Utilities Kingston

RAVENSVIEW
WASTEWATER TREATMENT PLANT
2021 ANNUAL REPORT

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1 EXECUTIVE SUMMARY

Ravensview Wastewater Treatment Plant (WWTP) operates under Ministry of the Environment, Conservation and Parks, ECA number 5556-BZFGZL. The facility was compliant with all conditions outlined in condition 7 of the above-mentioned ECA and are briefly described in the following sections of this report.

The average flow through the plant was 57,278 m^3/day for 2021.

The facility had zero secondary bypass events during the reporting year. The collection system had some wet weather overflow events which totaled 26,195 m^3. The overflow locations are listed in Appendix B, Table 2: Annual Overflow Summary.

Ravensview WWTP continues to generate interest from international groups while providing valuable research opportunities and hands-on experience to graduate students from local educational institutions such as Queen’s University.

Operational staff continually improve the operation of Ravensview WWTP taking full advantage of its state-of-the-art technology to protect the environment and maintain the quality of service our residents have come to know.

2 PLANT DESCRIPTION AND TREATMENT PROCESS

The following is a process overview and description of the treatment steps taken at Ravensview Wastewater Treatment Plant

Raw Wastewater Receiving

Raw wastewater from the central and east portions of Kingston is conveyed to the influent works. A Parshall flume metering device continuously measures the flow of raw wastewater into the plant. A newly constructed septage receiving station is now online and is located in the northeast corner of the property. The septage receiving station gives approved septic truck haulers a place to discharge the contents of their tanks. The septage receiving station monitors the quantity, origin, and contents being unloaded and provides some pre-treatment before the contents enter the treatment plant at the influent works.

Screening

Three large mechanical screens remove larger materials from the incoming wastewater stream. Screened material is conveyed to a screening press where the material is compacted and stored for offsite disposal.

Grit Removal

Grit settles out of the sewage as the water flows through the tanks which are covered to keep the odours in. Air is bubbled into the tank to speed up the settling of the sand, gravel, and other heavier and inorganic materials. In the bottom of the tank, a corkscrew like system pushes the settled grit into a hopper at the end of the tank. A pump lifts the grit and a small amount of water up into a separator where the grit is rinsed and then placed into a dumpster where it awaits disposal at a landfill.

Primary Clarifiers

After removing the screenings and grit, the only material left in the wastewater is organic material and dissolved contaminants. The wastewater flows very slowly from the one end of the tank to the other. As this happens, the solids, which are high in organic material, settle to the bottom. Large scrapers draw the material to one end of the tank where it is pumped across to the digesters for further processing. At the end of the primary clarifiers, the now cleaner wastewater, termed primary effluent, flows into troughs which then direct it to the secondary treatment process. In the primary clarifiers, any grease, fats, or oils that are suspended are skimmed off by rakes and are pumped to the digesters. Any floatable materials that may have slipped through the bars in the screening process will be ground up before entering the digester.

Biologically Aerated Filters

The primary effluent flows to a pumping facility which lifts the wastewater up to the channel running along the centre of the Biologically Aerated Filters (BAF) facility. In each of the 11 available cells, the wastewater flows from the central channel to the bottom of the filters, and up through the filter. As it does, the water is aerated to encourage growth of numerous microorganisms which consume carbon dissolved in the water, as well as reducing ammonia and phosphorus. These microscopic organisms, referred to as biomass, stick onto the Bio Styrene media (4 mm diameter polystyrene beads), which also act to filter any suspended materials. The beads are held in place under a concrete floor with nozzles which let the clean water flow out on the surface. The clean water is then disinfected with chlorine to kill any pathogenic microorganisms that may pass through the filters. Like other filters, these are backwashed periodically to remove excess biomass growth and filtered particles, to restore the filters' ability to process wastewater efficiently.

Disinfection

Disinfection is accomplished by adding sodium hypochlorite to the BAF facility effluent. The effluent flows by gravity to a chlorine contact chamber where ample time is provided for the chlorine to disinfect the BAF effluent. Just prior to exiting the chlorine contact tank, the wastewater is dosed with sodium bisulphite to de-chlorinate it, and to ensure no chlorine remains in the water entering the receiving stream.

Outfall

After de-chlorination, the disinfected effluent from the chlorine contact tanks is discharged to the St. Lawrence River through a 1500mm diameter outfall sewer with fourteen 250mm elbow diffusers, approximately 240m offshore.

BAF Backwash Residual Treatment

As wastewater is filtered through the BAF filter beds, the media becomes increasingly clogged and requires backwashing to remove excess contaminants and biomass. After leaving the BAF cell, the backwash residual water follows the backwash channel to 2 backwash residual tanks, each large enough to accommodate the volume of backwash residual from a backwash. One of two submersible backwash residual pumps pump the water with a pneumatical actuated butterfly valve controlling the rate of flow to equalize the flow back to the head of the plant.

Anaerobic Digesters

The digester facility consists of 3 primary digesters and 1 secondary digester. Inside, the mixture is heated to allow microorganisms to grow and consume carbon and to produce methane gas and carbon dioxide. The first primary digester, digester 3, is heated to 55 degrees Celsius (thermophilic), which further assists in the destruction of harmful bacteria in the solids. After approximately 15 days, the solids are transferred in series to two other primary digesters, digesters 1 and 2, which are heated to 36 degrees Celsius (mesophilic), where they remain for an additional 15 days before being stored in the secondary digester, digester 4, before being sent to the dewatering facility.

Sludge in digesters 1 and 2 is mixed using four mechanical mixers mounted on each of the digester's roofs that operate continuously. The sludge is recirculated through the use of three sludge recirculation pumps that circulate the sludge from the digesters through two sludge heat exchangers to ensure a thermophilic temperature range. Mixing in digester 3 is accomplished using a mixing pump and recirculation is done similarly to digesters 1 and 2 with three sludge circulation pumps circulating the sludge through a sludge heat exchanger to ensure a mesophilic temperature range. Digester 4 sludge is pumped to holding tanks in the dewatering building where it is recirculated until ready to be dewatered.

The methane gas produced is used as fuel for the boiler system which in turn provides heat for the digestion process via sludge heat exchangers. If more gas is being generated than can be used in the boiler, the excess gas can be used in a combined heat and power generation system, Co-gen, to help offset the power purchased from the grid or burned using a flare stack.

Dewatering

Liquid biosolid, which is about 2% solid and 98% water, is transferred from the secondary digester into 2 centrifuges where a polymer is added to help solids stick together, aiding the dewatering process. The centrifuge spins at a high-speed forcing solids, now cake, to the outer drum, separating it from the liquid, called centrate. The cake, which now has a solid content of about 30%, is augured using two shaft-less screw conveyers to a hole in the floor where it falls into a hopper. When enough material is in the hopper, a piston pump pushes the solid cake to the biosolids storage building. Alternatively, the cake materials can be loaded directly into a dump truck in a separate loading bay. The centrate, which contains many nutrients and some microorganisms, is returned to the headworks for treatment.

Biosolids Storage

The dry product, cake, that results from the treatment process may be stored for up to 240 days, based on ideal loading conditions. The cake can then be used on agricultural lands as a nutrient and soil conditioner when weather and crop conditions permit.

Standby Equipment

The power building houses two 575kW electric back-up generators that are designed to run the water pollution control plan in the event of a power outage. These units are powered by 12-cylinder, low emission natural gas engines that will start automatically in the event of a power failure. The aforementioned Co-gen is a combined heat and power generator. This 8-cylinder engine is designed to work on natural gas, digester gas which has been cleaned and the moisture removed, or a blend of these two fuels. The Co-gen unit is designed to run continuously and produce 375 kW of electric power and 500kW of heat reducing the amount of gas required to heat the digesters.

Figure 1 - Ravensview Wastewater Treatment Plant General Layout

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3 OPERATION

Adequate staffing as well as preventative maintenance and regular equipment inspections allowed operational problems to be diagnosed quickly and corrective actions to be taken immediately. Non flushable materials such as wipes, and grease continue to be more prominent in the sewer system resulting in some operational and maintenance challenges. Utilities Kingston is still implementing a public education program to make customers more aware of what materials should not be flushed down the sewers. This program has included radio and newspaper campaigns, social media campaigns such as Twitter and Facebook, bill stuffers, information on back of parking tickets, and bus information signs. This has been an ongoing campaign for the past few years with positive results.

4 BIO-SOLIDS MANAGEMENT

Ravensview WWTP processed 69,376 m^3 of liquid sludge through the centrifuge. Approximately 2,665m^3 of sludge cake was stored on site until Terra Pure Environmental applied it to land on licensed agricultural fields.

It is too hard to predict exactly where and when the bio-solids will be spread. Crops and weather will be the major variables that will dictate the course of the spreading season.

Appendix A, Table 1 contains active spreading locations and their appropriate Non-Agricultural Source Materials Plan (NASM).

5 MAINTENANCE

Staff continue to use our preventative maintenance program in accordance with manufacture's recommendations.

Additional Maintenance completed this year:

- Routine vibration monitoring.
- Gas skid media replacement.
- Gas skid accumulator replacement and increase tank capacity.
- Replacement of inlet isolation valves for gas skid.
- Digester #3 mixing pump check balls were replaced.

6 CAPITAL WORKS

The major highlights for capital works were:

- Grit auger replacement.
- Admin building HVAC system repairs and upgrades.
- Septage stage 1 media replacement.
- Roof repairs for Digesters 1 and 2.

7 EQUIPMENT CALIBRATION

All of the Treatment facility flow meters are calibrated annually by third party contractors. Calibration records are available upon request.

8 COMPLAINTS

There was one odour complaint related to Ravensview this reporting year. Operations were modified to attempt to alleviate odours. The odours were due to a very dry summer and low flows. Operations took a few clarifiers offline to send more flow to the ones that were online.

9 BYPASS & OVERFLOW SUMMARY

The facility had zero secondary bypass events during the reporting year. The collection system had some wet weather overflow events which totaled 26,195m^3 for 2021. The overflow locations along with their corresponding Pollution Control Plan identification numbers (PCP) are listed in Appendix B, Table 2: Annual Overflow Summary.

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