RAVENSVIEW WASTEWATER TREATMENT PLANT

2023 ANNUAL REPORT

TABLE OF CONTENTS

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 raw influent flow into the plant was 61,303 m^3/day.

The facility had three secondary bypass events during the reporting year totaling 3,043 m^3.

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

2.1 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. The septage receiving station 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, and origin, of the contents being unloaded and provides some pre-treatment before the contents enter the treatment plant at the influent works.

2.2 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.

2.3 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 screw 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.

2.4 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 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 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.

2.5 BIOLOGICAL AERATED FILTERS

The primary effluent flows to a pumping facility which lifts the wastewater up to a channel running along the centre of the Biological 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. In the filter the wastewater is aerated, this encourages growth of microorganisms which consume carbon dissolved in the wastewater, 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. Like other filters, these are backwashed periodically to remove excess biomass growth and filtered particles. This helps to restore the filters' ability to process wastewater efficiently.

2.6 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. This process de-chlorinates the water entering the receiving stream.

2.7 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.

2.8 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. The water is pumped back to the head of the plant using one of two submersible backwash residual pumps.

2.9 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, this produces 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. The sludge from digesters 1 and 2 is recirculated through two sludge heat exchangers, this helps the digester maintain the correct temperature. Mixing in digester 3 is accomplished using only a mixing pump. The sludge from digester 3 is also recirculated through a heat exchanger to maintain the correct temperature as well. 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 through the 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.

2.10 DEWATERING

Liquid biosolids, which are about 2% solid and 98% water, are pumped from the secondary digester into 2 centrifuges. Polymer is added to the biosolids before it enters the centrifuge, this helps the solids stick together, aiding the dewatering process. The centrifuge spins at a high-speed, forcing solids to the outer drum. This separates the solids, referred to as cake, from the liquid, called centrate. The cake, which now has a solids content of about 30%, is conveyed to 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.

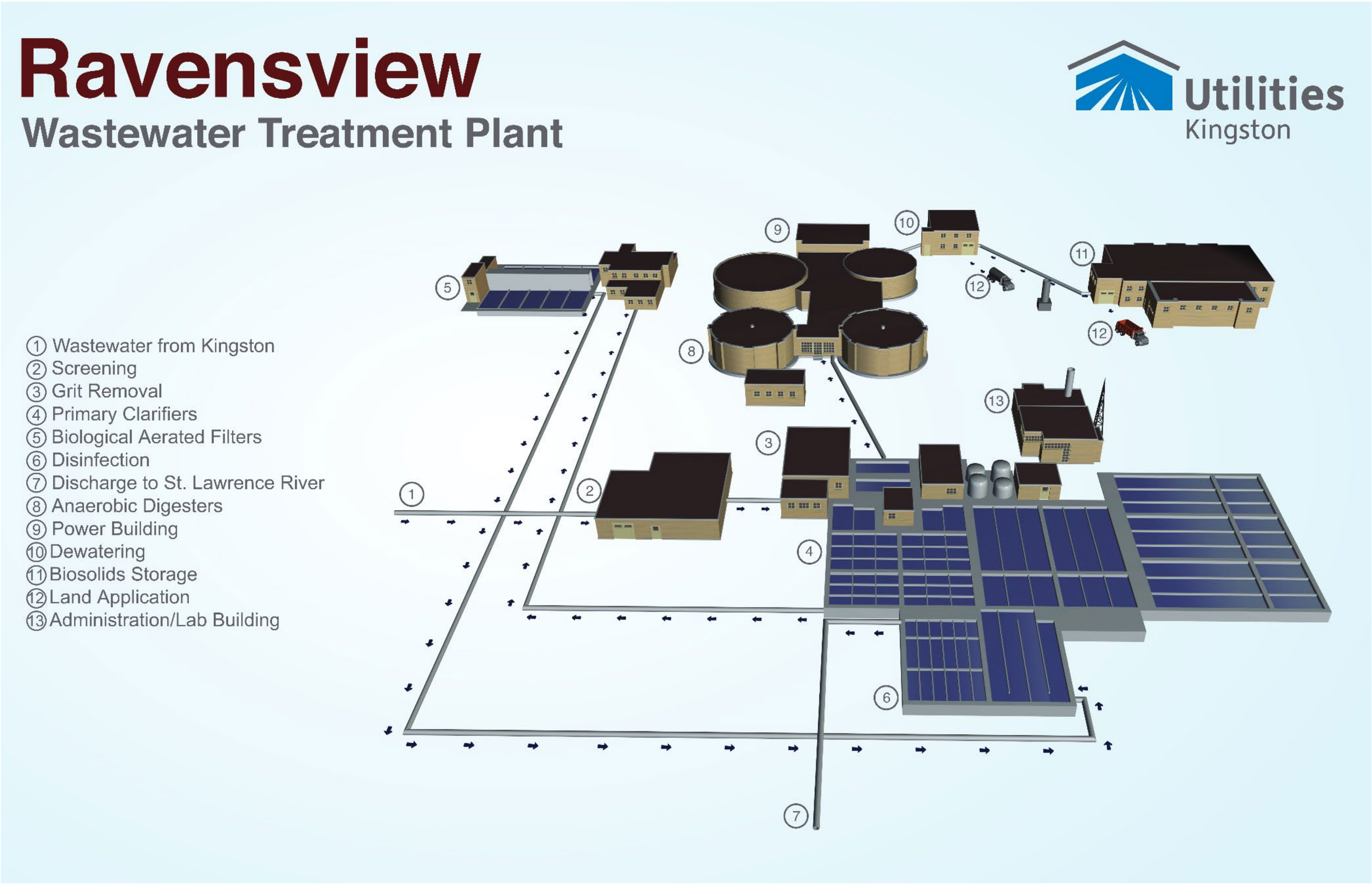
2.11 BIOSOLIDS STORAGE

The dry product, cake, that results from the treatment process is stored on site. The cake is then used on agricultural lands as a nutrient and soil conditioner when weather and crop conditions permit.

2.12 STANDBY EQUIPMENT

The power building houses two 575kW electric back-up generators that are designed to run the water pollution control plant 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 continues to implement a public education program to help customers become 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.

There were several large operational problems that occurred through the year. In September there was a buildup of polystyrene beads from the Biological Aerated Filters (BAF) that were drawn into the backwash tanks. These beads interfered with the level sensors in the backwash tanks, and the primary effluent channels. This level sensor interference led to one of the secondary treatment bypasses at the plant. Staff cleaned out the polystyrene beads and pump them back into the cells. Staff continue to monitor the presence of beads in the backwash tanks to ensure this does not happen again. During the fall the effluent from the plant had increased effluent concentrations, which were related to seasonal flow changes and maintenance being performed on the digester. Staff were able to react to the change in influent concentrations, and make process changes which led to improved effluent quality shortly after.

4 INFLUENT AND SEPTAGE

Utilities Kingston monitors the raw influent sewage, as well as the imported sewage from our septage receiving station for several parameters throughout the year.

The concentration of the monitored parameters, biochemical oxygen demand (BOD), Total Kjeldahl Nitrogen (TKN), Total Suspended Solids (TSS), and Total Phosphosrous (TP), in the sewage being received at the septage station has been increasing over the past several years. These higher concentrations lead to more frequent operational challenges, including maintenance on the influent screening equipment, and increased costs associated with treating the wastewater. In the next calendar year staff will increase sampling, and verification of septage loads. This will help ensure our treatment system is not impacted by the increasing concentrations of these parameters.

The concentration of the monitored parameters in the raw sewage has also been increasing over the past 5 years. Utilities Kingston has been working to remove stormwater flows into the sanitary sewer system (i.e., separating combined sewers), and it’s possible that the reduced stormwater in the sanitary system could have an influence on the increased concentrations of these parameters. The average temperature of the sewage being received at the facility is also increasing and could also be an indicator of the reduced stormwater inputs which are typically much colder than the raw sewage.

The annual average sample results for both Raw Influent and Septage Receiving for the past five years are shown in tables 4 and 5.

5 PLANT PERFORMANCE

The ECA number 5556-BZFGZL lists the limits and objectives for the concentrations of certain effluent parameters, this is shown in Table 3. The effluent objectives listed in this table are the concentrations we are expected to be below. The effluent concentration limits listed in the table are the concentrations we are required to be below. Ravensview WWTP did not exceed any of the limits set out in the ECA throughout the calendar year. However, the plant did exceed the objective for E. Coli in the month of May. The effluent limits and objectives are shown in Table 3, and the Final Effluent results can be seen in Table 6 and 7. Operational staff had difficulty managing seasonally increased raw influent concentrations. Staff managed the increased concentrations by increasing chemical dosages and taking primary clarifiers offline to increase flow rates through the plant. Final effluent TSS was elevated, however operators were able to maintain a concentration below the objective of 15 mg/L. The average daily influent flow for the year was 64.5% of the rated capacity of the facility, this is below the average influent flow rates from the past 8 years. The monthly average chlorine residual in the final effluent did not exceed 0.02 mg/L for any month of the year. Raw Influent, Septage, Final Effluent, and Sludge/Biosolids samples were collected and submitted to a third-party laboratory at or above the required frequencies based on the ECA.

6 BIO-SOLIDS MANAGEMENT

Ravensview WWTP processed 64,332.36 m^3 of liquid sludge through the centrifuge. Approximately 3,062.4 Metric Tonnes of sludge cake was stored on site until GFL Environmental applied it to land on licensed agricultural fields. A similar amount of sludge cake is expected to be produced next year.

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 active spreading locations and their appropriate Non-Agricultural Source Materials Plan (NASM).

7 MAINTENANCE

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

Additional Maintenance completed this year:

- Infrared scans of high voltage electrical was performed across the plant.
- Equipment and motors had routine vibration monitoring conducted.
- All primary clarifiers were cleaned and inspected.
- The gas Cogen alternator was serviced.
- The media in the septage odour control unit was replaced.
- Both grit tanks were cleaned and inspected.
- Digester 1 and 2 sludge recirculation line had all valves replaced.

8 CAPITAL WORKS

The major highlights for capital works were:

- One of the primary effluent pumps was sent out to be rebuilt.
- The scum pits had repairs completed.
- Concrete in the Bio-solids building was repaired.
- Lighting upgrades have begun throughout the plant.
- Effluent water line supplying water throughout the plant was replaced.
- A blower in the BAF was replaced.
- The gas Cogen had the Human Machine Interface (HMI) replaced.

9 EQUIPMENT CALIBRATION

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.

10 COMPLAINTS

In the 2023 reporting year, the Ravensview WWTP received one complaint regarding odours from the facility. Although staff did not notice any increased odours at the facility, efforts were made to change some of the maintenance procedures to reduce any odours. There were no additional odour complaints.

11 BYPASS & OVERFLOW SUMMARY

The facility had three secondary bypass events during the reporting year. These secondary bypass events were due to equipment malfunctions and high flows into the plant. The details of these events are listed in Table 2.

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
24326	Lot 20 Concession 3 South Town of Greater Napanee
60611	Lot 13-15 Concession 2 Loyalist Township
24405	Lot 7-8 Concession 4 Loyalist Township
60884	Lot 24-27 Concession 5 South Town of Greater Napanee

13 ANNUAL OVERFLOW SUMMARY

Table 2 – Annual Overflow Summary

PCP #	Location	Number of Events	Volume (m3)
1	Orchard-Emma Martin CSO	0	0.00
2	535 Rideau Belle Park Trunk	0	0.00
5	Dalton Ave PS	0	0.00
14	Barrack St E of King St	0	0.00
22	William St W of Ontario St	1	41.86
23	Earl St W of Ontario St	4	186.62
24	Gore St W of Ontario St	0	0.00
25	Lower Union W of Ontario St	3	396.65
26	West St S of King St	1	472.00
28	King St (O'Kill) PS	0	0.00
34	Helen St at Mack St	0	0.00
35	Palace Rd PS	0	0.00
41	Morton St PS	0	0.00
43	King-Portsmouth PS	1	574.00
48	West end of Sherwood Dr	0	0.00
50	South end of Parkway	0	0.00
51	Clarence St W of King St	1	450.16
52	Raglan Rd at Rideau St	1	161.45
53	Union St at Division St	1	0.02
55	King-George CSO	1	2507.80
56	King-Collingwood CSO	2	1166.63
65	535 Rideau Belle Park Local	2	751.64
68	Quebec St at Barrie St	0	0.00
69	Greenview Dr PS	0	0.00
70	Carlisle St at Chestnut St	0	0.00
74	Barrett Court	3	88.20
76	Ravensview Wastewater Treatment Plant	3	3043.00
79	Riverview Way PS	0	0.00
N/A	Total	24	9840.02

14 EFFLUENT OBJECTIVES AND LIMITS

Table 3 – 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	0.8 mg/L (Monthly Average)	1.00 mg/L
Total Ammonia Nitrate (Winter)	12.00 mg/L (October to May)	N/A
Total Ammonia Nitrate (Summer)	7.00 mg/L (June to September)	N/A
Total Ammonia Nitrate (Fall)	5.00 mg/L (July to August)	N/A
E. Coli	100 CFU/100mL	200 CFU/100mL
CBOD5 Monthly Average Daily Effluent Loading	N/A	2,375 kg/d
Total Suspended Solids Monthly Average Daily Effluent Loading	N/A	2,375 kg/d
Total Phosphorous Monthly Average Daily Effluent Loading	N/A	95 kg/d

Note: pH maintained between 6.0 to 9.5 at all times

15 SEPTAGE RECEIVING

Table 4 – Septage Receiving

Parameter	2019	2020	2021	2022	2023
BOD5 (mg/L)	204	804	565	790	1476
TP (mg/L)	360	29	22	53	99
TKN (mg/L)	7	548	227	299	564
TSS (mg/L)	114	1975	1213	995	3658

16 PLANT PERFORMANCE RESULTS

Table 5 – 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	Temp
January	39.00	48.00	2.00	15.06	19.4	7.81	13.33
February	36.00	95.00	2.40	14.53	18.43	7.8	14.03
March	27.00	27.00	1.90	14.95	17.33	7.96	14.82
April	41.00	39.00	1.80	13.31	15.55	7.62	15.18
May	19.00	25.00	1.00	9.33	11.15	7.63	15.18
June	29.00	30.00	1.30	11.3	13.44	7.51	14.92
July	29.00	55.00	1.80	12.73	15.68	7.52	17.75
August	14.00	30.00	3.90	12.95	17.3	7.59	14.28
September	23.00	36.00	2.00	18.29	21.56	7.55	15.66
October	70.00	183.00	3.40	27.7	31.25	7.45	12.5
November	56.00	114.00	3.70	25.56	32.42	7.22	13.45
December	46.00	65.00	2.20	13.81	19.05	7.37	15.2
Annual Average	35.75	62.25	2.28	15.79	19.38	7.59	14.69

Table 6 – Final Effluent Results (Part 1)
(Monthly Average)

Month	CBOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Phosphorus (mg/L)	Total Ammonia Nitrogen (mg/L)	Un-ionized Ammonia (mg/L)
January	1.90	4.70	0.36	1.62	0.01
February	3.00	4.20	0.38	1.83	0.01
March	3.00	3.10	0.50	1.73	0.01
April	1.80	3.50	0.56	1.68	0.02
May	1.80	3.20	0.47	0.72	0.01
June	1.60	3.40	0.58	1.25	0.01
July	2.10	5.40	0.73	1.47	0.01
August	3.40	6.10	0.43	0.74	0.01
September	2.40	12.90	0.75	1.05	0.01
October	2.70	14.20	0.71	3.55	0.01
November	3.40	12.90	0.56	5.5	0.01
December	2.60	9.40	0.34	1.65	0.01
Annual Average	2.48	6.92	0.53	1.90	0.01

Table 7 – Final Effluent Results (Part 2)

Month	pH	E Coli (CFU/100mL)	Acute Lethality (Pass or Fail)	Total Residual Chlorine (mg/L)
January	7.16	16	PASS	0.00
February	7.19	13	N/A	0.01
March	7.22	4	N/A	0.00
April	7.00	15	PASS	0.01
May	6.91	103	N/A	0.01
June	6.79	62	N/A	0.01
July	6.72	66	PASS	0.01
August	6.81	9	N/A	0.00
September	6.44	9	N/A	0.00
October	6.55	8	PASS	0.01
November	6.46	3	N/A	0.00
December	6.72	15	N/A	0.01
Annual Average	6.83	26.92	PASS	0.01

Table 8 – Effluent Loading Limits

Month	CBOD5 (kg/d)	Total Suspended Solids (kg/d)	Total Phosphorous (kg/d)
January	117	290	22
February	206	289	26
March	225	233	38
April	142	275	44
May	147	262	38
June	101	216	37
July	125	322	44
August	204	367	26
September	110	591	34
October	110	577	29
November	144	548	24
December	150	543	20
Annual Average	149	376	32

Table 9 – Annual Plant Influent Flows

Parameter	2016	2017	2018	2019	2020	2021	2022	2023
Average (m3/day)	59,640	86,200	69,005	77,265	59,435	57,278	68,505	61,303
Max (m3/day)	179,987	169,266	181,067	160,459	141,016	146,486	153,434	148,549
Design (m3/day)	95,000	95,000	95,000	95,000	95,000	95,000	95,000	95,000
Design Peak (m3/day)	193,000	193,000	193,000	193,000	193,000	193,000	193,000	193,000
Daily/Design (%)	62.8	90.7	72.6	81.3	62.6	60.3	72.1	64.5
Max/Peak (%)	93.3	87.7	93.8	83.1	73.1	75.9	79.5	77.0