Utilities Kingston

RAVENSVIEW
WASTEWATER TREATMENT PLANT

2018 ANNUAL REPORT

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REPORT CHECK LIST

Annual report submitted under Condition 10 of the certificate of approval number 2200-A82L2B.

Condition 10- The Owner shall prepare, and submit to the District Manager, a performance report, on an annual basis, within ninety (90) days following the end of the period being reported upon.

Condition 10- Each annual report shall contain at least the following information:

- Summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in Condition 7, including an overview of the success and adequacy of the works.
- Description of any operating problems encountered and corrective actions taken.
- Summary of any effluent quality assurance or control measures undertaken in the reporting period.
- Summary of the calibration and maintenance carried out on all effluent monitoring equipment.
- Description of efforts made and results achieved in meeting the Effluent Objectives of Condition 7.
- Tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed.
- Summary of any complaints received during the reporting period and any steps taken to address the complaints.
- Summary of all By-pass, spill or abnormal discharge events.
- Any other information the District Manager requires from time to time.

EXECUTIVE SUMMARY

The Ravensview Wastewater Facility operates under a Ministry of the Environment, Conservation and Parks, certificate of approval #2200-A82L2B. For the reporting year 2018 the facility was in compliance with all conditions outlined in condition 7 of the above mentioned Certificate of Approval and are briefly described in the following sections of this report.

Average flows through the plant decreased significantly from the extremely wet 2017 showing average flows of 69,146 $m^{3/}$day.

The facility had three secondary bypass events in the 2018 reporting year All by-pass details are listed in Table 7, the Bypass Summary section of this report.

Since the facilities commissioning in 2009, staff have been able to enhance the operation and to make this facility a highly rated Treatment facility. The Ravensview Facility continues to generate interest from international groups. We also are providing research opportunities to local Universities such as Queens to provide graduate students with valuable hands on experience.

As we continue into 2019, operational staff will continue to improve the operation of Ravensview and to use its state of the art technology to continually improve and protect the environment and maintain the quality of service our residents have come to know.

Plant Overview

The following is a process overview and description of the treatment steps taken at the 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 temporary septage receiving station is in place at the influent headworks for the local septic truck haulers while the new septage receiving station is under construction.

Screening

The first step in the treatment process is screening of the raw wastewater. Three large mechanical screens remove larger materials from the incoming wastewater stream. Screened material is conveyed to a screenings 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. From there 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 floatables and grit, the only material left in the wastewater is organic material and dissolved contaminants. In the primary clarifier tanks, 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 the 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 as well. 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 micro-organisms which consume carbon dissolved in the water, as well as reducing ammonia and phosphorus. These microscopic organisms, referred to as biomass, stick onto the BioStyrene 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 micro-organisms which pass through the filters. Like other filters, these are backwashed occasionally to remove excess biomass growth and filtered particles, in order to restore the filters ability to process wastewater efficiently.

Disinfection

Disinfection is accomplished by adding sodium hypochlorite at the effluent of the BAF facility. The effluent flows by gravity to the chlorine contact chamber where chlorine is allowed to be in contact with the wastewater. 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.

Discharge to the St. Lawrence River

After the wastewater has been disinfected and de-chlorinated, it flows by gravity out a 1050 mm diameter outfall sewer with fourteen 250 mm elbow diffusers, approximately 240 m offshore, and into the St. Lawrence River.

Anaerobic Digesters

Solids from the raw sewage entering the plant and from the Biological Aerated Filter backwash water are settled in the clarifiers, then pumped into the digesters. The digesters are sealed, anaerobic (without oxygen). Inside, the mixture is heated to allow micro-organisms to grow and consume carbon, and to produce methane gas and carbon dioxide. One of the digesters 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 which are heated to 36 degrees celsius (mesophilic), and remains for 15 days in each digester before being stored in the secondary digester and ultimately dewatered. The digestion process reduces the amount of carbon, stabilizing the material into what is called bio-solids, which is applied to approved farm fields, and used as soil nutrients and conditioning material.

Power Building

The Power Building houses two 575 kW electric back-up generators that are designed to run the wastewater treatment plant in the event of a power outage. These units are powered by 12 cylinders, low emission natural gas engines chosen specifically for this plant to avoid the need to use diesel fuel. These units will start automatically in the event of a power failure. A third unit within the power building is a combined heat and power generation system, or ‘Co-gen’ unit. 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. This beneficial use of the gas produced on the site helps offset the power purchased from the grid, and will offset the amount of gas required to heat the digesters.

Dewatering

Liquid bio-solids which is about 2% solid and 98% water, is funnelled from the digester holding tank into the centrifuge where a polymer is added to help the solids stick together. The centrifuge spins at a high speed forcing the solids to the outer drum and out of the liquid, where solids are pushed along and out of the centrifuge. The solids content (cake) is now about 30% and the cake material is augured 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 (bio-solids) to the Bio-solids Storage building. Alternately, the cake materials can be loaded directly into a waiting dump truck in a separate loading bay. The remaining liquid contains many nutrients and some microorganisms. After the centrifuge processes this liquid, called centrate, is returned to the plant for treatment.

Bio-solids Storage

One of the three main beneficial products produced at Ravensview is a nutrient rich bio-solid material.

The dry product resulting from the treatment processes may be stored on site for up to 200 days in large concrete bunkers. When approved farmland is available, the material is loaded into trucks within the Bio-solids Storage Building, in an odour controlled room.

Land Application

The stored bio-solids are held onsite until they can be used for agricultural land application. The bio-solids are transported and applied on fields that have been tested and approved by the Ministry of Environment, Conservation and Parks to meet standards with respect to distance from homes, wells, water bodies and sensitive lands. After application, the bio-solids are ploughed into the field to prevent off-site odours or wash-off. By carefully regulating the application only to licensed fields, the public is protected from contact with this material that may still contain some micro-organisms.

Administration/ Lab Building

All of the different devices and processes used at the Ravensview Wastewater Treatment Plant are connected to an onsite SCADA system which can be used to monitor and adjust plant processes. This system is located within the administration building. The building also contains a fully operating laboratory for onsite testing of various wastewater parameters as well as offices and lunchroom facilities.

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PLANT PERFORMANCE

The enclosed performance assessment summarizes and confirms the facility's compliance. Refer to appendix A for detailed tables and graphs for various parameter results.

All effluent quality and quantity parameters outlined in condition 7 of certificate of approval number 2200-A82L2B were complied with during the reporting period of 2018.

The following tables summarize the results obtained through monitoring of plant performance in accordance with condition 7 of the certificate of approval number 2200-A82L2B.

Table 1: Effluent Parameters

Effluent Objectives		
Effluent Parameter	**Objective** (mg/l)	**2018 Results** (avg.)
$CBOD_5$	15.0	2 mg/l
Total suspended solids (TSS)	15.0	5 mg/l
Total Phosphorus	0.8	0.43 mg/l
Total Ammonia Nitrogen (October 01 to May 31) (June 01 to 30 and September 01 to 30) (July 01 to August 31)	 12.0 7.0 5.0	 1.63 mg/l 1.33 mg/l 1.94 mg/l
Total Chlorine Residual	Non-detectable	0.01 mg/l
E. Coli (Monthly Geometric Mean Density)	100 counts/ 100 ml	5 counts/ 100 ml

Table 2: Effluent Limits

Effluent Limits			
Effluent Parameter	**Concentration Limit** (mg/l)	**Loading Limit from effluent (kg/d)**	**2018 annual average**
$CBOD_5$	25.0	2,375	110 (kg/d)
Suspended solids (TSS)	25.0	2,375	307 (kg/d)
Total Phosphorus	1.0	95	22.7 (kg/d)
pH	Maintained between 6.0 and 9.5		7.63
Acute lethality to rainbow trout			pass

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Table 3: Monthly Effluent Parameters

Maximum Monthly Comparison of Effluent 2018				
Month	**CBOD5 max concen/max loading (mg/L_kg/day)**	**TSS max concen/max loading (mg/L_kg/day)**	**TP max concen/max loading (mg/L_kg/day)**	**E. coli (Monthly geometric mean density)**
January	4mg/L-300kg/day	8mg/L 400kg/day	0.51mg/l 54kg/day	6
February	2mg/L-300kg/day	6mg/L 700kg/day	0.62mg/l 43kg/day	2
March	4mg/L-300kg/day	10mg/L 600kg/day	0.72mg/l 45kg/day	2
April	5mg/L-600kg/day	12mg/L 1100kg/day	0.77mg/l 57kg/day	2
May	4mg/L-200kg/day	12mg/L 900kg/day	0.65mg/l 43kg/day	2
June	2mg/L-100kg/day	6mg/L 400kg/day	0.58mg/l 43kg/day	2
July	2mg/L-200kg/day	9mg/L 600kg/day	0.45mg/l 29kg/day	3
August	4mg/L-200kg/day	26mg/L 1500kg/day	0.53mg/l 41kg/day	8
September	5mg/L-300kg/day	12mg/L 500kg/day	0.56mg/l 22kg/day	9
October	6mg/L-300kg/day	18mg/L 920kg/day	0.36mg/l 30kg/day	19
November	5mg/L-200kg/day	10mg/L 500kg/day	0.69mg/l 36kg/day	2
December	4mg/L -200kg/day	10mg/L 700kg/day	0.58mg/l 21kg/day	2

Table 4: Annual Plant Flows

Plant Flows (m^3/day)							
Parameter	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Avg. m^3/day	53,750	59,182	60,916	53,076	59,640	86,200	69,005
Max. m^3/day	143,808	158,736	185,620	136,899	179,987	169,266	181,067
Design. m^3/day	95,000	95,000	95,000	95,000	95,000	95,000	95,000
Design Peak m^3/day	193,000	193,000	193,000	193,000	193,000	193,000	193,000
% (daily/design)	57	62	69	56	63	91	73
% (peak/design)	75	82	96	71	93	88	94

Table 5: Effluent Parameters

Final Effluent Parameter Results								
Parameter (mg/l)	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**LIMITS**
$CBOD_5$	2.6	2	2.2	1.5	1.78	1.17	2	**25 mg/l**
Suspended Solids	4.1	5.2	4.3	4.4	6.0	6.1	5	**25 mg/l**
Total Phosphorus	0.45	0.49	0.42	0.40	0.47	0.40	0.43	**1.0 mg/l**
Total Chlorine	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	**< 0.04 mg/l**
Acute Lethality	All Pass	All Pass	All Pass	All Pass	All Pass	All Pass	All Pass	**Pass**

MAINTENANCE

In 2018 we continued with our preventative maintenance program of vibration testing, oil analysis and electrical surge protection.

The following bullet points highlight other major projects completed this year.

- Digester 2 mixing valve repairs and replacements
- Bar screen repairs
- Boiler control system upgrades
- Primary effluent pump rebuild
- Backwash tank cleanout
- Biosolids odour control system Carbon media change out
- Primary tank inspections
- Annual infrared scans on HV electrical
- Routine vibration monitoring

CAPITAL WORKS

The major highlights for capital works in 2018 at the Ravensview WWTP and associated sewage collection system were:

- Repair and waterproofing of digester roofs
- Continued work on the Wastewater Master Plan assessment.
- Construction of a new Septage receiving station
- Construction of the new Riverview Way Sewage Pumping Station
- Dalton Ave Pumping Station upgrades and refurbishment

Operations

Adequate staffing as well as preventative maintenance and regular equipment inspections lead to operational problems being diagnosed quickly and corrective actions implemented 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, through social media 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 three years with some positive results.

BIO-SOLIDS MANAGEMENT

The dewatering facility is the primary method of solids handling at the Ravensview facility. The secondary digested sludge is dewatered through a centrifuge and then stockpiled onsite in the bio-solids storage building.

In January of 2018, the dewatering facility at Cataraqui Bay Sewage Treatment Plant was under construction so liquid sludge was hauled to the Ravensview WWTP for processing. An approximately volume of 38,153m_3 of liquid sludge was transported from Cataraqui Bay Wastewater Treatment Plant to the Ravensview Wastewater Treatment Plant in 2018. With the combination of both Ravensview WWTP and Cataraqui Bay WWTP liquid sludge to process a combined volume of 119,590 m_3 of liquid sludge was processed through the centrifuge, and approximately 12,776 m_3 of sludge cake was stored on site until land applied on licensed agricultural fields. Land application is completed by Smith's Pumping service.

It is too hard to predict exactly where and when we will spread in 2019, as crops and weather will be the major variables that we will be dealing with in the 2019 spreading season. Below are the active C of A's and addresses for the City of Kingston in which spreading can take place.

Table 6: Biosolids Recipients in 2018

C Of A and NASM Plan #	Address	Expiry Date
21808	Middle Rd.	31/12/2018
21819	Hamilton Rd.	31/12/2018
21940	SunEdison Property	31/12/2018
22144	McIntyre Rd.	31/12/2019
22243	Multiple Farms (Milligan)	31/12/2019
22281	Haig Rd.	31/12/2019
22383	Brown Rd.	31/12/2020
22685	Multiple Farms	31/12/2020
22694	South Shore Rd.	31/12/2020
22853	Huffman Rd.	31/12/2021
22855	Lake Rd.	31/12/2021
22901	County Rd. 8	31/12/2021
22987	Sunbury Rd.	31/12/2021
23007	County Rd. 4	31/12/2021
23047	Palace Rd.	31/12/2021
23074	Simmons Rd.	31/12/2021
23110	Sunbury Rd.	31/12/2020
23119	Hamilton Rd.	31/12/2021
23215	Sand Hill Rd.	31/12/2021

EQUIPMENT CALIBRATIONS

All of the facility flow meters are calibrated annually by third party contractors. As a result of this proactive approach, the facility saw limited downtime of major equipment and saw very few mechanical or electrical failures this year. Calibration records are available upon request.

COMPLAINTS

There was one odour complaint concerning the Ravensview Wastewater Treatment Plant operations for the reporting year 2018. Due to construction at the Cataraqui Bay Wastewater Treatment Plant and construction of the new septage receiving facility, liquid sludge hauling and a temporary septage receiving station resulted in additional odours. Operations were modified to alleviate odours from these activities.

BYPASS SUMMARY

Table 7 summarizes the locations, volumes and durations of bypass events for the reporting year 2018. Table 8 summarizes the test results from samples taken during the 2018 bypass events at King – Collingwood CSO and King- George CSO as well as test results for secondary bypasses at Ravensview WWTP.

Table 8: Bypass Sampling Results

Parameter	Units	Ravensview WWTP (Secondary Bypass) Annual Avg.	King-Collingwood CSO Annual Avg.	King-George CSO Annual Avg.
Total Coliform	Cfu/100mL	N/A	986482	1762380
E coli	Cfu/100mL	85147	122270	242067
HPC	Cfu/mL	N/A	328849	576889
CBOD5	Mg/L	18	14	21.8
TSS	Mg/L	86	53	65
TP	Mg/L	2.42	0.68	1.03
TKN	Mg/L	15.1	4.9	6.5

Bypass Results Interpretations

All bypass discharges have a higher bacteria count due to no disinfection occurring. $CBOD_5$, TP & TKN results are much lower than typical raw sewage influent to the sewage plant due to the dilution of rain water during these events. All efforts are made to contain any debris in these discharges to the lake. After each bypass event, shoreline inspections near discharge points are done to monitor any debris that may come ashore. Clean up is done if debris is found.

APPENDIX A – MONITORED PARAMETERS RESULTS AND GRAPHS

Table 7: Bypass Summaries

Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	End Time	Volume (m^3)	Reason For Bypass	Precip (mm)
01/12/2018	West end of Sherwood Dr	1:12	18:01	3969.62	Heavy rain/ rapid snow melt	38.1
01/12/2018	South end of Parkway	7:37	9:35	51.55	Heavy rain/rapid snow melt	38.1
01/12/2018 – 01/13/2018	South end of Parkway	6:21	12:12	168.76	Heavy rain/rapid snow melt	38.1
01/12/2018	535 Rideau Belle Park Trunk	4:02	18:59	5365.02	Heavy rain/rapid snow melt	38.1
01/12/2018 – 01/13/2018	535 Rideau Belle Park Local	3:10	00:16	17126.93	Heavy rain/rapid snow melt	38.1
01/11/2018 – 01/12/2018	Earl St W of Ontario St	21:01	14:43	545.54	Heavy rain/rapid snow melt	38.1
01/12/2018	West St S of King St	3:14	20:20	7290	Heavy rain/rapid snow melt	38.1
01/12/2018 – 01/13/2018	King-George CSO	2:03	1:21	15644.4	Heavy rain/rapid snow melt	38.1
01/11/2018 – 01/13/2018	King-Collingwood CSO	22:35	6:10	40614.75	Heavy rain/rapid snow melt	38.1
02/20/2018 – 02/21/2018	535 Rideau Belle Park Local	12:25	14:48	5896.05	Heavy rain/rapid snow melt	26.1
02/20/2018	Earl St W of Ontario St	11:10	12:21	0.15	Heavy rain/rapid snow melt	26.1
02/20/2018	West St S of King St	13:02	23:15	1246	Heavy rain/rapid snow melt	26.1

Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	End Time	Volume (m^3)	Reason For Bypass	Precip (mm)
02/20/2018 – 02/21/2018	King-George CSO	11:38	21:25	10836.6	Heavy rain/rapid snow melt	26.1
02/20/2018 – 02/22/2018	King-Collingwood CSO	9:38	00:20	35691.13	Heavy rain/rapid snow melt	26.1
04/04/2018	Union St at Division St	15:33	15:34	1	Rain	26.6
04/04/2018	Earl St W of Ontario St	3:36	4:19	1.75	Rain	26.6
04/18/2018	King-Collingwood CSO	21:30	22:00	311.55	Prolonged rain	30.3
05/15/2018	Union St at Division St	6:38	6:50	0.58	Heavy rains	35.2
05/15/2018	535 Rideau Belle Park Local	6:24	7:01	259.3	Heavy rains	35.2
05/15/2018	Clarence St W of King St	6:41	6:56	103.11	Heavy rains	35.2
05/15/2018	Earl St W of Ontario St	18:16	9:55	443.93	Heavy rains	35.2
05/15/2018	Lower Union W of Ontario St	6:27	6:49	79.12	Heavy rains	35.2
05/15/2018	West St S of King St	6:41	6:48	11	Heavy rains	35.2
05/15/2018	King-George CSO	9:05	11:15	1036.8	Heavy rains	35.2
06/03/2018 – 06/04/2018	Earl St W of Ontario St	23:04	5:13	8.29	Heavy rains	20.6
06/13/2018	Union St at Division St	18:24	18:26	0.03	Heavy downpour	20.6

Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	End Time	Volume (m^3)	Reason For Bypass	Precip (mm)
06/13/2018	535 Rideau Belle Park Local	18:23	18:39	206.13	Heavy downpour	20.6
06/13/2018	Raglan Rd at Rideau St	18:24	18:29	8.79	Heavy downpour	20.6
06/13/2018	Lower Union W of Ontario St	18:24	18:36	52.37	Heavy downpour	20.6
06/27/2018	Earl St W of Ontario St	13:28	19:32	9.12	Rain	18.2
06/28/2018 – 06/29/2018	Earl St W of Ontario St	17:35	8:47	2.13	Blockage	0
07/10/2018	Earl St W of Ontario St	15:25	15:50	55.16	Brief thunderstorm	5.7
07/25/2018	535 Rideau Belle Park Local	11:57	12:18	51.74	Heavy rain	63.1
07/25/2018	Earl St W of Ontario St	00:51	00:55	387.86	Heavy rain	63.1
07/25/2018	Lower Union W of Ontario St	2:13	2:26	50.89	Heavy rain	63.1
08/07/2018	535 Rideau Belle Park Local	4:24	4:35	141.47	Thunderstorm	12.7
08/07/2018	Earl St W of Ontario St	4:20	5:11	135.5	Thunderstorm	12.7
08/07/2018	Lower Union W of Ontario St	4:23	4:28	13.24	Thunderstorm	12.7
08/08/2018	535 Rideau Belle Park Local	15:55	16:08	120.42	Heavy rain	30.3
08/08/2018	Earl St W of Ontario St	15:48	17:53	65.73	Heavy rain	30.3

Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	End Time	Volume (m^3)	Reason For Bypass	Precip (mm)
08/15/2018	West end of Sherwood Dr	21:53	1:50	1178.42	Multiple thunderstorms	79.8
08/15/2018	South end of Parkway	22:27	23:30	18.95	Multiple thunderstorms	79.8
08/15/2018	Helen St at Mack St	16:45	11:45	96.51	Multiple thunderstorms	79.8
08/15/2018	Union St at Division St	16:18	22:12	63.38	Multiple thunderstorms	79.8
08/15/2018	535 Rideau Belle Park Trunk	18:27	22:11	696.45	Multiple thunderstorms	79.8
08/15/2018	535 Rideau Belle Park Local	16:21	2:47	5789.64	Multiple thunderstorms	79.8
08/15/2018	Raglan Rd at Rideau St	16:19	22:25	608.59	Multiple thunderstorms	79.8
08/15/2018	Clarence St W of King St	16:23	22:18	2227.88	Multiple thunderstorms	79.8
08/15/2018	William St W of Ontario St	16:19	21:48	468.93	Multiple thunderstorms	79.8
08/15/2018	Earl St W of Ontario St	16:13	2:10	4070.36	Multiple thunderstorms	79.8
08/15/2018	Gore St W of Ontario St	16:21	21:52	615.82	Multiple thunderstorms	79.8
08/15/2018	Lower Union W of Ontario St	16:18	22:50	1170.46	Multiple thunderstorms	79.8
08/15/2018	West St S of King St	16:27	3:05	10804	Multiple thunderstorms	79.8
08/15/2018	Barrack St E of King St	4:33	23:01	315	Multiple thunderstorms	79.8

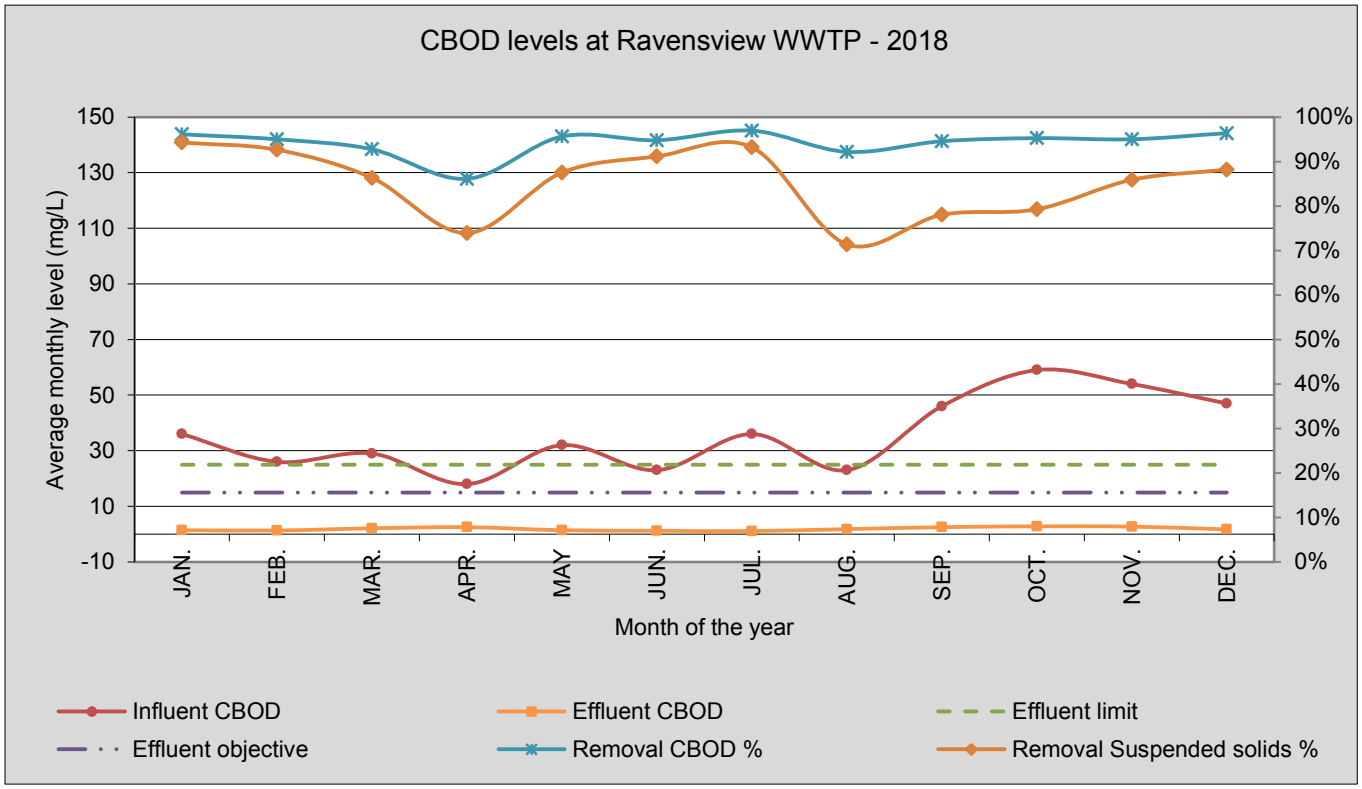
Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	End Time	Volume (m^3)	Reason For Bypass	Precip (mm)
08/15/2018	Quebec St at Barrie St	16:17	22:02	2052.11	Multiple thunderstorms	79.8
08/15/2018	Palace Rd Ps	16:36	17:05	21.11	Multiple thunderstorms	79.8
08/15/2018	King-George CSO	16:37	7:10	22864	Multiple thunderstorms	79.8
08/15/2018	King-Collingwood CSO	16:45	2:02	6350.25	Multiple thunderstorms	79.8
08/15/2018	Ravensview WWTP (Secondary Bypass)	17:10	18:34	2868	Multiple thunderstorms	79.8
08/27/2018 – 08/28/2018	Ravensview WWTP (Secondary Bypass)	23:45	1:45	2160	Brief Thunderstorm	9.7
08/28/2018	Ravensview WWTP (Secondary Bypass)	16:08	16:32	295	Pump failure	0
09/21/2018	Earl St W of Ontario St	4:10	9:58	204.05	Rain	16.7
09/21/2018	Lower Union W of Ontario St	6:25	9:26	51.92	Rain	16.7
09/26/2018	535 Rideau Belle Park Local	1:18	1:21	0.37	Rain	20.7
09/26/2018	Earl St W of Ontario St	1:10	2:36	245.39	Rain	20.7
09/26/2018	Lower Union W of Ontario St	1:21	1:39	47.23	Rain	20.7
10/02/2018	Earl St W of Ontario St	6:49	20:38	12.14	Rain	23.7

Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	End Time	Volume (m^3)	Reason For Bypass	Precip (mm)
09/26/2018	Earl St W of Ontario St	8:40	8:56	0.00086	Rain	7.1
10/11/2018	Earl St W of Ontario St	2:23	3:55	10.97	Rain	10.2
11/06/2018	Earl St W of Ontario St	15:10	15:42	0.01	Rain	8.1
11/26/2018	Earl St W of Ontario St	11:33	11:38	0.009	Rain	24.5
12/02/2018	Earl St W of Ontario St	10:25	12:40	11.67	Rain	11.5
12/21/2018	King-Collingwood CSO	5:00	9:27	771.5	Heavy rain	65.7
12/21/2018	Helen St at Mack St	19:15	21:50	41.77	Heavy rain	65.7
12/21/2018	535 Rideau Belle Park Trunk	20:09	22:00	148.33	Heavy rain	65.7
12/21/2018 – 12/22/2018	535 Rideau Belle Park Local	19:01	6:28	5782.97	Heavy rain	65.7
12/21/2018	Earl St W of Ontario St	17:18	17:57	522.7	Heavy rain	65.7
12/21/2018 – 12/22/2018	West St S of King St	19:11	1:25	951	Heavy rain	65.7
12/21/2018 – 12/22/2018	King-Collingwood CSO	18:18	17:35	17288.75	Heavy rain	65.7
12/21/2018 – 12/22/2018	King-George CSO	18:05	18:48	7349.4	Heavy rain	65.7

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

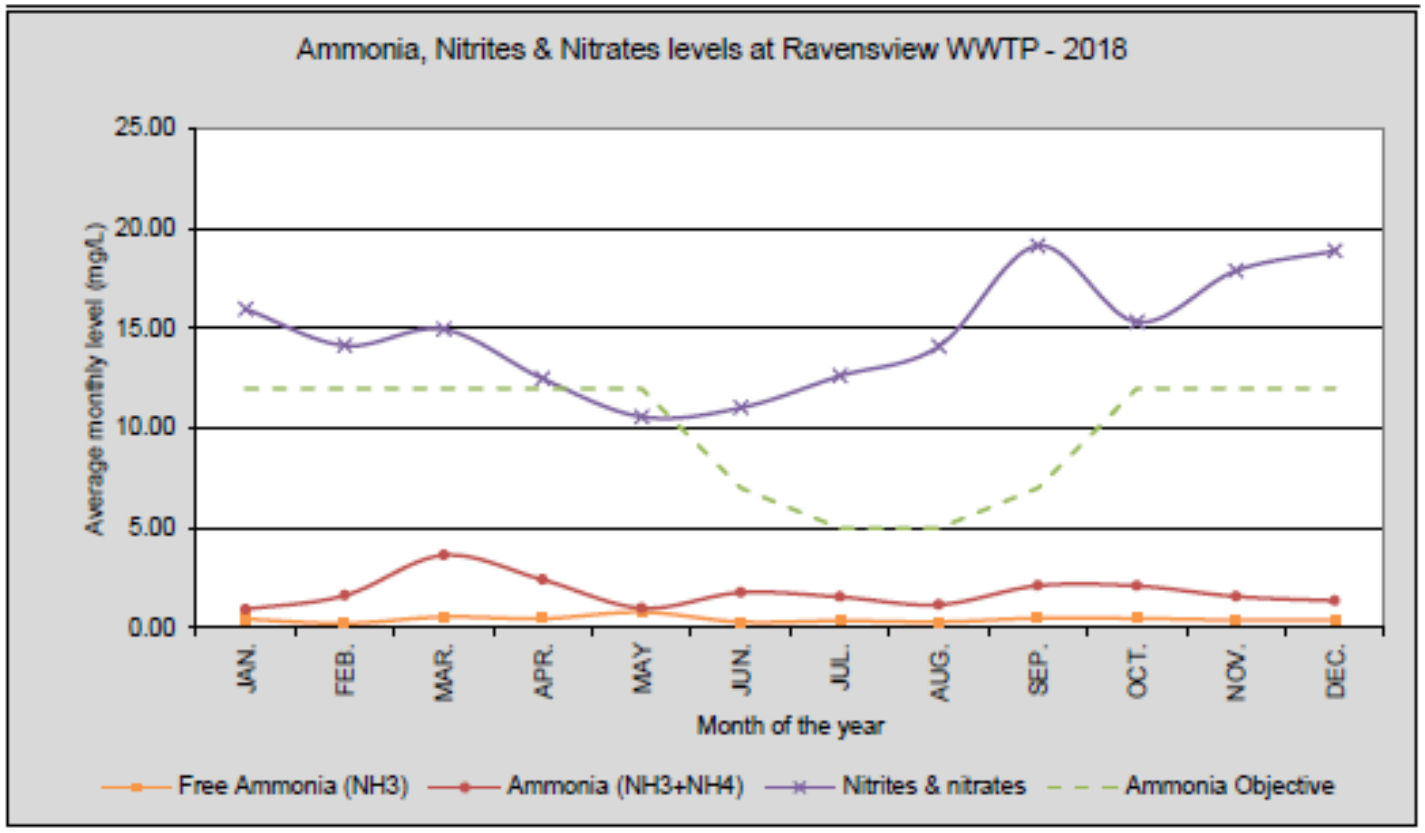
Month		Raw sewage CBOD	Final Effluent CBOD	Removal CBOD	Raw sewage Suspended solids	Final Effluent Suspended solids	Removal Suspended solids
	Units	mg/L	mg/L	%	mg/L	mg/L	%
JAN.		36.0	1.4	96%	82.0	4.7	94%
FEB.		26.0	1.3	95%	53.0	3.9	93%
MAR.		29.0	2.1	93%	30.0	4.1	86%
APR.		18.0	2.5	86%	23.0	6.0	74%
MAY		32.0	1.4	96%	36.0	4.5	88%
JUN.		23.0	1.2	95%	35.0	3.1	91%
JUL.		36.0	1.1	97%	50.0	3.4	93%
AUG.		23.0	1.8	92%	29.0	8.3	71%
SEP.		46.0	2.5	95%	51.0	11.2	78%
OCT.		59.0	2.8	95%	54.0	11.2	79%
NOV.		54.0	2.7	95%	39.0	5.5	86%
DEC.		47.0	1.7	96%	33.0	3.9	88%
	Average	35.8	1.9	94%	42.9	5.8	86%
	Objective		15.0			15.0	
	Limit		25.0			25.0	

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs



RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

		Raw sewage	Final Effluent	Final Effluent	Final Effluent	Final Effluent
			Final Effluent results			
Month		Free Ammonia (NH_3)	Ammonia (NH_3+NH_4)	Ammonia Objective	Nitrites & nitrates	Acute lethality to trout
	Unit	mg/L	mg/L	mg/L	mg/L	pass / fail
JAN.		0.44	0.93	12.0	15.98	pass
FEB.		0.22	1.62	12.0	14.15	pass
MAR.		0.55	3.64	12.0	14.96	pass
APR.		0.46	2.41	12.0	12.49	pass
MAY		0.79	0.99	12.0	10.58	pass
JUN.		0.29	1.77	7.0	11.03	pass
JUL.		0.36	1.55	5.0	12.62	pass
AUG.		0.30	1.16	5.0	14.11	pass
SEP.		0.48	2.11	7.0	19.15	pass
OCT.		0.47	2.10	12.0	15.33	pass
NOV.		0.39	1.57	12.0	17.90	pass
DEC.		0.41	1.35	12.0	18.90	pass
Average		0.43	1.77		14.8	
Objective			Variable			
Limit						


Ammonia, Nitrites & Nitrates levels at Ravensview WWTP - 2018
Average monthly level (mg/L)
25.00
20.00
15.00
10.00
5.00
0.00
JAN.
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
Month of the year
Free Ammonia (NH3)
Ammonia (NH3+NH4)
Nitrites & nitrates
Ammonia Objective

RAVENSVIEW Wastewater Treatment Plant
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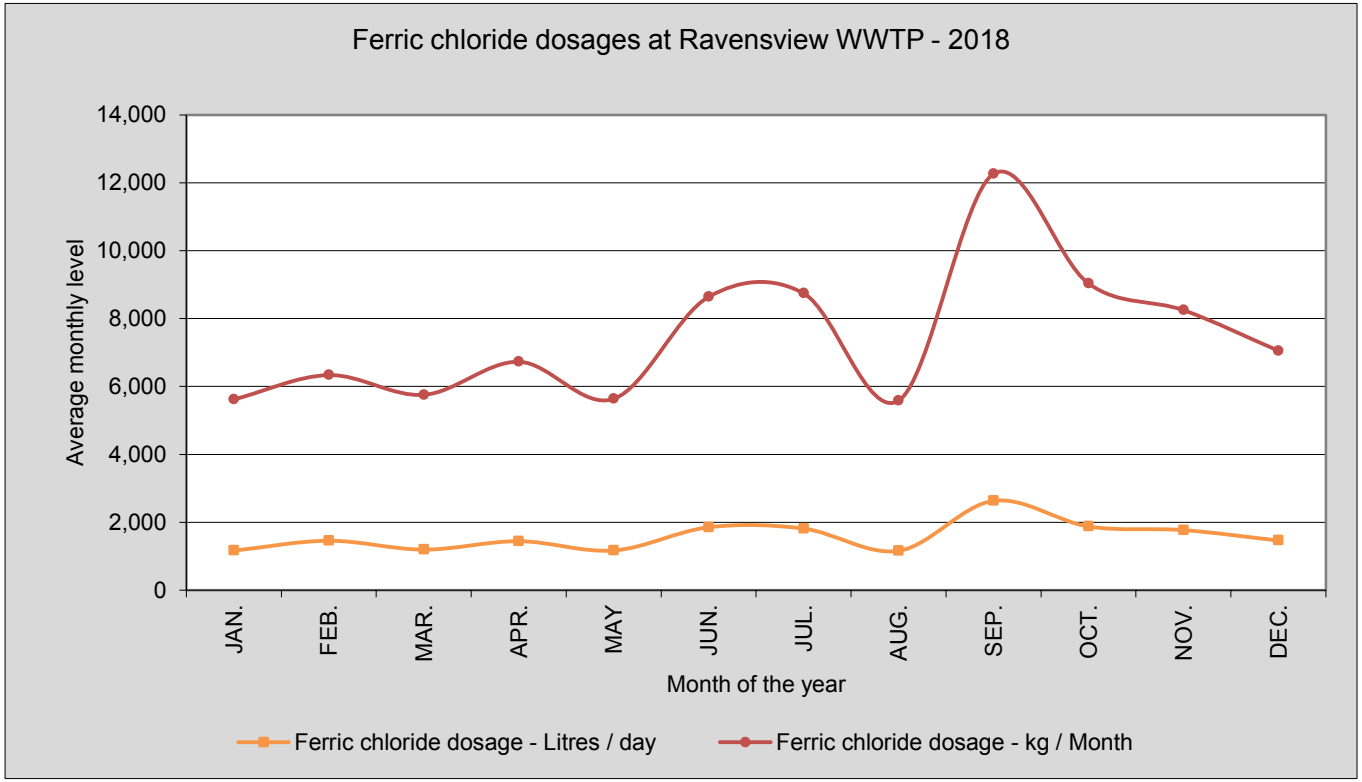
Monthly data

Ferric chloride

Month	Unit	**Dosage** Litres / day	**Dosage** Kg / day	**Dosage** Litres / month	**Dosage** Kg / month	**Dosage** mg/L
JAN.		1,167	181	36,190	5,619	2.82
FEB.		1,458	226	40,810	6,336	3.09
MAR.		1,196	186	37,070	5,755	2.83
APR.		1,445	224	43,340	6,729	2.46
MAY		1,171	182	36,300	5,636	2.57
JUN.		1,855	288	55,660	8,641	4.81
JUL.		1,817	282	56,320	8,743	5.74
AUG.		1,160	180	35,970	5,584	3.54
SEP.		2,633	409	78,980	12,262	9.77
OCT.		1,877	291	58,190	9,034	6.59
NOV.		1,771	275	53,130	8,248	5.03
DEC.		1,465	228	45,430	7,053	4.04
Average		1,585	246	48,116	7,470.00	4.44
Objective						
Limit						

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs

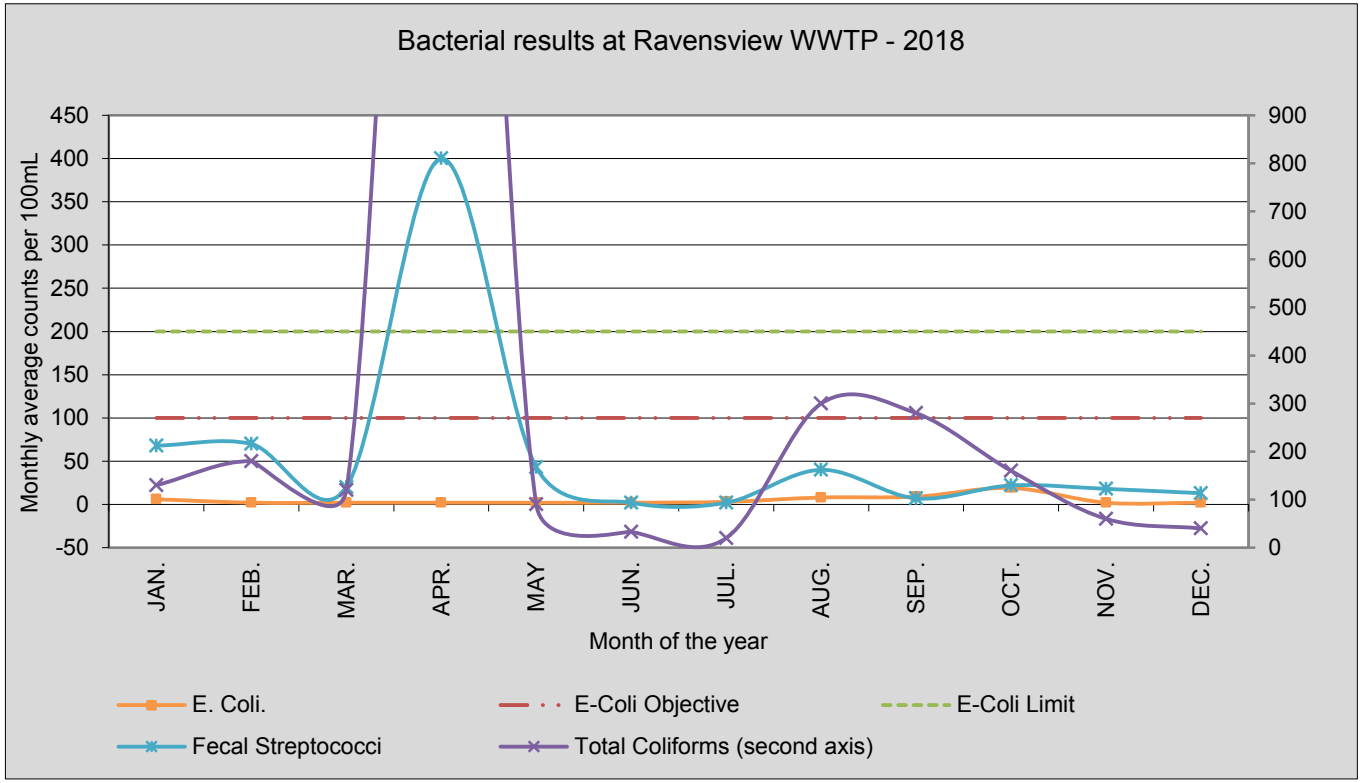


RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

Bacterial results

Month	Unit	Final Effluent **E. Coli.** counts / 100mL	**E-Coli Objective** counts / 100mL	**E-Coli Limit** counts / 100mL	Final Effluent **Total Coliforms (second axis)** counts / 100mL	Final Effluent **Fecal Streptococci** counts / 100mL
JAN.		6	100	200	130	68
FEB.		2	100	200	180	70
MAR.		2	100	200	120	20
APR.		2	100	200	2,700	400
MAY		2	100	200	90	43
JUN.		2	100	200	33	2
JUL.		3	100	200	20	2
AUG.		8	100	200	300	40
SEP.		9	100	200	280	7
OCT.		19	100	200	160	22
NOV.		2	100	200	60	18
DEC.		2	100	200	40	13
Average		4.92			342.75	58.75
Objective		100				
Limit		200				

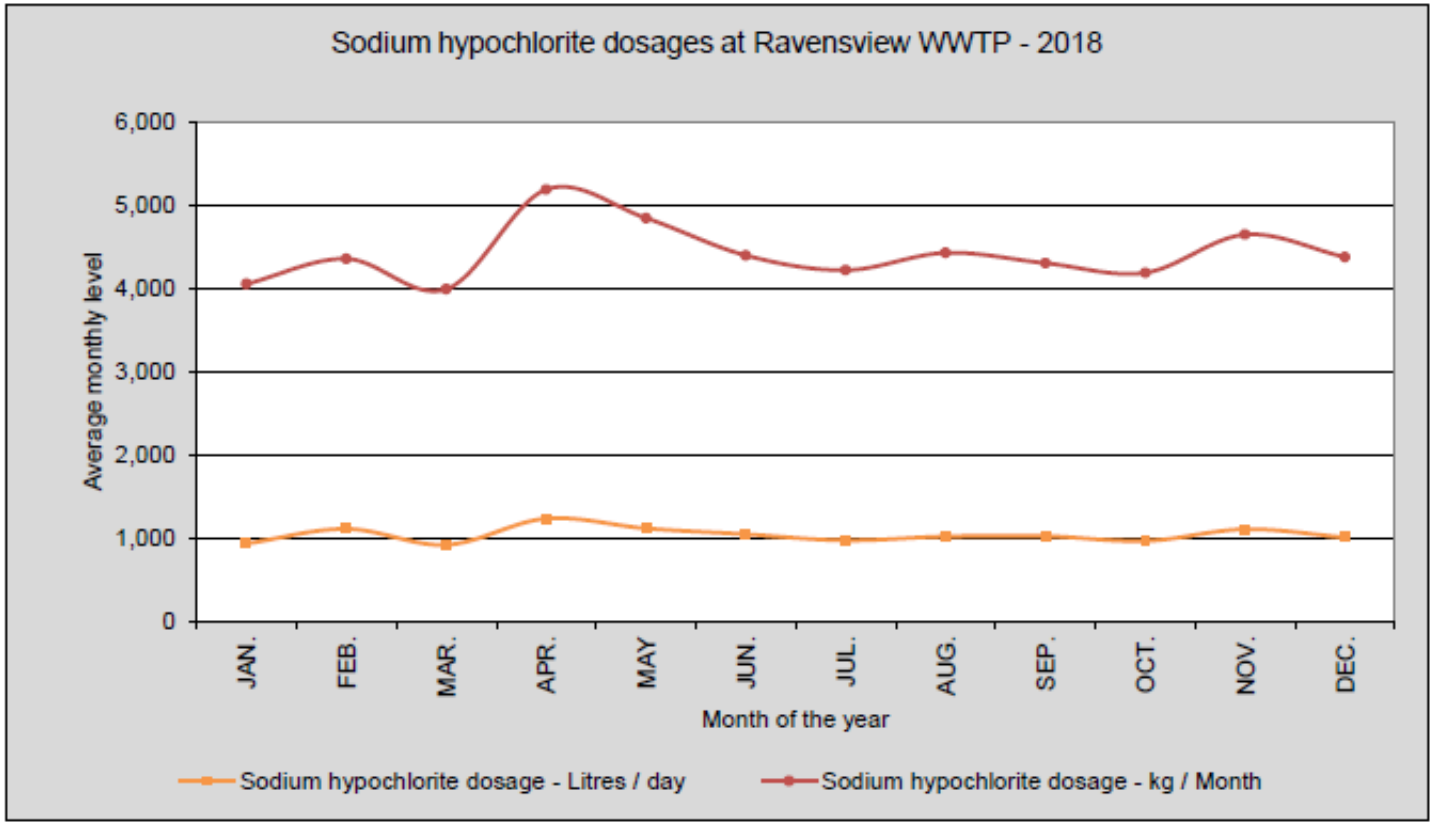
RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs



RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

Sodium hypochlorite

Month	Unit	**Dosage** Litres / day	**Dosage** Kg / day	**Dosage** Litres / month	**Dosage** Kg / month	**Dosage** mg/L	**Residual** mg/L
JAN.		930	130	28,822	4,047	2.10	0.80
FEB.		1,106	155	30,974	4,349	2.18	0.90
MAR.		915	129	28,375	3,984	1.97	0.78
APR.		1,230	173	36,903	5,181	1.95	0.73
MAY		1,112	156	34,461	4,838	2.24	0.84
JUN.		1,042	146	31,270	4,390	2.42	0.87
JUL.		968	136	30,009	4,213	2.72	0.94
AUG.		1,016	143	31,490	4,421	2.78	0.71
SEP.		1,020	143	30,604	4,297	3.39	0.91
OCT.		961	135	29,785	4,182	3.13	0.87
NOV.		1,102	155	33,049	4,640	2.82	0.95
DEC.		1,004	141	31,117	4,369	2.60	0.93
Average		1,034	145.2	31,405	4,409	2.53	0.85
Objective Limit							

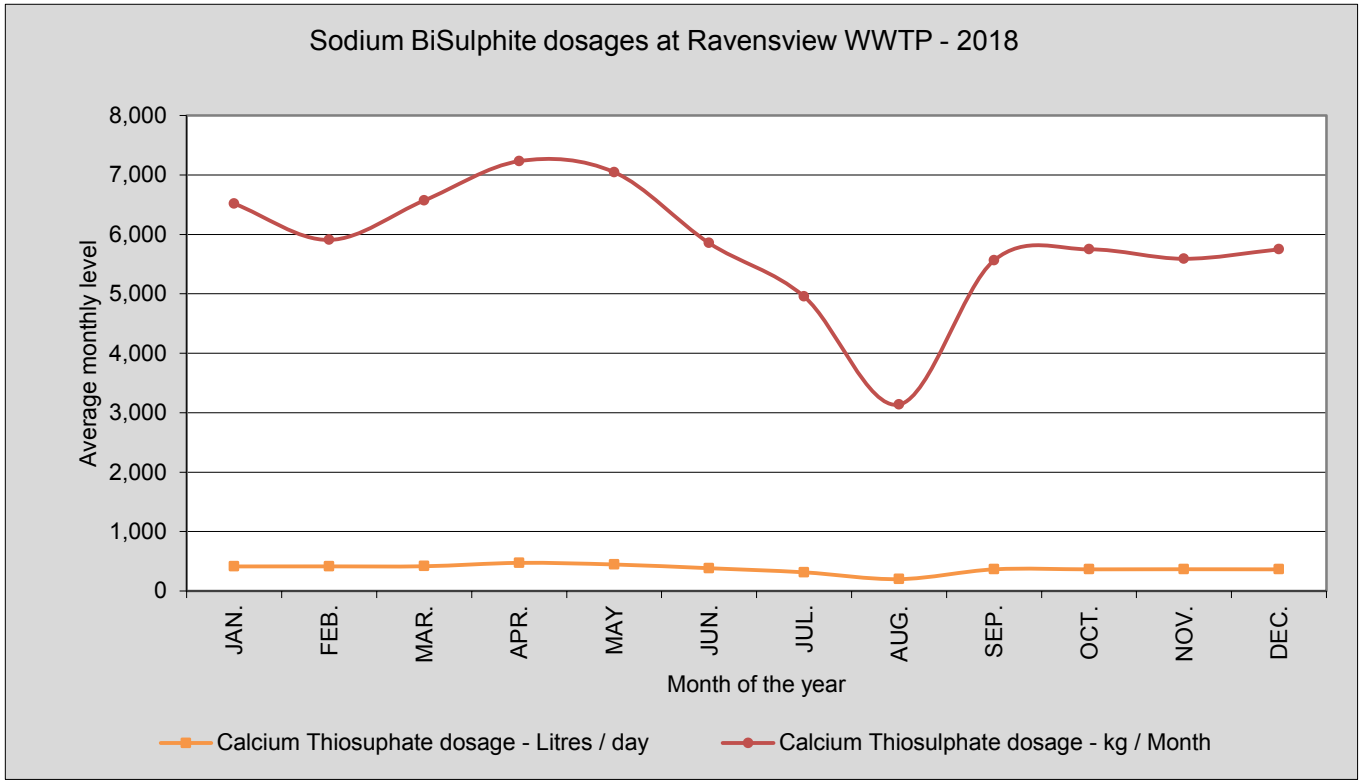

Sodium hypochlorite dosages at Ravensview WWTP - 2018
Average monthly level
6,000
5,000
4,000
3,000
2,000
1,000
0
JAN.
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
Month of the year
Sodium hypochlorite dosage - Litres / day
Sodium hypochlorite dosage - kg / Month

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

Sodium BiSulphite

Month	Unit	**Dosage** Litres / day	**Dosage** Kg / day	**Dosage** Litres / month	**Dosage** Kg / month	**Dosage** mg / L	**Residual** mg / L	**Compliance** Yes / No
JAN.		413	210	12,792	6,518	3.46	0.0	yes
FEB.		414	211	11,596	5,908	3.01	0.0	yes
MAR.		416	212	12,896	6,571	3.23	0.0	yes
APR.		473	241	14,196	7,233	2.82	0.0	yes
MAY		446	227	13,832	7,048	3.27	0.0	yes
JUN.		383	195	11,492	5,855	3.20	0.0	yes
JUL.		314	160	9,734	4,955	3.21	0.0	yes
AUG.		199	101	6,158	3,137	1.94	0.0	yes
SEP.		364	185	10,920	5,564	4.44	0.0	yes
OCT.		364	185	11,284	5,749	4.40	0.0	yes
NOV.		366	186	10,972	5,590	3.51	0.0	yes
DEC.		364	185	11,284	5,749	3.53	0.0	yes
Average		376	192	11,430	5,823	3.34	0.01	
Objective								
Limit								

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs

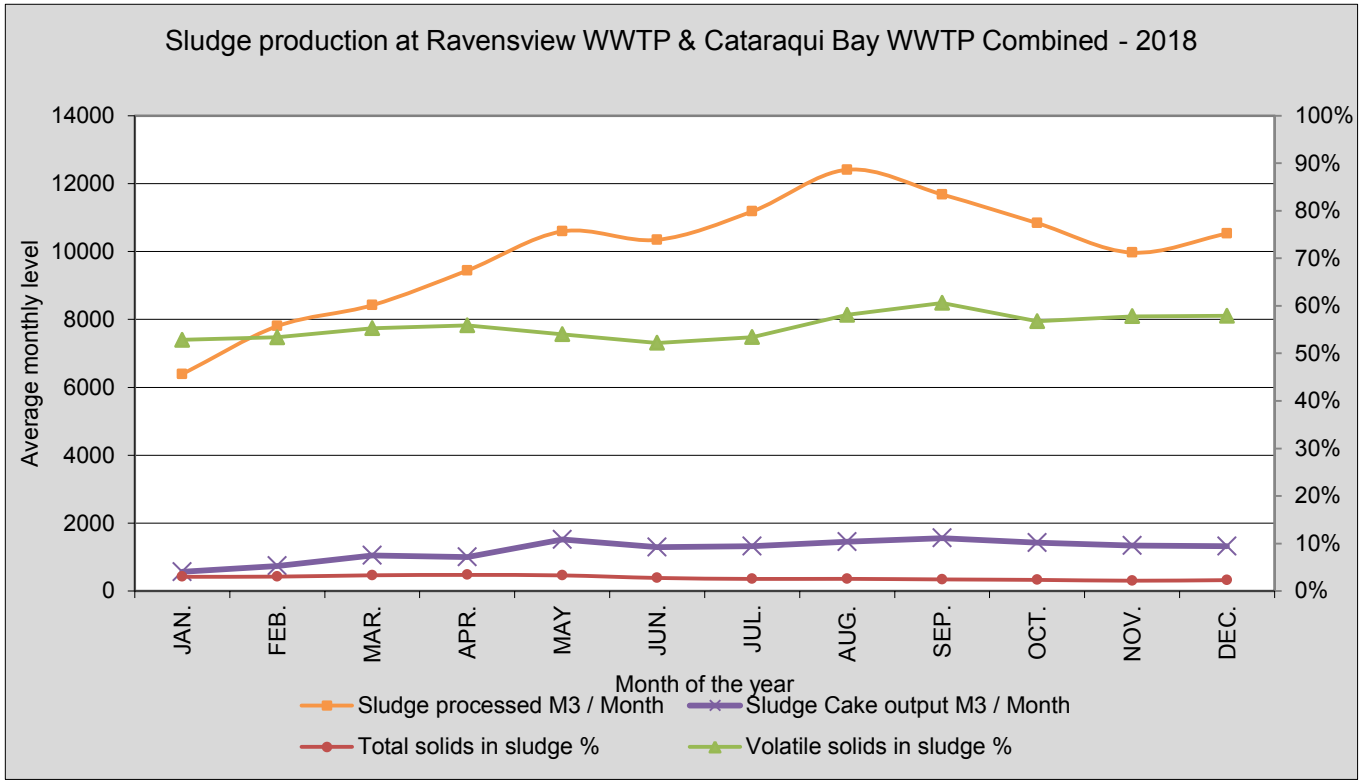


RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

		Digested sludge			Sludge Cake		
Month		**Sludge processed**	**Total solids in sludge**	**Volatile solids in sludge**	**Sludge Cake output**	**Total solids in sludge cake**	**Vol. Solids sludge cake**
	Unit	M3 / Month	%	%	M3 / Month	%	%
JAN.		6390	3.0%	52.8%	565	28.8%	49.3%
FEB.		7801	3.0%	53.4%	738	25.8%	52.9%
MAR.		8419	3.3%	55.3%	1,052	25.3%	54.3%
APR.		9440	3.4%	55.9%	1,000	25.1%	54.3%
MAY		10592	3.3%	54.0%	1,519	25.0%	55.5%
JUN.		10344	2.8%	52.2%	1,294	26.6%	53.2%
JUL.		11180	2.6%	53.4%	1,318	26.4%	54.4%
AUG.		12409	2.6%	58.1%	1,454	25.1%	56.6%
SEP.		11680	2.5%	60.6%	1,562	25.2%	58.1%
OCT.		10837	2.4%	56.8%	1,425	24.4%	57.2%
NOV.		9968	2.2%	57.8%	1,343	26.4%	57.0%
DEC.		10530	2.3%	57.9%	1,318	26.7%	56.7%
Average		9,966	2.8%	55.7%	1,216	25.9%	55.0%
Total		119590					

* Processed volumes are a combination of both Cataraqui Bay WWTP & Ravensview WWTP sludge productions.

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs

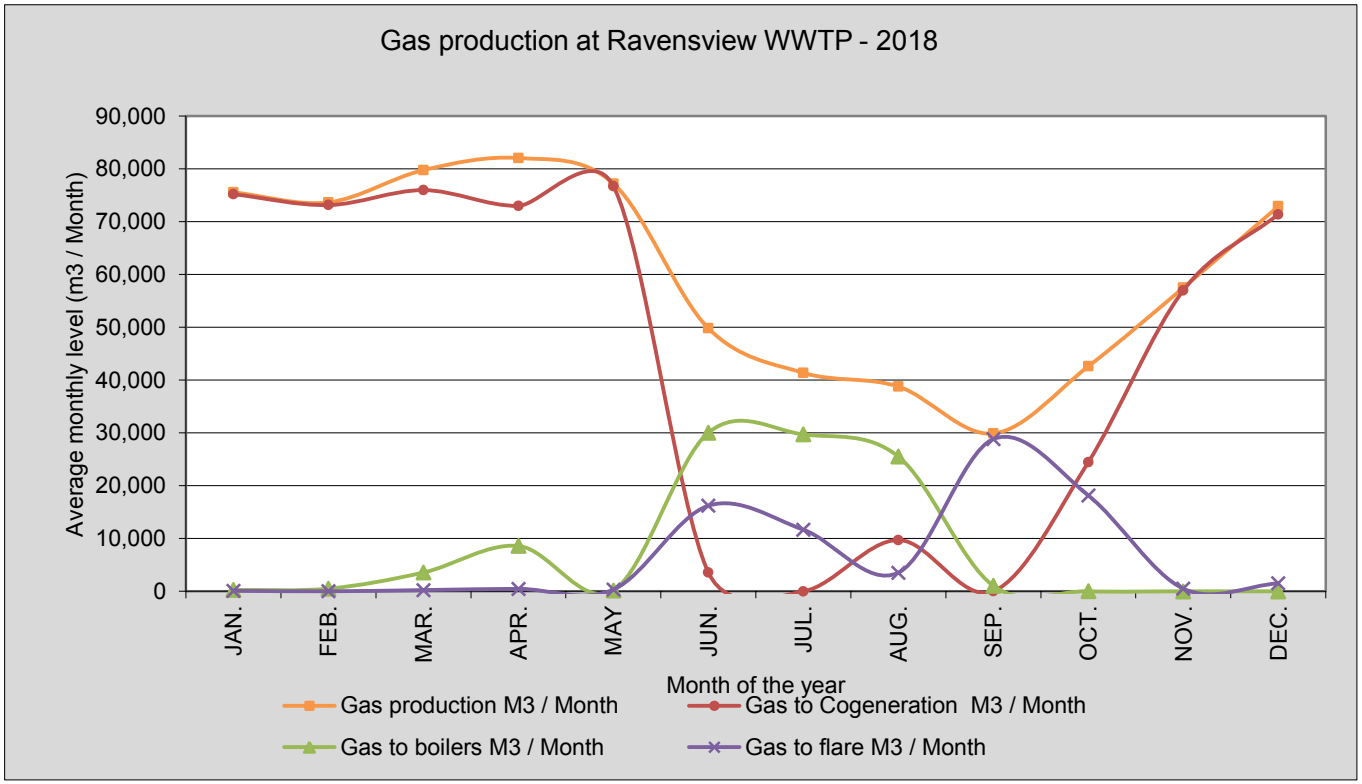


RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

Digester gas production

Month	Unit	Gas production M3 / Month	Gas to Cogeneration M3 / Month	Gas to boilers M3 / Month	Gas to flare M3 / Month
JAN.		75,534	75,190	246	98
FEB.		73,637	73,127	506	4
MAR.		79,746	75,955	3,560	231
APR.		82,029	72,971	8,586	472
MAY		77,189	76,698	160	331
JUN.		49,790	3,556	30,028	16,206
JUL.		41,363	0	29,696	11,667
AUG.		38,766	9,712	25,519	3,535
SEP.		29,876	2	1,045	28,829
OCT.		42,600	24,450	5	18,145
NOV.		57,466	56,964	0	502
DEC.		72,875	71,372	0	1,503
Average		60,073	44,999.8	8,279.3	6,793.6
Total		**720,871**	**539,997**	**99,351**	**81,523**

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs

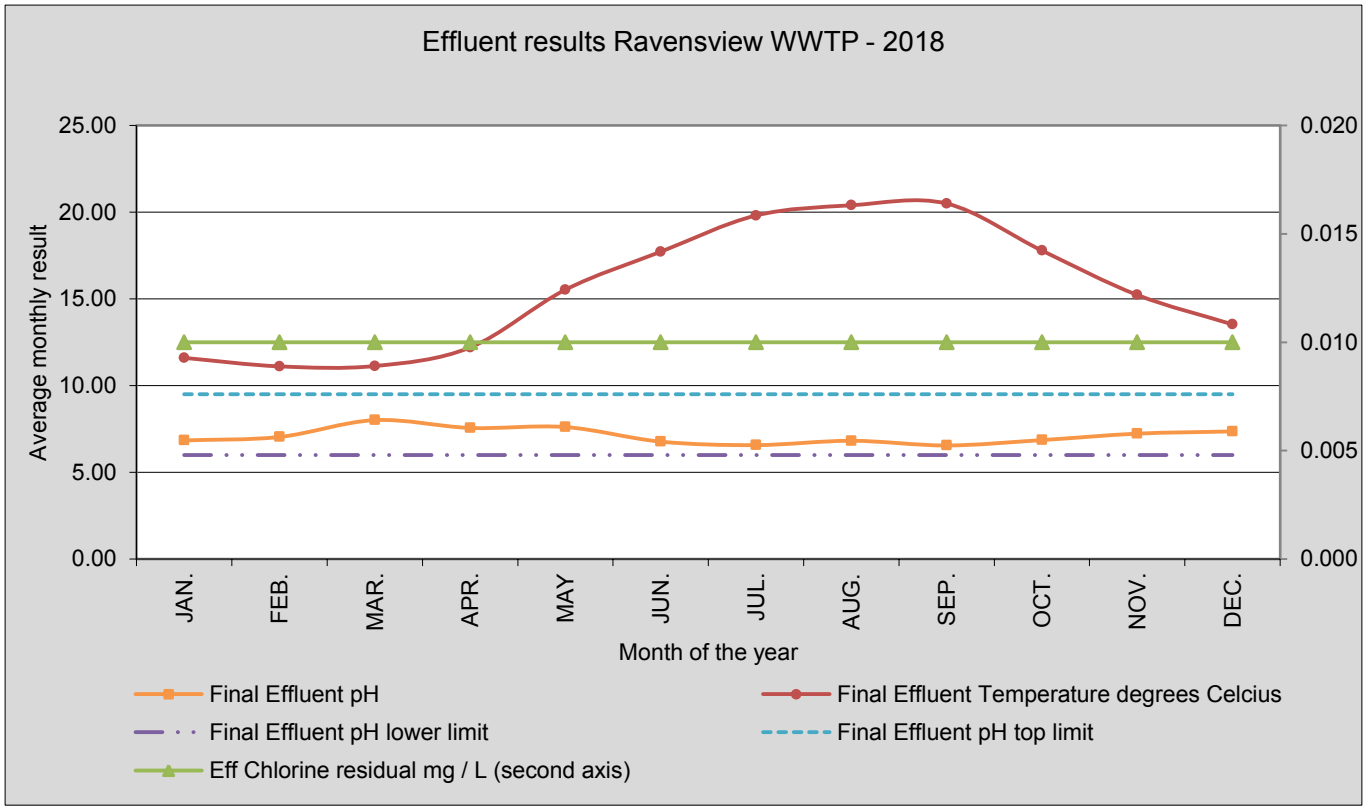


RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

Effluent Summary from daily samples

Month	Final Effluent pH	Final Effluent pH lower limit	Final Effluent pH top limit	Final Effluent Temperature	Eff Chlorine residual
Unit				degrees Celcius	mg / L (second axis)
JAN.	6.84	6	9.5	11.6	0.0
FEB.	7.04	6	9.5	11.1	0.0
MAR.	8.01	6	9.5	11.1	0.0
APR.	7.56	6	9.5	12.2	0.0
MAY	7.61	6	9.5	15.5	0.0
JUN.	6.77	6	9.5	17.7	0.0
JUL.	6.57	6	9.5	19.8	0.0
AUG.	6.82	6	9.5	20.4	0.0
SEP.	6.55	6	9.5	20.5	0.0
OCT.	6.86	6	9.5	17.8	0.0
NOV.	7.23	6	9.5	15.2	0.0
DEC.	7.36	6	9.5	13.5	0.0
Average	7.1			15.5	0.01
Objective Limit					

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs



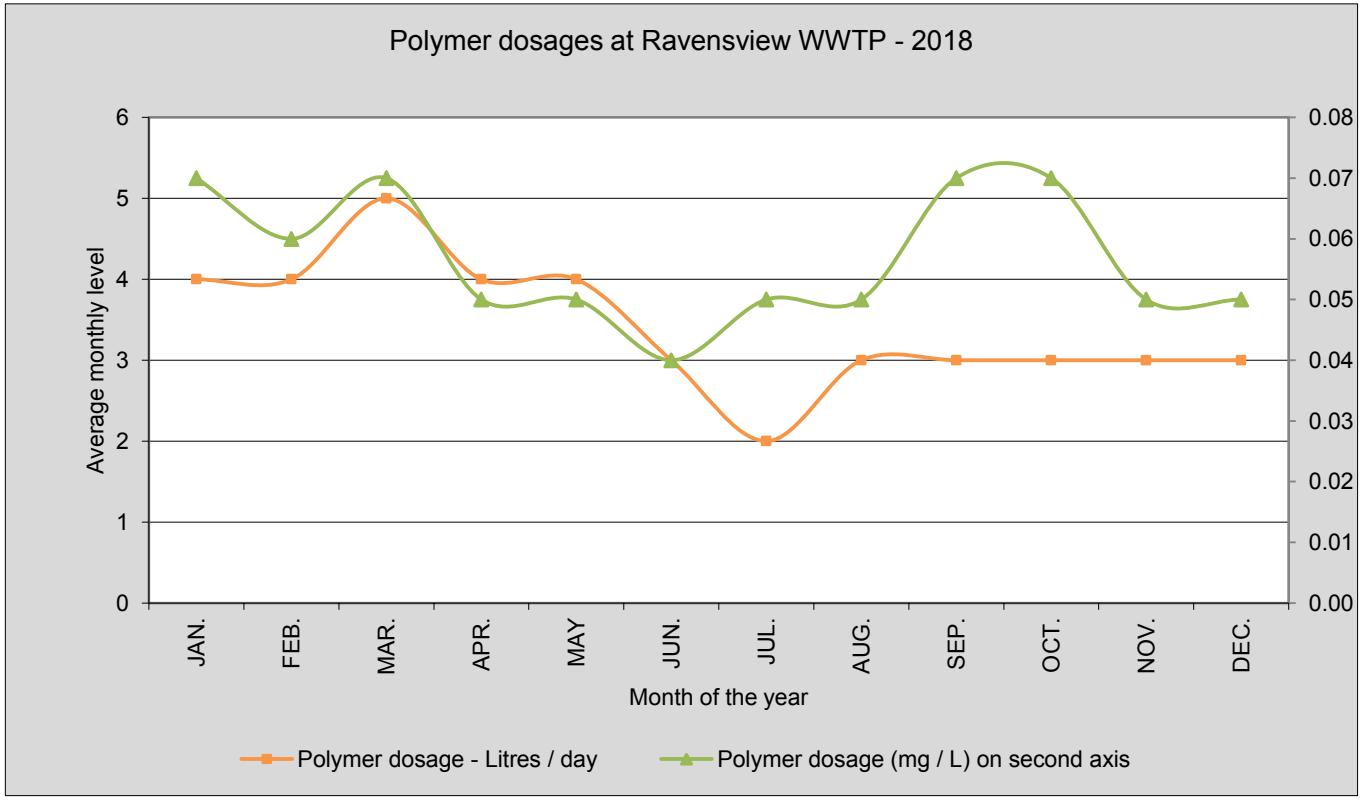
RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

Polymer dosage

Month	Unit	**Dosage*** Kg / day	**Dosage** Kg / month	**Dosage** mg / L
JAN.		4	134	0.07
FEB.		4	122	0.06
MAR.		5	140	0.07
APR.		4	131	0.05
MAY		4	109	0.05
JUN.		3	81	0.04
JUL.		2	77	0.05
AUG.		3	79	0.05
SEP.		3	82	0.07
OCT.		3	88	0.07
NOV.		3	80	0.05
DEC.		3	81	0.05
Average		3.42	100	0.06
Objective				
Limit				

Note: *: Calculated value

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs

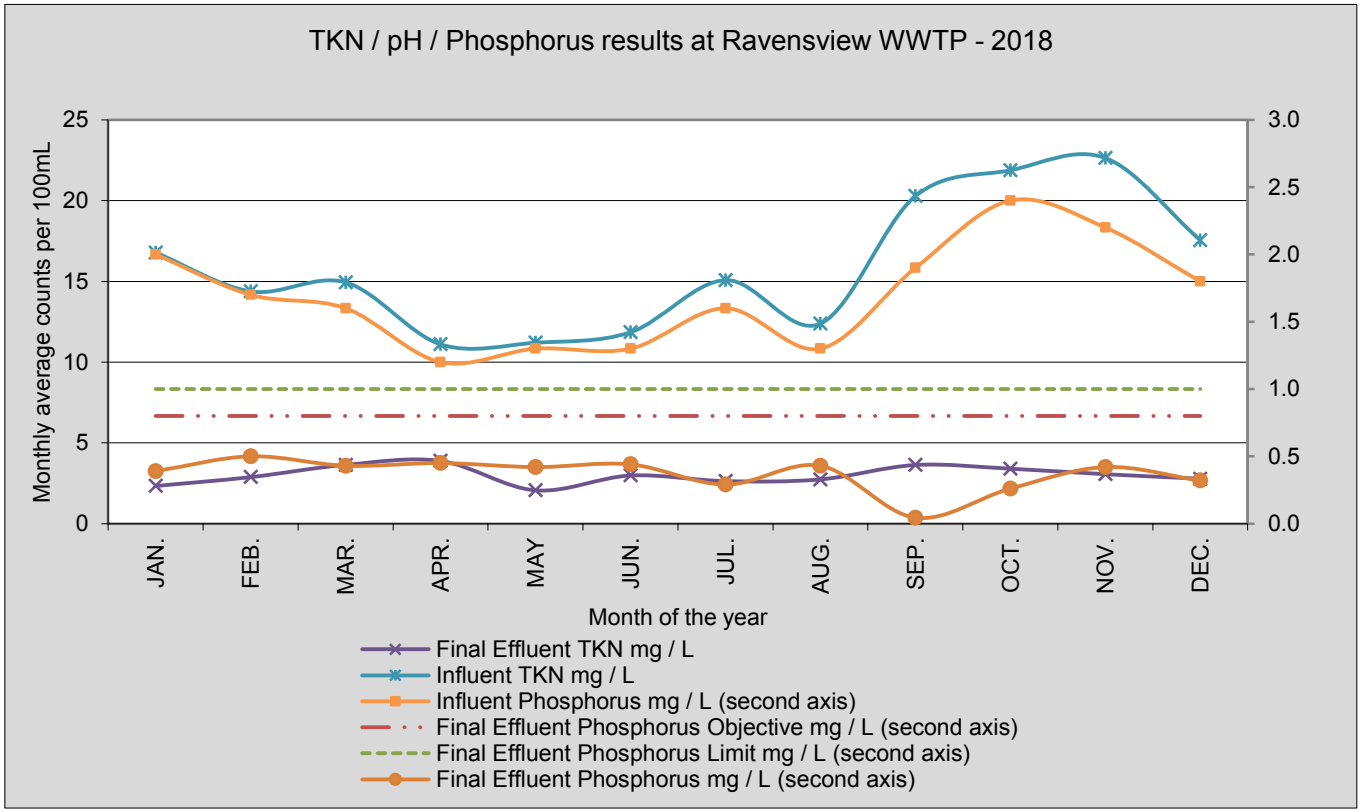


RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

TKN / Influent pH / Phosphorus

Month	Influent TKN	Final Effluent TKN	Removal TKN	Influent pH	Influent Phosphorus	Final Effluent Phosphorus	Removal Phosphorus
Unit	mg / L	mg / L	%		mg / L (second axis)	mg / L (second axis)	%
JAN.	16.78	2.33	86%		2.00	0.39	81%
FEB.	14.38	2.88	80%	7.70	1.70	0.50	71%
MAR.	14.94	3.64	76%	8.02	1.60	0.43	73%
APR.	11.10	3.88	65%	8.10	1.20	0.45	63%
MAY	11.20	2.06	82%	7.94	1.30	0.42	68%
JUN.	11.85	2.98	75%	7.62	1.30	0.44	66%
JUL.	15.08	2.63	83%	7.55	1.60	0.29	82%
AUG.	12.38	2.74	78%	7.80	1.30	0.43	67%
SEP.	20.28	3.63	82%	7.56	1.90	0.04	98%
OCT.	21.88	3.40	84%	7.75	2.40	0.26	89%
NOV.	22.64	3.06	86%	7.65	2.20	0.42	81%
DEC.	17.55	2.78	84%	7.73	1.80	0.32	82%
Average	15.84	3.00	80%	7.77	1.69	0.37	77%
Objective						0.8	
Limit						1.0	

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs



RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly data

		Flows					
Month	Unit	Monthly Minimum Flow	Monthly Rated capacity Flow	Monthly Maximum Flow	Monthly Average Flow	Monthly Total Flow	Monthly Total Grit removal (Estimate)
		m3 / day	m3 / day	m3 / day	m3 / day	m3 / Month	m3 / Month
JAN.		46,363	95,000	181,067	76,752	2,379,298	1.5
FEB.		57,673	95,000	159,803	84,405	2,363,333	1.5
MAR.		56,977	95,000	113,361	74,552	2,311,125	1.5
APR.		69,075	95,000	176,475	101,573	3,047,195	1.5
MAY		70,856	95,000	112,916	80,023	2,480,719	1.5
JUN.		57,587	95,000	110,904	67,090	2,012,699	1.5
JUL.		40,224	95,000	112,102	55,299	1,714,269	1.5
AUG.		46,926	95,000	140,216	58,828	1,823,668	1.5
SEP.		40,386	95,000	83,633	48,302	1,449,072	1.5
OCT.		36,522	95,000	85,398	48,951	1,517,475	1.5
NOV.		48,444	95,000	147,285	65,476	1,964,285	1.5
DEC.		41,803	95,000	162,890	68,504	2,123,630	1.5
Average		51,070	95,000	132,171	69,146	2,098,897	1.5
Objective							
Limit							

RAVENSVIEW Wastewater Treatment Plant
2018 ANNUAL REPORT
Monthly Graphs