Report to the Township of Madawaska Valley for the Condition Assessment of the Wastewater Treatment System

SUBMITTED BY

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STATEMENT OF CONFIDENTIALITY

OCWA's Report to
Township of Madawaska Valley for the
Condition Assessment of the Wastewater Treatment System

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1 Background

The Ontario Clean Water Agency (OCWA) was retained by the Township of Madawaska Valley to complete condition assessments of the water and wastewater systems that service the community.

The purpose of the condition assessment was to:

1. Understand the present state of the facilities and underground assets that are used to deliver water and wastewater services; and

2. Identify required spending on the infrastructure systems to ensure water and wastewater services can be sustained over the long term.

The outcomes of this report support other asset management planning processes in the Township, including the Asset Management Plan, Water and Wastewater Rate Study and the Water Financial Plan.

It should be noted that although called a condition assessment, the scope of this project includes a comprehensive assessment of the current state of the system that considers functional and operational observations in addition to an assessment of physical condition.

It is noted that two separate reports have been prepared for the water and wastewater systems, respectively. The details of the water system are located in the report entitled “Report to the Township of Madawaska Valley for the Condition Assessment of the Water Treatment System”.

2 Scope

This report captures all assets that comprise the wastewater treatment system. This includes:

- Wastewater Pollution Control Plant
- Pumping Stations
- Sewage Collection System

3 Methodology

The methodology to complete the condition assessment was as follows:

1. Complete a desktop analysis of all available asset information. This includes drawings, schematics, annual reports, past budgets, plant performance data and plant maintenance data.

2. Complete site visits to obtain visual condition information of assets and to understand other plant performance issues that may be observed through hands-on observations of the facilities. It should be noted that the scope of the project did not include the visual assessment of sewer mains or other buried assets.

3. Discuss with system operators to understand history and issues with the assets that may not be apparent through a review of available information or visual assessment observations.

4. Establish the spending that is required to address any observed asset condition or performance deficiencies. The majority of the spending is related to the rehabilitation or replacement of infrastructure assets, however, in some cases additional studies or investigations have been recommended.

4 Limitations

This report is a planning document to inform future works that will be necessary to maintain the current performance of the wastewater treatment system. The recommended spending includes proposed projects to address asset needs as they deteriorate over the planning period. The recommended projects are expected to generally ensure that the systems continue to perform at recent historical levels (i.e. to maintain current service levels). The spending recommendations do not reflect any projects that would be required to increase system performance or increase service levels.

The following limitations are noted:

- Some of the expenditures identified may require preceding engineering studies to properly refine associated cost estimates or refine the scope of work. The costs of potential front-end engineering work have been estimated and included in the cost estimates.
- The accuracy of spending amounts identified in the report decrease with time. OCWA uses the AACE cost estimating framework to identify our cost estimate classification. Activities recommended in the 5+ year window are considered to be Class 5 cost estimates (+/- 50%), with increasing accuracy in shorter term project cost estimates.
- Expenditures recommended in this report are the costs required to maintain proper functioning of the infrastructure assets and do not include the costs associated with routine operational expenditures such as operational service costs (i.e. OCWA O&M), labour costs, energy costs, chemical costs, communication costs, etc.
- The state of assets can change quickly. The assessment of the assets reflect a point in time based on information that was readily observable.
- No destructive or intrusive testing was completed. In some cases, recommendations for additional testing may be made to confirm the current state of an asset.

5 Wastewater Treatment System Overview

The Madawaska Valley Wastewater Treatment System is comprised of a water pollution control plant (WPCP), three pumping stations, and a collection system, which are all included in this report. The WPCP in Barry's Bay was originally constructed in 1975 and has undergone major upgrades and rehabilitation works since its construction, with the most significant work being done between 2009 and 2012. The sewage collection system is largely the original 1970s construction.

5.1 Barry's Bay WPCP Overview

The Barry's Bay WPCP is an ISAM SBR based treatment plant that utilizes primary treatment, secondary treatment, phosphorus removal, tertiary treatment, and UV disinfection. Bio-solids are managed through aerobic sludge digestion and land applied several times per year. The effluent is discharged through an outfall into Lake Kamaniskeg following UV disinfection.

Raw wastewater is pumped to a grit channel from the pump station #1. First, the raw wastewater passes through a 6 mm fine screen with a screw auger and grinder and then into twin grit channels for sediment removal. The solids removed from the headworks are manually bagged and disposed of. The plant also has the ability to accept septage, but the receiving station is not presently in service.

Following the headworks, the wastewater flows into two parallel integrated surge anoxic mix (ISAM) trains for secondary treatment. The ISAM system consists of three tanks in series. The first tank provides anaerobic conditions and doubles as a primary clarifier, allowing settling of the suspended solids. A continuous decant occurs from the anaerobic tank to the anoxic tank (SAM reactor). When the anoxic tank is full, jet pumps are used to transfer the wastewater into the SBR tank. In the SBR tank the wastewater is aerobically treated using jet aerators. Settled sludge from the ISAM tanks is transferred to the aerobic digesters, while the treated wastewater from the SBR flows first into an equalization tank and is then pumped to the tertiary filters. After, passing through the upflow deep bed sand filters the wastewater is then disinfected with a UV system and flows through gravity to the plant's outfall into Lake Kamaniskeg.

The sludge from the anaerobic ISAM tanks is partially digested before being wasted to the aerobic digesters. The two digesters are aerated to provide mixing and oxygen for further treatment. The (approximately 3% total solids) biosolids are then transferred to a seasonal storage tank. The seasonal storage tank contains a mixer to limit the thickening and deposition of solids.

5.2 Sewers

The vast majority of the Barry's Bay sewage collection system was constructed as part of a single project from 1972 to 1974. A small number of new sewer mains have been constructed in the north end of the system over the past 20 years or to service new development.

There is a total of approximately 11.4 km of sewer mains. This system is mostly gravity sewers with forcemains connecting and feeding the pumping stations and WPCP. The material of all sewers is concrete. The majority of the sewer are 8" in diameter.

6 Condition and Performance Assessment

Condition and performance assessments identify areas/processes/equipment that are in need of upgrades, improvements, or replacements that may require spending to ensure services can be maintained. This assessment is broken down into different areas:

- Assessment of Capacity (WPCP Capacity, Pump Station Capacity, Future Demand Projections)
- Assessment of Treatment Proficiency
- Assessment of Equipment Condition (Site visit)
- Assessment of Recent System Events

6.1 Assessment of System Capacity

The wastewater treatment system's capacity to treat the existing and future sewage flows during normal operation and emergencies are critical for determining the timeline for future plant expansion or upgrades.

6.1.1 WPCP Flow Capacity Assessment

To assess the present capacity to treat sewage flows, the last 15 years of daily treated water flows were compiled from OCWA's WISKI process database.

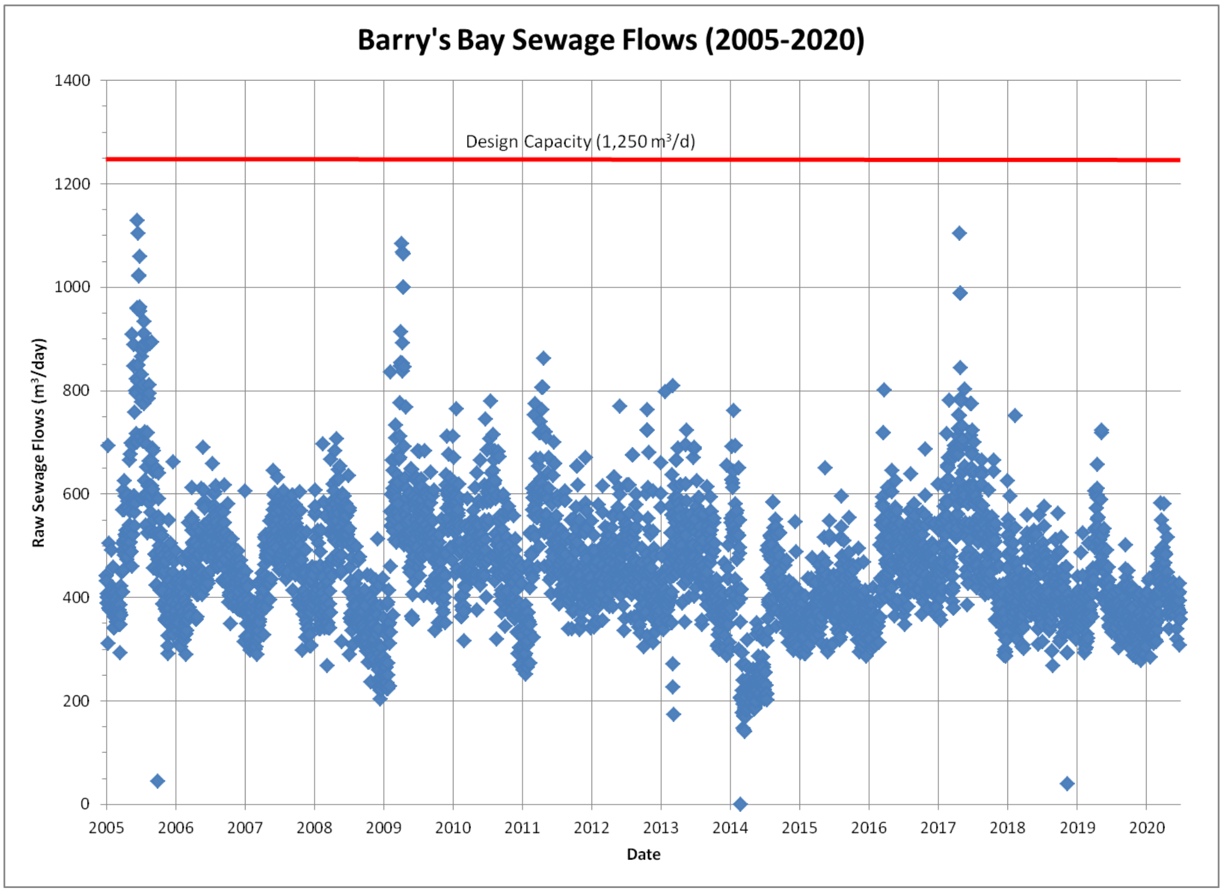

Figure 1: Barry's Bay Sewage Flow History (2005-2020)

Figure 1 shows the wastewater flow in comparison to the plant's rated capacity. The average flow over the 15-year period is 450 m^3/day, while the plant has a capacity to treat 1,250 m^3/day. Peak flows of up to 1128 m^3/d have occurred very infrequently over this period.

It should be noted that the WPCP averages 86 m^3/day more than the water treatment plant. This represents approximately 20% of the influent flow to the wastewater treatment plant. This disparity in water produced versus wastewater collected is due to the inflow and infiltration (I&I) of stormwater or groundwater into the wastewater collection system. I&I are usually leaks or improper connections to the sewer main that allow for rainwater and snowmelt to be directed to the WPCP.

In the case of the Barry's Bay WPCP, flow varies seasonally between 300-600 m^3/day with high flows rarely exceeding 800 m^3/day. The highest recorded flow in the last 15 years, was 1,128 m^3/day. Treatment capacity expansion is a consideration for wastewater facilities when average flows are between 70-80%. Equalization storage also becomes a consideration when peak flows start to exceed treatment capacity with the occurrence of treatment bypassing. At present, average flow is at 36% of the plant's design capacity and there is no history of bypassing at the plant. Therefore, there is no capacity expansion or installation of additional equalization storage recommended for the foreseeable future. Due to the significant seasonal variation, the potential for spring melt infiltration is high and therefore I&I investigation is recommended to identify and reduce excess incoming flows.

6.1.2 Pumping Station Assessment

To determine if the pumping stations require expansion, their present flow capacity must be compared to sewage existing flows. However there are no flow monitors to measure the incoming flows at the pumping stations.

The overall service strategy and sanitary collection system configuration have not changed substantially since the original design of the system, and therefore it is reasonable to assume that the capacity of each facility is adequate. It is recommended that flow meters be installed at each pumping station, and then inflows can be compared to the pumping station capacities to understand if there are any current or expected capacity deficiencies. Flow monitoring data would also help identify wet weather infiltration in the sewers and allow for more accurate planning for future residential expansion.

6.1.3 Population Growth

The last factor that is significant in determining the necessity of future plant expansion is the population growth within the municipality. As a population grows, both peak wastewater flow and average wastewater flows can grow proportionally. Estimations of future expansions to treatment capacity can be determined by estimating the rate of growth within a municipality.

To estimate the growth of water users on the system, the population of Barry's Bay has to be projected into the future. This projection can be accomplished by looking at planning documents and population census history.

Table 1: Barry's Bay Population History

YEAR	BARRY'S BAY CENSUS POPULATION
1996	1086
2001	1115
2006	1178*
2011	1241
2016	1259

**Population for 2006 was interpolated based on 2001 and 2011 data since no data for that date was available.*

As seen in Table 1, the population of Barry's Bay has been increasing steadily over the last 20 years. This increasing population is the equivalent of an annual growth rate of 0.74%, which is approximately half the Canada average of 1.4%. Based on a 0.74% annual population growth rate of 15% over 20 years, the wastewater treatment plant will not require expansion within the next 20 years since current average flows have been 450 m^3/day, while the plant has a capacity to treat 1,250 m^3/day.

6.2 Treatment Proficiency Assessment

From the recent WPCP effluent history, the effluent quality data was compiled in Table 2.

Table 2: Wastewater Effluent Parameter History (From Annual Reports 2015-2019)

PARAMETER	ECA LIMIT (OBJECTIVE)	YEAR	2015	2016	2017	2018	2019
Treated cBOD (mg/L)	15 (10)	Annual Avg. (Monthly Ranges)	2.1 (2-5)	2.4 (2-7)	2.75 (2-10)	3.8 (2-14)	2.4 (2-10)
TSS (mg/L)	15 (10)	Annual Avg. (Monthly Ranges)	0.79 (0-4.5)	3.6 (0-17)	8.2 (0-29)	7.7 (0-18)	9.4 (0-33)
Phosphorus (mg/L)	0.2 (0.1)	Annual Avg. (Monthly Ranges)	0.05 (0.03-0.17)	0.11 (0.03-0.42)	0.14 (0.03-0.33)	0.09 (0.03-0.35)	0.10 (0.03-0.34)
Total Ammonia Nitrogen (mg/L)	Non-Acutely Lethal (1 in summer or 3 in winter)	Annual Avg. (Monthly Ranges)	2.7 (0.18-13.7)	1.7 (0.03-42)	2.3 (0.05-17.2)	7.3 (0.16-22.4)	2.3 (0.09-9.2)
Escherichia Coli [cfu/100mL]	200 (100)	Geo.Mean (Monthly Ranges)	3.2 (2-2060)	10.4 (2-7600)	10.2 (2-1240)	9.2 (2-4400)	6.4 (2-252)
Sludge produced (m^3/year)			903.5	1319	1080	870	

Table 2 illustrates that between 2015-2019 effluent quality standards have been generally achieved, with the exception of ammonia in 2018. These results also provide information that can be used to understand the properties of the treatment effectiveness and difficulties at the Barry's Bay WPCP:

- The low average concentration of cBOD contained in the plant's effluent and the few incidences of samples greater than the objective concentration is indicative that the plant's aeration system is performing effectively. Reducing oxygen demand in the effluent is critical to preventing harm to aquatic life. Low effluent oxygen demand also shows that compounds contained in the wastewater are being decomposed.
- Suspended solids concentration in the effluent was low in 2015, but over the last 5 years, both average and maximum concentrations have been steadily increasing. Suspended solids are linked to the effectiveness of the plant's secondary treatment and filtration system. A high suspended solid

concentration may indicate a poor mixture of coagulation/flocculation chemicals or an ageing filter media that is losing its effectiveness.

- The pattern of phosphorus in the effluent over the last five years shows a slight mirroring of the results seen with the suspended solids. Since the removal of phosphorus is linked to sufficient chemical dosing and the effectiveness of the plant's filtration system, improvement to the plant's filtration system would likely reduce the phosphorus concentration.
- The facilities annual reports have shown that the ammonia in the effluent is consistently low during the summers and consistently high in the winters. This may be due to the relationship between temperature and the effectiveness of nitrification and de-nitrification bacteria. Increasing the temperature during biological treatment process, can decrease ammonia concentration in the effluent by increasing the productivity of the bacteria to destroy ammonia. A cost-effective method to maintain temperatures during the winter months may be to cover/insulate the aeration tanks. In addition, other process changes were suggested in in the recent OCWA Facility Optimization Report, some of which were implemented in 2019 and may have positively impacted the ammonia levels in the effluent.
- The presence of e.coli in the plant's effluent is to be expected to a limited degree, but over the last 5 years, there have been individual samples showing very high concentrations. Due to the random nature of these incidents and there being no obvious trend, these individual results may be linked to a number of different issues. A possible cause is a temporary higher than normal concentration of suspended solids in the treated effluent. Suspended solids can block UV disinfection and shield bacteria from deactivation.

6.3 Equipment Condition Assessment

The condition of each asset was determined through visual observations and discussions with operational staff during a site visit to the Barry's Bay WPCP. The assessment results of each process area are provided below.

6.3.1 Water Pollution Control Plant

6.3.1.1 Process – Mechanical

Although this category covers all equipment not otherwise specified below, including safety equipment, it is mainly referring to the plant piping that is present throughout the plant. The plant's safety equipment is presently in good condition, but due to the necessity that this equipment is maintained at the highest level of functionality, spending in this area will need to be more aggressive than in other areas throughout the plant. The oldest plant piping would be from the original construction in 1975. It is difficult to assess the condition of buried piping so it may be necessary for some minor replacements to occur in the long-term.

6.3.1.2 Process – Mechanical and Process - Grinder

The grinder process is composed of a filter screen, auger, and the grinder at the very start of the treatment process. This means that it encounters some of the grittiest and most abrasive material in the plant, which will wear out equipment at an accelerated rate. The major concern in this case is the wearing out of the grinder unit and the auger. Minor replacements of components, like brushes, are expected in the every few years, but the auger itself and the grinder may also need to be replaced in the time frame of 10-15 years.

6.3.1.3 Process – Mechanical and Process - Pumps

From both the visual assessment and from the plant's work history, the pumps were shown to be wearing out at a rate consistent with their expected service life. Given that the plant's pumps are from 2011, it is expected that most will be able to continue to operate for another 10 years, but after that, pump replacements may need to be undertaken. It is also expected that the pumps will need some degree of major maintenance in the form of rebuilds to replace worn out parts and to extend operational life. The progressive cavity pumps that pump sludge may wear out sooner to the erosive nature of the pumped material. This may require early replacement or more frequent part replacement.

The plant's chemical feed system, located in the old chlorine building, includes both the feeds for sodium carbonate and PAS-8. Given the condition of these systems and that they were both installed with the last plant upgrade, they should be able to operate for at least another five years without replacement. It should be noted that the chemical storage tank in the old chlorine building predates the 2011 upgrade, but its fibreglass construction did not show signs of deterioration and should be able to continue to operate until the next chemical system replacement.

6.3.1.4 Process – Mechanical and Process – Blowers

The plant's blowers, used for the SBR tanks and the aerobic digesters, were installed as part of the most recent plant upgrade and will not require replacement for the foreseeable future. After 20 years of service, rehabilitation of the equipment to extend their operational life or complete their replacement should be considered.

6.3.1.5 Process – Mechanical and Process – UV

The UV system is composed of lamps, sleeves, wipers, assembly modules, and ballast. In-channel systems also require a dedicated electric and control panel along with UV intensity instrumentation. A UV system can operate for over twenty-five years with available parts and good maintenance so there is not much expected in terms of capital works associated with this type of system. The major issue is the continuous yearly cost for replacement parts. Lamps, sleeves, and wipers in particular have a very short service life. Yearly cost for UV part replacement should be assumed during the system's operation.

6.3.1.6 Process – Mechanical and Process – Media

Historically, the plant's filter media has been shown to be capable of maintaining a low level of suspended solids in the effluent within regulatory requirements. It should be noted that the concentration of TSS was significantly lower in 2015 and 2016 but has been increasing year over year. The increase in TSS in recent years may be a sign of decreased filter effectiveness. The upflow sand filter's media used in the tertiary system does need to be replaced over time as some material is lost during the filtration process. This regular media top-up may become insufficient in maintaining media effectiveness. It is recommended that the filter media is replaced if the recommended operational changes in the OCWA FOP Report prove ineffective and TSS concentration continues to rise.

6.3.1.7 Process – Mechanical and Process – Valves

The plant and pumping stations contain a large number of new isolation valves. The majority of the isolation valves are manually driven without actuators. These valves are in very good condition with little visible wear. Although the condition of the valves needs to be monitored and the valves should be exercised regularly, it is expected that there will be minimal need for valve replacements in the next 20 years.

The few control valves in the plant may need to be replaced within the 20-year timeframe, but they are still presently in fair condition and should be able to continue operation for at least the next five years.

6.3.1.8 Process – Electrical

The process electrical systems associated with the Motor Control Centre (MCC) were part of the recent facility upgrade. This system was in good condition and it is likely that the system will only require minor maintenance and component replacement over the next 20 years.

6.3.1.9 Process – Instrumentation and Control

The instrumentation and control equipment was observed to be in good condition. Considering the varied lifespan of instrumentation and control equipment, it is likely that replacement will continue to be a regular occurrence. Control systems like the SCADA system can require regular updates every seven years while Process Logic Controllers (PLCs) can last between 12-15 years. Analyzers can start to fail as early as 10 years, while meters can last over 20 years. It is expected that the control system will require replacement in the 5-10 year range, while instrumentation will need replacement incremental replacement over the next decade. Spare part kits should be considered in order to reduce replacement costs and extend the longevity of instruments.

6.3.1.10 Process – Piping

Process piping is composed of the piping for the chemical feed system, process air for the SBR and digesters tanks, effluent piping to the plant's outfall, and transfer piping between processes for sludge and wastewater. Due to the plant's age and the material used, most of the plant's piping is in excellent condition. The exception to this is the plant's outfall pipeline into the lake. The outfall's present condition is unknown and given the outfall's age, it is possible that its condition may have deteriorated and could require repairs. A comprehensive inspection of the outfall is recommended in the next five years.

6.3.1.11 Process – Structural

The process structural system refers to concrete tankage found in the Grit Channel, the aerobic digesters, the sludge storage, and the ISAM treatment trains. From outside observation, there were no significant signs of concrete corrosion and erosion with the new tankage. These process tanks can off-gas corrosive compounds with the breakdown of organic compounds, like hydrogen sulphide. It is not expected that the new tanks that were built in the recent upgrade will have any corrosion issues. The tanks that were repurposed to be digesters and for sludge storage are more likely to face concrete issues in the future. With the abrasive nature of sludge and the corrosive off-gassing that can occur, it is recommended that the digesters and sludge storage cells be emptied, cleaned, inspected, and repaired (if needed) with a frequency of every five years.

It should ne noted that this condition assessment did review any parts of the plant associated with the damaged SBR train or include any recommendations or planning associated with its correction.

6.3.1.12 Facility – Mechanical

The facility's mechanical equipment refers to the heating, ventilation and air conditioning (HVAC) system through the WPCP. This is primarily represented as a number of unit heaters and vents/louvres. The equipment is in good to fair condition with the latter referring to equipment located in the old chlorine building. This equipment has an expected service life of approximately 20 years, so these assets are likely to require rehabilitation or replacement in the long term (i.e. 10+ years). In the case of the unit heaters, the brand was identified as one with a reputation for long life, so replacement after a longer service life would not be unexpected.

6.3.1.13 Facility – Electrical

Like with the process electrical, the facility's electrical systems associated with the transformer, cabling, and electrical panels were part of the recent facility upgrade. No immediate spending activities were identified and it is unlikely that there will need major maintenance works within the next 10 years.

6.3.1.14 Facility – Architectural

The facility's architectural assets refer to the cladding/siding, windows, doors, and protective paint. The present condition of the old chlorine building is fair with minor deterioration of the brick cladding, internal paint, and other aspects of the building's architecture. Minor spot repairs may be needed for the old chlorine building in the long-term (10-20 years) period to continue operations in the building.

The new WPCP building, housing the filtration, chemical treatment, UV, and electrical systems are in excellent condition in terms of its architectural assets with little to no deterioration observed.

The office building, located beside the old chlorine building, is showing more severe deterioration. Although this building is not a priority in terms of plant performance, efforts should be made to rehabilitate the building in the near future. Works may include partial to complete replacement of the building's cladding, roof, flooring, windows, and doors. Properly maintaining these systems can reduce heating and AC costs in the long term. The exact works required for the structure should be a product of a building inspection. Considering the buildings visible age, it may be advisable to consider the complete replacement of the control building in the long-term, if rehabilitation of the building is not viable.

6.3.1.15 Facility – Structural

The facility's structure refers to the concrete and steel that makes up the building itself. In this case, the roof is also included as part of the facility structure. The structure of the old chlorine building and the office building date back to the facility's original construction in the 1970s. Given that the old chlorine building's structure is approaching 50 years of age, it is in remarkable condition. The concrete interior shows little structural deterioration. The office building's wooden construction was observed to be in worse condition with visible deterioration, both internally and externally.

The roof of the old chlorine has been previously identified as in need of replacement by operations staff. It is also recommended that during future building rehabilitation, the office building's structure should be analyzed for structural deficiencies that are not visible during this condition assessment.

Rehabilitation of the office building should therefore include the potential for additional work that has yet to be identified.

6.3.1.16 Emergency Power

The onsite emergency generator was installed as part of the recent plant upgrades. With regular maintenance, this type of generator should be able to provide back-up power to the plant for the next two decades before consideration for its replacement. Rehabilitation is recommended to occur after 2030.

6.3.1.17 Pumping Stations

Pumping Station #1 is composed of a wet well sewage lift station with an above-ground control panel. It was observed to have visible deterioration of metal components within the pumping station, but the concrete structure was seen to be in relatively good condition considering the early 1970s construction. Piping and valves contained within were recently replaced and are in excellent condition.

Pumping Station #2 is composed of both an in-ground lift station well and a building containing a generator set for emergency power with control and electrical equipment. There is visible wear on the concrete of the pumping station, but considering its age and the corrosive nature of sewage off-gassing, the concrete is in fair condition and likely to last for the foreseeable future. Internal sewage piping and valves have been partially replaced in the last few years with the new piping in excellent condition, but the old material shows extensive surface corrosion. Replacement of the remaining sewage piping should be a consideration in the next 10 years. The diesel genset located on-site is considerably older than much of the other equipment in the pumping station genset building. Based on its obvious age, visibly worn condition, and surface corrosion; the generator will likely need to be replaced in the next 8-13 years.

Pumping Station #3, is composed of wet well sewage lift station with an above-ground control ground panel. Its present condition is fair as there is some minor visible damage to the well's concrete structure. Minor repairs to the concrete structure could be conducted, but presently the structure is unlikely to be compromised by the existing damage.

For all three pumping stations, the submersible pump's condition could not be assessed due to their submerged state. It must be assumed that they are wearing out at a rate comparable to their age and it is likely that equipment failure could start to occur in the next 10 years.

6.3.1.18 Sewage Collection System

The sewage collection system is comprised of 13.1 km of sewer mains. These sewer mains feed into the three pumping stations, which in turn pump the sewage to the WPCP. Assessing the condition of the sewer mains could not be conducted visually, but their condition must be inferred through the frequency of repairs (Section 6.4), the level of infiltration (Section 6.1.1), and the age of the asset. Considering the early 1970's installation and the frequency of blockages within the system, over time some distortion to the mains may have occurred or a build-up of material. Both cases could be related to infiltration into the system. Without identifying the exact location of the problems, repairs to the mains cannot be conducted. To that end, it is recommended that camera inspections of the sewer lines be conducted on a percentage of the mains every year

6.4 System Event History Assessment

From the recent Wastewater System Annual reports, a history of the recent major maintenance works was compiled in Table 3.

Table 3: System Work History (2014-2016, 2018-2019)

YEAR	2014	2015	2016	2017	2018	2019
WPCP Work History	Raw Sewage Flow Meter Replacement Repair of UV power line Wasting Actuator Replacement	UV part replacement PS #3 upgrades Davit bases for fall protection system	UV part replacement Outfall inspection and repair Digester clean-out Genset cable repairs UPS replacement		PS #1 upgrades	Biosolids mixing/ Transfer pump replacement
Collection System Work History	Lakeview Pkwy blockage	Old Barry's Bay blockage Opeongo frozen sewer line	Lakeview Pwky blockages		Conway and Bay St. backups	Paugh Lake rd, Lakeview Pkwy, Bay St., and Opeongo sewer blockages

When analyzing the work history in Table 3, it must be done in the context of the system's age and condition. The WPCP structure can be dated to the early 1970s along with the Town's collection system, while a majority of the process equipment was installed in the most recent major upgrade in (2012). This puts a portion of the WPCP structure and distribution at approximately 50 years of age with ISAM tanks, tertiary building, and process equipment at approximately 8-10 years of age.

From the history of recent maintenance work at the WPCP, it is evident that there is a focus on three types of works. There are condition-based replacements for equipment that was not part of the 2012 upgrade (raw water flow meter, pumping station upgrades) and then there are replacements for equipment with low life expectancy (UV disinfection components and uninterruptible power supplies (UPS)), and finally there are singular issues unrelated to the plant upgrade (repairs to generator electrical line, replacement of biosolids mixing pump). It is expected that these trends will continue for the near future with occasional replacements of equipment in the old chlorine building and pumping stations, the rectification of issues related to the plant upgrade, and regular replacements of short-lived equipment. In the long term (10+ years), it is expected that replacements and maintenance activities related to the new sections of the plant will become more frequent.

The majority of the works in the system's recent history were expected to occur based on their expected equipment life span. The pumping stations are from the original construction in the 1970s, and given the corrosive atmosphere of a sewage wet well, replacements of couplings, valves and piping are expected after over 40 years of operations. Components of a UV disinfection system (lamps, wipers, ballast, etc.) tend to have a limited life span of approximately five years. A stock of UV components should be maintained as components are usually replaced on a piecemeal and as-needed basis.

There were also schedule major maintenance tasks like the outfall inspection and digester clean-out that are completed on a five year schedule. Digester clean-outs and clean-outs of sludge storage tanks prevent the build-up of solid material within the tanks. These clean-outs and the occasional clean-out of the ISAM trains allow also allow structural inspections of the concrete, which is otherwise submerged. Likewise, the inspection of the outfall also allows for the condition of the structure to be determined. The early identification of deterioration allows for repairs to be made before the damage becomes significant.

The unexpected works were for the replacement of the biosolids mixing/transfer pump. Although biosolids are very abrasive and can wear out a pump at an accelerated rate, it is still unusual that a biosolids pump would require replacement after only seven years of operation. The replacement pump should be selected through a comparison of alternatives, recognizing that the more expensive pump may last longer and therefore be a better financial decision.

In terms of the collection system, the major recorded issue is the yearly sewer main blockages. Sewer main blockages are common in all sewage systems that have an insufficient slope, an infiltration of roots, a buildup of fast/oils/greases, or low insufficient/irregular flow. These issues can allow for solid materials to settle, build-up and then block sewage flow resulting in sewage back-ups into houses. Though these blockages are likely due to low flow within the collection system, based on the age and presence of infiltration in the system (Section 6.1.1), root infiltration may also be present. The only reliable method for identifying specific deficiencies to address in the sewer system is to conduct video inspections.

7 Condition Assessment Recommendations

Recommended actions for future capital works are derived from Section 6 above.

- No upgrade of the treatment capacity is required to handle present and future incoming sewage flow (Section 6.1),
- Upgrade of the treatment process to account for deficiencies in existing treated water quality (Section 6.2),
    - Improve nitrification through the covering of the ISAM trains and inlet area. This covering would be to reduce the heat loss to the atmosphere and therefore increase the process temperature, which would improve the nitrification efficiency.
- Replacement of equipment to account for an existing poor condition and likelihood of failure in the near future (Section 6.3),
    - The majority of the process equipment is between 8-9 years old, since it was part of the 2010-2012 plant upgrade. Therefore with the majority of equipment at the plant is still in good condition and early in its lifecycle, where equipment replacements are uncommon. In the next ten years, equipment not related to the plant upgrade will be more likely to need replacement. After the next 10 years, equipment repairs, rehabilitations, and replacements will occur on a more frequent basis. In particular, it should be expected that maintenance costs for process pumps, blowers/compressors, chemical feed systems, and instrumentation and control equipment will increase.
    - The present condition of the office administration building at the WPCP is poor with rehabilitation or replacement of the structure required in the short term.

- Replacement of equipment based on a history of failure and repairs (Section 6.4).
  - The only consistent trend shown is the clearing of blockages. This is a routine operational issue in wastewater collection system. The location of blockages will continue to be monitored, and any increase in frequency may require localized camera inspection followed by rehabilitation activities to address any observed defects.
  - It is also recommended that inspections of the plant's structural concrete continue with clean-outs of the digesters and sludge storage tanks at a frequency of at least every five years. Inspection of the outfall, ISAM trains, and collection system should occur at least every 10 years.
- Additional capital identified through this or previous assessment reports.
  - Installation of a dewatering system for the biosolid sludge. This could take the form of either a rotary drum thickener or a centrifuge, but would allow for increased storage capacity of the sludge storage tank and reduce the number of required trips for sludge haulage. Due to limited space for new construction, a design consultant should conduct a feasibility studies to determine viable options for such an upgrade.
  - Installation of dissolved oxygen metering throughout the ISAM system may allow for greater optimization of the aeration blowers and reduce operating costs.
  - Installation of platforms and guardrails for the access to the ISAM tanks. This would improve safety at the plant and provide greater access to the ISAM trains, which would improve operational efficiency.

7.1 Recommended Capital and Major Maintenance Projects

Please refer to Section 4 for the limitations associated with these recommended projects and cost estimates.

SHORT TERM RECOMMENDED WORKS (1-5 YEARS)	ESTIMATED COST	YEAR
I&I assessment with either flow measurement or camera inspections	$15,000	every 2 years
Roof replacement of old main/chlorine building	$50,000	2024
Additional DO meter installations in ISAM train	$25,000	2025
Office building rehabilitation	$40,000	2022
SBR platform installation	$35,000	2021
Installation of covers for the ISAM and grit channel	$150,000, price depends on the quality and intended longevity of the cover	2026
Digester and Sludge storage clean-out and inspection	$15,000	Every 5 years

MEDIUM TERM RECOMMENDED WORKS (6-10 YEARS)	ESTIMATED COST	YEAR
Outfall inspection	$5,000	Every 5 years
Septage Receiving Station Refit and Commissioning	$50,000	2027
Installation of pumping station flow meters	$25,000	2028
Installation of dewatering system	$500,000	2031