CATARAQUI BAY
WASTEWATER TREATMENT PLANT

2022 ANNUAL REPORT

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1 EXECUTIVE SUMMARY

Cataraqui Bay Wastewater Treatment Plant (WWTP) operates under Ministry of the Environment, Conservation and Parks, ECA number 3714-9YURZF. The facility was compliant with all but one of the conditions outlined in condition 7 of the above-mentioned ECA. The non-compliant months and effluent parameter is described in the following sections of this report.

The average daily flow through the plant was 29,381 m3/day.

There were no bypass events at the Cataraqui Bay WWTP and there were four bypass events within the Kingston West Sewage Collection System in the reporting year. The details of the bypasses are listed in Appendix B, Tables 2 and 3, in the Bypass Summary section of this report.

Plant staff continue to maintain operations during the facility upgrades. There has been continued planned and reactive maintenance as well as capital works at both the facility and within the collection system. Details regarding these improvements are in the report.

We have continued to provide additional training to staff at the facility to increase their knowledge of the process upgrades currently underway.

2 PLANT DESCRIPTION AND TREATMENT PROCESS

The following is a process overview and description of the treatment steps taken at Cataraqui Bay WWTP. The descriptions contained within this report relate to ECA number 3714-9YURZF.

A detailed description of the upgraded WWTP will be provided when the facility performance report relates to ECA number 4163-ACPPRK.

2.1 GRIT REMOVAL

The first step in the treatment process is grit removal. This is accomplished by introducing air into the bottom of the grit channel. The heavier solids in the wastewater settle to the bottom of the tank, while the organics that require treatment stay in suspension and move on to the next step of the treatment process.

2.2 SCREENING

The second operation is the removal of large particles and floating debris such as wood, rags and plastics from the raw water. These items are removed using mechanical screens that rake the debris from the wastewater stream and onto a belt conveyor.

2.3 FLOW SPLITTING

The screened wastewater discharges into a channel where a flow splitter divides the flow into two separate channels that lead to both C and D plants. The channels are equipped with motorized gate valves to control the flow rate to each plant.

2.4 PRIMARY SETTLING

The heavier organics settle by gravity to the bottom of the primary clarifiers. This forms a sludge blanket on the bottom of the tank. The settled sludge is collected by collector flights and scraped into a hopper at the end of the tank. The settled sludge is then pumped to digestion facilities for further treatment. As wastewater is discharged from the primary clarifiers, it is dosed with aluminum sulfate for phosphorus removal.

2.5 AERATION

Organic matter is broken down by microorganisms in the Aeration tanks. The microorganisms are supplied with air, and food (which is provided by the primary clarifier effluent). Healthy populations of microorganisms are maintained by returning some of the biomass from the final clarifiers. The aeration process effectively removes 95% of the biochemical oxygen demand from the incoming wastewater.

2.6 FINAL SETTLING

After the breakdown of the wastewater is completed, the mixture of microorganisms (mixed liquor) from the aeration tanks flows into the final clarifiers for solid-liquid separation. The biomass formed in the aeration tanks settles to the bottom of the final clarifiers. A portion of this biomass is returned to the head of the aeration tanks. The remainder of the biomass is pumped to sludge thickening facilities.

2.7 DISINFECTION

The supernatant effluent from the final clarifiers is then directed to the disinfection facilities. Chlorine is dosed to the wastewater just prior to entering the chlorine contact tank where disinfection of the final effluent occurs. Just after exiting the chlorine contact tank the wastewater is dosed with calcium thiosulphate for de-chlorination to ensure no chlorine remains in the water entering the receiving stream.

2.8 OUTFALL

After de-chlorination, the disinfected effluent from the chlorine contact tank is discharged back to Lake Ontario through a 1500 mm and a 900 mm outfall sewer. The diffusers at the ends of the sewer lines are located 25 m offshore and 16 m below water surface level.

2.9 SLUDGE THICKENING

The sludge thickening facility consists of two rectangular holding tanks, dual rotating drum thickeners and a polymer system. Sludge is thickened from 0.5% solids to approximately 3.5% solids before being pumped to the digester facilities.

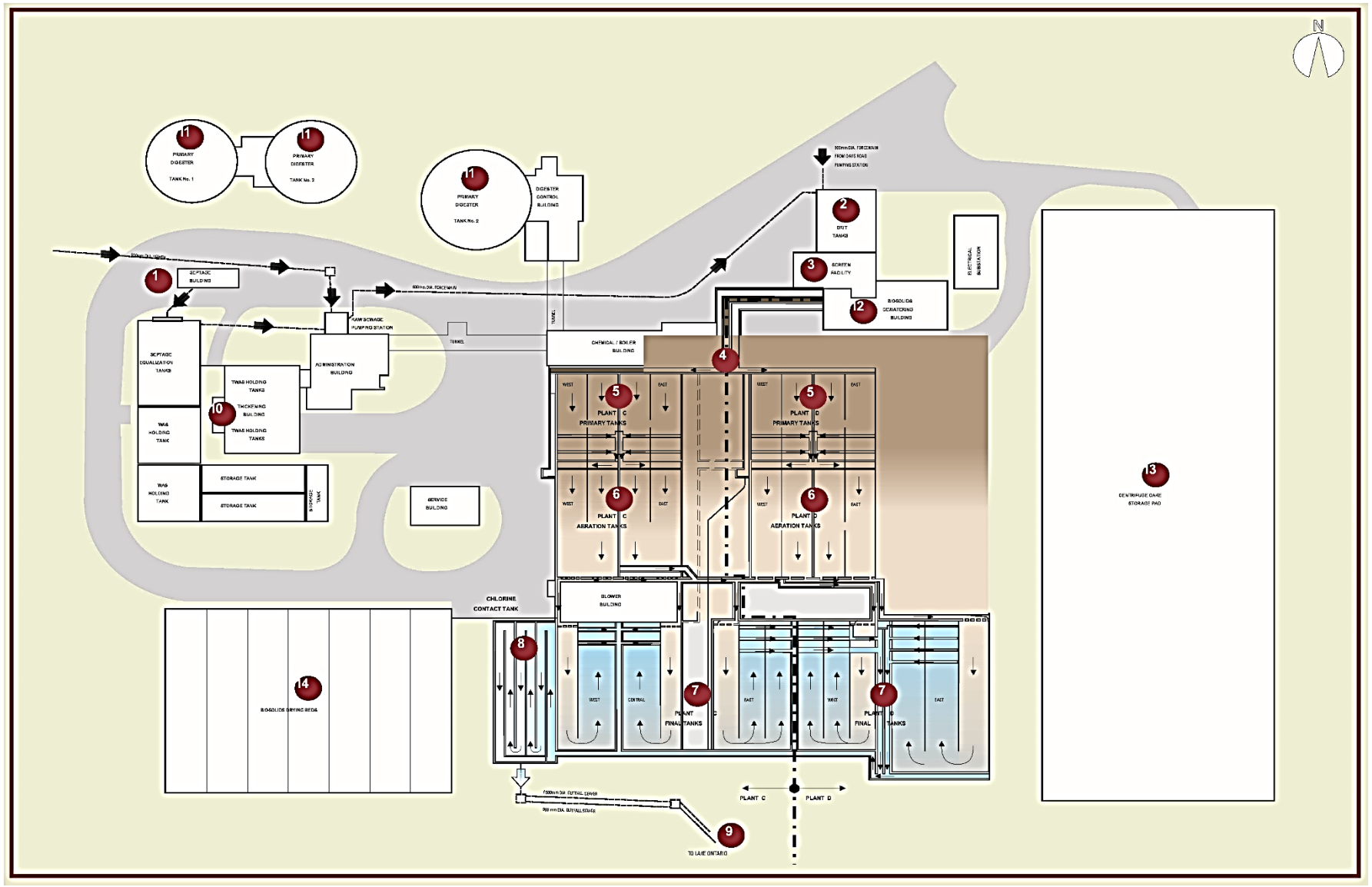
2.10 BIOSOLIDS MANAGEMENT

The sludge from the primary and final clarifiers as well as the sludge from the thickening process is pumped to the digester facilities. The digester facilities consist of one primary digester, one secondary digester and a holding tank. In the primary digester, the sludge is heated, mixed and re-circulated under controlled anaerobic conditions. The anaerobic digestion process produces gas and biosolids. The gas produced is rich in methane which is used as fuel for the boiler system which in turn provides heat for the digestion process. The biosolids produced through sludge digestion are dewatered and used on agricultural lands as a nutrient and soil conditioner when weather and crop conditions permit.

2.11 BIOSOLIDS DEWATERING

The biosolids produced through digestion are dewatered by centrifugation. The centrifuged cake produced is land applied when weather and crops permit.

FIGURE 1 – CATARAQUI BAY WASTEWATER TREATMENT PLANT GENERAL LAYOUT



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3 OPERATION

Adequate staffing as well as preventative maintenance and regular equipment inspections resulted in minimal disruptions to operations of the plant. 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 four years with positive results.

The Cataraqui Bay WWTP received a peak flow rate above the approved Peak Flow Rate of 134,400 m^3/d once through the calendar year. During a wet weather event in December a flow rate of 141,017 m^3/d was recorded. The treatment process was able to continue as normal during this peak flow rate.

4 PLANT PERFORMANCE

Work on the upgrades to the facility continues, and several parts of the treatment process came online for the first time in 2022. Operations staff ran into some treatment difficulties as the plant and operators adjusted to these new processes. These difficulties led to increased Total Phosphorous (TP) concentrations in the final effluent. The Cataraqui Bay WWTP had three non-compliant monthly average result for TP, with monthly average effluent concentrations above the limit of 1.0 mg/L. These occurred in the months of August, October, and November. Each of these non-compliant results were reported to the MECP. Operators were able to adjust the process and the effluent concentrations of TP have now been reduced to normal levels.

For several months this year, the Total Suspended Solids (TSS) in the final effluent was above the objective but below the requirements set out by the MECP in the ECA. These elevated TSS numbers are a direct result of the new treatment process that has been brought online.

Aside from the non-compliant levels of TP the plant was compliant with all other Final Effluent limits. Raw Influent, and Final Effluent samples were collected and submitted to a third party laboratory at or above the required frequencies based on the ECA.

5 BIO-SOLIDS MANAGEMENT

Cataraqui Bay WWTP processed 32,601.08 m3 of liquid sludge through the centrifuge. Approximately 2,531.19 Metric Tonnes of sludge cake was stored on site until GFL Environmental applied it to land on licensed agricultural fields.

The location and date of land application of the Bio-solids produced largely depends on weather, and the crops being grown on the receiving lands. Appendix A, Table 1 contains the Non-Agricultural Source Materials Plan (NASM) numbers, and addresses of receiving lands for bio-solids produced by the City of Kingston.

6 MAINTENANCE

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

Additional Maintenance completed this year:

- Infrared scans of HV electrical were performed across the plant.
- Equipment and motors had routine vibration monitoring conducted.
- The onsite diesel generator was serviced and received routine maintenance.
- Chains and flights in all clarifiers and gravity thickeners were tightened and inspected.

- The mixer in Digester #1 was refurbished and put back into service.
- All BAF building blowers were serviced and inspected.

7 CAPITAL WORKS

In October 2016 work began on plant wide upgrades. The original proposed project completion timeline was 4 years (2016-2020). Although the original proposed completion date has passed, the Cataraqui Bay WWTP continues to undergo an extensive process, electrical/instrumentation, and mechanical upgrade.

Additional capital works within our sewage collection system include:

- Construction of the new Days Road Pumping Station continues.
- Pressure sensors were installed at multiple pumping station locations.

8 EQUIPMENT CALIBRATIONS

Third party contractors calibrated all plant flow meters, online analyzers, and lab equipment. As a result, the facility saw limited downtime of major equipment and saw very few mechanical or electrical failures this year. Calibration records are available upon request.

9 COMPLAINTS

In the 2022 reporting year, the Cataraqui Bay WWTP received no official complaints regarding the facility or treatment process.

10 BYPASS SUMMARY

There were four bypass events in 2022 in the Kingston West Collection System. Table 2 summarizes the location, volume, and duration of the four bypass events for the reporting year. Table 3 summarizes the test results from the sample taken during the bypass event.

11 BYPASS RESULT INTERPRETATIONS

All bypass discharges have a high bacteria count due to the lack of disinfection. CBOD5, TP, and TSS results are typical raw sewage influent levels. Best efforts are made to capture the debris contained in any discharges to the lake. After each bypass event, shoreline inspections near discharge points are done to monitor any debris that may come ashore, and clean-up is done if debris is found.

For further information about this report or any questions regarding accessibility, contact Tim Bourne at tbourne@utilitieskingston.com or call 613-546-1181 Ext 2190.

12 BIOSOLIDS RECIPIENTS

Table 1 – Biosolids Recipients

Non-Agricultural Source Materials Plan (NASM)	Address
24327	Lot 12 Concession 1 South, Town of Greater Napanee
23525	Lot 16 Concession 2, Town of Greater Napanee
25097	Lot 7-9 Concession 3, Loyalist Township
24326	Lot 26-31 Concession 1, Stone Mills Township

13 BYPASS SUMMARY

Table 2 – Bypass Summary

Date	Location	Start Time	Duration	Volume (m3)	Reason
February 17, 2022	Crerar Pumping Station	02:45	7 Hours and 45 Minutes	44.75	Heavy Rain
June 1, 2022	Crerar Pumping Station	20:00	8 Hours and 15 Minutes	98.3	Heavy Rain
June 3, 2022	Crerar Pumping Station	20:15	3 Hours	37.8	Heavy Rain
December 23, 2022	Crerar Pumping Station	17:15	10 Hours and 45 Minutes	159.3	Heavy Rain

Table 3 – Bypass Sampling Results

Date	Location	E. Coli (CFU/100mL)	CBOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorus (mg/L)
February 17, 2022	Crerar Pumping Station	48,467.00	7.3	47.7	0.32
June 1, 2022	Crerar Pumping Station	30,333.33	7.3	52	0.33
June 3, 2022	Crerar Pumping Station	24,000	Under 3.00	36	0.29
December 23, 2022	Crerar Pumping Station	95,750	5.8	24.25	0.37

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14 PLANT PERFORMANCE

Table 4 – Monthly Effluent Concentrations

Month	Objective (mg/L)	Limit (mg/L)	CBOD5 (mg/L)	Total Suspended Solids (mg/L)
January	15.00	25.00	7.80	12.50
February	15.00	25.00	9.30	15.30
March	15.00	25.00	10.00	18.40
April	15.00	25.00	7.60	16.50
May	15.00	25.00	10.50	16.30
June	15.00	25.00	8.00	8.90
July	15.00	25.00	7.10	15.80
August	15.00	25.00	7.00	11.50
September	15.00	25.00	9.40	21.20
October	15.00	25.00	6.80	18.80
November	15.00	25.00	9.00	19.50
December	15.00	25.00	8.30	16.00
Annual Average	N/A	N/A	8.40	15.89

Table 5 – Final Effluent Results

(Monthly Average)

Month	Total Chlorine (mg/L)	Total Phosphorus (mg/L)	Total Phosphorus Loading (kg/d)	E. Coli (CFU/100mL)	Acute Lethality (Pass or Fail)
January	0.00	0.98	23.4	28	N/A
February	0.01	0.62	17	231	N/A
March	0.00	0.50	17	59	N/A
April	0.01	0.54	22.9	166	N/A
May	0.01	0.86	28	16	N/A
June	0.02	0.94	40.2	21	N/A
July	0.01	0.92	23.1	11	Pass
August	0.01	1.16	20.4	11	N/A
September	0.01	0.94	21.1	163	N/A
October	0.00	1.03	24.9	112	N/A
November	0.01	1.11	32.3	45	N/A
December	0.01	0.76	21.2	9	N/A
Annual Average	0.01	0.86	24	73	N/A

Table 6 – Effluent Loading Limits

Effluent Parameter	Limit	Loading Limit from Effluent	Annual Average
CBOD5	25.0 mg/L	970 kg/day	246 kg/day
Total Suspended Solids	25.0 mg/L	970 kg/day	469 kg/day

Table 7 – Monthly Flows

Month	Rated Capacity (m3/day)	Average Flow (m3/day)	Approved Peak Flow (m3/day)	Peak Flow (m3/day)
January	38,800	23,467	134,400	49,355
February	38,800	28,080	134,400	102,452
March	38,800	38,078	134,400	98,068
April	38,800	37,824	134,400	103,391
May	38,800	30,940	134,400	102,313
June	38,800	35,176	134,400	102,952
July	38,800	23,645	134,400	52,668
August	38,800	24,098	134,400	95,217
September	38,800	24,459	134,400	91,895
October	38,800	24,234	134,400	59,426
November	38,800	28,015	134,400	86,931
December	38,800	35,111	134,400	141,017
Annual Average	N/A	29,427	N/A	90,474

Table 8 – Annual Plant Flows

Parameter	2016	2017	2018	2019	2020	2021	2022
Average (m3/day)	26,072	30,042	28,963	29,251	27,189	27,225	29,381
Max (m3/day)	67,405	121,860	94,957	91,976	82,297	51,566	88,225
Design (m3/day)	38,800	38,800	38,800	38,800	38,800	38,800	38,800
Design Peak (m3/day)	134,400	134,400	134,400	134,400	134,400	134,400	134,400
Daily/Design (%)	67.2	77.4	74.6	75.4	70.1	70.2	75.7
Max/Peak (%)	50.2	90.7	70.7	68.4	61.2	38.4	65.6