CATARAQUI BAY
WASTEWATER TREATMENT PLANT

2023 ANNUAL REPORT

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1 EXECUTIVE SUMMARY

On December 14th, 2023, the Cataraqui Bay Wastewater Treatment Plant (WWTP) revoked the Ministry of the Environment, Conservation and Parks, ECA number 3714-9YUKZF, and began to operate under ECA number 4163-ACPPRK. An amended ECA, number 2497-CYPPUP was issued on December 22nd, 2023, following a change that was made to the system description, this is the current ECA for the facility.

During 2023 the facility was compliant with all but one of the conditions outlined in condition 7 of ECA number 3714-9YUKZF. The non-compliant month and effluent parameter is described in the following sections of this report.

The average daily flow through the plant was 28,740 m3/day.

There were no bypass events at Cataraqui Bay. There were three spills to the environment of Digester Gas, due to flare stack problems.

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 3714-9YUKZF, as the WWTP was required to comply with the regulatory requirements of ECA number 3714-9YUKZF for most of the 2023 reporting year.

A detailed description of the upgraded WWTP described in ECA number 2497-CYPPUP will be provided in the next annual report.

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 wastewater. 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.

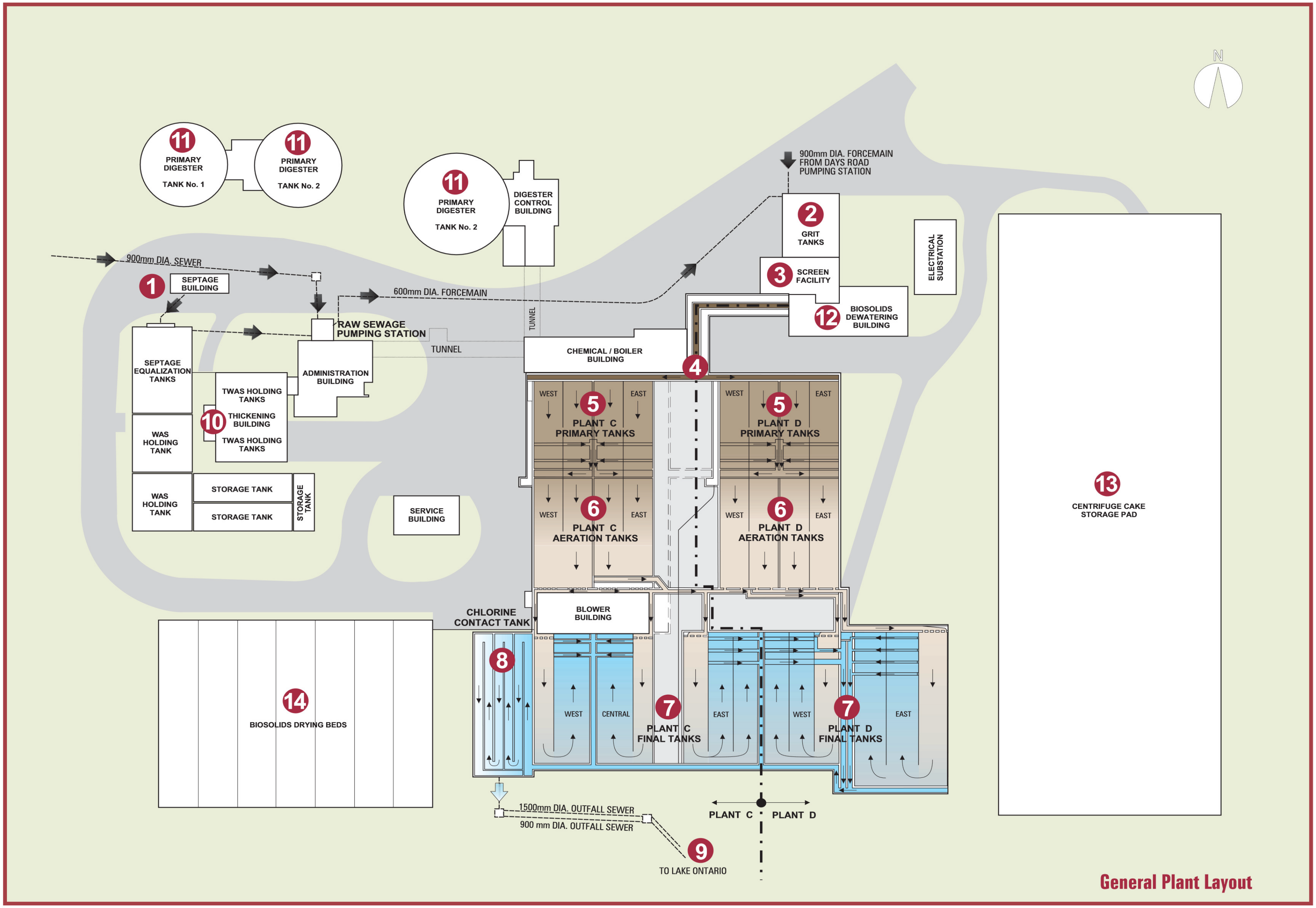
2.10 BIOSOLIDS MANAGEMENT

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 the operation 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 continues to implement 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 many years with positive results. During the summer of 2023 staff worked to educate owners of grease traps within our system on how to properly maintain their equipment. Pamphlets describing the importance of appropriate grease trap maintenance and how it impacts our system were delivered to many restaurants across the city.

Operators encountered several operational difficulties throughout the year. Staff investigated the integrity of the Biological Aerated Filter decks in an effort to locate the source and reason that BAF beads (polystyrene product) were discharging from the BAF cells. Staff found and replaced a broken nozzle that is meant to hold back the beads, while allowing secondary effluent to flow through.

Further, Operators had difficulties maintaining effluent limits and objectives during the summer and fall months, details are below in the Plant Performance section.

The new Calcium Thiosulphate (Captor) line to the final effluent dose location has continued to plug up with deposits. Staff attempted to mitigate this operational issue by flushing the line and have developed a flushing schedule. However, despite these efforts the problem has persisted and as such, a temporary line to ensure continued dosing of Captor has been added, while staff work to find a permanent solution.

4 PLANT PERFORMANCE

Substantial Completion of the plant upgrade was achieved in February 2023. Throughout the reporting year, the remaining construction was completed, and the plant was commissioned by December 31, 2023, with the exception of the chlorination system of which Utilities Kingston received an amended ECA from the MECP. Remaining clean-up type work (i.e., correcting deficiencies noted during commissioning) and the commissioning of the chlorination system, and heating, ventilation and air conditioning systems continues.

The Cataraqui Bay WWTP had one non-compliant monthly average result for Total Phosphorus (TP) of 1.07 mg/L, with the monthly average effluent concentration above the limit of 1.0 mg/L. This occurred in the month of October. This non-compliant result was reported to the MECP, after discussing the efforts made to improve the effluent concentrations (including contacting a consultant) no further actions were required.

In July the E.Coli concentration in the final effluent exceeded the objective but remained well below the limit, the objectives and limits can be seen in Table 2.

The annual average concentration of Total Suspended Solids (TSS) for 2023 was below the limit, but above the objective outlined in the ECA, all Objectives, and Limits are listed in Table 2. All Effluent monitoring results are shown in Table 4 and 5. The elevated TSS concentrations are a direct result of the new treatment process.

The chlorine residual in the final effluent did not exceed the monthly average limit of 0.02 mg/L for any month of the year. No other parameters were above their limit or objective.

Operators experienced operational challenges as plant systems came online and were commissioned. Work has advanced to optimize the processes and correct deficiencies to ensure the safe and compliant operation of the plant. A consultant has been retained to assist the operations group to improve the quality of the effluent from the plant. Staff will continue with mitigation strategies to reduce concentrations of TP and TSS in the plant effluent. The concentration of raw influent into the plant remains consistent throughout the year, however during the wet seasons concentrations are somewhat reduced, indicating some infiltration of ground water, or potentially illegal sump pump connections to the sanitary collection system. Annual raw influent monitoring results can be seen in Table 3. 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 43,489.6 m^3 of liquid sludge through the centrifuge. Approximately 2,396.27 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. 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 the manufacturer'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.
- Rebuild completed on west chlorine gas regulator.
- BAF cell 4 nozzle replacements completed.
- Sludge pump lobes and seals replaced.
- South RDT drum was inspected, and cracks in the drum were welded.

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 on the Cataraqui Bay WWTP include:

- Replaced flare stack regulating valve.
- Installed a new grinder on the feed line to Digester 3.
- BAF air compressor wet tank installed.

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 2023 reporting year, the Cataraqui Bay WWTP received no official complaints regarding the facility or treatment process.

10 BYPASS AND SPILL SUMMARY

There were no bypasses at the Cataraqui Bay WWTP in 2023.

There were three spill events of un-combusted Digester Gas to the environment, totaling 52.25 m^3 that were reported to the MECP in the 2023 reporting year. These spills occurred when the pilot light of the flare stack blew out in high winds. When the flare is not lit digester gas not being consumed in the boilers was not burnt at the flare stack, this is considered a spill to the environment.

11 BYPASS RESULT INTERPRETATIONS

As noted above there were no bypasses at the Cataraqui Bay WWTP in 2023. However, it should be noted that bypass discharges have a high bacteria count due to the lack of disinfection. $CBOD_5$, TP, and TSS results are typical raw sewage influent levels. When bypasses occur, 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
60616	Lot 11-15 Concession 2 Town of Greater Napanee
24326	Lot 23-24 Concession 3 South Town of Greater Napanee
24326	Lot 20 Concession 3 South Town of Greater Napanee
60611	Lot 13-15 Concession 2 Loyalist Township
60884	Lot 24-27 Concession 5 South Town of Greater Napanee

13 EFFLUENT OBJECTIVES AND LIMITS

Table 2 – Effluent Objectives and Limits

Effluent Parameter	Objective	Limits
CBOD5	15.00 mg/L (Monthly Average)	25.00 mg/L (Monthly Average)
Total Suspended Solids	15.00 mg/L (Monthly Average)	25.00 mg/L (Monthly Average)
Total Phosphorus	1 mg/L (Monthly Average)	1.00 mg/L
Total Chorine Residual	<0.02 mg/L	0.02 mg/L
E. Coli	100 CFU/100mL	200 CFU/100mL

Note: pH maintained between 6.0 to 8.5 at all times

14 PLANT PERFORMANCE RESULTS

Table 3 – Raw Influent Results

(Monthly Average)

Month	BOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorus (mg/L)	Total Ammonia Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	pH
January	248	426	5.50	23.33	41.33	7.15
February	171	162	3.40	18.1	37.53	7.28
March	194	159	4.20	17.36	35.96	7.3
April	170	138	2.90	18.28	32.15	7.29
May	193	176	2.80	22.56	28.43	7.17
June	173	134	3.00	22.14	34.5	6.91
July	208	142	3.80	23.18	36.45	7.15
August	162	170	4.10	19.42	35.46	7.19
September	294	252	4.00	25.8	40.53	6.77
October	206	169	4.70	26.68	43.4	6.98
November	151	164	3.50	23.18	35.46	6.85
December	122	73	2.30	15.21	26.13	7.31
Annual Average	191	180.42	3.68	21.27	35.61	7.11

Table 4 – Monthly Effluent Concentrations (Part 1)
(Monthly Average)

Month	CBOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorous (mg/L)	Total Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)
January	7.50	15.00	0.72	8.76	10.98
February	8.10	23.30	0.65	11.27	14.25
March	6.60	11.20	0.46	10.55	12.76
April	8.00	9.00	0.57	8.64	11.13
May	6.50	14.30	0.80	0.73	2.35
June	8.60	20.00	0.86	3.70	7.48
July	10.80	27.20	0.98	4.79	8.35
August	5.80	22.60	0.76	1.55	3.82
September	7.80	19.00	0.94	1.27	3.45
October	4.50	20.90	1.07	0.48	3.40
November	6.40	29.80	0.71	0.52	3.66
December	3.90	14.30	0.39	2.56	4.45
Annual Average	7.04	18.88	0.74	4.57	7.17

Table 5 – Monthly Effluent Concentrations (Part 2)

Month	Nitrate	Nitrite	E. Coli	pH	Acute Lethality (Pass or Fail)
January	13.73	0.34	38	7.15	N/A
February	13.23	0.68	62	7.27	N/A
March	13.49	0.32	12	7.17	Pass
April	13.38	0.70	18	7.43	N/A
May	16.88	1.50	27	7.21	N/A
June	20.16	1.06	13	6.85	N/A
July	18.58	1.59	109	7.27	N/A
August	19.34	1.06	17	7.41	N/A
September	26.60	1.48	7	7.26	N/A
October	27.90	1.29	19	7.39	N/A
November	26.18	0.59	11	7.41	N/A
December	15.88	0.18	16	7.53	N/A
Annual Average	18.78	0.90	29	7.28	N/A

Table 6 – Effluent Loading Limits

Effluent Parameter	Loading Limit from Effluent	Annual Average
CBOD5	970 kg/day	202.4 kg/day
Total Suspended Solids	970 kg/day	542.7 kg/day
Total Phosphorous	39 kg/day	21.3 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	35,434	134,400	65,972
February	38,800	38,221	134,400	82,315
March	38,800	37,801	134,400	59,631
April	38,800	33,935	134,400	62,950
May	38,800	30,553	134,400	108,514
June	38,800	22,942	134,400	32,718
July	38,800	22,407	134,400	45,600
August	38,800	26,112	134,400	48,849
September	38,800	19,058	134,400	21,741
October	38,800	20,815	134,400	25,785
November	38,800	22,305	134,400	34,205
December	38,800	35,293	134,400	63,469
Annual Average	N/A	28,740	N/A	54,312

Table 8 – Annual Plant Flows

Parameter	2016	2017	2018	2019	2020	2021	2022	2023
Average (m3/day)	59,640	30,042	28,963	29,251	27,189	27,225	29,381	28,707
Max (m3/day)	179,987	121,860	94,957	91,976	82,297	51,566	88,225	108,514
Design (m3/day)	95,000	38,800	38,800	38,800	38,800	38,800	38,800	38,800
Design Peak (m3/day)	193,000	134,400	134,400	134,400	134,400	134,400	134,400	134,400
Daily/Design (%)	62.8	77.4	74.6	75.4	70.1	70.2	75.7	74.0
Max/Peak (%)	93.3	90.7	70.7	68.4	61.2	38.4	65.6	80.7