Utilities Kingston

CATARAQUI BAY
WASTEWATER TREATMENT PLANT

2019 ANNUAL REPORT

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REPORT CHECK LIST

Annual report submitted for the Environmental Compliance Approval number 4163-ACPPRK.

Condition 11(6) the first annual report shall cover the period from the commencement of operation of the sewage works to the end of the calendar year and shall be submitted within sixty (60) days following the end of such reporting period. Each subsequent annual report shall be submitted within sixty (60) days following the end of the calendar year being reported upon.

Condition 11(6)(a)to(l).Each annual report shall contain at least the following information:

- Executive Summary
- Tabulation and comprehensive interpretation of all monitoring data and analytical results collected during the reporting period, and a comparison to the effluent quality and quantity
- Summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the works
- Description of all operating problems encountered and corrective actions taken during the reporting period
- Tabulation of the volume of sludge generated in the reporting period and an outline of anticipated volumes to be generated over the next reporting period, and an outline of the sludge handling methods and disposal areas to be utilized over the next reporting period
- Evaluation of the calibration and maintenance procedures conducted on all monitoring equipment
- Summary of effluent quality assurance or control measures under taken
- Summary of any complaints
- Summary of all by-passes
- Evaluation for the need for modifications to the works to improve performance and reliability and to minimize upsets and bypasses

EXECUTIVE SUMMARY

The Cataraqui Bay Wastewater facility was compliant with all concentrations, loadings, sampling and maintenance as required in environmental compliance approval 4163-ACPPRK. Additional details can be found in the tables contained in Appendix A.

Average flows through the plant decreased slightly in 2019 showing average flows of 29,251 $m^{3/}$day.

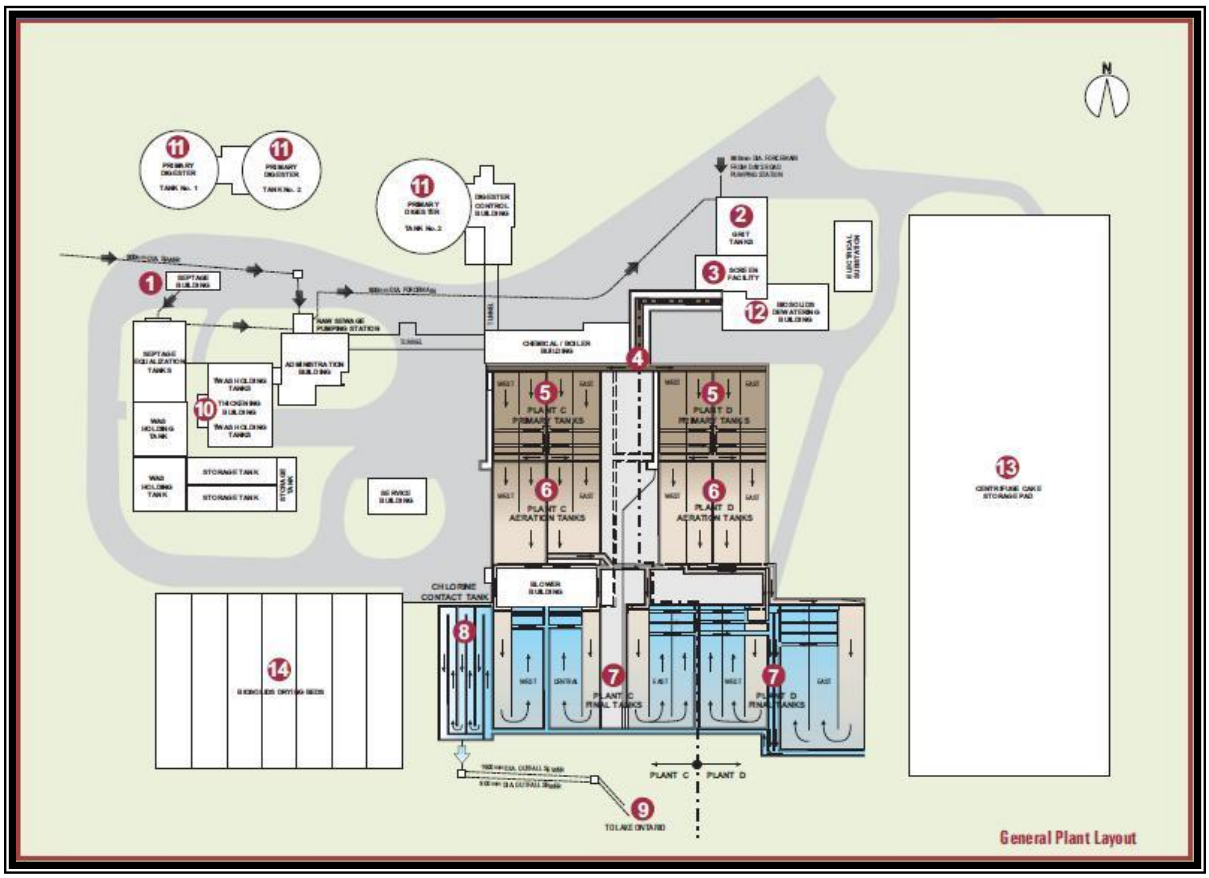
Plant staff continue to maintain operations during the facility upgrades and have continued with planned and reactive maintenance as well as capital works at both the facility and within the associated collection system. Details regarding these improvements are located in the report.

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

The facility saw two secondary bypass events at the Cataraqui Bay Wastewater Treatment Plant and one bypass event within the Kingston West Sewage Collection System in the 2019 reporting year. All by-pass details are listed in Table 7, the Bypass Summary section of this report. All the bypasses were due to rainfall events.

PLANT OVERVIEW

The following is a process overview and description of the treatment steps taken at the Cataraqui Bay wastewater treatment plant.



Grit Removal

The first step in the treatment process is grit removal. This is accomplished by the introduction of air at the bottom of the grit channel. The heavier solids in the wastewater will settle to the bottom of the tank, while the organics required to be treated stay in suspension and move on to the next treatment step.

Screening

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

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.

Primary Settling

The heavier organics settle by gravity to the bottom of the primary clarifiers and form a sludge blanket on the bottom of the tank. The settled sludge is collected by longitudinal 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 sulphate for phosphorus removal.

Aeration

Aeration is the biological process that involves the assimilation of organic insoluble and soluble matter by the action of micro- organisms. The micro-organisms flourish under stable conditions of respiration through air supply and food provided by the primary clarifier effluent. The aeration process effectively removes 95% of the biochemical oxygen demand from the incoming wastewater.

Final Settling

After the assimilation is completed in the aeration tanks, the mixed liquor from these 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, where a portion is returned to the head of the aeration tanks to continue assimilation of the food in the primary effluent and the remainder is pumped to sludge thickening facilities.

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-chlorinating to ensure no chlorine remains in the water entering the receiving stream.

Outfall

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

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.

Biosolids Managment

The sludge from the primary and final clarifiers as well as the sludge from the thickening process is pumped to the digestion 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.

Biosolids Dewatering

The biosolids produced through digestion are dewatered through centrifugation. The centrifuged cake produced is land applied when weather and crops permit. Since January 2018, liquid sludge has been hauled from Cataraqui Bay WWTP to Ravensview WWTP for processing due to site construction.

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 conditions 6 and 7 of environmental compliance approval number 3714-9YURZF were compiled during the reporting period of 2019.

The following tables summarize the results obtained through monitoring of plant performance in accordance with conditions 6 and 7 of the environmental compliance approval number 3714-9YURZF. Effluent objective and limits for environmental compliance approval number 4163-ACPPRK will become effective once the facility upgrades are complete.

Table 1: Effluent Results

Effluent Objectives		
Effluent Parameter	**Objective** (mg/l)	**2019 Results** (avg.)
$CBOD_5$	15.0	4.9 mg/l
Total suspended solids (TSS)	15.0	5.7 mg/l
Total Phosphorus	1	0.42 mg/l
Total Chlorine Residual	<0.02	0.01 mg/l
E. Coli (Monthly Geometric Mean Density)	200 counts/ 100 ml	26 counts/ 100 ml

Table 2: Effluent Limits

Effluent Limits			
Effluent Parameter	**Concentration Limit** (mg/l)	**Loading Limit from effluent (kg/d)**	**2019 annual average (kg/d)**
$CBOD_5$	25.0	970	123
Suspended solids (TSS)	25.0	970	145
Total Phosphorus	1.0	39	11.4
Total Chlorine Residual	0.02		0.01

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Table 3: Monthly Effluent Parameters

Maximum Monthly Comparison of Effluent 2019				
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	8mg/L 300kg/day	7mg/L 200kg/day	0.53mg/l 16kg/day	162
February	14mg/L-480kg/day	14mg/L 480kg/day	0.46mg/l 18kg/day	44
March	15mg/L-460kg/day	9mg/L 200kg/day	0.72mg/l 19kg/day	32
April	2mg/L-57kg/day	6mg/L 200kg/day	0.28mg/l 12kg/day	22
May	5mg/L-200kg/day	6mg/L 200kg/day	0.33mg/l 15kg/day	6
June	5mg/L-200kg/day	11mg/L 320kg/day	0.55mg/l 18kg/day	3
July	9mg/L-200kg/day	5mg/L 100kg/day	0.62mg/l 15kg/day	3
August	6mg/L-200kg/day	7mg/L 100kg/day	0.51mg/l 14kg/day	15
September	5mg/L-100kg/day	5mg/L 90kg/day	0.94mg/l 21kg/day	3
October	16mg/L-410kg/day	12mg/L 310kg/day	0.78mg/l 20kg/day	12
November	4mg/L-100kg/day	17mg/L 420kg/day	0.90mg/l 29kg/day	4
December	8mg/L-200kg/day	10mg/L 310kg/day	0.57mg/l 18kg/day	9

Table 4: Annual Plant Flows

Plant Flows (m^3/day)							
Parameter	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Avg. m^3/day	26721	27145	26147	26072	30042	28963	29251
Max. m^3/day	78981	90801	56583	67405	121860	94957	91976
Design. M^3/day	38800	38800	38800	38800	38800	38800	38800
% (daily/design)	68.9%	70.0%	67.4%	67.2%	77.4%	74.6%	75.4%

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Table 5: Annual Effluent Results

Final Effluent Parameter Results								
Parameter (mg/L)	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**LIMITS**
$CBOD_5$	19.34	6	5.3	4.05	3.13	5	4.9	25
Suspended Solids	5.53	6.2	6.5	4.8	5.09	6	5.7	25
Total Phosphorus	0.57	0.61	0.55	0.51	0.55	0.40	0.42	1.0
Total Chlorine	0.01	0.01	0.01	0.018	0.018	0.01	0.01	<0.02
Acute Lethality	n/a	n/a	All Pass	All Pass	All Pass	5 Pass/ 1 Fail	Pass	Pass

Note: Acute lethality testing was started in 2015.

MAINTENANCE

In 2019 we continued with our preventative maintenance program of vibration testing, oil analysis and electrical surge protection. Preventative maintenance and inspections were performed on most clarifiers during the summer months.

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

- Repaired chains and flights for secondary tanks
- Annual infrared scans on HV electrical
- Routine vibration monitoring
- Diesel generator repair & maintenance

CAPITAL WORKS

In October 2016 work began on plant wide upgrades. During the proposed project completion timeline of 4 years (2016-2020), the Cataraqui Bay Wastewater Treatment Plant will undergo an extensive process, electrical/instrumentation, and mechanical upgrade.

The additional major highlights for capital works in 2019 at the Cataraqui Bay WWTP and associated sewage collection system were:

- Portsmouth Pumping Station upgrade assessment
- Environmental Assessment of the Days Rd Pumping Station
- Continued work on the Wastewater Master Plan assessment

OPERATIONS

Preventative maintenance and regular process and equipment inspections lead to operational problems being diagnosed quickly and corrective actions implemented immediately. Non flushable materials such as wipes and grease have become more prominent in the sewer system resulting in some operational and maintenance challenges. Utilities Kingston has implemented 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 two years with some positive results.

BIOSOLIDS MANAGEMENT

The dewatering facility is the primary method of solids handling at the Cataraqui Bay facility. The secondary digested sludge is dewatered through a centrifuge and then stock piled until land application is available during the summer season.

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 approximate volume of 27,807m3 of liquid sludge was transported from Cataraqui Bay Wastewater Treatment Plant to the Ravensview Wastewater Treatment Plant in 2019. With the combination of both Ravensview WWTP and Cataraqui Bay WWTP liquid sludge to process a combined volume of 122,184 m3 of liquid sludge was processed through the centrifuge, and approximately 14,887 m3 of sludge cake was stored on site until land applied on licensed agricultural fields. Land application is completed by Terra Pure Environmental.

It is too hard to predict exactly where and when we will spread in 2020, as crops and weather will be the major variables that we will be dealing with in the 2020 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 2019

C Of A and NASM Plan #	Address	Expiry Date
22383	Brown Rd.	31/12/2020
22685	Multiple farms	31/12/2020
22694	South Shore Rd.	31/12/2020
22853	Huffam 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
23048	Multiple farms	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
23425	Parry/Chambers Rd.	31/12/2022
23430	Simmons Rd.	31/12/2022
23525	County Rd. 8	31/12/2022
23950	County Rd. 8	31/12/2023
24091	Multiple farms	31/12/2023

EQUIPMENT CALIBRATIONS

All of the plant flow meters, online analyzers and lab equipment 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 have been no official complaints about the Cataraqui Bay Wastewater Treatment Plant operations for the reporting year 2019.

BYPASS SUMMARIES

Table 7 summarizes the locations, volumes and durations of bypass events for the reporting year 2019. Table 8 summarizes the test results from samples taken during the 2019 bypass events.

Table 7: Bypass Events

Bypass Event Record						
Date mm/dd/yyyy	Location	Start Time	Duration (hr + mins)	Volume (m^3)	Reason For Bypass	Precip (mm)
03/31/2019-04/01/2019	Cataraqui Bay WWTP (secondary bypass)	19:30	6:30	1659	Past rain/ rapid snow melt	1.1
03/31/2019-04/01/2019	Crerar Pumping Station	19:00	12:20	1133	Past rain/rapid snow melt	1.1
10/31/2019-11/01/2019	Cataraqui Bay WWTP (secondary bypass)	21:40	20:30	5600	Heavy rain/snow melt	53

Table 8: Bypass Sampling

Bypass Event Sampling Results Annual Average for Cataraqui Bay Wastewater Treatment Plant		
Parameter	**Units**	**Cat. Bay STP Annual Avg.**
E coli	Cfu/100mL	241000
$CBOD_5$	mg/l	17
TSS	mg/l	67
TP	mg/l	1.47
Bypass Event Sampling Results Annual Average for Crerar Pumping Station		
Parameter	**Units**	**Crerar PS Annual Avg.**
E coli	Cfu/100mL	40000
$CBOD_5$	mg/l	4.3
TSS	mg/l	25
TP	mg/l	0.58

BYPASS RESULT INTERPRETATIONS

$CBOD_5$, TP & TSS results are much the same as typical raw sewage influent to the sewage plant.

APPENDIX A – MONITORED PARAMETERS RESULTS AND GRAPHS

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Month		Raw sewage CBOD5	Final Effluent CBOD5	Removal CBOD5	Raw sewage Suspended solids	Final Effluent Suspended solids	Removal Suspended solids
	Units	mg/L	mg/L	%	mg/L	mg/L	%
JAN.		146.0	5.0	97%	149.0	4.0	97%
FEB.		124.0	7.0	94%	236.0	6.0	97%
MAR.		154.0	10.0	94%	216.0	8.0	96%
APR.		106.0	2.0	98%	154.0	3.0	98%
MAY		108.0	4.0	96%	84.0	4.0	95%
JUN.		127.0	4.0	97%	161.0	7.0	96%
JUL.		177.0	5.0	97%	134.0	4.0	97%
AUG.		137.0	4.0	97%	111.0	5.0	95%
SEP.		137.0	4.0	97%	188.0	3.0	98%
OCT.		110.0	6.0	95%	136.0	7.0	95%
NOV.		81.0	3.0	96%	74.0	9.0	88%
DEC.		77.0	5.0	94%	114.0	8.0	93%
	Average	123.7	4.9	96%	146.4	5.7	96%
	Objective		15.0			15.0	
	Limit		25.0			25.0	

CATARAQUI BAY Wastewater Treatment Plant
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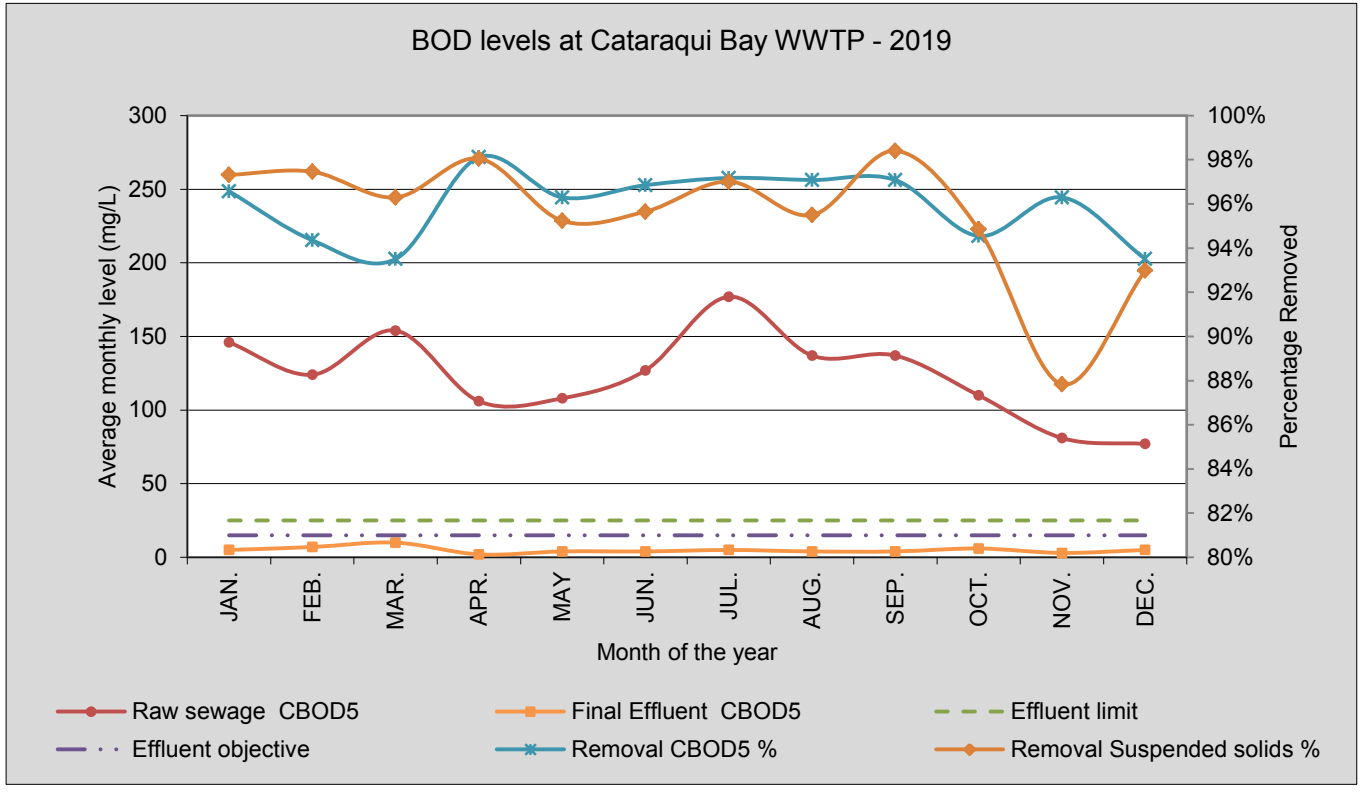
Monthly Graphs



CATARAQUI BAY Wastewater Treatment Plant
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			Final Effluent results	
		Raw sewage	**Final Effluent**	**Final Effluent**
Month		**Free Ammonia (NH_3)**	**Ammonia (NH_3+NH_4)**	**Nitrites & nitrates**
	Unit	mg/L	mg/L	mg/L
JAN.		0.31	15.60	3.9
FEB.		0.35	18.90	1.7
MAR.		0.37	21.30	0.8
APR.		0.38	16.90	1.0
MAY		0.23	12.50	1.8
JUN.		0.29	7.26	6.6
JUL.		0.41	7.05	12.4
AUG.		0.31	5.79	11.4
SEP.		0.44	7.26	10.0
OCT.		0.48	2.89	17.3
NOV.		0.35	5.22	16.0
DEC.		0.28	5.78	11.7
Average		0.35	10.54	7.88
Objective			Variable	
Limit				

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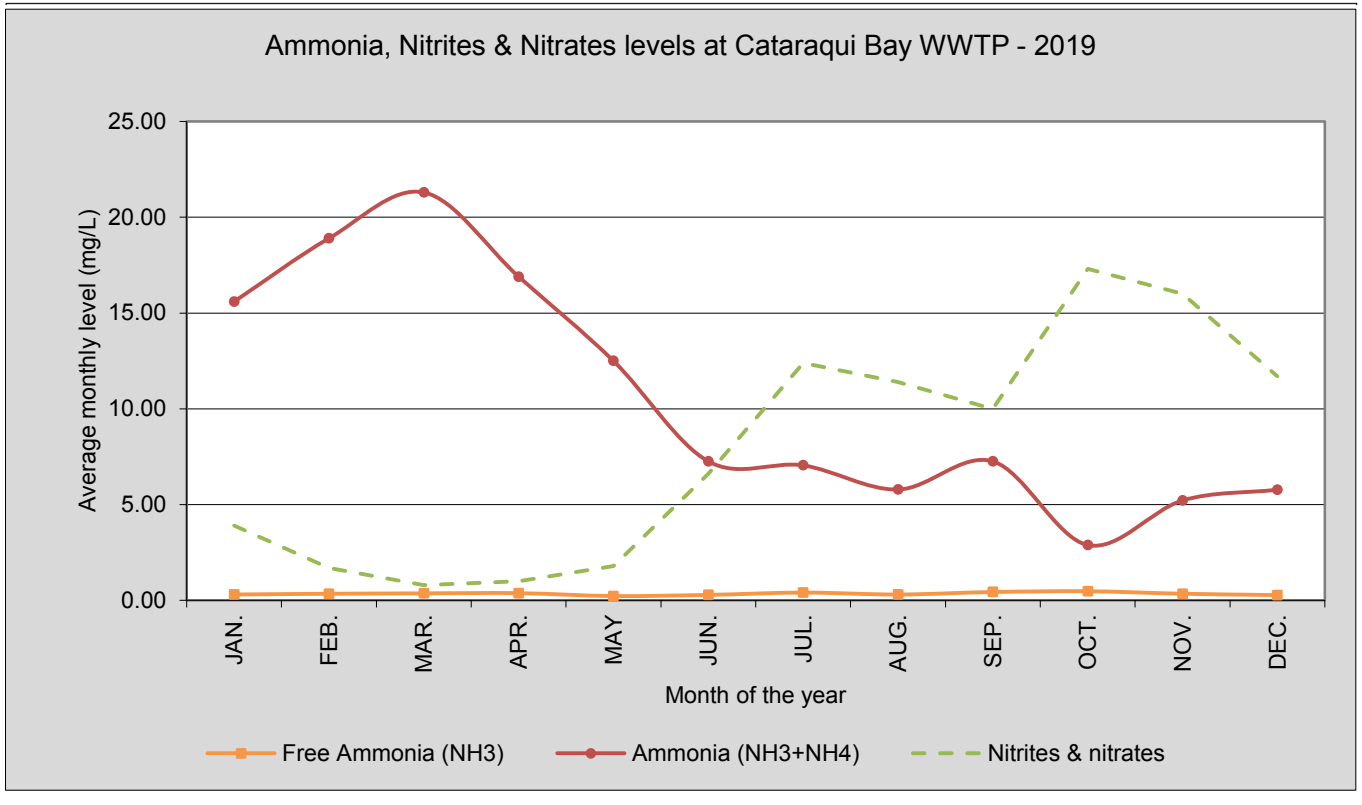

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Aluminum Sulphate

Month		**C Plant**	**C Plant**	**D Plant**	**D Plant**
	Unit	Litres / day	mg/l	Litres / day	mg/l
JAN.		165	12	104	9
FEB.		177	13	121	11
MAR.		145	11	134	10
APR.		163	10	128	8
MAY		125	10	98	10
JUN.		84	11	101	11
JUL.		41	17	145	20
AUG.		121	22	136	22
SEP.		36	17	169	21
OCT.		6	19	0	28
NOV.		5	15	178	17
DEC.		6	18	331	24
Average		90	15	137	16

CATARAQUI BAY Wastewater Treatment Plant
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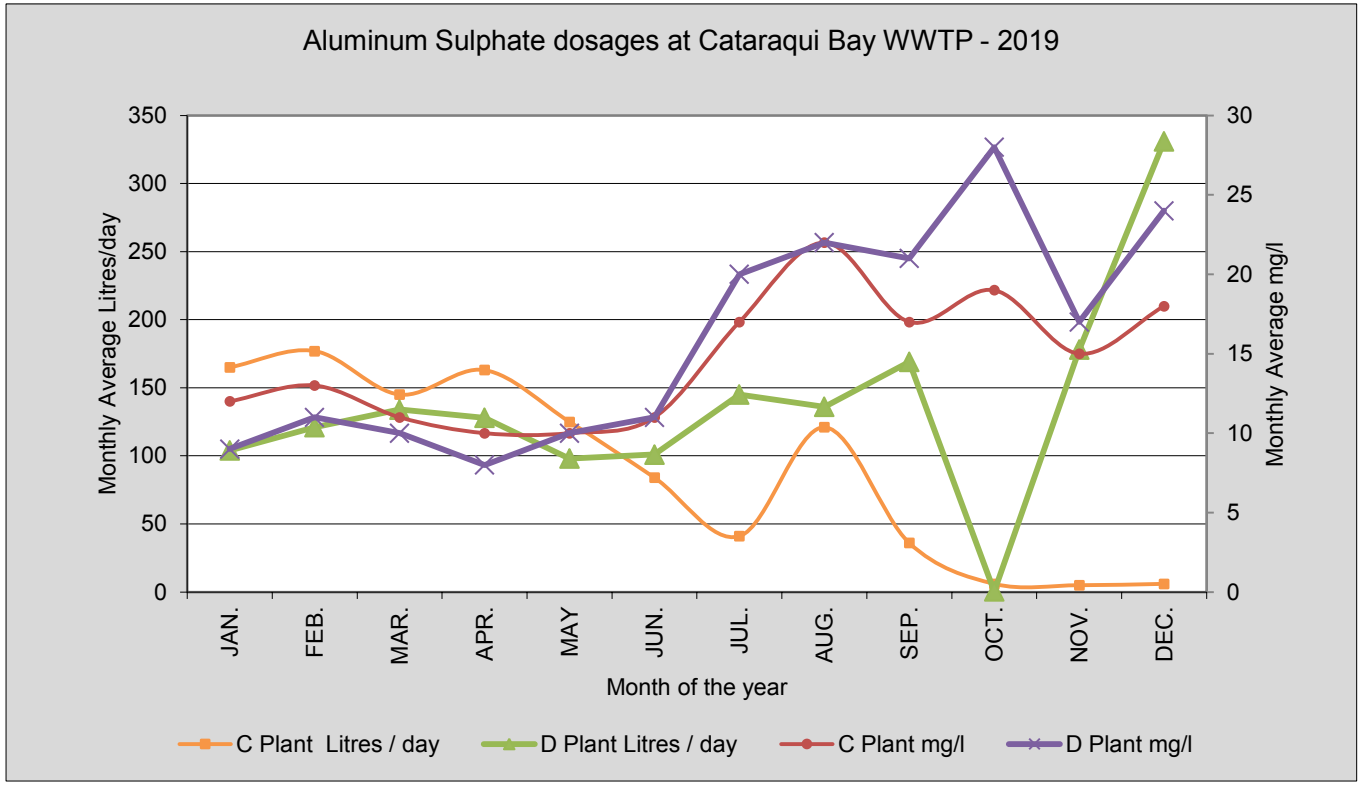

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		Bacterial results				
		Final Effluent		**Final Effluent**	**Final Effluent**	**Final Effluent**
Month		**E. Coli.**	**E-Coli Objective**	**Total Coliforms (second axis)**	**Fecal Streptococci**	**Acute lethality to trout**
	Unit	counts / 100mL	counts / 100mL	counts / 100mL	counts / 100mL	pass / fail
JAN.		162	200	12,737	1,422	pass
FEB.		44	200	9,114	2,215	
MAR.		32	200	1,583	312	
APR.		22	200	2,000	443	
MAY		6	200	2,269	900	pass
JUN.		3	200	334	152	
JUL.		3	200	132	51	
AUG.		15	200	840	83	pass
SEP.		3	200	200	56	
OCT.		12	200	1,468	231	
NOV.		4	200	487	165	pass
DEC.		9	200	2,603	989	
Average		26.25		2,813.92	584.92	
Objective		200				

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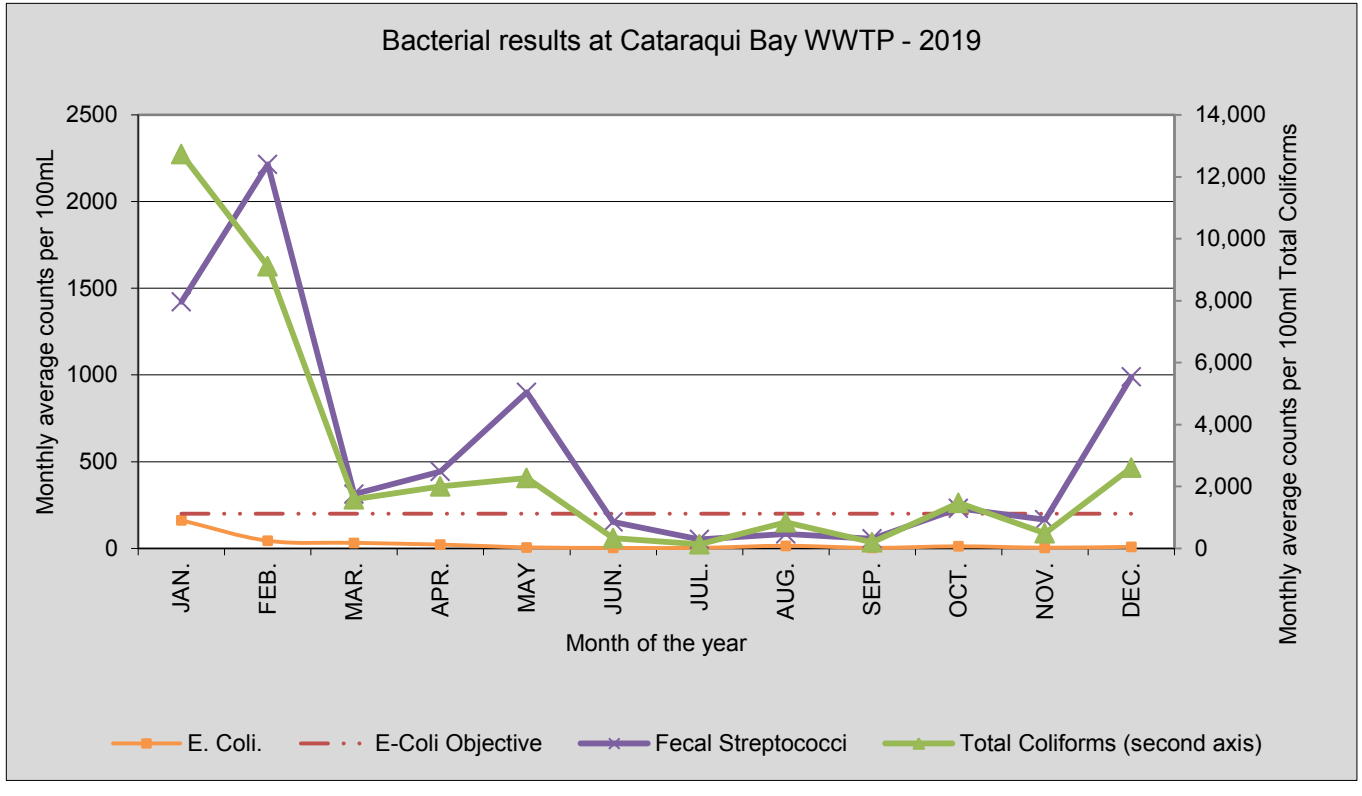

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Chlorination

Month		**Dosage**	**Dosage**	**Dosage**	**Residual**
	Unit	Kg / day	kg/month	mg/L	mg/L
JAN.		43	1,329	1.47	0.30
FEB.		30	849	1.10	0.37
MAR.		41	1,257	1.34	0.40
APR.		42	1,253	1.18	0.40
MAY		40	1,242	1.18	0.36
JUN.		56	1,691	1.98	0.30
JUL.		51	1,591	2.34	0.38
AUG.		51	1,593	2.64	0.35
SEP.		45	1,348	1.93	0.38
OCT.		67	2,069	2.34	0.33
NOV.		40	1,204	1.32	0.37
DEC.		52	1,597	1.55	0.41
Average		47	1,418.58	1.70	0.36

CATARAQUI BAY Wastewater Treatment Plant
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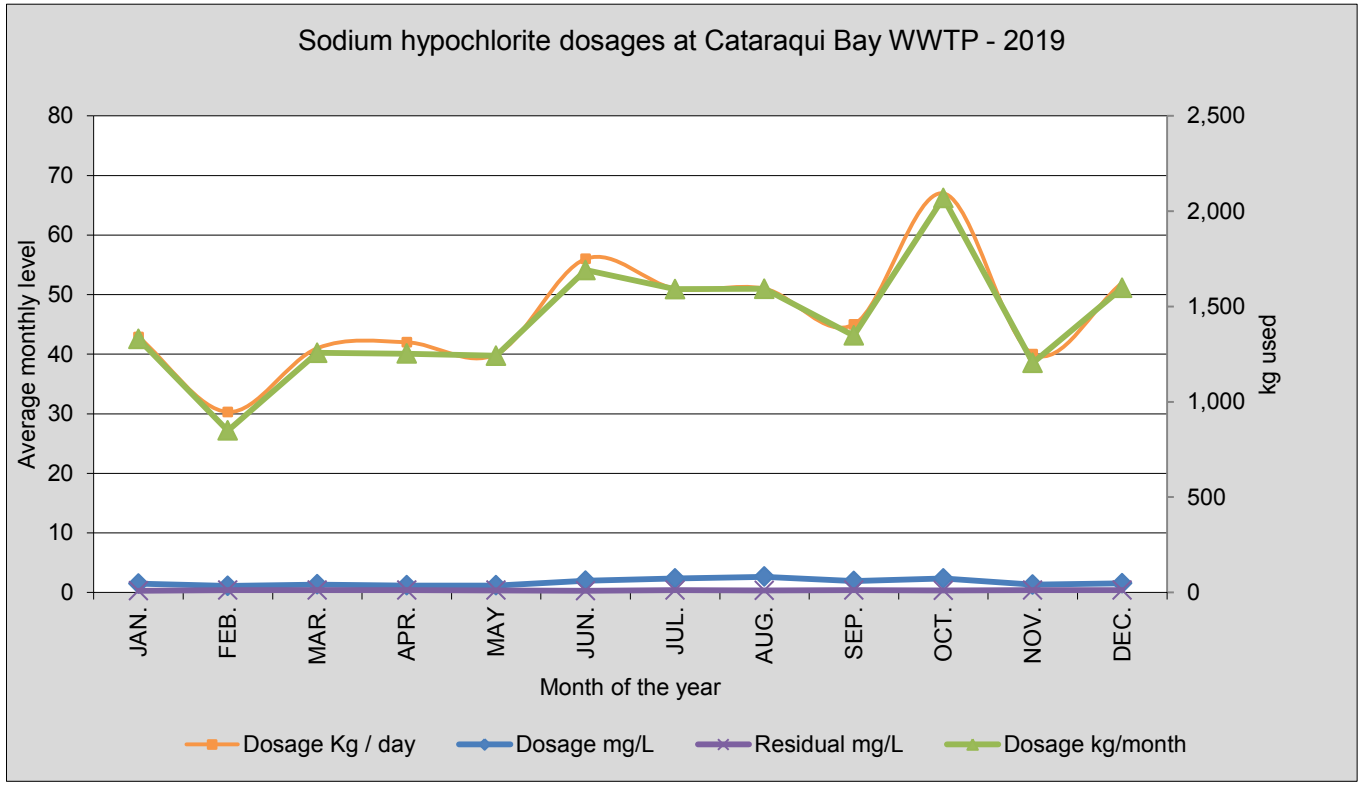

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Calcium Thiosulphate

Month		**Dosage**	**Dosage**	**Dosage**	**Residual**	**Compliance**
	Unit	Litres / day	Litres / month	mg / L	mg / L	Yes / No
JAN.		141	4,371	4.69	0.0	yes
FEB.		175	4,895	6.44	0.0	yes
MAR.		168	5,219	6.00	0.0	yes
APR.		87	2,600	2.00	0.0	yes
MAY		148	4,590	4.00	0.0	yes
JUN.		112	3,356	4.00	0.0	yes
JUL.		125	3,874	6.00	0.0	yes
AUG.		130	4,032	6.00	0.0	yes
SEP.		159	4,755	7.00	0.0	yes
OCT.		114	3,533	4.00	0.0	yes
NOV.		181	5,442	6.00	0.0	yes
DEC.		111	3,452	4.00	0.0	yes
Average		138	4,177	5.01	0.0	

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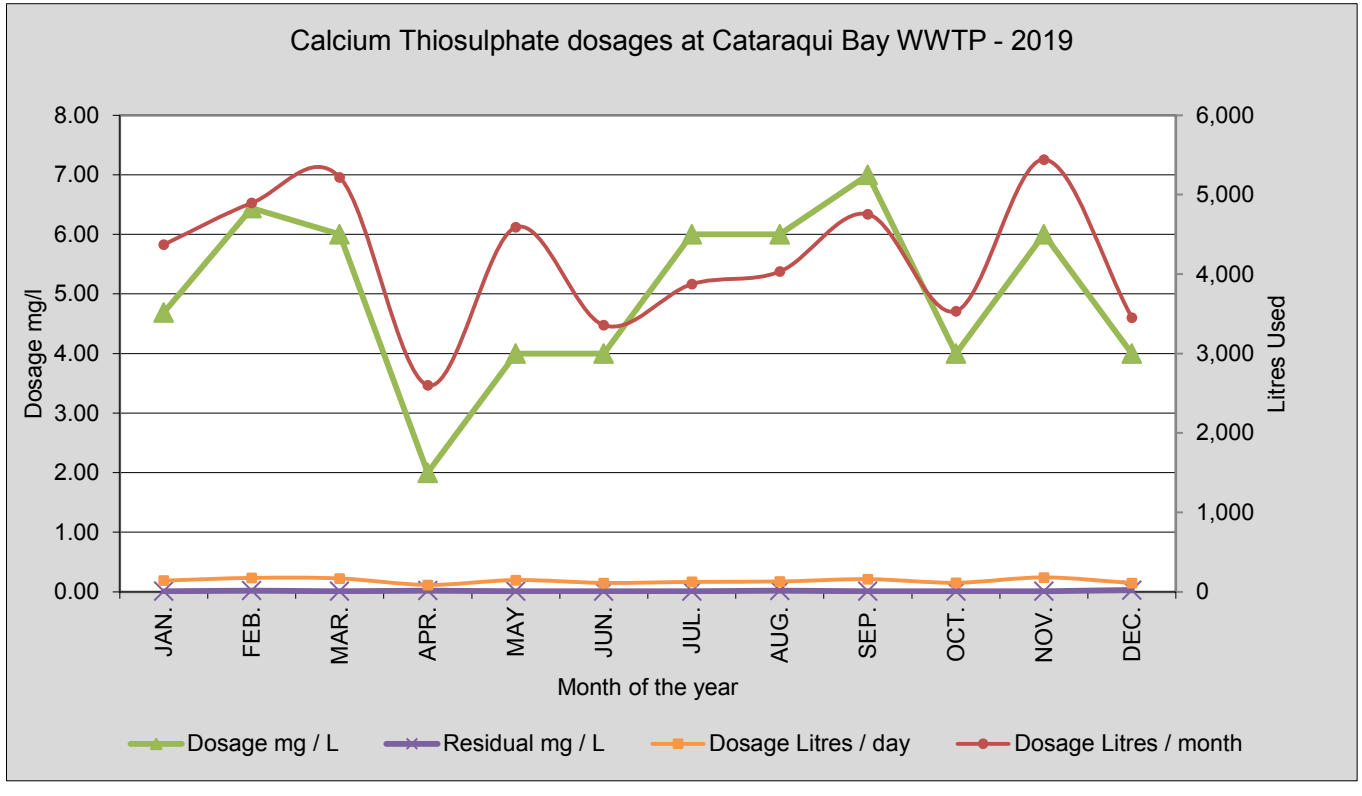

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Effluent Summary from daily samples

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.	7.86	6.5	9	11.10	0.01
FEB.	7.73	6.5	9	12.20	0.02
MAR.	7.80	6.5	9	12.10	0.01
APR.	7.87	6.5	9	12.40	0.02
MAY	7.86	6.5	9	14.40	0.01
JUN.	7.83	6.5	9	17.50	0.01
JUL.	7.62	6.5	9	20.50	0.01
AUG.	7.68	6.5	9	21.20	0.02
SEP.	7.87	6.5	9	20.30	0.01
OCT.	7.84	6.5	9	17.60	0.02
NOV.	7.87	6.5	9	15.40	0.01
DEC.	7.79	6.5	9	14.70	0.03
Average	7.8			15.78	0.02

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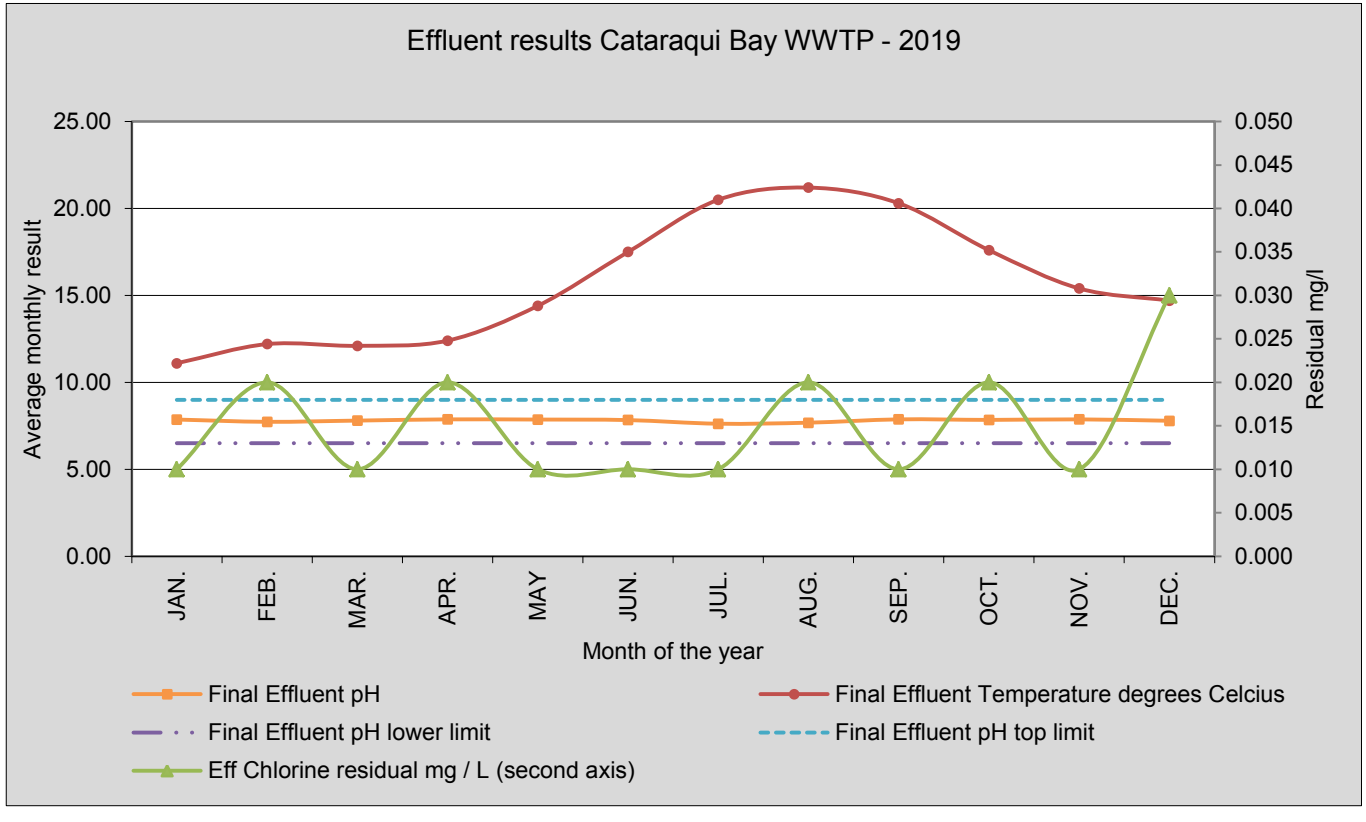

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TKN / Influent pH / Phosphorus

Month		Influent TKN	Final Effluent TKN	Influent pH	Influent Phosphorus mg / L (second axis)	Final Effluent Phosphorus mg / L (second axis)	Removal Phosphorus
	Unit	mg / L	mg / L				%
JAN.		29.60	17.10	7.50	2.88	0.38	87%
FEB.		31.30	20.60	7.45	2.78	0.37	87%
MAR.		33.80	24.00	7.48	3.34	0.35	90%
APR.		24.50	18.30	7.61	1.95	0.22	89%
MAY		22.20	12.60	7.45	1.96	0.25	87%
JUN.		26.90	9.70	7.46	4.14	0.43	90%
JUL.		39.70	9.10	7.44	3.93	0.52	87%
AUG.		33.70	7.50	7.37	3.28	0.53	84%
SEP.		33.10	8.90	7.52	3.42	0.59	83%
OCT.		34.40	4.80	7.65	4.07	0.56	86%
NOV.		24.10	7.00	7.66	1.74	0.49	72%
DEC.		22.30	8.80	7.54	2.05	0.49	76%
Average		29.63	12.37	7.51	2.96	0.43	85%
Objective						1.0	
Limit						1.0	

CATARAQUI BAY Wastewater Treatment Plant
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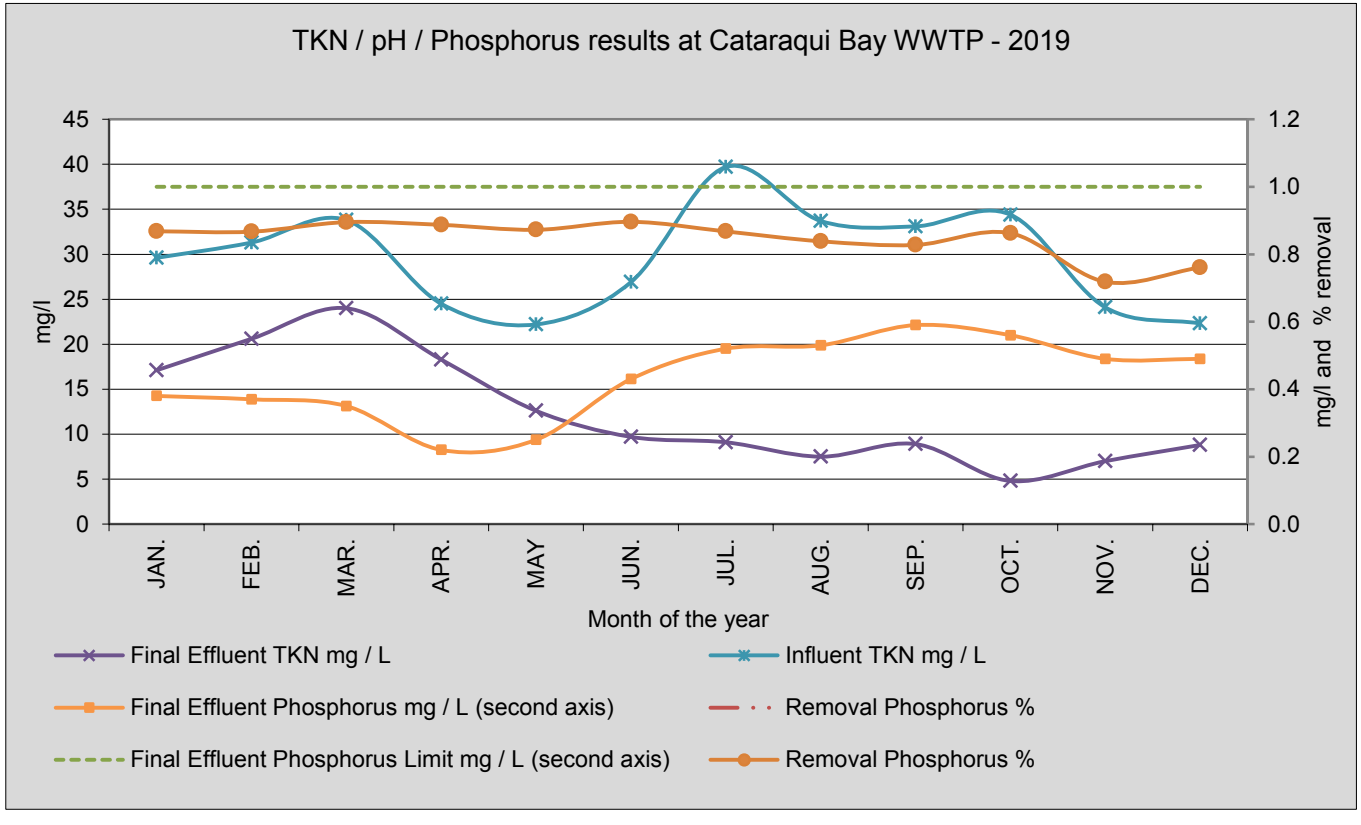

CATARAQUI BAY Wastewater Treatment Plant
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effluent flow

		Flows				
		Monthly	**Monthly**	**Monthly**	**Monthly**	**Monthly**
Month		**Minimum Flow**	**Rated capacity Flow**	**Maximum Flow**	**Average Flow**	**Total Flow**
	Unit	m3 / day	m3 / day	m3 / day	m3 / day	m3 / Month
JAN.		23,394	38,800	39,380	28,909	896,172
FEB.		23,059	38,800	39,837	27,728	776,387
MAR.		22,425	38,800	72,692	32,204	998,324
APR.		29,197	38,800	56,451	36,224	1,086,710
MAY		28,639	38,800	55,210	36,323	1,126,020
JUN.		22,933	38,800	38,876	28,897	866,921
JUL.		18,366	38,800	25,962	22,044	683,377
AUG.		6,259	38,800	29,089	21,552	668,107
SEP.		18,694	38,800	32,342	23,311	699,321
OCT.		21,661	38,800	55,211	29,382	910,834
NOV.		23,729	38,800	91,976	31,605	948,164
DEC.		25,833	38,800	56,778	32,835	1,017,885
Average		22,016	38,800	49,484	29,251	889,852
Objective						
Limit						

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