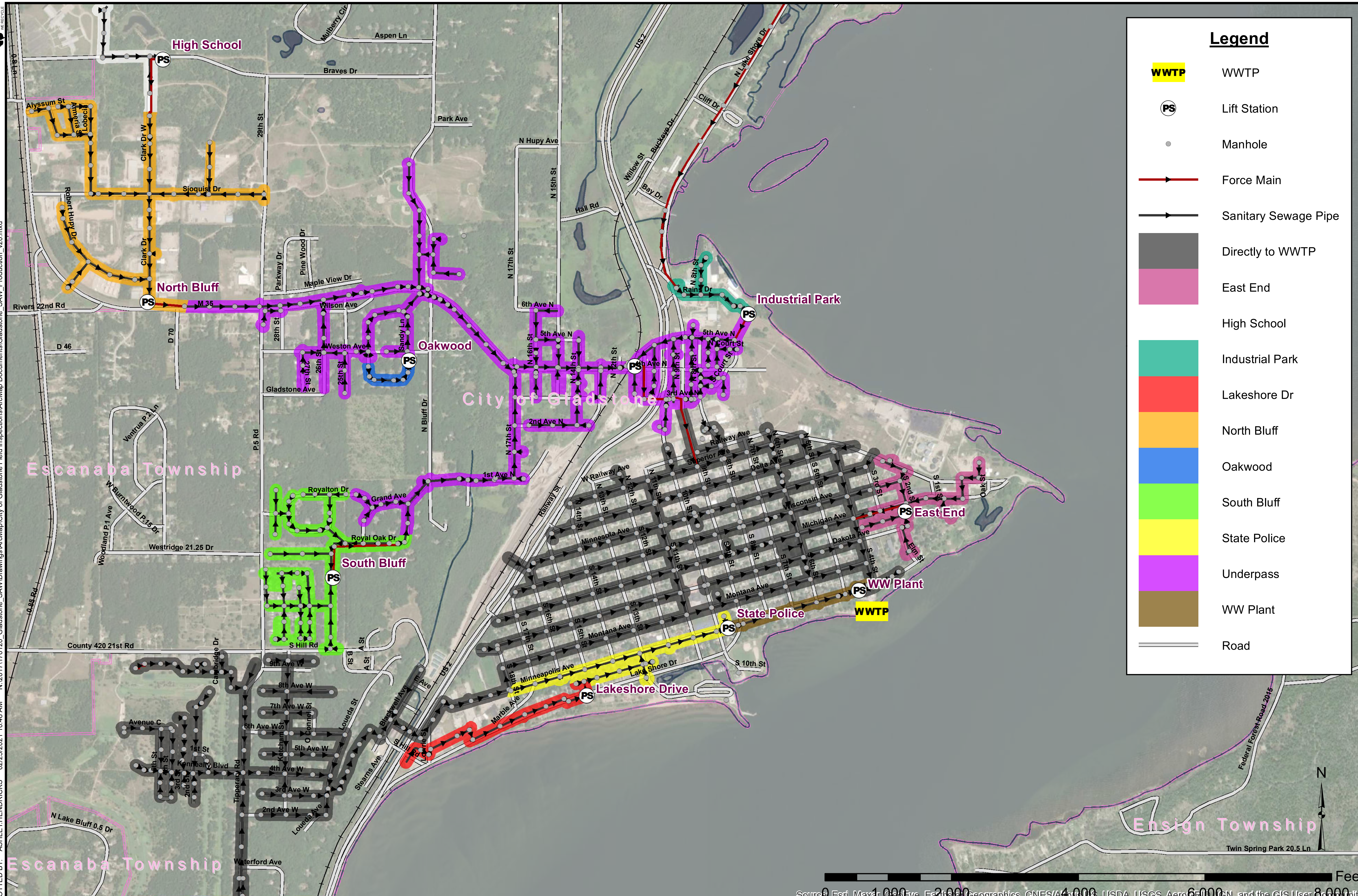

FIGURE 10: LIFT STATION TRIBUTARY AREAS

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Table 7: System Flow and I/I

COLLECTION SYSTEM					
Description:	Entire to WWTP		Existing Flows		
Population:	5,373 (includes Masonville)		Annual Avg. Day:		0.71 MGD
Tot. Footage:	156,000 (mainline)		Peak Hydraulic:		3.24 MGD
Tot. in-mi:	353 (includes laterals)				
INFILTRATION DURING HIGH GROUNDWATER CONDITIONS					
Year	**Non-precipitation Days (Mar-May & Sep-Oct) (7-14 day worst case avg.)**	**Number of Days**	**Avg. Day (MGD)**	**Per Capita (gpcd)**	**Per Inch-Mile (GPD/in-mi)**
2015	May 04 - 10	7	0.643	120	1,822
2015	Sep 01 - 04	4	0.514	96	1,456
2016	Apr 11 - 23	13	0.767	**143**	2,173
2016	Oct 18 - 25	8	0.849	**158**	2,405
2017	May 02 - 10	9	0.854	**159**	2,419
2017	Nov 18 - 23	6	0.783	**146**	2,218
2018	Apr 16 – 30	15	0.792	**147**	2,244
2018	Nov 10 - 17	7	0.808	**150**	2,289
2019	May 10 - 17	8	1.411	**263**	**3,997**
2019	Nov 4 - 12	9	0.878	**163**	2,487
	Guidance Limits			**120**	**3,000**

INFLOW DURING STORM (RAIN) EVENTS					
Year	Highest Rainfall Days (Apr – Oct) (6 Minimum)	Precipitation (in)	Flow (MGD)	Per Capita (gpcd)	Per Inch-Mile (GPD/in-mi)
2015	09/02/15	1.55	0.729	136	1,744
	05/03/15	1.20	0.713	133	1,706
	07/24/15	1.05	0.609	113	1,457
	05/29/15	1.00	0.700	130	1,675
	06/24/15	0.90	0.757	141	1,811
	05/11/15	0.75	0.766	143	1,833
2016	07/16/16	2.00	0.833	155	1,993
	08/20/16	1.30	0.824	153	1,971
	06/25/16	1.20	0.668	124	1,598
	09/16/16	1.00	1.020	190	2,440
	10/17/16	1.00	0.875	163	2,093
	07/17/16	0.80	0.913	170	2,184
2017	06/24/17	2.10	1.525	**284**	**3,648**
	06/11/17	2.00	1.127	210	2,696
	07/11/17	1.45	1.340	249	3,206
	08/01/17	1.20	1.076	200	2,574
	06/18/17	1.00	1.482	**276**	**3,545**
	09/20/17	1.00	0.823	153	1,969
2018	04/15/18	1.00	0.771	143	1,844
	06/16/18	1.25	1.008	188	2,411
	06/17/18	0.80	1.016	189	2,431
	10/08/18	1.00	0.938	175	2,244
	10/09/18	1.15	1.240	231	2,967
	10/10/18	0.95	1.640	**305**	**3,923**
2019	04/17/19	1.25	1.842	**343**	**5,218**
	05/19/19	1.30	2.058	**383**	**5,830**
	05/27/19	0.85	1.829	**340**	**5,181**
	08/26/19	1.30	0.833	155	2,359
	09/12/19	1.10	1.062	198	**3,008**
	09/18/19	1.65	1.399	260	**3,963**
	Guidance Limits			**275**	**3,000**

WWTP flow data from 2015 to 2019 was reviewed as a preliminary I/I evaluation to gauge whether additional data generation and analysis would be appropriate.

Total system flow during high groundwater periods (infiltration impacted) routinely topped the 120 gpcd infiltration guidance figure. Flow during the largest precipitation periods (inflow impacted) exceeded the 275 gpcd and 3,000 gpd/in-mi guidelines numerous times.

System-wide average base flow is estimated at 0.66 MGD which is approximately 123 gpcd. Gladstone's 2018 average annual billed potable water was 228,000 GPD. The base sewer flow can be expected to be 10 to 20 percent higher than billed water to account for the smaller quantities of unavoidable infiltration.

Results - Subsystems

Subsystems Delineation

The location of the collection system flow monitoring and pump stations can be found in Figure 9 and Figure 10 above. The following paragraphs summarize the City's 2018 flow monitoring with detailed descriptions and flows included in the City's 2019 I/I Evaluation.

2018 Flow Monitoring

As part of Gladstone's SAW funded asset management program development, four flow monitors were installed in the wastewater collection system from September 7, 2018 to December 4, 2018. The flow monitoring data is summarized below in Table 8.

Table 8: 2018 Flow Monitoring

METER LOCATIONS AND TRIBUTARY AREAS					
No.	**Location**	**Trib. Area Mainline Sewer Footage**	**Trib. Area Sewer & Lateral Inch-Miles**	**Trib. Area Est. Equiv. Service Population (a)**	
Meter #1	Dakota Ave & S 4th St	100,251	230 in-mi	1,113	
Meter #2	Montana Ave & S 5th St	60,509	156 in-mi	1,879	
Meter #3	Superior Ave & S 17th St	81,275	180 in-mi	2,524	
Meter #4	4th Ave N (M35) & N 17th St	46,534	103 in-mi	1,445	
Not Metered	na	12,272	32 in-mi	381	
TOTALS (b)		173,033	418 in-mi	5,373	
(a) Estimated equivalent population based solely on mainline sewer footage percentage of whole multiplied by total service population *(b) Note Meter 4 flows into 3 which feeds into 1 with tributary areas included in respective totals*					
Average Dry Weather Flow (Infiltration)					
Meter	**Period**	**7- Day Avg. (GPD)**	**Per Capita (gpcd)**	**Per in-mi (GPD/in-mi)**	**Guidelines (GPD/ in-mi)**
#1	Sep 25 – Oct 1	237,000	**213**	1,030	3,000
#2	Sep 25 – Oct 1	101,000	54	647	4,000-5,000
#3	Sep 25 – Oct 1	146,000	58	811	3,000-4,000
#4	Sep 16 – Sep 22	98,000	68	951	4,000-5,000
WWTP (a)	Sep 25 – Oct 1	534,000	99	1,278	3,000
			(guide=120)		
Maximum Wet Weather Flow (Inflow)					
Meter	**Period**	**Peak Day (GPD)**	**Per Capita (gpcd)**	**Per in-mi (GPD/in-mi)**	**Guidelines (GPD/in-mi)**
#1	Oct 10 - 16	648,000	**582**	2,817	3,000
#2	Oct 11 - 17	251,000	134	1,609	4,000-5,000
#3	Oct 10 - 16	338,000	134	1,878	3,000-4,000
#4	Nov 5 - 11	280,000	194	2,718	4,000-5,000
WWTP	Oct 9 - 15	1,291,000	240	**3,089**	3,000
			(guide=275)		

Dry weather infiltration produced the higher per capita flows in Tributary Area #1. Wet weather flows pointed toward Area #1. Areas in the collection system assumed to have excessive I/I are shown in Figure 11 on the following page.

Pump Stations

Also, as part of the SAW AMP program, the City's wastewater collection system pump stations were inventoried and drawdown tested in 2018 to estimate pumping rates (most are not metered other than runtime hour meters). Hour meter readings were then used to approximate flows for the pump station tributary areas to assist in identifying I/I problem areas.

Wet weather inflow from the pump stations data indicates potential in the Underpass, East End, and South Bluff Pump Station service areas. Pump timings are not an acceptable substitute for flow metering but are an additional indicator of potential I/I problem areas.

Downtown Business District Roof Drains

An inventory of commercial roof drains to identify flat roofs with potential connections to the sanitary system was performed for the City's 2019 I/I Study. There were 24 buildings identified which may be contributing inflow. The contributing area may be as much as 326,650 sf which could contribute up to 183,000 gallons in a one-inch rainfall event. See additional details in Appendix A.

Peak flows from these rooftops during rain or snowmelt events can have a dramatic effect on local collection capacity. This can be compared to having parking lots with storm drain catch basins connected directly to the sanitary collection system.

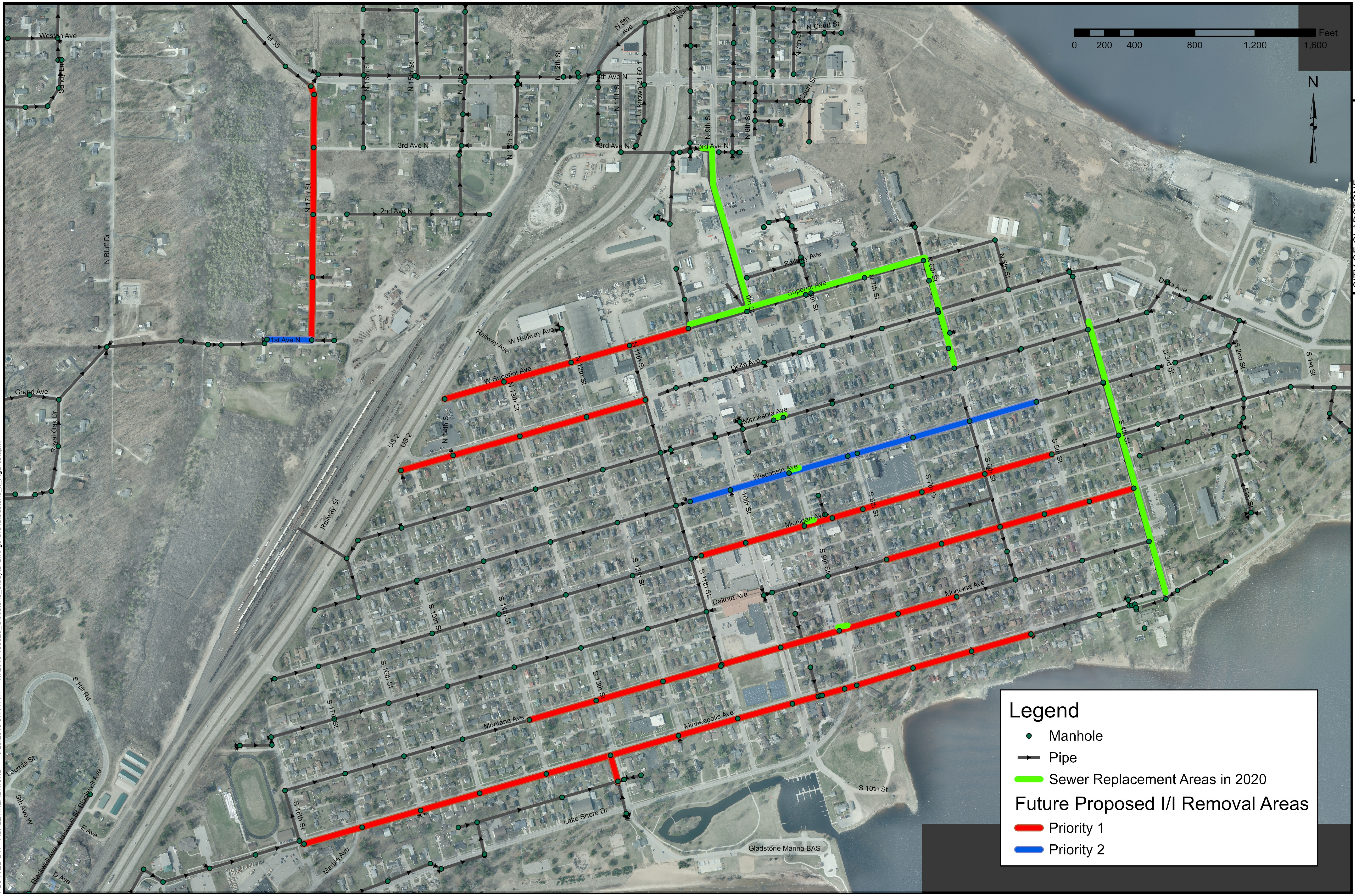

FIGURE 11: Collection System I/I Removal Alternative

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Manholes

There were 312 sanitary manhole castings identified during SAW asset management program inventory and evaluation as having perforated covers and are therefore potential inflow sources (although over 90% had only two pick holes with the remainder having 3 to 29 holes). They have been incorporated into the City's asset management based annual maintenance and capital spending planning (casting and cover replacement).

Treatment Capacity

The Gladstone WWTP was initially constructed in 1938 as a primary treatment plant and was expanded under several contracts as noted below.

- 1938 – Initial Construction, Primary Settling, Disinfection, and Anaerobic Sludge Digestion
- 1972 – Modified current preliminary treatment and added Rotating Biological Contactor (RBC) Secondary Biological Treatment. Improvements to Anaerobic Sludge Digestion, including the dual fired boiler, were constructed at this time.
- 1994 – two Complete RBC shafts and media were replaced

The 1972 WWTP expansion was designed for an annual average flow of 1.0 MGD and a peak sustained flow through secondary treatment of 3.0 MGD.

The proposed future 25-year, 24-hour peak hydraulic flow is 4.2 MGD, and this has not been seen in recent years.

<u>Combined Sewers and System Overflows</u>

There are no known combined sewers in the Gladstone system. Under the SAW funded AMP program, all sanitary and storm system manholes were inventoried and over 65,600 ft of sanitary sewer was TV inspected in 2019 to 2020 (to NASSCO standards) with results incorporated into the asset management plan's database.

<u>Pump Station Capacities and Adequacy</u>

All pump station capacities are viewed to be adequate with the exception of the Underpass Lift Station which experienced a backup and overflow during 2019's largest rain event. The City has since addressed issues with the Underpass Lift Station. The City performs regular monitoring and upgrading of station equipment. Station capacities are noted Table 5 on page 36. All pump stations were inventoried and drawdown tested as part of the City's SAW funded asset management program in 2018. Controls and alarms are up-to-date and operating as required.

The Underpass major pump station has an on-site generator while the others are served during emergencies via trailer-mounted generators.

<u>Operation and Maintenance Issues</u>

Collection system

Gladstone has a vactor/jetter type sewer cleaner providing routine and as-needed maintenance of the collection system. Known problem areas are noted and receive appropriate additional attention.

All pump stations are visited several times a week with routine maintenance and equipment replacements typically handled by City staff or via annual O&M budgets.

WWTP

General - The major treatment unit processes have been reviewed through several evaluations over the past five years; most notably the SAW funded Asset Management Program. Noted O&M issues follow.

- The raw sewage pumping system has required regular maintenance to remove rags and foreign objects which have lodged in the pump volute. In addition, the motors are located below grade along with the VFDs. Replacement of the exiting pumps is recommended based on the age, location, circumstances of the existing pumping system.
- The existing primary settling process is significantly undersized per Ten State Standards and lacks the important reliability function of the dual tank system, which allows for one tank to remain in service while maintenance is performed on the other tank.
- The design of RBCs is based upon the surface area provided for biomass growth. The amount of surface area required is a function of the concentration of soluble BOD to be removed, the temperature of the incoming sewage, and the flow rate per square foot of media surface. An additional train of RBCs comparable in size to the existing is recommended to achieve reliable permit compliance under the original design conditions during the winter months (1.0 MGD, 210 mg/L influent BOD, 40^{o}F).
- Digester mixing equipment is reported by operators to not be capable of maintaining the sludge in suspension over time. Equipment is approximately 45 years old and in need of a significant rehabilitation or replacement. A dedicated hot water boiler burns either digester gas or natural gas and uses the heated water to maintain the necessary temperature in the digester. The hot water is recirculated through the heating jacket on the gas mixing tube. The dual fired digester boiler is 45 years old, is relatively inefficient

and incorporates much obsolete technology. Improvements to the digester boiler and anaerobic digester mixing system are needed in the near future.

- The existing control and monitoring system for the Gladstone WWTP is analog based. These systems are obsolete today. A digital based SCADA system is needed to record and trend data, monitor treatment functions, and control important processes.

Climate Resiliency

Planning

Part of a utility owner's responsibilities in the current era is to develop climate adaptation planning regarding their utility system's vulnerabilities to climate change and system resiliency going forward. Gladstone recently updated their database of wastewater system assets as part of the Michigan SAW Grant program to in part ensure system resiliency regarding climate change, especially Great Lakes water levels.

Climate Factors

Two primary climate related hazards affecting Gladstone's utility systems are seasonal winter snow/cold, and precipitation (both extreme individual events plus effect on ground/surface water levels). Great Lakes (Lake Michigan & Green Bay) water levels are currently at 30 year highs. Increased lake levels have caused increased I/I into the system. Recent testing suggests a very rough outfall pipe friction factor combined with very high water levels in Lake Michigan is also limiting the discharge capacity from the WWTP. It is suggested that monitoring is necessary on a long term basis to insure any future impacts are addressed in a timely manner.

Critical Assets Impacts and Risks

Excessive winter snow either through a single event or through cumulative seasonal buildup affects access to system components such as major pump stations or structures at the WWTP for both normal operations and alarm or failure response.

Excessive cold affects any exposed mechanical or chemical processes at the WWTP.

Extreme precipitation causes higher flows at the WWTP through inflow sources and rain enhanced infiltration. Seasonal or climate related increase in ground water and surface water elevations also contribute to increased flow at the WWTP via pipe and structure infiltration.

Any extreme weather event can contribute to power outages affecting wastewater collection, treatment, and safe discharge even with on-site and portable power generators available (they must be maintained and available).

Responses

The City is an active participant in County Emergency Planning. As a northern Michigan City, Gladstone routinely plans and budgets for winter weather disruption to City services. Public Works, Electrical, Water, and Wastewater Departments plan and have equipment available for snow removal in extreme events.

Cold vulnerable equipment and processes at the WWTP are protected from the elements and supplemental heating can be provided if required.

Peak WWTP flow capacity is a primary reason influencing this Project Plan as the City continues its efforts to plan for and minimize the effects of excess precipitation impacted flow increases.

The WWTP and major pump station (Underpass) have permanent standby power while portable generator units available to address other less critical outages.

Fiscal Sustainability Plan

Inventory of Critical Assets

Both collection system and treatment works assets were inventoried as part of the City's SAW funded asset management program developed during 2018 to 2020. City of Gladstone completed SAW in 2020.

Evaluation of Inventoried Assets

Condition, performance, criticality, and replacement value of inventoried assets are evaluated in the SAW program and long term fiscal planning is being developed to sustain the assets.

Water and Energy Conservation and Sustaining the Treatment Works (Maintenance & Funding)

Certification regarding water and energy conservation efforts and fiscal sustainability documentation are planned to be provided by the City as part of the SRF program funding application process. Current SRF Guidance indicates that preparation of Fiscal Sustainability Plan (FSP) documentation is an eligible cost for inclusion in SRF funding. The City plans to meet SRF requirements if they move ahead into the application phase of the SRF funding process. The FSP would address maintenance, repair or replacement, and funding for treatment works assets.

Need for the Project

Compliance Status

A copy of Gladstone's current NPDES permit can be found in Appendix B. Gladstone's WWTP operates in compliance with its NPDES permit.

Orders

An Enforcement Notification, with a Draft Administrative Consent Order (ACO), has been delivered to Gladstone in February 2021 due to excessive I/I in the collection system along with WWTP needed improvements. It will be necessary to address excessive I/I issues and improvements to the WWTP as needed; it will be approved in conjunction with execution of the ACO. This is becoming a State-wide policy of EGLE in recent times. ACO boiler plate is not flexible. Schedules and the annual improvement plan are flexible.

Based on a meeting between the city and EGLE in April 2020, the ACO will include the following items:

- A schedule of compliance for WWTP and Collection System Improvements
- A requirement for an ACO Plan by the City to address excess I/I on an annual basis, as financially feasible.
- A Corrective Action Plan for WWTP improvements will be required.
- Potential to propose and negotiate the ACO
- A WWTP O&M Manual will be required.
- A Project Performance Certification (PPC) required once the ACO improvements have been made.
- EGLE wants to participate in Basis of Design review meeting
- An SSES report and I&I amendment will be required.
- The PPC will be a requirement and must be performed when proposed ACO improvements are complete. It is recognized that Bay De Noc water levels play an important role.

The ACO will allow for WWTP upgrades to move ahead prior to eliminating the excess I/I. The ACO will mandate collection system improvements.

Water Quality Problems

Providing effective wastewater collection and treatment protects both the surface and ground waters. The ultimate goal of wastewater treatment is to protect the quality of the waters of the State of Michigan and to protect public health. The City's facility treats the influent wastewater prior to discharging to Little Bay de Noc reliably and efficiently. Maintaining that treatment process functioning efficiently, reliably, and at the highest possible level of treatment is a major responsibility of the City of Gladstone. The need for this project is ultimately to protect the quality of water in Little Bay de Noc and Green Bay/Lake Michigan thereby protecting citizens and visitors.

<u>Projected Needs</u>

General

The 1 MGD WWTP was upgraded in 1974 to treat an annual average flow of 1.0 MGD and a maximum sustained rate through secondary treatment of 2.5 MGD. Evaluations under the SAW program proposed a future peak design flow of 3.5 MGD to include increased infiltration in aging pipes and to reflect potential growth in Masonville, Kipling, and North Bluff areas.

A 20-year population projection can be found on Table 2. Wastewater service area potential expansion and effect on treatment facility flows is noted in Table 9 which follows.

Variations in treatment system flows from low flow dry weather days to peak flow heavy precipitation days and the ability to respond with quality treatment is a standard need for the treatment facility. Process design and equipment specifications routinely address flow variations whether caused by climate factors or service area change. Individual severe weather incidents are also considered for flow volumes, power outages, site access, process efficiency planning and financial planning (criticality and susceptibility in asset business risk evaluations).

Table 9: Current and Estimated Future WWTP Flows

Item	Current Masonville	Current Total	Estimated Future
Annual Average (MGD)	0.029	0.74	1.00
Maximum Month (MGD)	0.033	1.48	1.70
Maximum Day (MGD)		2.82	3.00
Peak Hydraulic (MGD)		3.00	4.20

Residential Needs

Projected needs concentrate more on reliability and continued future efficient processes rather than major changes in either residential or commercial flows. Future flows are based on approximately 100 gpcd base residential sewage flow (which includes unavoidable infiltration) confirmed by flow monitoring in 2018.

Industrial, Commercial, and Institutional Needs

None of the commercial flow contributors in Gladstone are subject to formal Industrial Pretreatment Programs. Any future major industrial development would be addressed on a case-by-case basis via existing wastewater ordinances. Both volume and make-up of wastewater flows would need to be addressed and either pretreatment or WWTP enhancement undertaken if needed.

The state of Michigan has set water quality standards for PFOA and PFOS for discharges from WWTP, particularly those into bodies of water used for drinking water supply. Preliminary studies by the State have indicated that the greatest predictor of PFAS/PFOS pollution is upstream discharge from industrial sources, such as electroplating companies, paper factories, chemical manufacturers, plastics makers, auto parts manufacturers, landfills and aviation component manufacturers. So far, most PFAS/PFOA/PFOS interventions have taken place directly at the industrial source. Sampling at WWTPS and land application field sites throughout the State have found only a few cases where discharge or biosolids/sludge were temporarily restricted. Local manufacturing industries in Gladstone are a known potential risk factor, and the City will continue to monitor and manage risks in compliance with State of Michigan guidelines.

Future Environment without the Project

The primary purpose of this project is to ensure the treatment facility is equipped to handle capacity for its existing and projected flow rates and to continue to comply with its NPDES discharge permit requirements. The goal is to protect State surface and ground water quality and public health. Ability to reliably meet these goals moving forward would be adversely affected without the project. The project will improve treatment reliability and efficiency.

ANALYSIS OF ALTERNATIVES

Gladstone wastewater planning prior to 2000 centered on upgrading existing WWTP process as outline in the 1998 report. Emerging treatment technologies and a need to minimize improvement costs led to consideration and evaluation of new and different approaches to accept, treat, and discharge wastewater. Each alternative considered the follow:

- Overall performance and capability to meet NPDES requirements
- Ability to adapt to potential changes in the NPDES permit
- Stability which Infiltration and Inflow affects
- Capital and O&M cost
- Reliability and Ease of Operation

An analysis of feasible alternatives was performed and included a monetary evaluation, assessment of environmental impacts, performance, and reliability. Process equipment sizing is based on compliance with the requirements of the "Recommended Standards for Wastewater Facilities" (Ten State Standards 2014).

Identification of Potential Alternatives

The following several paragraphs describe and assess common alternatives which must be considered whenever large capital expenditures are planned. Following this, a section entitled Analysis of Principle Alternative provides a detailed option review of the options that are consider most feasible.

No Action

No action would result in several continuing adverse impacts on the Gladstone WWTP and its customers. Included among such impacts are:

- Degradation of facilities and reduction in value of past citizen investments.
- Continued risk of process overflow under peak hydraulic conditions
- Increasing frequency of NPDES permit violations
- Excess energy use
- Inefficient operations

This is not recommended for further evaluation.

Optimize Performance of Existing Facilities

Optimizing of the existing facilities alone, without capital improvements, will not incorporate improved technologies; will not restore the service life to facilities and system; will not take advantage of improvements to reduce energy use; and will fail to improve the sustainability of the facility.

Water and Energy Efficiency

Selected equipment shall have greater energy efficiency verses original components. Equipment items are to be optimized and controlled via variable frequency drives (VFD) which will improve efficiency. Electric motors will be high efficiency types.

Screening Improvements will increase the service life and treatment effectiveness throughout various unit processes.

Regional Alternatives

Since the late 1990s, there has been discussion related the potential for the City of Gladstone to convey wastewater to the City of Escanaba WWTP, rather than treat it locally. Ideas had been put forth for many decades. In several instances efforts were made to evolve concepts and estimate costs. However, the two governing bodies ultimately determined that the potential benefits did not outweigh the project costs and potential complications related to establishing a regional sewer authority.

Under the City of Gladstone's SAW program, consideration was again given to regional system. It was discussed with Gladstone and Escanaba Wastewater System planners and preliminary capital costs were developed. Conceptual cost development suggests that it may not be cost effective to convey wastewater to the Escanaba WWTP. Gladstone already provides service to a small regional user base (City plus Masonville and Brampton Township customers). Based on recent discussions with Gladstone, the preference is that City municipal wastewater flow will not be directed to Escanaba.

Estimated costs are summarized below. Refer to Appendix D for detailed costs.

Transmission Infrastructure	$ 15,028,000
Gladstone Equalization & Pumps	$ 1,250,000
Escanaba WWTP Capacity Upgrade	$ 1,500,000
Purchase of Capacity	$ 1,000,000

Total Construction Cost	$ 18,778,000
Total Capital Cost	$ 26,424,000
Assumed Escanaba User Rate Multiplier	1.2
Assumed Billable Wastewater Flow	10.8 MGal/Month
Estimated Monthly O&M to Escanaba	$ 45,000
Gladstone Collection System O&M	$ 175,000
Total Annual Regional O&M	$ 715,000
Total Present Worth of Regional Alternative:	$ 32,707,000

Construct New WWTP at Present or New Site

Planning in the SAW asset management process and discussion leading up to this report have proposed very significant WWTP improvements to modernize and sustain reliability of the existing facility. With the large capital investment in an older facility, it is natural to consider the cost of a new WWTP at the existing location or at a new site. The current site area is inadequate for an essentially new WWTP while maintaining service in the existing facility. A new site would require a new NPDES permit. Construction on any site would also involve demolition of the existing unused plant components.

The principal alternative discussed below is assumed to be the most cost effective approach to accomplish the scope of improvements recommended for Gladstone. However, because the potential total upgrade is a significant sum of money it was necessary to verify that a significant process change or entirely new plant was not cost effective.

Analysis of Principal Alternatives

Follow is the evaluation of most feasible alternatives for improving the Gladstone WWTP

Description of Principal Alternatives

1) Alternate 1 - Improvements to Existing WWTP

Alternative 1 is based on the 1998 WWTP Report by McNamee, Porter, and Seeley, Inc. and essentially involves upgrading of the existing treatment unit processes with addition of general improvements. This alternative relies on older proven technology which has been effective in Gladstone since 1974. Best available insights as to future NPDES provisions suggest that RBC treatment along will remain adequate for many years. Following is a list of improvements included in Alternative 1.

- Construction of a New Administration Building
- Raw Sewage Pumping Improvements
- Construction of New Fine Screening and Grit Removal Facilities
- A Second New Primary Settling Tank
- Upgrade of Six Existing RBC shafts
- New RBC Treatment Train in Building
- One New Final Settling Tank
- Improvement to Hydraulic Design Capacity
- Anaerobic Digester Improvements
- SCADA Improvements
- A package of miscellaneous facility improvements common to all evaluation alternatives

Screening and Grit Removal Area

The WWTP currently has a one-inch manually raked coarse screen and constant velocity grit removal channel with manually shoveled grit removal. Both fall very short of the technologies needed today to efficiently operate a wastewater treatment plant to minimized O&M costs and ultimately costs to the public. This report recommends improvements to add automatically raked fine screening to remove solids larger than 4 or 6 mm (1/4 or 3/8-inch) and to add automatic vortex type grit removal. Finer screening and more efficient grit removal will extend the life of downstream equipment and reduce overall WWTP maintenance. These processes are standard on nearly all small, medium and large WWTPs today.

Four options for screening and grit removal using different layouts and equipment were considered for Gladstone as described below. Each utilized vortex type grit removal which is efficient and very cost effective in small to medium sized plants. Fine screening equipment evaluated varied from automated in-manhole screening to inclined rake bar screening equipment with washer/compactors. The following specific options were compared:

1. No Action
2. Vertical Screen located in manhole with Vortex Grit Removal Installed in new location downstream of Primary Effluent Pumping.
3. Inclined Basket Type Screen with integral solids washing and dewatering. The screen would be located in the existing grit channel area and vortex grit removal would be located in new structure to the west.

4. Inclined bar type screen with separate washer compactor and Vortex Grit Removal installed in compact new screen/grit garage west of the existing headworks.
5. Similar to Option 3 but involving additional hydraulic and equipment provision along with increased building space to more conveniently accommodate future expansion.

During initial selection it was felt that automated screening in a new manhole (Option 1) was not as reliable and trouble free as other options. This was not included in the economic analysis.

Option 2 included vortex removal very similar to other options, but utilized the existing headworks area to install a Rotomat type inclined screw screen to reduce footprint and save money. This equipment would reduce the area of the exterior garage needs, but the screening equipment is much less robust and provides less dewatering capacity for screenings than other available types. It does allow for rotating the screen basket out of the flow channel for maintenance.

Options 3 provide for new automatic inclined bar screening, with separate washing and compacting of screenings. A single screen with bypass and vortex grit system would be located in a new screen/grit garage west of the existing headworks area.

Finally, Option 4 is similar to Option 3 but allows more space for future provisions in the new Screen/Grit Garage. Table 10 summarizes a present worth analysis conducted of Options 2 through 4. The present worth was found using the 2020 real discount rate of 0.3% for a 20-year planning period. Evaluation was conducted in 2019 dollars.

Table 10: Present Worth Analysis of Screen and Grit Options

	Option 2 Basket Screen	Option 3 Bar Screen W W/C Minimum	Option 4 Bar Screen W W/C Optimum
Capital Costs	$1,782,000	$2,268,000	$2,414,000
Annual O&M Costs	$36,610	$37,520	$37,520
Salvage Value	$389,000	$529,000	$363,000
Present Worth of O&M	$710,000	$728,000	$728,000
Present Worth of Salvage Value	$367,000	$499,000	$342,000
Total Present Worth	$2,125,000	$2,497,000	$2,800,000

The above layout options and costs were discussed at the July 2017 City/C2AE work session, followed by multiple conceptual versions of Screen/Grit with Administration Building layouts. Effort was put forth considering ways to install fines screening prior to the Existing Primary Effluent or Raw Sewage Pumps. The drop in hydraulic grade line needed to accommodate upstream screening and grit removal left too little available control depth in the existing pump wet well. The Screen/Grit Garage is located along the west building wall in a more southerly location to allow room for the proposed Administration Building to be constructed to the north to shield the headworks from public view. The recommended alternative is Option 3.

RBC and Final Clarifier Improvements

As indicated in the previous assessment section, the existing RBCs perform acceptably under present circumstances as represented by the monthly operating records for 2014 to 2017. However, the existing Final Clarifiers are undersized for peak flows according to the Ten States Standards criteria generally employed by EGLE to analyze WWTP facilities.

The original Basis of Design for the RBCs was an average flow of 1.0 MGD with an influent BOD of 210 mg/L. The system's reliability under this loading, coupled with the winter time minimum influent wastewater temperatures is suspect. In addition, manufacturers of RBC systems generally recommend that a 10% safety factor be applied to the media surface area to allow for unanticipated fluctuations in loading. This was not taken into account in this report's performance estimates.

To equip the Gladstone WWTP to provide reliable cold weather treatment at the original design conditions would require an additional train of three shafts to operate in parallel with the existing equipment, and one additional comparably sized clarifier.

2) Alternate 2 – Rotating Belt Filter Primary Treatment with RBC Secondary Treatment

Alternative 2 is based on utilizing Rotating Belt Filters (RBF), a newer innovative technology, to replace Primary Settling. The objective is to provide effective primary separation while eliminating the high cost of enclosed primary settling basins and sludge collection mechanisms, and to reduce the required robustness of a headworks facility. To protect the RBF unit a coarse screen shall be installed upstream of the RBF units. Primary solids removed on the RBF will be handled as described later in this report.

Three new RBF units will be installed in a new building located west of the current headworks and south of the proposed Administration Building. RBF Primary Treatment would be proceeded by pre-screening with an automatic inclined drum screen removing solids larger than 12 mm. The screening process will be enclosed. The following improvements proposed for Alternative 1 are also included in Alternative 2:

- Construction of a New Administration Building
- Raw Sewage Pumping Improvements
- Upgrade of Six Existing RBC Shafts
- New RBC Treatment Train in Building
- One New Final Settling Tank
- Improvement to Hydraulic Design Capacity
- Anaerobic Digester Improvements
- SCADA Improvements
- Package of miscellaneous facility improvements common to all evaluation alternatives

3) Alternate 3 - New Oxidation Ditch

Alternative 3 includes a new Extended Aeration Oxidation Ditch secondary treatment process to replace current Primary Clarification and RBCs. Application of Oxidation Ditches on the current small site would be very difficult; however, but it was felt possible though final layout may not be ideal. Environmental and Floodplain issues were discussed with EGLE. The existing anaerobic digesters would be converted to Aerobic Digesters for processing the waste activated sludge. Full Land Application would be used for Biosolids Handling. Because the location of the existing final settling tank was considered necessary to locating the Oxidation Ditch it was proposed that two new circular Final Settling Tanks be constructed with optimum settling depths for activated sludge. A combined waste and recycle activated sludge pump station will be included. Other improvements include, which are common to all options, are:

- Construction of a new Administration Building
- Raw Sewage Pumping Improvements
- Improvement to Hydraulic Design Capacity
- SCADA Improvements
- Package of miscellaneous facility improvements common to all evaluation alternatives

4) Alternate 4 – Rotating Belt Filter Primary Treatment with Moving Bed Bioreactor Secondary Treatment

Alternative 4 utilizes Rotating Belt Filter (RBF) Primary Treatment as a cost effective substitute to conventional Primary Settling (as in Alternate 2). Moving Bed Bioreactors (MBBRs) are used as an upcoming fixed film secondary process to reduce mechanical maintenance requirements potentially associated with RBCs. MBBR treatment is relatively new, but this process is recently approved in Michigan by EGLE. MBBR will be a mostly fixed film process involving submerged media to grow desired bacteria and fine coarse bubble aeration to provide oxygen to reduce waste. MBBR tanks will be exposed and located south of the existing RBC Building. With MBBR treatment it will be possible to install RBF units in the space current occupied by RBCs within the existing building. It is proposed that RBF pre-screening be installed in the existing headworks area. Under the options Biosolids handling will use Anaerobic Digestion as exists today with full Land Application of waste solids. Other improvements are as discussed for Option 2.

5) Alternate 5 – Conventional Primary Clarifier with Moving Bed Bioreactor Secondary Treatment

Alternative 5 combines components from Alternatives 1 and 4, combining more traditional primary treatment while replacing the aging RBC units with more modern MBBR secondary treatment. The following list depicts improvements and/or modifications to be made to the WWTP.

- Construction of a New Administration Building
- Raw Sewage Pumping Improvements
- Construction of New Fine Screening and Grit Removal Facilities
- A Second New Primary Settling Tank
- MBBR Secondary Treatment
- One New Final Settling Tank
- Improvement to Hydraulic Design Capacity
- Anaerobic Digester Improvements
- SCADA Improvements
- A package of miscellaneous facility improvements common to all evaluation alternatives

<u>Description and Evaluation of Supporting Improvements Common to Alternatives 1 Through 5</u>

<u>Administration Building</u>

Wastewater Treatment today requires administrative space for laboratory analysis; facilities control and operations; administrative office space for coordination and paperwork; a combined meeting/training/ and breakroom; restroom and shower facilities; storage for office, lab, and general materials; and sampling at a minimum. In some cases, control areas can be combined with the laboratory, but it has generally been found useful to separate the Superintendent's office, and break room from other areas.

In Gladstone, the administrative space in total is approximately 500 square feet (sf) within the existing Primary and RBC area. A door separates the hazardous primary settling area from the laboratory and administrative space. The laboratory and administrative area does not meet the current Ten State Standards. Since the 1998 WWTP Study staff has planned for new administrative space. In 2010, a new storage garage was built and temporary administrative space was assigned within that building. It is recommended that the 1998 plan for new administration building be implemented with the next WWTP upgrade.

Administrative space allocation from 1998 were reviewed along with space allowance at other Upper Peninsula plants. A work session with Gladstone wastewater staff and C2AE wastewater engineers/architects was held in mid-2018. Revised space allocations were proposed in an effort to eliminate little-used space and reduce project costs. Table 11 below lists the areas assigned for development of initial layouts. The total proposed Administration space is 2,400 sf.

Table 11: Recommended Administrative Space Allowances

Description	Area (sf)
Entry	100
Laboratory	600
Control Area	150
Administrative Office	200
Training and Break Room	350
Shower Room	150
Restroom	150
Storage	300
Common/Corridor	400

Biosolids Handling

The following options for Biosolids Handling and Disposal at Gladstone were developed and evaluated. Variations or differences in Biosolids alternates were based on feasible technologies, cost effective operation, and specific wastewater stream unit process being considered. Although the City is aware of emerging contaminants and developing PFOA/PFAS/PFOS regulations, no additional criteria were utilized in this evaluation beyond the known characteristics of conventional treatments. Based on Statewide sampling of Michigan WWTPs in 2018, it is felt by the regulatory community that PFOS (normally the worse-case compounds) will not be a problem unless influent wastewater has high industrial components as are normally controlled under an Industrial Pretreatment Program

The following alternatives for Biosolids Handling and Disposal were considered within the scope of this report.

A. Screw Press Dewatering and Electric Drying/Dehumidification to Class A Standard for Primary and Secondary Biosolids.
B. Complete Anaerobic Digestion with Land Application of Primary and Secondary Solids (present handling process)
C. Complete Aerobic Digestion with Land Application
D. Screw Press Thickening and Landfill Disposal of Primary and Secondary Solids
E. Landfill Disposal of Primary RBF Biosolids with Anaerobic Digestion of Secondary MBBR Biosolids

The greatest detail related Biosolids comparison costing in provided in Appendix D.

Table 12 below is a summary of the Present Worth cost comparison of Biosolids Handling alternatives independent from liquid process options, intended to be a completely separate evaluation. The present worth was found using the 2021 real discount rate of -0.5% for a 20-year planning period.

Table 12. Biosolids Handling Alternative Costs

	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Costs	$1,762,000	$1,636,000	$1,294,000	$1,272,000	$2,628,000
Total Project Costs	$2,291,000	$2,127,000	$1,683,000	$1,654,000	$3,417,000
Present Worth of O&M	$1,861,000	$1,270,000	$1,380,000	$3,940,000	$1,825,000
Total Present Worth	**$3,489,000**	**$2,691,000**	**$2,505,000**	**$5,115,000**	**$4,254,000**

The present worth evaluation above indicates that when possible, Anaerobic or Aerobic Digestion of Biosolids with Land Application for disposal remains the cost effect option in terms of Present Worth life cycle costs. It is noted that from a total present worth cost basis Anaerobic and Aerobic Digestions are equal within the accuracy of the evaluation.

Each of the proposed overall WWTP liquid treatment alternatives described above were evaluated with the Biosolids Handling alternative (A through E) that was expected to be most applicable and cost effective. In all, five different liquid treatment alternatives were costed, each with one of five Biosolids Handling alternatives. Appendix D includes a cost breakdown and present worth analysis for each of the five stand-alone Biosolids Handing alternatives.

The five liquid process alternatives (1 through 5), with the assigned technically feasible Biosolids Handling alternatives (A through E) are outlined below:

Alternative 1: Upgrade of the Existing RBC Treatment Process including complete Anaerobic Digestion and Land Application.

Alternative 2: RBF Primary Treatment, RBC Secondary Treatment, including Complete Anaerobic Digestion and Land Application

Alternative 3: Oxidization Ditch, Aerobic Digestion, and Land Application

Alternative 4: RBF Primary Treatment, MBBR Secondary Treatment, including Aerobic Digestion, and Land Application

Alternative 5: Headworks, Additional Primary Clarifier, MBBR Secondary Treatment, and Complete Anaerobic Digestion of Primary and Secondary Biosolids with Land Application

Capital improvements required to sustain reliability and maintain treatment performance of Biosolids have been determined from the SAW asset management plan and are include in the costs for each Alternative. Complete upgrades to existing digester tanks is required under most Digestion options. Under landfill and Class A alternatives, exiting digester space is available for use as gravity thickening and equalization storage, however the existing rectangular 500K sludge storage tank is also available when anaerobic or aerobic digestion is not an ongoing unit process

With Rotating Belt Filters for liquid treatment (Alternative 2), the solids removed on the filter will contain increased grit quantities and therefore are not considered ideal for Anaerobic or Aerobic Digestion. Secondary biological sludge was not considered ideal for Anaerobic Digestion but could be stabilized with Aerobic Digestion. With liquid alternative options including primary settling sludge and secondary sludge either Anaerobic or Aerobic Digestion were considered feasible. In these cases, Anaerobic Digestion offered the following differentiating benefits:

- Increased reduction of volatile solids
- Less energy input required
- Potentially qualifying for Green Project Reserve principal forgiveness
- Contained odors

RBF solids can be pumped directly to an anaerobic or aerobic digester or dewatered with an integral screw presses to approximately 20% dry solids for disposal in a landfill. This lent the RBF alternative to be practical with any of the five biosolids options, but as mentioned above grit quantities in RBF solids leaned this toward landfill disposal. With

Alternative 3 (Oxidation Ditch) no primary solids are produced and the waste sludge is normally processed by Aerobic Digestion. Alternative 4 and 5 (Moving Bed Bioreactor), was also evaluated with several of the biosolids options in Appendix D, but when combined with Primary Settling and Headworks grit removal, Anaerobic digestion and land application was the option recommended for this report. Primary settling and Rotating Biological Treatment also were evaluated with Anaerobic Digestion as has been the historical practice.

Aerobic Digestion was evaluated as a complete replacement for Anaerobic Digestion and also as a means of treating secondary sludge if primary sludge was taken to a landfill. This option included conversion of the existing Primary and Secondary Anaerobic Digesters to Aerobic Digesters with addition of coarse bubble aeration equipment. In general, side by side comparison of Aerobic and Anaerobic Digestion showed the capital costs and present worth cost to be very close (within limits of the accuracy of evaluation). Ultimately, concern existed in that Aerobic Digestion is not typically used with fixed film treatment processes (RBC or MBBR). References in Michigan could not be found.

Comparison of sludge options suggested that, when feasible, landfill disposal of biosolids was significantly less cost effective than Land Application

Biosolids Option A: evaluated Electric Air Evaporation of blended Primary and Secondary sludges for production of Class A Biosolids. Class A biosolids are controlled to much lesser degree by ELGE and are suitable for distribution to the public. Option A included the following components.

- Modification of the existing 500K gallon sludge storage for use as sludge blending, gravity thickening, and liquid sludge equalization. Existing digesters would be abandoned.
- An inclined screw press for dewatering of blended sludge to approximately 20% solids
- Installation of press and evaporation equipment in the southerly train of the abandoned RBC tanks
- Class A sludge storage within a 400 sf building.

Although this Option A was somewhat less cost effective on a capital and present worth basis, it offered several strong benefits. User rate impact would be negligibly increased, approx. 25 cents. Advantages and disadvantages of Class A Biosolids (Option A) and Anaerobic Digestion disposal of Class B Biosolids is summarized below.

Class A Biosolids with Dewatering and Electric Drying

1. Somewhat more expensive
2. More flexible to deal with future regulation

3. More sophisticated equipment requiring increased operation and maintenance
4. Greater energy usage (would not qualify for Green Project Reserve savings)
5. Could allow for sale of existing disposal property in the future
6. Makes current digester space available for other uses in the future
7. Additional flexibility regarding biosolids disposal: land application, sale of Class A, or landfill in emergency situations

Class B Biosolids with Anaerobic Digestion and Land Application

1. Least costly
2. Simplest with minimum operation and maintenance.
3. More reliable
4. May qualify for up to $700,000 in Green Project Reserve principal forgiveness (similar to a grant)
5. Requires upgrade of existing digesters
6. Allow for additional available space in existing RBC tankages

The comparison of Biosolids options included the following assumptions;

- $60 per ton for Landfill disposal assuming that application for daily cover was not allowable on the long run
- Electrical cost at $0.15 per kilowatt hour.
- Sinking fund allowances were included for purchase of 80 acres of additional disposal land and 10-year replacement of sludge disposal vehicles
- Trucking costs including depreciation per mile, and City labor costs per hour were included. These number were based on present miles and hours per trip as provided by the City.

Anaerobic Digestions is proven in Gladstone. Facilities are old and need of significant upgrade but are structurally sound and able to be rehabilitated. Equipment can be replaced. For Gladstone, digestion and land application is evaluated as the most cost effective Biosolids Handling alternative because disposal land if available and operating personnel perform disposal activities at great saving over outside contracting. This report recommends Biosolids Option B as the recommended plan.

However, the electric drying process (Option A) is rapidly evolving. Research is continuing by C2AE to confirm overall energy costs, refine long term maintenance costs, and to develop a strong comfort with overall reliability. We hope it may be possible to provide a final consideration of this alternative at the time of project design. Capital costs associated with the SRF loan would be very close.

Hydraulic Capacity

The existing WWTP is rated for peak hydraulic capacity of 3.0 MGD (some references state 2.5 MGD). This was based on an unknown Great Lake design water level. Work under the SAW program has estimated a 25-year, 24-hour peak flow of 4.2 MGD. The maximum day flow known to have entered the plant in 2020 was 2.82 MGD.

It is proposed in this Project Plan for the WWTP to accept an instantaneous peak flow of 4.2 MGD. Preliminary hydraulic flow computations have been run with physical arrangements represented by RBF/RBC/and MBBR alternatives. To accept peak flow above 3.0 MGD, improvements will be needed to the hydraulic capacity of the WWTP; this is dramatically affected by the potentially high lake levels in 2020 and into the near future. Future hydraulic capacity will be significantly increased through piping and tankage upgrades recommended in this Project Plan (Improved Headworks, Primary Tank addition, Pumping upgrades, MBBR tankage, and a new Final Settling Tank). However, the existing 16-inch Effluent Outfall pipe limits flow between the Chlorine Contact Tank (CCT) and Lake Michigan. Recent testing suggests a rough outfall pipe friction factor combined with very high water levels in Lake Michigan is limiting the discharge capacity from the WWTP. Plant influent flow in the range of 2.6 to 2.8 MGD results in surcharging of the Final Settling Tanks (FST) and could result in overflow. Although lower Lake Michigan levels will help in the future, acceptance of high peak flows will require hydraulic capacity upgrades.

This report considered three alternatives to upgrade hydraulic capacity downstream of the Final Settling Tanks:

1. Install a new, parallel 16-inch outfall sewer to the location of the present discharge
2. Install a 4.2 MGD Effluent Booster Pump Station (EBPS) downstream of the Chlorine Contact Tank
3. Raise the working elevations in the Final Settling Tanks and Chlorine Contact Tanks by approximately three feet to provide increase Hydraulic Grade line or driving force to Lake Michigan.

Recent Outfall testing following plugging of the RS Wet Well overflow is more accurate than previous. This suggests that the Outfall Sewer is not broken or plugged, but may instead have a relatively rough wall equivalent to a Hazen Williams C value of 95 to 100. This roughness factor combined with a relatively higher velocity and high Lake level results in the backup. A parallel pipe to the same location as the original outfall can be approved by EGLE without NPDES permit revision. This will reduce the head loss in the outfall by 75% or more.

Another feasible option is to build a new Effluent Booster Pump Station downstream of the Chlorine Contact Tank. This would be a submersible pump station which would accept controlled overflow from the Chlorine Contact Tank to be pumped under pressure through the Outfall Pipe to the receiving waters. It would use a reverse flow valve upstream in the existing Outfall to force pumped flow to the Lake. Normal flow would be conveyed by gravity through the Outfall, while WWTP flow exceeding the gravity flow capacity will then be pumped. Once pumping is initiated, all flow to the Lake must be pumped. Actual use of electricity for pumping is very low on an annual basis because pumping is only activated with abnormally high influent flows.

The third option evaluated to improve the Outfall capacity is to raise the tank levels in the CCT and FST. This provides a higher water surface in the WWTP to drive additional flow to Lake Michigan. This improvement requires raising tank walls and other improvements. One Important side benefit of this options is the additional settling depth in the FST and additional contact time in the CCT. Evaluation of costs presented below are in 2019 dollars.

Total Project Costs for each alternative were estimated as follows:

Option 1 (New Parallel Outfall)	Approximately $2,450,000
Option 2 (EBPS)	$568,000
Option 3 (Raise Tank Walls)	$663000

Above are Total Project costs including Construction, Planning, and Contingencies. Regarding a Present Worth comparison, the operation and maintenance will not significantly affect the capital cost comparison above. The new outfall will minimize operation and maintenance costs and is the most technically sound option ignoring costs. Annual costs of operating a EBPS (Option 2) are very low with infrequent operation and very low power costs for occasional pumping. Raising tank walls (Option 3) will increase the Secondary Influent pumping head by approximately three feet, but this has very low annual electric costs impacts. Maintenance is not increased. Although Total Project and theoretical Present Worth cost for Option 3 is somewhat higher than Option 2, it has the strong benefit of increasing settling depth and Chlorine Contact time. Option 3 is the recommended approach.

<u>The Monetary Evaluation</u>

A cost evaluation, in the Present Worth format, was conducted for the principal, feasible alternates as described in the prior section and restated below.

Alternative 1: Upgrade Existing Process

Alternative 2: RBF-RBC-Anaerobic Digestion

Alternative 3: Oxidation Ditch-Aerobic Digestion

Alternative 4: RBF-MBBR-Aerobic Digestion

Alternative 5: Upgrade Existing Process, with MBBR Secondary Treatment-Anaerobic Digestion

Cost Evaluations were based on the following.

1. Construction Costs as detailed in Appendix D
2. Assumed 10% Overall Project Contingencies and 20% Engineering, Legal, Fiscal Planning, and Administrative costs.
3. Escalation to construction in 2024 at 2.5% per year
4. $0.15 per KWH electrical costs
5. City labor costs as shown in Appendix D
6. $60/Wet Ton Landfill Disposal Costs
7. Present Worth Evaluation in compliance with Michigan CWF format

Table 13 Summarizes Construction, Capital, Operation, and Total Present Worth cost for each of the four primary alternatives. The present worth was found using the 2021 real discount rate of -0.5% for a 20-year planning period.

Table 13: Cost Effective Analysis for Alternatives

	Alternative 1 PST, RBC, AnD	Alternative 2 RBF, RBC, AnD	Alternative 3 OD, AD	Alternative 4 RBF, MBBR, AD	Alternative 5 PST, MBBR, AnD
Construction Costs	$14,208,000	$12,510,000	$18,757,000	$13,842,000	$13,728,000
Engineering, Planning, Contingencies	$4,262,000	$3,753,000	$5,627,000	$4,153,000	$4,118,000
Capital Costs	$18,470,000	$16,263,000	$24,384,000	$17,995,000	$17,846,000
Annual O&M Costs	$594,000	$668,000	$917,000	$720,000	$640,000
Present Worth of O&M Costs	$12,528,000	$14,088,000	$19,340,000	$15,185,000	$13,498,000
Salvage Value	$5,186,000	$4,567,000	$6,847,000	$5,053,000	$5,011,000
Present Worth of Salvage Value	$5,733,000	$5,049,000	$7,570,000	$5,586,000	$5,540,000
Total Present Worth	**$25,265,000**	**$25,302,000**	**$36,154,000**	**$27,594,000**	**$25,804,000**

The Present Worth Analysis in Table 13 combines components available for major unit processes (i.e. Primary Treatment, Secondary Treatment, Biosolids Handling). Following is a listing of unit process options which were compared in developing the overall alternatives evaluation.

- Preliminary Treatment
  - Mechanical Fine Screening and Vortex Grit Removal
  - Mechanical Coarse Screening
- Preliminary Treatment
  - No Primary Treatment
  - Primary Settling
  - Rotating Belt Filters
- Secondary Treatment
  - Rotating Biological Contactors (RBC)
  - Oxidation Ditch
  - Moving Bed Bioreactor (MBBR)
- Biosolids Handling
  - Anaerobic Digestion with Land Application
  - Aerobic Digestion with Land Application
  - Landfill Disposal of Primary Solids with Aerobic Digestion and Land Application of Secondary Solids

Alternative Delivery Methods

It is proposed that improvements be implemented under the Design-Bid-Construct delivery method with a general contractor as opposed to construction manager. Alternative delivery methods such as Design Build and Multiple Prime Contractors will not be employed.

Staging Construction

Construction of improvements will be staged to maintain continuous treatment while construction is under way. See "Partitioning the Project" below for more detail.

Partitioning the Project

The long-term needs of the Gladstone treatment facility and collection system are discussed in this report. Needs of the collection system are being refined in the 2018 to 2020 SAW Asset Management Plan and 2019 Infiltration and Inflow Report. The City of Gladstone recognized the need for long-term collection improvements to maintain structural integrity of the sanitary system and reduce infiltration and inflow. The City intends to partition the total collection system needs into numerous construction phases over the next several decades to enable improvements to within the limited financing capability of the service district. The 20-year improvement plan includes the following segments:

1. WWTP Improvements 2021 to 2024
2. Initial Collection Improvements 2024 to 2030
3. Less critical collection and Pumps Stations 2030 to 2040

The Environmental Evaluation

Correspondence related to environmental impact aspects of this project can be found in Appendix C. Table 14 summarizes potential environmental and public health impacts of the evaluated alternatives with brief descriptions following.

Table 14: Environmental Evaluation

Category	No Action	Alt. #1 PST, RBC, & AnD	Alt. #2 RBF, RBC, & AnD	Alt. #3 OD & AD	Alt. #4 RBF, MBBR, & AD	Alt. #5 MBBR, PST, & AnD
Cultural Resources:						
Historical/Archaeological	0	0	0	0	0	0
Long Term Area Aesthetics	4	1	2	2	1	1
Natural Environmental:						
Climate	0	0	0	0	0	0
Air Quality	2	1	2	2	1	1
Wetlands	0	0	0	0	0	0
Coastal Zones	0	1	1	2	1	1
Floodplains	0	0	0	0	0	0
Natural Wild and Scenic Rivers	0	0	0	0	0	0
Surface Waters	2	1	1	1	1	1
Topography	0	0	0	1	0	0
Geology	0	0	0	0	0	0
Soils	0	1	1	2	1	1
Agricultural Resources	0	0	0	0	0	0
Sensitive Habitats	0	0	0	0	0	0
Threatened/Endangered Species	0	0	0	0	0	0
Unique Features	0	0	0	0	0	0
Long Term Water Quality	2	0	0	0	0	0
Long Term Utility Reliability For Environmental Protection	4	2	1	1	1	0
Total (lower is less impact)	14	7	8	11	6	5

(0 signifies no impact, 1 represents some impact, and 5 signifies the greatest impact)

Abbreviations:

PST – Primary Settling Tank
RBC – Rotating Biological Contactor
AnD – Anaerobic Digestion
RBF – Rotating Belt Filter
AD – Aerobic Digestion
OD – Oxidation Ditch
MBBR - Moving Bed Bioreactor

Implementability and Public Participation

The City of Gladstone has completed construction projects over the past several decades. All are openly discussed at public Commission meetings, including with cost impacts. The Project Plan will be advertised and displayed for citizen review for one month prior to a formal Public Hearing. The City contracted with an engineering design consultant (C2AE) for assistance in the planning process and will utilized quality based selection for their design consultant at the appropriate time. They will also contract a bond counsel for assistance in arranging project funding.

Technical and Other Considerations

Infiltration and Inflow

General

Infiltration occurs when groundwater enters either mainline or service lateral sewers through cracked or broken pipes, footing drains, and defective pipe joints.

Inflow is surface runoff that enters the sanitary sewer system via loose/defective or vented manhole covers, broken pipes, and illegal storm drainage cross connections such as catch basin leads, yard drains, culverts, or roof drains.

Infiltration and inflow were addressed previously in the “Existing Facilities – Infiltration and Inflow” section of this report with flow data noted in Table 7 and Table 8 starting on Page 46. EPA criteria for a system of Gladstone’s size is 3,000 to 6,000 GPD/in.-mi of sewer (i.e. per 660 ft of 8-inch sewer). MDEQ/EGLE guidelines are stormwater inflow <275 gpcd and groundwater infiltration <120 gpcd during high water.

Gladstone has exceeded both measures by a moderate amount, with infiltration exceedance in 2016, 2017, and 2018 up to 263 gpcd and inflow exceedance in 2017, 2018, and 2019 up to 383 gpcd.

Pump Stations

Also, as part of the SAW AMP program, the City’s wastewater collection system pump stations were inventoried and draw-down tested to aid in WWTP system and WWTP flow analysis and modeling.

I/I Related Cost Effective Analysis

General

The following excerpts are quoted from the EGLE Project Planning guidance:

"I/I removal may be cost-effective compared to the operational costs for transport and treatment of the clear water. However, projects proposing I/I removal solely to reduce operational costs are not eligible. In order to be eligible for SRF funding, a proposed project must demonstrate that the I/I is resulting in a capacity problem that can be addressed either through new construction to alleviate the capacity problem or through removal of I/I."

Table 15 as follows summarizes the present worth analysis presented in the 2019 I/I Study (see summary in Appendix A). Although additional improvements to the WWTP have been recommended, the portion contributing to increasing flow capacity is isolated in the table below. Based on the cost effectiveness analysis, it appears that upgrading the sustained flow treatment capacity of the WWTP is the cost effective alternative to prevent collection system overflows or bypasses of treatment. Evaluation was conducted in 2019 dollars.

Table 15: I/I Removal Present Worth Analysis

Alternative	WWTP Addl. Treatment	WWTP Equalization	Sewer Replacement	Sewer Rehabilitation
1) Initial Capital Cost	$2,739,032	$2,845,200	$7,859,631	$5,781,439
2) Annual OM&R Costs	$7,967	$9,890	-$2,000	-$500
3) Future Salvage Value	$276,000	$285,000	$3,628,000	$1,483,000
4) Present Worth of 20 yr. O&M	$157,000	$194,000	-$40,000	-$10,000
5) Present Worth of 20 yr. Salvage	$266,000	$273,000	$3,487,000	$1,426,000
Total Present Worth (1+4-5)	**$2,631,000**	**$2,767,000**	**$4,333,000**	**$4,346,000**

Using 2019 real discount rate of i = 0.2% for n = 20 yr. (EGLE SRF Website 05-25-18)

1) *Total project cost including construction, engineering, legal, administrative, permits, testing, environmental mitigation, and contingency*
2) *Estimated increase or decrease (-) due to alternative being considered*
3) *Based on following estimated useful lives: land = permanent, sewers/piping = 50 yr. facilities/structures = 40 yr., rehabilitation = 30 yr. equipment = 20 yr.*
4) *= Annual * (1+i)^n-1 / i*(1+i)^n [Present Value of Future Payment Series]*
5) *= Future * 1 / (1+i)^ [Present Value of Future Value]*

I/I Related Treatment

The Gladstone WWTP was upgraded in 1974 to treat an annual average flow of 1.0 MGD and a maximum sustained rate through secondary treatment of 2.5 MGD. Evaluations under the SAW program proposed a future peak 25-year, 24-hour flow of 4.2 MGD, with peak hour flow of 3.5 MGD.

To upgrade the existing WWTP to accept and treat the 25-year flow, the following unit process improvements are recommended. These are detailed more in the Selected Project section of this report.

1. Raw Sewage Pumping improvements, pump replacement
2. Mechanical Fine Screening
3. Vortex Grit Removal System, Complete with Pumps and Classifier with Cyclone
4. Rehabilitation of Existing Primary Tank, Construction of Additional Primary Clarifier
5. Replacement of the current RBC process with a new Moving Bed Bioreactor process
6. Addition of one new Final Settling Tank
7. Modernize and upgrade chemical feed processes
8. Replace two primary effluent pumps
9. Anaerobic Digester improvements

I/I Related Equalization

Based on flow monitoring conducted in 2018, a hydrograph of flow to the WWTP associated with the 25-year, 24-hour runoff event has been developed following EPA criteria. This work has computed a peak 25-year, 24-hour hydraulic flow of 4.2 MGD. The computed equalization volume required to limit flow through primary and secondary treatment to 3.5 MGD is 0.7 MG. The cost effectiveness analysis was developed assuming an Equalization Tank volume of 0.7 MG.

I/I Removal

Sewer separation experience in other UP communities has shown that I/I removal via a public infrastructure project can likely be successful in removing less than 50% and closer to 30% of the I/I when it is predominantly caused by infiltration and rain enhanced infiltration such as in Gladstone. Storm and sanitary sewers are already separated with remaining inflow coming from leaks (ponding over castings, cracked or leaking sewers influenced by rainfall/snowmelt, etc.) and private sources (footing drains, yard drains, roof leaders, etc.).

I/I removal estimates and related costs target the older, deeper portions of the collection system where 2018 flow monitoring along with pump station pumping rate reviews and City Staff knowledge indicate I/I potential problem areas are concentrated.

I/I Recommendations

A cost effectiveness analysis suggests that upgrading the treatment capacity of the WWTP is the cost effective alternative to eliminate overflows or bypasses of treatment.

In addition to WWTP improvements, the City realized that collection system renovation must be an ongoing process. To that end, the following collection work is recommended by the report with a suggested timeline. These recommendations are based on information available as of this date.

Wholesale replacement or rehabilitation of the Collection system to remove I/I is not practical or cost effective. The recommendation is to target the areas of highest I/I first, gauge the benefit, then continue if such rehabilitation proves to be cost efficient. The recommended initial project included the City's 9th Street corridor to take advantage of other infrastructure planning and financing. Construction in this area is was completed in 2020.

Structural Integrity

Structural integrity of the existing collection, pumping, and treatment system is best defined in the 2019 to 2020 SAW Asset Management Plan (65,600 ft of sewer was TV inspected under the Saw program). The program identifies overall condition rating (or Probability of Failure) for sewers, manholes, pump stations, and WWTP assets. The condition rating can be assumed as a major contributing factor to structural integrity. Following is a summary of asset management ratings from 2019. The manholes and pipes are still being inventoried, and thus, are not included in Table 16.

Table 16: Summary of 2018 Asset Management Rating

Description	Probability of Failure (1-5)	Business Risk (1-25)
Average Collection Lift Stations	2.8	11
Average WWTP Facility Asset	2.9	10
WWTP Asset with: Probability of Failure of 3 or higher Business Risk of 6 or Higher	60 of 100	84 of 100

A probability of failure of 1 is excellent condition (brand new) and 5 is horrible condition (unserviceable); Business Risk is a rank of attention for replacement: 1 to 5 is low priority, 6 to 15 is medium priority, and 16 to 25 is high priority (replace these assets first).

The structural integrity of the wastewater system on an overall basis is moderate and is fairly good for a system this old. The oldest portions of City's collection system are about 100 years old. The WWTP was originally constructed in 1938 with a significant upgrade in 1972 and minor upgrades in 1994.

Industrial Pretreatment

Gladstone does receive limited non-domestic discharges, but does not operate under a EGLE Industrial Pretreatment Program permit. Procedures, methods, and monitoring are per City standard under their self-developed Waste Control Plan. It is expected that the improvements recommended will have a positive impact on industrial pretreatment issues.

Growth Capacity

The proposed 20-year future annual average flow rate is 1.0 MGD. Under low to moderate lake and ground water levels this result in a reserve average annual treatment capacity of approximately 0.38 MGD.

Areas Currently Without Sewers

Developed areas within the community service districts are all currently served. A sewer force main exists from Rapid River to Gladstone. Connection by individual grinder pump stations is possible in the future. Connection of planned residences in Masonville and Brampton Township could result in an average annual demand increase of approximately 0.03 MGD.

Reliability

One of the key reasons for this project is to protect facility integrity and enhance treatment reliability. Mechanical, electrical, and instrumentation replacements with modern versions will by default improve overall system reliability. Critical processes and assets have been evaluated under the SAW asset management program and this Project Plan to strive for affordable reliability.

Alternative Sites and Routing

All improvements under the principal alternatives are contained on the existing site. Considerations for alternate siting and routing are minimal due to the extensive infrastructure already in place.

Combined Sewer Overflows

There are no combined sewer overflows associated with the Gladstone WWTP facility

Project Site Contamination

There are no known contamination sites at the area of the proposed project.

Green Project Reserve

After reviewing the EGLE Green Project Reserve Guidance document and based on experience from past projects it is proposed that capital improvements upgrading the Anaerobic Digester may qualify for Green Project Reserve principal forgiveness. Other proposed improvements are not felt to meet the categorical project requirements. Higher efficiency electrical components may meet the business case requirements.

Principal Alternatives Summary

Table 17 below summarized technical and cost advantage and disadvantages of various options involved in the four primary Alternatives. Table 18 provides a ranking based on environmental, cost, technical, and other issues.

Table 17: Alternative Advantages and Disadvantages

Primary Treatment Processes

Conventional Screening , Grit Removal, Primary Clarifiers	
Advantages	Disadvantages
• Long Term Proven Performance • Minimal energy consumption • Operator familiarity with processes • Highest Solids Remove Efficiency • Minimum O&M	• Higher capital cost • Second primary clarifier required • Screen and grit systems require new building • Complex construction staging • Increase Site Space Utilization • Requires added site area
Rotating Belt Filter (RBF)	
Advantages	Disadvantages
• Compact equipment footprint • Possible installation in existing building • Solids can be digested (anaerobically) or hauled to landfill if land application option becomes inviable • Option to increase solids content of primary sludge in digester (if paired w/ Anaerobic Digester) • Feasible without Fine Screening or Grit Removal	• Requires pilot testing • Limited national experience, new technology • Only one or two manufacturers • Requires pre-screening • Routine belt maintenance required • May be more maintenance intensive • Higher energy use than Primary Settling • Pilot Results suggest lower TSS and BOD removals than conventional primary treatment

Biological Secondary Treatment Processes

Rotating Biological Contactor (RBC)	
Advantages	Disadvantages
• Minimal energy consumption • Operator familiarity with fixed-film processes • Proven over time in Gladstone	• RBCs have minimal potential for upgrade to higher levels of treatment • Requires additions to existing buildings • Complex construction staging • More mechanical maintenance • Some consider obsolete technology
Oxidation Ditch	
Advantages	Disadvantages
• Biological process can be expanded in future if needed for higher levels of treatment • Reliable technology with minimal potential for failure	• Very tight fit on existing site. May require additional land • High energy consumption

• Simple process control • Reliable with High Peak Flows (I/I)	• Operations staff will need to learn new activated sludge process • Highest environment impacts during construction
MBBR	
Advantages	Disadvantages
• Biological process can be expanded in future to allow higher levels of treatment • Compact footprint • Relatively low mechanical requirements	• High energy cost • Potential for catastrophic media loss • Operations staff will need to learn new fixed-film process • Relatively new technology in Michigan • Few Installations in Michigan

Biosolids Digestion and Handling

Anaerobic Digestion	
Advantages	Disadvantages
• Potential for net-neutral energy generation • Operator familiarity with current process • Simpler retrofit of existing equipment	• Higher potential for process upset • Significantly more complex equipment • Requires handling flammable gas. Greater safety hazard. • Odor problems when hauling or maintaining
Aerobic Digestion	
Advantages	Disadvantages
• Minimal process control and operator attention required • Required if Primary Sludge were to be landfilled	• Increased energy consumption • Will require modifications to the sludge storage tank • Lower solids concentration will require more trips to land application site. • Requires adding a new heating boiler • Potential odor problems when aerating
RBF Screening Landfill	
Advantages	Disadvantages
• Minimizes sludge hauling to land disposal	• Significant increase in solids hauled to landfill. • Eliminates ability to anaerobically digest secondary sludge. • High odor generation potential • Dependent on landfill

Table 18: Alternative Ranking

Item	Category	No Action	Alt. #1	Alt. #2	Alt. #3	Alt. #4	Alt. #5
1.	Short Term Environmental Impacts	4	2	3	5	1	1
2.	Long Term Environmental Impacts	5	2	3	4	1	1
3.	Mitigation of Environmental Impacts	4	3	1	5	1	1
4.	Reliability	5	1	4	3	2	2
5.	Implementation	1	2	4	5	2	2
6.	Infrastructure Improvements	5	3	2	4	1	1
7.	Growth Capacity	5	4	3	2	1	1
8.	Annual Costs	5	1	2	4	3	3
9.	Operation & Maintenance	1	2	3	5	4	3
10.	Water Quality	5	1	4	3	2	2
11.	Emergency Redundancy	5	3	1	4	2	2
12.	Probability of Success	5	1	3	2	4	2
	Totals (lower is better)	**50**	**25**	**33**	**46**	**24**	**21**

1. <u>Short-term Environmental Impacts:</u> Principal short-term impacts are those resulting from construction such as removal of vegetation, soil erosion, sedimentation, noise, dust, and traffic disruption.
2. <u>Long-term Environmental Impacts:</u> In evaluating long-term impacts, important considerations are the severity of permanent displacement of natural flora and fauna, quality of the effluent discharged to the receiving water, energy and resource costs and changes in land use and productivity caused by the project.
3. <u>Mitigation of Environmental Impacts:</u> The mitigation category ranks alternatives on the basis of the difficulty and cost to provide environmental impact mitigation measures such as erosion control during construction.
4. <u>Reliability:</u> Reliability is judged in terms of probability of malfunction, necessary maintenance and other associated problems.
5. <u>Implementation Capability:</u> This evaluation category indicates the ability of State, regional and local units of government to reach agreement on a plan and to fund and carry through with the plan.
6. <u>Infrastructure Improvement:</u> This category rates the alternatives in order of the amount of incidental beneficial infrastructure (utilities) improvement resulting from a project alternative.

7. Growth Capacity: Growth capacity gauges incidental system capacity growth potential resulting from problem correction actions.
8. Annual Costs: Ranking in this category is based on estimated annual costs to the typical user for each alternative.
9. Operation & Maintenance: This category is based on the estimated system operation and maintenance needs for each alternative.
10. Water Quality: Water quality is based on the ability of each alternative to protect existing ground and surface waters.
11. Emergency Redundancy: The ability of an alternative to provide treatment redundancy for emergencies.
12. Probability of Success: Probability that a given alternative would be followed through and solve system deficiencies.

SELECTED ALTERNATIVE

Relevant Design Parameters

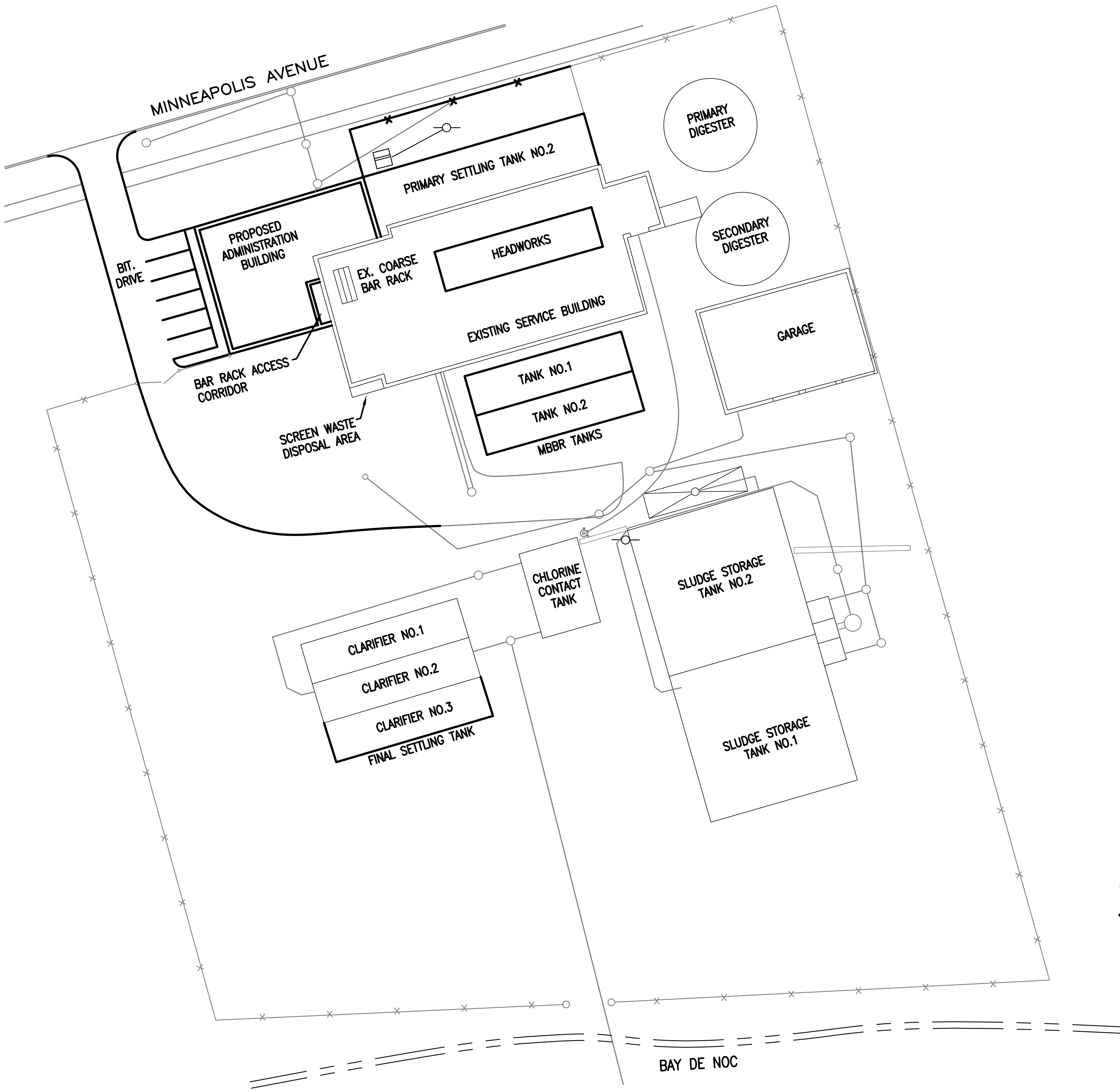
<u>Overall WWTP Improvement Recommended Alternative</u>

The recommended alternative is No. 5 as described under Analysis of Alternatives with costs as summarized in Table 13 on Page 74. Note that the total present worth value of the project is slightly higher than the Alternative 1, but within the error of engineering evaluations. Due to intensive maintenance of RBC shafts within Alternative 1 and2, Alternative 5 is the selected Alternative.

The recommended treatment option for Gladstone is Alternative 5 which includes:

- Installation of Three New Raw Sewage Pumps
- Headworks complete, consisting of Automatic Fine Screening and Vortex Grit Removal
- Additional Primary Settling Tank, Covered
- Installation of a new Moving Bed Bioreactor (MBBR) fixed film secondary treatment process
- Addition of One New Final Settling Tank with Secondary Effluent piping improvements.
- Rehabilitation of the Existing Primary and Secondary Anaerobic Digesters
- Construction of a new Administration Building
- General WWTP improvements to promote reliability, sustainability, and energy efficiency

A conceptual site plan of improvements is provided on the following page in Figure 12 and of the administration building in Figure 13.



LEGEND

EXISTING

PROPOSED IMPROVEMENTS

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FIGURE 12
PROPOSED WWTP SITE IMPROVEMENTS

REVISIONS

REV	DESCRIPTION	DATE

PROJ. #: 210088

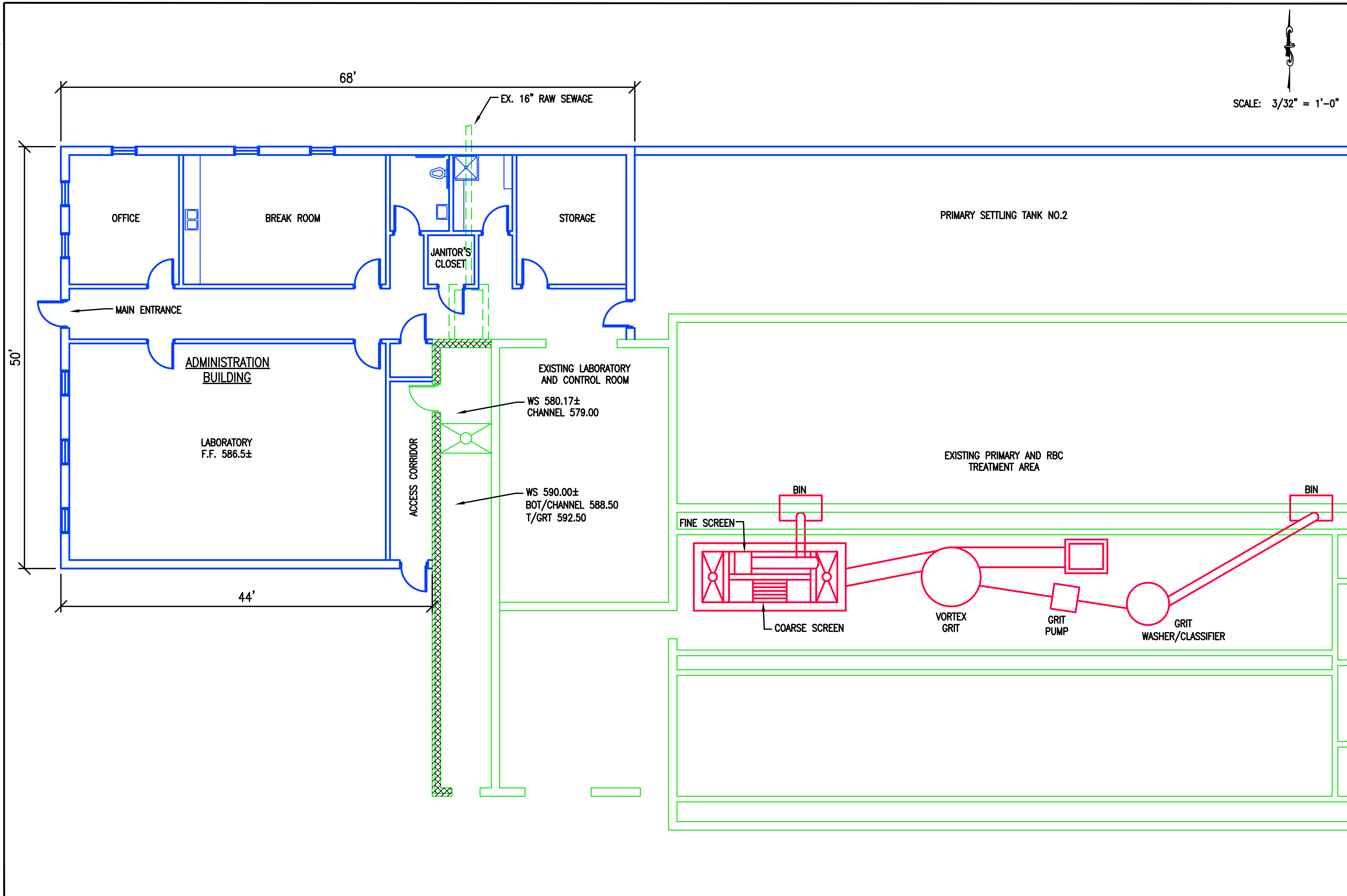
DATE: MARCH 2021

SHEET

1

PRELIMINARY

WE RECYCLE



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WWTP SRF PROJECT PLAN
DELTA COUNTY, MICHIGAN

FIGURE 13
PROPOSED WWTP ADMINISTRATION BUILDING & SCREENING

REVISIONS

REV	DESCRIPTION	DATE

PROJ #: 210088
DATE: MARCH 2021
SHEET
1

PRELIMINARY

Major Process Features –Summary of Proposed Capital Improvements

Table 13 is hereinbefore provided to summarize capital improvements suggested based on this evaluation and report. Table 19 on the next page includes, for Alternative 5, construction costs for improvements needed to upgrade treatment processes, general planned improvements to accommodate long term needs, and several asset management driven priority improvements.

Table 19 is a summary of individual improvements with construction costs escalated to 2024 (2.5% per year); all improvements are categorized as Priority 1 (Phase 1) and there are no Priority 2 improvements. Table 19 includes all eligible and ineligible improvement costs under the SRF program including mitigation of environmental impacts. A more detailed breakdown of construction costs is included in Appendix D.

Priority 1 improvements are those directly related to immediate treatment performance, NPDES compliance, facility preservation, and energy use reduction. Priority 2 Improvements could be of somewhat lesser urgency than Priority 1. All improvements listed Priority 1 and are recommended as needed for Gladstone over the planning period.

Table 19: Phase 1 - Construction Costs

Description	Construction Costs
Administration Building	$1,367,000
Digester Gas Handling System, Gas Handling Equipment	$95,000
Digester Gas Piping and Valves, Replacement & Upgrades	$60,000
Engineering Studies and Evaluations	$82,000
Facility Coating, Painting, Masonry and Concrete	$412,000
Facility Piping and Valve Improvements	$488,000
Final Clarifier, 3rd Final Tank	$1,333,000
HGL - Raise Secondary and Chlorine Tank Walls	$364,000
HVAC Rehabilitation (SAW), General Upgrades	$96,000
MBBR Equipment and Tanks, New Treatment Process	$2,329,000
New Screen and Grit Process, within Existing RBC Area Nema 7 Rating Electrical Service	$1,921,000
Primary Anaerobic Digester (No. 1) Mixing and Rehabilitation	$801,000
Primary Clarifier No. 2	$1,942,000
Primary Digester Heating Boiler and Exchanger Replacements	$400,000
Primary Electrical Service Area Upgrade, NEC Code, EPA Requirements	$298,000
Raw Sewage Pump Improvements	$356,000
Chlorine Contact Tank Rehabilitation (SAW)	$50,000
Return Sludge Pumping	$497,000
Roof Rehabilitation (SAW), Replacement	$83,000
SCADA System, Converting Plant to Digital Control	$240,000
Secondary Digester (No. 2) Rehabilitation and Cover Replacement	$205,000
Secondary Treatment Pumps	$146,000
Site Improvements (Pavement, Fencing, Restoration Landscaping)	$121,000
Window and Door Replacement (SAW)	$42,000
Total Construction Costs	**$13,728,000**

Unit Process Sizes as Related to Service District Needs

Unit processes have been sized for an average annual flow of 1.0 MGD based on the current NPDES permit. New tankages have been sized for an average annual flow of 1.5 MGD for long term future conditions. Unit processes have been sized for peak hour flows of 3.5 MGD and peak instantaneous flows of 4.2 MGD which is projected as the current 25-year, 24-hour flow.

Depending upon ground water levels in the collection system, current average flows range between 0.60 and 0.75 MGD. At all but the highest groundwater levels, with corresponding elevated rates of WWTP influent I/I, the WWTP has between 0.25 and 0.40 MGD of reserve capacity.

Previously discussed future flow additions could include:

- Brampton and Masonville Townships along Bay Shor Drive (Estimated 200 EDUs, 0.04 MGD)
- Gladstone Industrial Park (0.01 MGD)
- Gladstone North Shore Development.
- Miscellaneous Growth

It is estimated that the current design capacity of 1.0 MGD is adequate to handle these flow increases.

<u>Treatment Flow Diagram</u>

A Proposed WWTP Flow Schematic is provided on the following page in Figure 14.

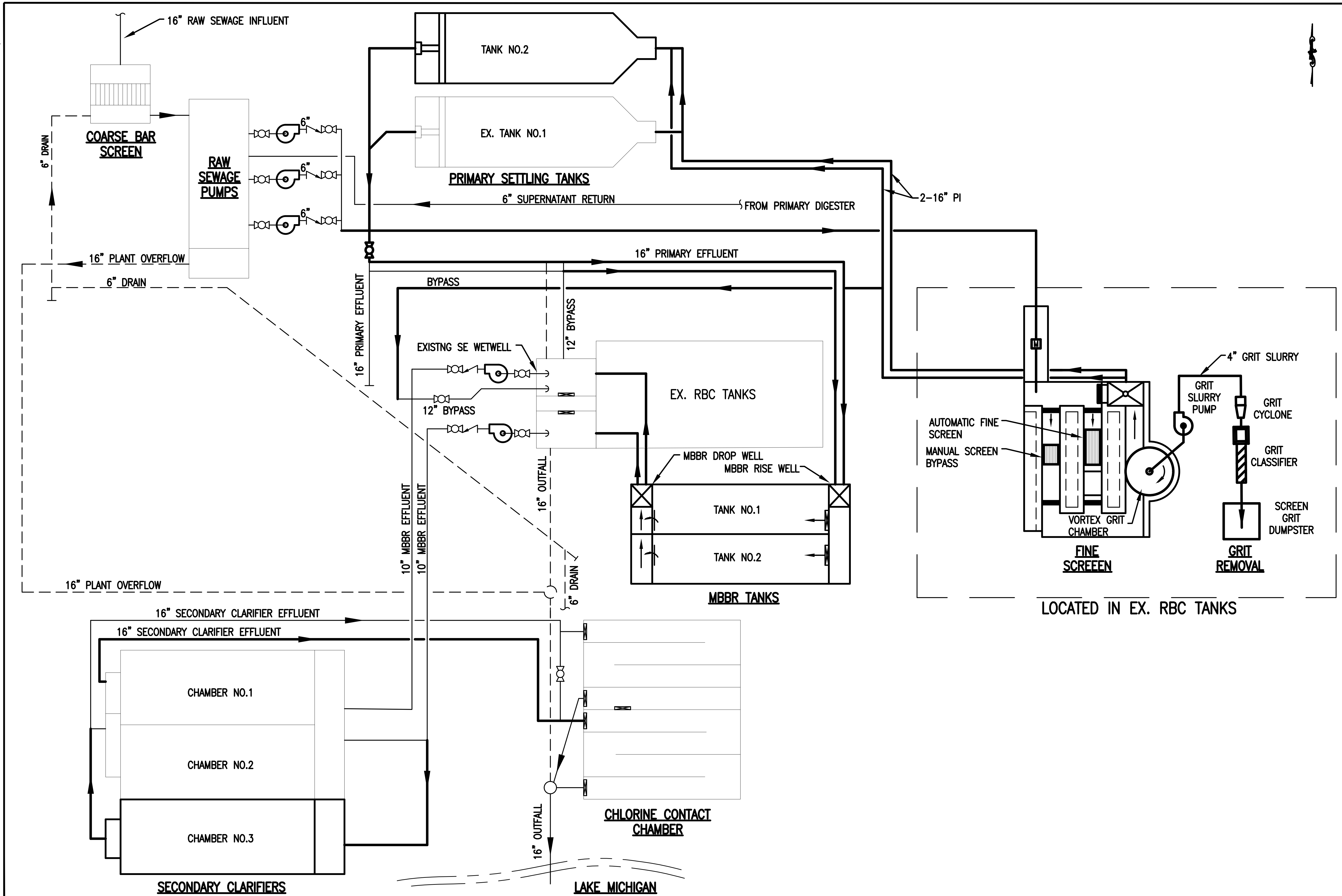

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FIGURE 14
PROPOSED WWTP FLOW SCHEMATIC

REVISIONS

REV	DESCRIPTION	DATE

PROJ. #: 210088

DATE: MARCH 2021

SHEET

1

PRELIMINARY

Description and Design Criteria for Individual Improvements

Following is a description and design basis for major proposed improvements all associated with Alternative 5, or the recommended alternative. Additional detail can be found in the supporting cost opinions in Appendix D. Condition and Business Risk factors for existing equipment is available in the Gladstone SAW Asset Management Plan. Below is an item by item description.

Administration Building.

A new Administration Building is proposed to house the Laboratory, Superintendents Office, Training and Break Room, Shower and Restrooms, and Storage.

Floor Area	2400 sf
Wall Construction	Concrete Masonry interior, Architectural Exterior Block
Roof Construction	Wood Truss with Standing Seem Metal
Floors	Slab on Grade with Conventional Footings

Headworks Improvements

A complete Headworks system shall be retrofitted within the repurposed existing RBC treatment Area. RBC trains are to be demolished, the existing service area shall receive upgrades to meet current design standards such as Nema 7 rated HVAC and electrical service. Headworks improvements will include automatic fine screening with washing/compacting, vortex grit removal including grit pumps with classifier. Existing manual bar rack will remain in service to protect raw sewage pumps from large debris. See Figure 13 for a conceptual layout of the Headworks and

Fine screen will be an inclined rotary basket type with screw type dewatering elevator. The unit is proposed for installation in the existing RBC tankage.

Screen Type:	Inclined, Rotating, Circular Basket Type Screen
Dewatering and Conveying:	Rotary Screw
Hydraulic Capacity:	4.2 MGD, 30% Blinded
Channel Dimensions:	36” Wide
Screen Opening:	6 mm (1/4”)
Estimated Head loss:	16” Water Column

Existing constant velocity grit channel is to be abandoned in favor of a new self-contained vortex grit unit within the existing RBC tanks.

Grit Removal:	Stainless Steel Shell Located within Existing RBC tanks
Vortex Upper Diameter:	8’-0”
Vortex Lower:	3’-0”
Design Flows:	1.0 MGD Annual Average, 4.2 MGD Peak Hydraulic
Materials of Construction:	316 Stainless Steel

Grit Removal Performance:	95% of Grit 100 Mesh or Coarser
Grit Slurry Pumps:	Two, End Suction Centrifugal, Hardened Internals
Capacity:	Approx. 200 gpm
Grit Piping Diameter:	3” and 4”
Grit Cyclone/Classifier:	Tangential 4” Slurry Feed, 4” Slurry Concentrate, Single Cyclone, Approx. 200 gpm Capacity
Grit Concentrators:	12” Inclined Screw Type, Single Unit 316 Stainless Steel, Materials of Construction

New Raw Sewage Pumps

New vertical, dry pit sewage pumps will be installed with variable speed drives. Due to physical and hydraulic limitations within the WWTP, it was most feasible to locate pumps prior to fine screening and grit removal. It is recommended that high quality units be installed.

Number of Pumps:	3
Pump Type:	Vertical, Dry Pit Submersible
Impellor Type:	Enclosed, Non Clog
Capacity:	1450 gpm
Accessories:	Variable Frequency Drives
Power:	460 V, 3 Phase

Additional Primary Settling

An additional aluminum covered Primary Treatment tank shall be installed to the North of the existing. A conceptual layout is available in Figures 12 and 14. Proposed Primary Tank will be similar in size and function as the existing. City will be able to feed chemicals to the primary tanks to improve performance. WAS may be pumped to the Primaries for co-settling, but would primarily be wasted to the digesters. Overflows from the Headworks system shall be provided to protect against flooding, along with primary treatment bypass options. Influent and Effluent Pipes are to be housed in a pipe gallery, allowing access and maintenance. Design BOD and TSS removal range from 50-60%.

Primary Tank Description:	Rectangular, Concrete, Aluminum Covered
No. of Units:	1 Additional Tank, Matching Existing
Dimensions:	14’-0” W x 68’-0” L
SWD:	11’-0”
Hydraulic Rating:	1.0 MGD Average Annual, 4.2 MGD Peak
Surface Settling Rate:	350 gpd/Sf at 1.0 MGD

Weir Overflow Rate:	12,700 gpd/lf at 1.0 MGD
Effluent Trough:	Concrete Channel, with Adjustable Effluent Weir
Scum Handling:	Manual Scum Collector with Box, Pumped to Digester or Manually Scooped
Sludge Handling:	Interconnection to Existing Piston Sludge Pumps
Chemical Feed:	Sch. 80 PVC Chemical Feed
Primary Effluent Sampling:	Automatic Effluent Sample, Tap PE Line

Existing Primary Service Building Upgrade for Headworks System

The existing Primary and RBC Building will be improved to house the Headworks and Primary Tank No. 1 in a Class 1, Division 1 Environment. The Headworks area will be isolated from the abandoned RBC Area, Existing Lab, and Furnace Room. Electrical and HVAC Systems will be upgraded. RBC tank floor openings will be closed and code complaint ingresses provided, to MBBR sludge pumps within South RBC Train.

Approximate Area	
Headworks Room:	2,720 sf
WWTP Miscellaneous:	1830 sf
Existing Construction:	CMU with Concrete Roof (the south wall of the building has removable wall panels for equipment access)
Approximate Headroom:	
Headworks Area:	11'-3"
Miscellaneous Area	8'-0"
Substructure Interior Depth	
Headworks Area:	7'-0"
Miscellaneous Area	12'-0"
Proposed Improvements	
Electrical	Replace, Nema 7/Nema 12
HVAC	Continuous Ventilation in Headworks/Primary area
Ingress/Egress	Code Compliant

Electrical Service Improvements

The existing 480-volt, 3 phase electrical system dates from 1974 and relies up on portable generator plug-in for backup electrical service. It is proposed to improve the 480-volt distribution system with new Motor Control Centers complying with EPA criteria for redundancy in MCCs. Along with general electrical system upgrades it is planned to install a diesel powered permanent standby generator with automatic transfer switch.

Generator Type	Diesel
Generator Capacity	300 KW

Location/Enclosure:	Outside, Metal Enclosure, sub-base fuel tank
MCC Installations	
MCC-A and B	Existing Electrical Area (Nema 1)
MCC-C and D	MBBR Area (Nema 3X or Nema 4)
New 208V-120V Lighting Panels	
Headworks/MBBR	2 Panels
Administration Building	2 Panels

SCADA Improvements

The current WWTP control and monitoring system is 50 years old and utilizes long-time obsolete analogue technology. It is proposed to upgrade the instrumentation system with new SCADA (Supervisory Control and Data Acquisition) system. This will include a new SCADA main control panel (MCP) along with redundant programmable logic controllers and operating computers. New signal devices such as flow meters, level sensors, gas detectors, etc. are included in the budgeted costs.

New Secondary Treatment Pumps

Existing vertical non-clog Secondary Effluent Pumps are nearing 50 years old. New vertical, dry pit submersible effluent pumps will be installed with variable speed drives.

Number of Pumps:	2
Pump Type:	Vertical, Dry Pit Submersible
Impellor Type:	Enclosed, Non Clog
Capacity:	3,000 gpm
Accessories:	Variable Frequency Drives
Power:	460 V, 3 Phase

Moving Bed Bioreactor (MBBR) Tanks and Equipment

A new Moving Bed Bioreactor (MBBR) process will be installed south of the existing RBCs. The existing RBC process will be abandoned; RBC shafts and equipment will be demolished after the new MBBR system is complete and successfully placed in operation. Two new open, reinforced concrete MBBR tanks constructed with a common center wall will be provided. The hydraulic grade line through the proposed MBBR system will be evaluated during design to minimize pumping requirements and optimize energy efficiency.

The MBBR system installed in the new tanks will consist of a coarse bubble diffuser aeration system, biomass media carriers with sufficient surface area for the required fixed film treatment organisms. Submerged screens will be provided to retain the media in the aeration basin and prevent release to the clarifiers. New low pressure aeration blowers will be installed in the exiting headworks building to furnish oxygen needed for the MBBR organisms.

MBBR Tanks

Number of Tanks:	2
Side Water Depth:	14 ft
Approximate Size:	24 ft Wide x 50 ft Long
Construction:	Reinforced Concrete, 4500 Ksi

MBBR Media

Description:	Plastic, High Surface Area

Aeration System:

Diffusers:	Coarse Bubble
Diffuser Submergence:	13.5 ft
Blower Type:	Rotary Screw
Number of Blowers:	3
Blower Capacity:	600 cfm, 30 Hp Each

Waste Sludge Pumping

A new Waste Sludge pumping system will be provided to serve the MBBR process. Two new waste sludge pumps will be installed in the lower level of the Headworks Building (abandoned RBC space).

WAS Pump Description:	Vertical, Non-Clog
Number of Pumps:	2
Pump Capacity:	250 gpm
Electrical Service:	480 Volt, 3 Phase, VFD Drive

Final Settling Tanks

One new rectangular Final Settling Tank (FST) will be installed in parallel with two existing tanks. New Secondary Effluent piping will be installed to reduce hydraulic losses through the FSTs and allow increased peak flow handling capacity.

Final Settling Tank

Tank Size:	14-0" W x 58'-8" L x 8'-6" Average SWD
Maximum SWD:	10'-0" (Existing SWD to be Increased, See Below)
Surface Settling Rate:	1420 GPD/sf at 3.5 MGD

Weir Overflow Rate:	11,220 GPD/lf
FST Improvements:	Inlet Distribution Hydraulics, SWD Increase, Relocated Weirs. Relocated Handrails and Tank Access

WWTP Piping and Valve Upgrade

All piping and valves are at least 46 years old and portions are 90 years old. The overall process piping was evaluated under the 2017 SAW Asset Management plan. This report is proposing a capital improvement allowance to replace piping and valve assets which are judged to have high SAW Business Risk ratings. Old cast iron piping for the most part will remain useable but process valves three-inch and larger will be upgraded under this item.

Primary Anaerobic Digester No. 1 Structure Rehabilitation and Mixing System

The exiting Primary Anaerobic Digester will be rehabilitated for continued use into the future. This was evaluated during the SAW Asset Management program. The existing system including the reinforced cast-in-place concrete dome, is structurally sound but is in need of concrete restoration, technological upgrade, and replacement of equipment which has outlived its useful life. Ultimately it is proposed to complete the following Primary Digester Improvement as describe within the design basis below. However, sludge dehumidification/dryer system is still being evaluated. Please see biosolids section above.

Primary Digester Structure		
	Deteriorated Concrete	Chip and Repair Outside
	Interior Coating:	Abrasive Blast and Recoat
	Interior Costing:	Coal Tar Epoxy
	Dome Exterior:	3" New Polyurethane Foam insulation, 60 Mil EPDM Membrane
	Safety:	Replace Pressure Vacuum Relief, Manway, and Sample Port
Mixing System		
	Existing Gas Mix Equipment	Demolish
	New Mixing System	Pump and Nozzle System, Vaughan
	Pump Capacity:	800 gpm, 25 Hp
	Pump Type/Number:	Vaughn Vertical Chopper Pump/ 2 Recommended

The existing Anaerobic Digestion system is adequately sized to handle the 1.0 MGD propose future treatment capacity. Additional digester gas related improvements are discussed in other locations.

Secondary Digester No. 2 Rehabilitation

The existing Secondary Digester will remain in service. The existing gas holder, floating cover will be replaced. An allowance will be made for other minor improvements.

Primary Digester Heating Boiler and Exchanger Replacement

The existing 1974 dual fired sludge tube heat exchanger will be removed and replaced by a separate boiler and spiral heat exchanger system. The boiler will operate on Digester Gas or natural gas. The new boiler will be installed at the present location, but space may be available within the upper Headworks level if desired. New recirculation pumps will be installed.

New Boiler:	Dual Fired, Hot Water, Digester Gas, and Natural Gas
Heating Capacity:	200,000 Btu/hr
New Heat Exchanger:	Spiral, Water and Sludge Channel Type
Recirculation Rate:	150 gpm
Recirculation Pumps:	2 Vertical Non-Clog at 150 gpm Each

Digester Gas Handling Improvements

Improvements to the digester gas handling equipment is consider to be a high Business Risk Factor (Gladstone Asset Management Plan) and also is proposed as a safety upgrades with the 46-year age of this equipment. Improvements include replacement of Pressure Control Valves, Flame Arrestors, Pressure Relief Valves, Moisture Separators, Waste Gas Burner, and system monitors.

Digester Gas Piping and Valve Replacement

It is proposed to replace all original iron gas piping with four-inch minimum stainless steel. Stainless Steel valves will also be installed.

Facility Surface Rehabilitation (Painting and Masonry/Concrete Restoration)

A capital allowance is also recommended for rehabilitation of concrete, masonry, and ferrous surfaces where determined to be necessary. All exterior spalling concrete will be rehabilitated. Deteriorated and spalled brick veneer will be replaced. Painting will be done as feasible under the requested allowanced.

HVAC Rehabilitation

Replacement or rehab of the existing Treatment Building HVAC is necessary. The upgrade is partially completed within the previous RBF Building and Digester Boiler Improvement. This item is intended to affect the pumping areas, gallery areas, and existing service building spaces.

Heating System:	Gas Fired Unit Heater
Individual Area Ventilation:	Roof or Wall Fans with Automatic Dampers

Chlorine Contact Tank Rehab

Rehabilitation of the chlorine contact tank is required. Patching of spalled concrete near water elevation. Repairs will extend the service life of the concrete structure.

Roof Rehabilitation

Existing roofing material is nearly 30 years old, leaks are evident throughout the plant. Interior drains lines are severely corroded, especially within headworks area of the plant. It is recommended to replace approx. 6,000 sf of roof material, with new interior drain lines.

Window and Door Replacement

Approximately 500 sf of windows and doors are to be replaced within the plant. Doors within the headworks facilities are failing and are in need of replacement. Windows adjacent to the original primary treatment facilities are in poor condition, it is recommended to replace.

Hydraulic Improvements

Increased hydraulic capacity is required to offset high Lake Michigan water levels and to accept increased collection system flows needed to meet State statutes for sewage treatment. The selected alternative to increase hydraulic capacity is Option 2 – Raise Chlorine Contact Tank and Final Settling Tank operating water surfaces. Raising the tank walls and hydraulic structures within the tank will create a higher operating water surface and a greater driving force to push effluent through the Outfall. Although the cost for this option is slightly higher than the least expensive options (Effluent Booster Pump Station), an important side benefit is increase settling depth in the clarifiers and increase disinfection Contact Time. Reinforced concrete will be used to extend existing walls upward.

Walls of the FST will be raised approximately 3.0- feet along with walkways, handrails, effluent launders and other internal structures. New sludge collector mechanisms have been budgeted for each existing settling tank. Improvements will also be made to influent flow distribution to aid performance. Existing effluent launders and steel catwalks will be salvaged and reused in the final installation. New handrail will be provided. Exterior and interior walls of the Chlorine Contact Tank and Effluent Manhole A will be raised. Hydraulic gate operators, overflow weirs, and castings will be elevated also.

Final Settling Tank

Water Surface Increase:	Approximately 3.0 ft
Side Water Depth:	13’-0” Maximum, 10’-0” Minimum
Surface Settling Rate:	1,421 GPD/sf at 3.5 MGD
Weir Overflow Rate:	13,460 GPD/lf at 4.2 MGD
Sludge Collectors:	New Drives, Shafts, Sprocket, Chains
Scum Collectors:	Rehabilitate Coatings
Reused Components:	Launder, Walkways, Gates, Grating (new concrete frames)
New Components:	Aluminum Handrail

Chlorine Contact Tanks

Water Surface Increase:	Approximately 3.0 ft
Side Water Depth:	Approximate 8’-11” at Average Flow
Chlorine Contact Time:	17.2 Min at 3.5 MGD

Reused Components:	Sluice Gates
New Components:	Aluminum Handrail

Effluent Manhole A

Water Surface Increase:	Approximate 3.0 ft

Site Improvements

Site improvements will be made as required by specific process and tank construction. In general, work is below the FEMA 500-year flood level and construction will be minimized. New and replacement hot mix asphalt will be needed. Some fence and main gate improvements will be needed.

RBF Pilot Study

It is understood that an on-site pilot study of Rotating Belt Filter equipment will be required by EGLE for approval of the Project Plan. This will be done in the summer of 2020 at the Gladstone WWTP per a pilot study plan to be approved by EGLE. The duration of the pilot operation is expected to be approximately seven days. The pilot study will confirm the liquid and solid throughput rates and expected removal of TSS and BOD. Key components are:

- Selection/procurement of pilot equipment and pilot operations
- Drafting and approval of the pilot protocol
- Assignment of laboratory analysis responsibility
- Delivery and operation of the pilot
- Completion of the pilot reports (Manufacturer and Engineer)

Upon the completion of the RBF pilot study from November of 2020 (refer to Appendix A for detailed report dated February 2021), data suggests that RBF units do not perform as reliably as conventional primary treatment tanks. Multiple belt mesh size screens were deployed at Gladstone; best results were obtained with the 250-micron belt. Average removals of 40% for TSS and 23% for BOD, were observed. Historical data from the past 7 years, suggest that the primary tank successfully removes 50% TSS and 60% BOD on average. Due to reliability, flexibility, and familiarity it is suggested that Gladstone proceed with conventional primary clarifiers.

Sewer System Evaluation Survey (SSES)

An SSES is planned for 2021.

Additional Design Criteria

Any WWTP system components that are recommended under this Project Plan would be designed using local (City), regional, and Ten State Standards plus meet EGLE guidelines and requirements

Residuals Management

Generated residuals management (after digester process improvements) is not planned to change. Biosolids are digested by Anaerobic Digestion using one High Rate Primary Digester and one Secondary Digester with a Gas Holder Floating Cover. Following the Secondary Digester solids are directed to rectangular Sludge Storage Tanks No. 3 and 4 (halves of one tank) where further decanting and gravity thickening occurs. Gladstone disposes of sludge on City land, utilizing WWTP staff and equipment, under an EGLE approved Residuals Management Plan (RMP). For current location and more information on land application, refer to the Project Maps section. All costs associated with Residual Management are contained within the Digester costs above.

The existing system of Anaerobic Digestion with Land Application will be upgraded.

- The exiting primary digester structure will be rehabilitated
- The existing Secondary Digester structure will be rehabilitated and floating cover will be removed.
- A new dual fired Digester Gas boiler with Spiral Heat Exchanger is proposed
- A nozzle type mixing system with mixing pumps is proposed for the primary high rate digester.
- Digester gas piping and equipment will be upgraded.
- New cover will be installed on the Secondary Digester.

Collection System

Initial collection system work recommended as part of future capital improvement planning includes replacement/repair of numerous sewer sections in the older downtown area of the City. This work can be prioritized to match other planned infrastructure and/or street reconstruction efforts undertaken by the City as funding is secured. An example is the 9th Street reconstruction project being undertaken by the City in 2019 to 2020.

Pump Station Types and Sizes

No new wastewater pump stations are recommended as part of this project plan. The City's capital improvement planning includes addressing pump station components as they become deficient. Continued monitoring and evaluation of the city's Underpass Pump Station after current City rehab efforts of its force main is already planned by the City. The City is continuing force main rehab/rehab here.

Project Maps

Locations of the WWTP, pump stations, sewers, and force mains can be found in Figure 8. Lengths and sizes of sewers and force main can be found in Table 5. Full size maps can be found in the pocket in Appendix F. The WWTP proposed site improvements are in Figure 12 and 13; the WWTP flow schematic is shown in Figure 14.

Under an EGLE approved RMP, the City is currently disposing of sludge via land application on City owned land using WWTP staff and equipment. The forest covered land was purchased in 2000 and has very low potential for public exposure. Figure 15 below shows the location of the land application site relative to the WWTP, north of the City in Baldwin Township along Perkins 30.5 Road, just west of US Hwy 41. This land is approximately 358 acres and is located in Township 42N, Range 22W, and Section 36 (45.985N, 87.008W). However, not all of the acreage is usable or accessible for land application; only about 80 of the 358 acres is available for land application. The total trucking miles, round trip, is about 22 miles and each truck can hold a volume up to 3,000 gal. The City currently averages 98 truckloads per year.

Figure 15: Location of Land Application Site of Residuals

Green Project Reserve

Several of the improvements described herein for the selected alternative are felt to meet the requirement for inclusion under the Green Project Reserve portion of American Recovery and Reinvestment Act. These are listed with a reference to their description in Table 20 below:

Table 20: Green Project Reserve Improvements

Item	Improvement	Green Reserve Category	Page Reference
1.	Biosolids Improvements-Biogas Utilization	Energy Efficiency	67

A brief summary of environmental benefits is provided below from explanation included in this report.

Biosolids Improvements-Biogas Utilization

Major biosolids improvements are required to sustain anaerobic digestion, provide reliable treatment into the future, and allow the beneficial use of the biogas (digester gas or methane) formed in the anaerobic digestion process. This process has been used in the past but is in jeopardy of abandonment due to age and condition. Table 19 on Page 92 lists all WWTP improvements. Biogas improvements discussed herein include:

- Anaerobic Digester Mixing and Rehabilitation
- Digester Gas Boiler and Heat Exchanger
- Secondary Digester Rehabilitation
- Digester Gas Control and Conditioning Equipment
- Gas Piping and Valves

Biogas will be used as a primary fuel for a new boiler system that will continue to heat the contents of the high rate anaerobic digester and portions of the existing service building. It is estimated that the energy savings will be 150,000 Btu/hr during the heating season. The total project cost of biosolids improvements is $1,180,600.

Digester gas use is categorically eligible for the Green Project Reserve under Section 3.2-1 of the Guidance Manual, but the alternative must also be cost effective without consideration of GPR principal forgiveness. The cost effectiveness analysis of Biosolids Handling is combined with the Sewage process and is contained in Appendix D, where seven separate combinations of treatment and biosolids handling were compared in a present worth analysis. Anaerobic digestion is cost effective and the selected alternative based on financial and performance criteria.

Although anaerobic digestion was compared assuming GPR principal forgiveness, on a dollar basis it is the preferred approach to handling of biosolids from the new MBBR process in Gladstone. Anaerobic digestion is preferred with the more volatile organic solids associated with the activated sludge process. The use of Biosolids allow the process to be energy-neutral as opposed to the high use of energy in the aerobic digestion option.

Controlling Factors

- Planning and design will be in accordance with applicable industry standards including, EGLE standards, WEF MOP 8 Manual of Practice, Ten States Standards for Wastewater, and normal practice
- EGLE and USACE Permitting Requirements will be controlling factors

- OSHA and MiOSHA Requirements
- SHPO and THPO Requirements
- Regional Utility Standards

Special Assessment District Projects

A special assessment district is not planned nor applicable to this project.

Sensitive Features

Work will take place on treatment facility grounds and be isolated from any potential sensitive environmental locations. It will be necessary to protect the waters of the Little Bay De Noc during construction. Noise and dust must be controlled. Work will be within 500 ft of Little Bay De Noc which will require a Joint Permit Application (EGLE and USACE).

Environmental impacts will be minor and temporary construction related. Mitigation measures as necessary will be required via construction contracts. Permits (along with related agency reviews) will be obtained during the design process.

Schedule for Design and Construction

A proposed project schedule follows in Table 21.

Table 21: Schedule

Task Description	Planning Date
Gladstone Authorizes Project Plan Preparation (Complete)	SAW 2017
Intent To Apply Submittal to EGLE (Complete)	December 2019
Project Plan/EGLE Meeting (Complete)	February 2020
Rate Methodology Approved (SAW Deliverable)	April 2020
Complete Preliminary Draft Project Plan	April 30, 2020
Sign Administrative Consent Order (ACO)	April 2021
Rotating Belt Filter Pilot Study Start	June 2020
Contract and Begin SSES	February 2021
Complete Pilot Study	February 2021

Task Description	Planning Date
Final Submittal of Gladstone SAW Package	October 2020
Complete SSES	July 2021
Submit Revised Draft Project Plan To EGLE	March 15, 2021
Submit Final Draft Project Plant to EGLE	April 15, 2021
Advertise for Public Hearing	April 12, 2021
Hold Public Hearing	May 17, 2021
Submit SRF Project Plan	June 1, 2021
Engineering Agreement Authorized & Interim Financing Established if Necessary	July 1, 2021
Design Begins	July 1, 2021
Final State Project Priority List Published	October 2021
Submittal of Draft Plans & Specifications	November 19, 2021
EAS Publish	February 2022
Submittal of DWRF Application Part I & II	February 15, 2022
Submittal of Final Plans & Specs (**3rd Quarter Funding**)	January 25, 2022
Issuance of Construction Permit	March 3, 2022
FONSI Clearance	March 9, 2022
Publication of Bid Advertisement	March 9, 2022
Opening of Bids	April 9, 2022
Submittal of DWRF Application Part III, Including Resolution of Tentative Contract Award	April 15, 2022
EGLE Order of Approval	May 16, 2022
SRF Bonds Sold	June 6, 2022
Construction Notice To Proceed	August 5, 2022
Complete Construction	November 2024

Cost Summary

SRF Eligible Project Funding

No WWTP improvements have been identified as ineligible for SRF project funding at this time.

Phase 1, Project Cost Breakdown

Table 19 on Page 92 provides a breakdown of construction costs for each improvement proposed for funding under this project phase.

Table 22 below provides a breakdown of administrative, engineering, construction, and contingency cost associated with the recommended Phase 1 project.

Table 22: Phase 1 - Project Cost Summary

Description	Amount
Construction Total	**$13,728,000**
Administration, Legal, and Bonding	$145,000
RBF Pilot Study	$30,000*
I & I Work plan and Project Plan Amendment	$23,000*
Sewer System Evaluation Survey	$45,000*
Total Preliminary Engineering (Planning)	**$98,000***
Design Engineering	$1,243,000
Bidding (Basic Services)	$35,000
Additional Services	$184,000
Construction General Engineering (Basic Services)	$323,000
Resident Project Representative	$378,000
Post Construction (Basic Services)	$17,000
Engineering Total	**$2,180,000**
Subtotal	**$16,053,000**
Contingency	**$964,000**
Project Total	**$17,017,000**

*Note: *Costs are included within the Construction Total*

Authority to Implement Selected Alternative

The City of Gladstone is incorporated as a Home Rule City in the State of Michigan. The City has successfully implemented facility improvements projects over the past 50 years. The City has shown it has the legal, institutional, technical, financial and managerial resources to accomplish implementation of the recommended alternatives.

User Costs

This report has recommended improvements and suggested a phasing of improvements to reduce the short term effects on user rates on City residents. All project improvements are categorized as Phase 1 and are outlined in Table 19. The Phase 1, proposed SRF project, is presented in Table 22 to demonstrate the impact on user rates that may be possible with a project of this size. This breakdown assumes a 30-year debt service on the bond at an interest rate of 2.125% (2021 interest rate). O&M is not expected to increase. Expected user rate impact is noted below:

SRF Loan Amount	$17,017,000
Anticipated Interest Rate	2.125%
Term	30 Years
Annual Debt Service	$772,929
Monthly Debt Service	$64,411
Estimated System EDUs	2,222
User Rate Impact / EDU	$29 / month

The Phase 1 proposed project includes all improvements which involve energy conservation and water use conservation. These components will be submitted to EGLE for funding under the Green Project Reserve. It is possible that principal forgiveness may exist for components which qualify for the Green Project Reserve.

Note that user rate impact may increase negligibly if sludge drying/dehumidification (Class A Biosolids) is selected.

Disadvantaged Community

Gladstone is a disadvantaged community.

Useful Life

Remaining Useful Life of all wastewater assets is available in 2019 to 2020 SAW Asset Management Plan process evaluation and asset rating lists (see Appendix A).

For new capital improvements including those under the proposed SRF project the total useful lives are as listed below based on methodology for salvage value computation.

- Building: 40 years
- Underground facilities including piping and foundations: 50 years (100 years expected based on performance of existing systems).

- Short-lived equipment: 20 years (30 to 40 years expected based on performance of existing equipment).

Equipment Depreciation and Replacement

Separated from capital improvements, planning for regular equipment replacement is an important component of plant operations and should be a line item in the budget. Recommendations for annual repair, replacement, and improvement (RRI) of existing short-lived systems was conducted under the 2019 to 2020 SAW program. The amount of proposed annual RRI funding contribution is factored into recommended user rates.

EVALUATION OF ENVIRONMENTAL IMPACTS

General Descriptions

Summary

The anticipated environmental impacts resulting from implementation of the selected alternative can include beneficial and detrimental, short and long term, and irreversible or irretrievable impacts. The following is a discussion of the expected environmental impacts for the recommended plan.

Beneficial or Adverse

Impacts of the recommended plan are primarily beneficial, but some short-term construction related negative impacts do exist.

The beneficial impacts of the selected alternative include:

1. Improved reliability of waste water treatment and protection of the Little Bay de Noc surface waters
2. Improved treatment performance and effluent quality discharged
3. Reduced use of electrical energy

Short-term negative impacts are related to construction and include:

1. Low intensity noise from construction activities and equipment
2. Dust from the limited site improvements such as site grading
3. Potential impacts of soil erosion and sedimentation
4. Slight air quality impacts from painting and coating work
5. Slight solid waste contribution from demolished materials

Construction activities for the proposed plan will occur on an existing developed site. This allows containment of many of the construction related adverse impacts and the mitigation measures necessary to minimize those impacts.

Construction related jobs would be generated and local contractors would have an equal opportunity to bid on the work. Local suppliers of piping or building materials and equipment would also benefit.

Construction related impacts such as noise and dust would be generated. Contract documents will require dust control. Spoil from excavation will require approved disposal and erosion control mitigation. The aesthetics for the immediate area of the construction would be temporarily affected until restoration is complete. Where impacted, existing structures would be tested for hazardous material during the design phase. If any are found, disposal will be according to State law.

The project is not expected to encounter contaminated soil. Minimal dewatering of groundwater to facilitate construction will be needed.

Construction of the improvements will help insure long-term reliability and efficiency of the wastewater utility system within the study area.

No significant impacts are anticipated on other cultural or environmentally sensitive resources. Copies of environmental review correspondence can be found in Appendix C.

Short and Long-Term

- Trade-offs: The short-term adverse impacts associated with construction activities would be minimal in comparison to the long-term continued benefits to the area through improved infrastructure. Short-term positive impacts due to construction (such as temporary increases in employment and material purchases) have no offsetting detrimental long-term impacts.
- Limiting Future Options: The recommended project should have no adverse impacts regarding, the limiting choice of future options. Improving wastewater treatment reliability should in fact improve on the number of options available to the study area.
- Future Land and Water: The project segments are not expected to have adverse effects relative to limiting the range of future land and water use options.
- Long Term Risks: There are no known long-term risks to public health or safety due to the recommended project. The project will enhance the environmental quality and improve public health and safety.

Irreversible and Irretrievable

- Fossil fuels, human labor, construction materials, and wear on equipment, would be utilized during construction. Financial resources of Gladstone and the State of Michigan would also be committed.

Analysis of Impacts

Direct Impacts

- General
  - Correspondence, maps, etc. relative to each of the items below can be found in Appendix C.

- Construction Impacts
  - Natural and Manmade Features and Vegetation
    - No disturbance is planned of significant natural or manmade features or vegetation. None exist within the expected immediate impact area of the project.
  - Floodplains, Wetlands, Shorelands, and Streams
    - No significant impact is expected on floodplain, wetlands, shorelands, or streams. Related correspondence/map(s) can be found in Appendix C.
    - No crossings of creeks or rivers are planned under the recommended project.
  - Agricultural Lands
    - There is no defined agricultural land in the vicinity of the alternatives.
  - Construction Methods and Areas of Disturbance
    - Construction activity impacts will be short term as previously noted and are not expected to be unusual for underground utility or building construction.
    - Construction related dust will be minimized through contract enforcement of mitigation measures such as watering
    - Where applicable, contract documents will require construction methods and disturbed areas to be minimized regarding their impact to the site and neighboring areas. Details will be developed during the design and permitting process.
  - Rare, Threatened, Endangered, or Special Concern Species
    - Correspondence regarding possible project impact on natural settings and sensitive ecosystems with appropriate State and Federal agencies can be found in Appendix C. The project should have no impact on endangered species, significant plant communities,

natural features, or prime and unique agricultural land. Any required mitigation measures would be coordinated with EGLE during the design and permitting process.

- Archaeological, Historic, and Cultural Resources
  - Construction of the Gladstone WWTP improvements is not anticipated to have any adverse effect on historical, archaeological, geological or recreational areas. All construction will take place on City of Gladstone WWTP property. Excavation in previously unexcavated areas is very limited
- Traffic Impacts and Haul Routes
  - Temporary construction traffic impact both on other street users and on the equipment/supply routes will be coordinated with City staff to keep impacts to a reasonable, relatively easily mitigated level.
- Surface and Groundwater Impacts from Dewatering
  - Any required construction excavation dewatering will be monitored and on a level with typical construction activities in the area. Discharge water will be stilled if necessary as part of contract and permit required sedimentation control measures.
- Consumption of Materials
  - Materials consumption during construction and later operation of the recommended improvements could not be considered significant or excessive. Fuel for operating construction equipment and various piping materials would be the primary materials consumed.

- Operational Impacts
  - Groundwater or Surface Water discharges
    - Neither surface water nor groundwater quality is expected to be adversely affected by the project. Improved treatment performance and reliability will serve to improve surface and groundwater in the long run. Mitigation measures to control construction run-off will be required by the contract documents.

- Odors, Noise, Traffic, and Accidents/Spills
  - Implementing the improvements will reduce overall system operation and maintenance efforts due to replacement of outdated equipment and installation of newer, more reliable equipment
  - No changes in facility odors, noise, traffic, or accident/spill potential are expected from any of the alternatives under consideration. Updating systems to more reliable and efficient operation helps to minimize adverse operational impacts.

- Social Impacts
  - Costs and Methods to Mitigate Impacts
    - Details of mitigation measures will be worked out during the design and permitting process. Where adverse impacts due to installation of the recommended improvements cannot be avoided, mitigation measures will be included. Costs for mitigation measures were considered and included where applicable in project opinions of probable cost. Mitigation measures needed during construction will be included in construction contract documents.
  - Employment, Traffic, and Access
    - The project will create short-term economic benefits in areas of construction employment and materials supply. No relocation of residents or businesses is expected to result from the project. Long-term human, social and economic impacts will be positive through increased efficiency, reliability and capacity in area utility infrastructure.
    - Temporary increased traffic/dust during construction will take place however the network of streets allows access for nearby residences

<u>Indirect Impacts</u>

- Development and Transportation: The project segments will take place on Gladstone WWTP site property and should not induce changes in rate, density or type of land development nor associated transportation routes.
- Land Use: The project is not expected to change current land use patterns.
- Air and Water Quality: Air and water quality changes stemming from primary and secondary development are expected to be temporary and minor to non-existent.
- Secondary Growth: Secondary growth is also not expected.

- Natural Setting and Sensitive Features: None are in the area of the project.
- Cultural Impacts: Impacts generated by the recommended improvements on cultural, human, social and economic resources will be beneficial in the long term. Continued efficient and reliable operation of the area's utility system(s) contributes to a stable infrastructure promoting public health and safety.
- Aesthetics: The project will produce no overall permanent damage to existing area aesthetics. Relatively modest sized tanks will be constructed on the WWTP grounds blending in with numerous other similar sized tanks.
- Resource Consumption and Solid Waste Generation: No additional or increased resource consumption will occur due to these projects other than the construction related issues previously noted.

Cumulative Impacts

- General: The project itself is not expected to produce adverse impacts to the environment that increase over time or increase due to repetition.
- Watercourse Discharges: No additional discharge points are planned.
- Water Quality: Maintaining and protecting water quality is the goal of the project.
- Induced Development: No additional development incentive is expected to be created other than what occurs by default with improvements to a utility system.
- Multiple or Segmented Projects: No other municipal projects of this value or scope are planned during the same time frame. The City paces this type of work to both maintain its utility systems and keep user rate impact reasonable. Normally budgeted utility projects occur annually with planning aimed at schedule and location to minimize adverse impact to the public.

MITIGATION

General Mitigation

Where adverse impacts due to installation of the recommended improvements cannot be avoided, mitigation measures will be implemented. Costs for mitigation measures were considered and included where applicable in project opinions of probable cost. Mitigation measures needed during construction will be included in construction contract documents.

Short-Term Construction-Related Mitigation

General Construction

Construction problems anticipated include groundwater control and areas of inferior structural/pipe bedding and backfill soil material. These are normal occurrences with construction in the area and prior planning/design will create a situation where these problems will pose no significant difficulties for qualified contractors.

Construction Spoils

Disposal of construction spoils in wetlands, floodplains, shorelines or other sensitive areas will be prohibited. It is anticipated that spoils disposal areas and methods will need to be permitted. All spoils will be disposed of off-site at an approved location.

Transportation Issues

Any traffic disruptions that occur (such as equipment deliveries or construction related traffic) will be organized and controlled to minimize disruption of local, transient and emergency traffic. Construction related traffic will be regulated by construction contract language and City ordinances/policy. All needed barriers and signing will be in conformance with applicable MDOT standards. Disruption is expected to be minor and localized to the WWTP facility site.

Contaminated Soil

If needed or discovered, contaminated soil and/or construction dewatering discharge will be planned and budgeted for with methods covered under project construction specifications. This project does not anticipate encountering contaminated soils or groundwater.

Wetlands

The project segments will not infringe on any designated wetland areas.

Stream Crossings

No stream crossings are anticipated under the proposed work.

Endangered/Threatened Species

None are located in the WWTP grounds – see correspondence in Appendix C.

Permitting

Wastewater system construction permitting will be obtained during the design process. Construction documents will require the contractor to obtain needed erosion control and building permits.

Safety

All work shall comply with Federal, State and local laws governing activities, safeguards, devices and protective equipment. Minimum requirements are defined by the U.S. Department of Labor and the Michigan Occupational Safety and Health Act.

Dust and Noise

Construction dust and noise will be required to be kept to a minimum. No on-site burning will be allowed. Use of water or other suppressants will be used to control fugitive dust and prevent violation of Rule 901 and contractors will be required to use gas engine muffled exhausts.

Erosion

Soil Erosion and Sedimentation Control permits will be required for the project. Site-specific mitigation measures will be addressed during design and included in the construction contract documents. At a minimum, mitigation measures will include a silt fence as needed along the work site perimeter.

Restoration

Damaged curbing, driveway and sidewalk surfaces will be restored to equal or better condition in accordance with best management practices. All disturbed site soil will be restored with topsoil, seed, fertilizer, and mulch.

Utilities

Disruption of utilities during construction will be kept to the minimum necessary to allow new installations. Repairs will be made in a timely manner. Careful sequencing with Owner is required in bidding documents to avoid interruptions to the treatment process. No untreated or partially treated discharge of effluent to will be allowed.

Valuable Features

Implementation of the selected alternative is not expected to significantly impact more extensive or valuable existing features such as mature vegetation. Areas of expected underground construction are open treatment facility grounds.

Mitigation of Long-Term Impacts

General Construction

The City does not expect any long-term impacts from the general construction activities.

Siting Decisions

Work will be confined to the WWTP grounds.

Operational Impacts

Long-term operational issues will not be adversely changed by the projects; rather, operations should be enhanced through new more reliable equipment installations and treatment processes.

Mitigation of Indirect Impacts

Master Plan and Zoning

Long range planning by the City of Gladstone identified the project segments evaluated in this report and all impacts take place within the WWTP property or developed City streets and would have no effect on planning and zoning in the community. The work will not impact historical features, agricultural land, or sensitive features.

Ordinances

Local ordinances are in place regarding minimum building construction and operation standards and site erosion control. Wetlands, floodplains, and other sensitive habitats are protected by State laws and permitting procedures.

Land Requirements

None needed for the recommended alternatives.

Staging of Construction

Staging will not be necessary other than that needed to minimize operational impact on the treatment facility.

Socio-economic and Environmental Justice Issues

Costs and less tangible impacts such as construction traffic would have no disproportionate impact any area group. Impacts are spread evenly amongst community collection system users.

Noise

Construction dust and noise will be kept to a minimum via construction contract requirements.

PUBLIC PARTICIPATION

Public Meetings

Wastewater system needs and generic potential fixes have been openly noted at several City Commission meetings over the past decade. The Commission has discussed and approved studies both at the WWTP and regarding the collection system over the past three to four years. This includes a council meeting that presented the SAW findings by C2AE in December of 2020; a council meeting that approved a resolution to submit the I & I to EGLE and authorize the Notice of Intent in December of 2019; and during a rate review presentation by UFS in November 2019.

The Formal Public Hearing

A public hearing on the information presented in this report is scheduled for / was held on ___ _______. A written transcript of the public hearing along with a summary of public comment(s) received will be / is included in Appendix E.

Public Hearing Advertisement

An advertisement was placed in ____________________, advertising the formal public hearing. The advertisement was placed on __________. Simultaneously to the advertisement publication, copies of the project plan were made available to the public at both the Wastewater Treatment Plant and at City Hall. Appendix E has the advertisement affidavit and physical copy of the advertisement that was placed.

Public Hearing Transcript

A stenographer from _______________ was present to record and transcribe the public hearing. Full transcripts along with public hearing agenda is available in Appendix E.

Public Hearing Comments

Please see Appendix E, which contains a memo which summarizes the public hearing and the comment(s) received.

Comments Received and Answered

The comment(s) received may be found in the transcript or summary memo found in Appendix E.

Adoption of the Project Plan

Agency and Owner preliminary review comments are / will be incorporated into the final version of this Project Plan. The plan was adopted by the City of Gladstone Commission on ____________.