Utilities Kingston

RAVENSVIEW
WATER POLLUTION CONTROL PLANT

2024 ANNUAL REPORT

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1 EXECUTIVE SUMMARY

Ravensview Water Pollution Control Plant (WPCP) operates under Ministry of the Environment, Conservation and Parks, Environmental Compliance Approval (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 52,292 m^3/day. The facility had no secondary treatment bypasses in 2024. Operational staff continually improve the operation of Ravensview WPCP to protect the environment and maintain the quality of service Kingston 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 Water Pollution Control 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 1500 mm diameter outfall sewer with fourteen 250 mm elbow diffusers, approximately 240 m 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 two 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 three primary digesters and one 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 °C (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 °C (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.

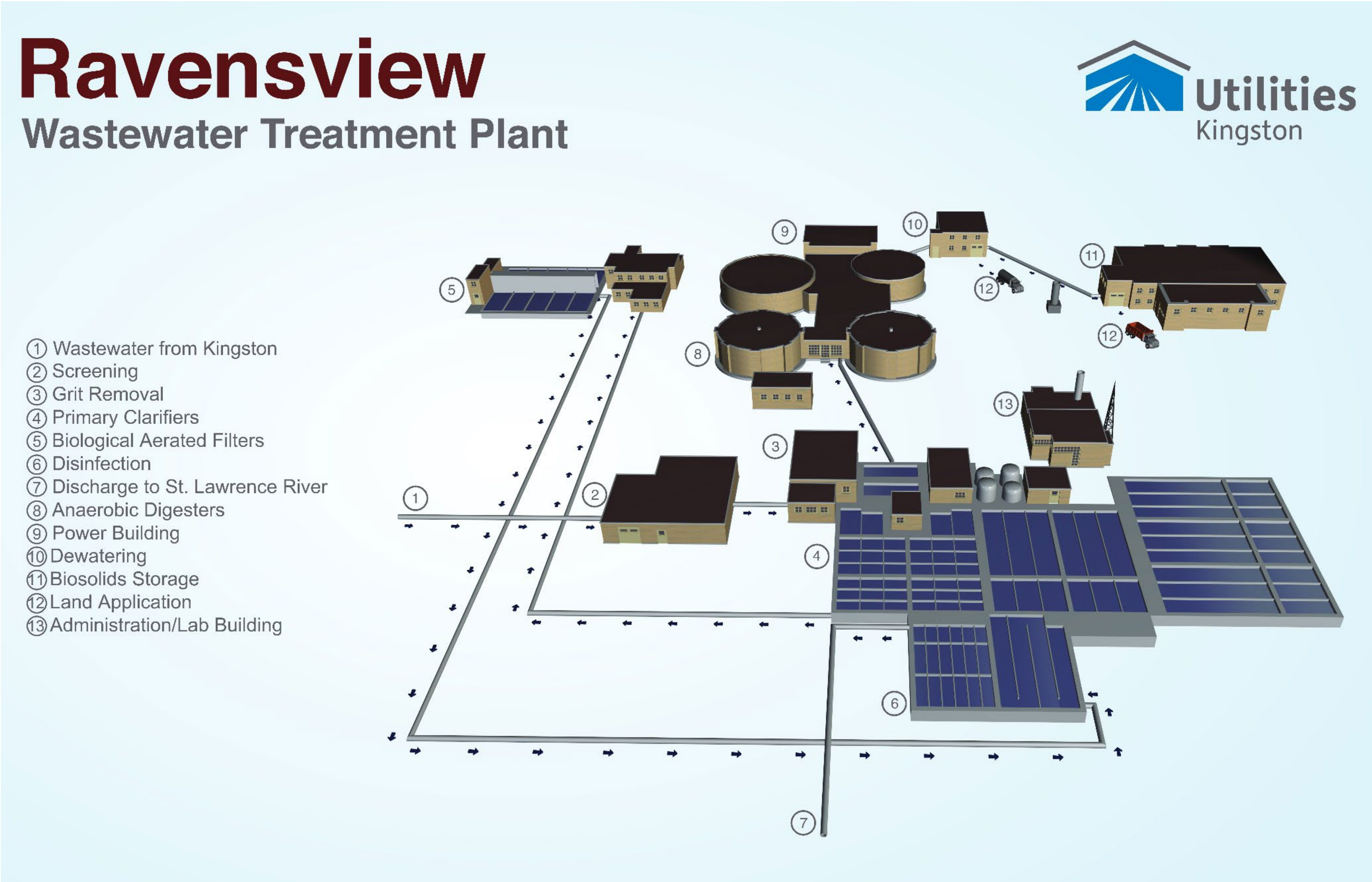
2.11 BIOSOLIDS STORAGE

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 575 Kilowatt (kW) 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 500 kW of heat reducing the amount of gas required to heat the digesters.

Figure 1 - Ravensview Water Pollution Control Plant General Layout



3 OPERATION

Preventative maintenance and regular equipment inspections reduced equipment down time, and 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, 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 2024 staff educated owners of grease traps on how to properly maintain their equipment. Pamphlets describing the importance of appropriate grease trap maintenance and how it impacts the City's sanitary sewer collection system were delivered to many restaurants across the city.

There were several large operational challenges that occurred through the year.

In June, Digester 3 was put back online following a cleaning, and maintenance overhaul of the digester and associated infrastructure. Following Digester 3 coming online and returning to normal operation, Digester 2 was taken offline for the same cleaning and maintenance overhaul.

Through the fall flows into the plant of raw sewage decreased dramatically because of the dry weather. During this period, the incoming sewage was much more concentrated than expected at that time of year. This led to difficulties treating the sewage, and required adjustments to the treatment process to maintain effluent quality.

4 INFLUENT AND SEPTAGE

Utilities Kingston monitors the raw influent sewage, as well as the imported sewage from the 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 Phosphorous (TP), in the sewage being received at the septage station has been increasing over the past several years. These higher concentrations lead to 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 the 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 several years. Over the past several years, Utilities Kingston has been working towards separating the combined storm/sanitary sewers to reduce stormwater flows into the sewer system, 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.

Annual average sample results for Septage Receiving from the past six years, and the 2024 annual average sample results for Raw Influent are shown in Tables 3 and 4 respectively.

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 2. The effluent objectives listed in this table are the concentrations Utilities Kingston are expected to be below. The effluent concentration limits listed in the table are the concentrations Utilities Kingston are required to be below. Ravensview WPCP did not exceed any of the limits set out in the ECA throughout the calendar year. However, the plant did exceed some of the objectives set out in the ECA. There were four samples throughout the year where plant effluent was below the pH objective of 6.50. In the month of November, the monthly average effluent Total Suspended Solids (TSS) exceeded the objective of 15 mg/l. The annual average Final Effluent results can be seen in Table 5 and 6.

Operational staff had difficulty managing seasonally increased raw influent concentrations, but managed the increased concentrations by increasing chemical dosages, taking primary clarifiers offline to increase flow rates through the plant, and taking offline and cleaning several channels and tanks in the system. Final effluent TSS was elevated, however operators were able to maintain a concentration below the monthly average limit of 25 mg/L.

The average daily influent flow for the year was 55% of the rated capacity (95,000 m^3/day) 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, and the highest single measurement was 0.02 mg/l. All monthly effluent loading rates were below the limits set out in the ECA, the loading results can be found in Table 7 below. 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 WPCP processed 75,399.44 m^3 of liquid sludge through the centrifuge. Approximately 3,503.91 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 (NASM) Plan.

7 MAINTENANCE

Staff continue to follow a 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.
- Backwash tanks were cleaned.
- A BAF air compressor was rebuilt.
- BAF blowers had various major work done, including: two cores rebuilt, HMI's were replaced.
- Clarifier influent channels were taken offline, cleaned, and the air lines were inspected and replaced as needed.
- Both Centrifuges had major maintenance performed and refurbished.

8 CAPITAL WORKS

The major highlights for capital works were:

- One of the primary effluent pumps was sent out to be rebuilt.
- Digester 2 Taken offline, cleaned and has routine maintenance completed to associated equipment and piping.

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 2024 reporting year, the Ravensview WPCP received four complaints regarding odours from the facility. Influent flows into the facility were quite low and more concentrated during the late summer and fall seasons. During this time the facility received all four of the odour complaints. Efforts were made to clean tanks, and ensure all equipment was operating as it should to help reduce odours coming from the facility.

11 BYPASS & OVERFLOW SUMMARY

The facility had no secondary bypass events during the reporting year. There was an unavoidable planned release of digester gas as part of the maintenance on the digester. Utilities Kingston worked with the MECP to receive approval for the release, and monitored the process closely.

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 29-30 Con 3, Town of Greater Napanee
25097	Lot 7-9 Con 3, Loyalist Township
25196	Lot 8-12 Con 2 South, Town of Greater Napanee
24405	Lot 25-27 Con 4 South, Town of Greater Napanee
24842	Lot 1-3 Con 2, Leeds and the Thousand Islands
61937	Lot 14 Con 6 North, 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	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
pH	6.5 - 9.0	6.0 - 9.5 (at all times)

14 SEPTAGE RECEIVING

Table 3 – Septage Receiving

Parameter	2019	2020	2021	2022	2023	2024
BOD5 (mg/L)	204	804	565	790	1476	1072
TP (mg/L)	360	29	22	53	99	30
TKN (mg/L)	7	548	227	299	564	287
TSS (mg/L)	114	1975	1213	995	3658	2334

15 PLANT PERFORMANCE RESULTS

Table 4 – 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	20	27	1.60	15.34	16.58	7.45	12
February	25	36	2.00	16.98	19.9	7.79	11.6
March	30	37	1.90	17.88	19.85	7.81	13.75
April	36	62	2.20	16.15	19.28	7.72	12.78
May	26	38	1.70	14.68	16.6	7.66	12.46
June	25	52	1.90	15.58	17.13	7.54	13.43
July	31	58	1.90	13.74	16.28	7.48	16.03

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
August	30	58	2.00	15.18	18.38	7.56	14.42
September	40	73	2.50	24.83	25.55	7.59	13.38
October	59	73	2.90	29.7	30.48	7.54	14.14
November	51	72	3.30	28.73	30.9	7.71	13.63
December	33	63	2.70	17.68	23.83	7.49	12.88
Annual Average	34	54	2.22	18.87	21.23	7.61	13.38

Table 5 – 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	2.00	5.00	0.37	1.99	0.01
February	3.00	4.40	0.54	2.3	0.01
March	2.10	5.20	0.72	2.83	0.01
April	1.90	4.80	0.68	1.89	0.01
May	1.80	4.60	0.48	1.68	0.01
June	3.00	2.80	0.66	1.03	0.01
July	1.70	6.70	0.76	0.97	0.01
August	3.00	5.20	0.50	1.7	0.01
September	1.80	7.60	0.60	5.53	0.01
October	2.30	14.10	0.67	3.77	0.01
November	3.20	22.60	0.69	5.57	0.02
December	2.60	7.70	0.50	3.07	0.02
Annual Average	2.37	7.56	0.60	2.69	0.01

Table 6 – Final Effluent Results (Part 2)

Month	pH	Temperature (°C)	E Coli (CFU/100mL)	Acute Lethality (Pass or Fail)	Total Residual Chlorine (mg/L)
January	6.79	14.59	9	PASS	0.01
February	6.90	14.36	4	N/A	0.01
March	6.85	15.23	2	N/A	0.01
April	6.88	16.21	15	PASS	0.01
May	6.89	17.16	3	N/A	0.01
June	6.77	19.05	32	N/A	0.01
July	6.75	20.47	23	PASS	0.02
August	6.80	19.79	10	N/A	0.01
September	6.81	20	9	N/A	0.01
October	6.75	18.84	2	PASS	0.01
November	6.79	17.66	3	N/A	0.01
December	6.89	16.02	2	N/A	0.01
Annual Average	6.82	17.45	9.50	PASS	0.01

Table 7 – Effluent Loading Limits

Month	CBOD5 (kg/d)	Total Suspended Solids (kg/d)	Total Phosphorous (kg/d)
January	130	325	24
February	179	263	32
March	123	305	42

Month	CBOD5 (kg/d)	Total Suspended Solids (kg/d)	Total Phosphorous (kg/d)
April	128	322	46
May	96	246	26
June	159	148	35
July	92	362	41
August	153	265	26
September	84	355	28
October	85	524	25
November	122	864	26
December	113	335	22
Annual Average	**122**	**360**	**31**

Table 8 – Monthly Plant Influent Flows

Month	Rated Capacity Average Daily Flow (m3/day)	Average Daily Flow (m3/day)	Approved Peak Daily Flow (m3/day)	Peak Daily Flow (m3/day)
January	95,000	64,905	193,000	114,856
February	95,000	59,755	193,000	76,527
March	95,000	58,654	193,000	80,716
April	95,000	67,125	193,000	129,380
May	95,000	53,454	193,000	66,670
June	95,000	52,938	193,000	70,103
July	95,000	54,048	193,000	93,723
August	95,000	51,016	193,000	97,517
September	95,000	46,665	193,000	87,821
October	95,000	37,155	193,000	42,640
November	95,000	38,245	193,000	58,844
December	95,000	43,541	193,000	61,103
Annual Average	N/A	52,292	N/A	81,658

Table 9 – Annual Plant Influent Flows

Parameter	2018	2019	2020	2021	2022	2023	2024
Average (m3/day)	69,005	77,265	59,435	57,278	68,505	61,303	52,292
Max (m3/day)	181,067	160,459	141,016	146,486	153,434	148,549	129,380
Design (m3/day)	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
Daily/Design (%)	72.6	81.3	62.6	60.3	72.1	64.5	55.0
Max/Peak (%)	93.8	83.1	73.1	75.9	79.5	77.0	67.0