



# **HUMBER TREATMENT PLANT**

## **2019 Annual Report**



**March 31, 2020**

## EXECUTIVE SUMMARY

The Humber Treatment Plant (HTP) is one of four wastewater treatment facilities operated by the City of Toronto. This facility, located at 130 The Queensway, has a rated capacity of 473,000 m<sup>3</sup>/day or 473 ML/day, and serves an equivalent population of approximately 685,000. Humber Treatment Plant discharges into Lake Ontario and operates under Amended Environmental Compliance Approval No. 9032-ABZNYQ, issued on July 21, 2016.

The average daily flow rate in 2019 was 313.6 ML/day. Influent concentrations of Biochemical Oxygen Demand (BOD), Total Phosphorus (TP) and Total Suspended Solids (TSS) averaged 247.6 mg/L, 5.3 mg/L and 293.3 mg/L, respectively.

Humber Treatment Plant achieved the following effluent quality and loading rates in 2019 in comparison to ECA limits:

	ECA <sup>1</sup>	2019 Final Effluent
Total Suspended Solids (TSS)	25.0 mg/L	9.7 mg/L
Carbonaceous Biochemical Oxygen Demand (CBOD <sub>5</sub> )	25.0 mg/L	5.4 mg/L
Total Phosphorus (TP)	1.0 mg/L	0.4 mg/L
Escherichia Coli (E. Coli) <sup>2</sup>	200 CFU/100mL	83 CFU/100 mL
pH	6.0-9.5	Annual Minimum: 6.4
		Annual Maximum: 7.7
Total Residual Chlorine (TRC) (i.e. Dechlorination)	0.02 mg/L	0.009 mg/L
TP Loading Rate	473.0 kg/day	139.5 kg/day

<sup>1</sup> Referenced from Condition 6 and 7 of ECA No. 9032-ABZNYQ, issued on July 21, 2016.

<sup>2</sup> Arithmetic mean of monthly geometric mean data.

Sludge generated at the Humber Treatment Plant is transferred to the Ashbridges Bay Treatment Plant via the Mid-Toronto Interceptor (MTI) for further treatment and disposal. During 2019, an average of 5,397 m<sup>3</sup>/day of waste activated sludge was removed from the system. Of this, 5,108 m<sup>3</sup>/day was thickened and stabilized prior to transfer and 290 m<sup>3</sup>/day was transferred directly. An average of 67 dry tonnes of biosolids and waste activated sludge was transferred per day.

Ferrous chloride consumption for phosphorus removal totalled 639.5 tonnes as iron (Fe). There was no polymer consumption for waste activated sludge (WAS) thickening. Total sodium hypochlorite (12% w/v) consumption for disinfection totalled 3798.3 m<sup>3</sup>. Sodium Bisulphite (SBS) (38% w/w) consumption for effluent dechlorination totalled 666.3 tonnes.

There were 19 bypass occurrences in 2019 where each occurrence received preliminary, primary treatment, nutrient removal, as well as disinfection and dechlorination before being blended with fully treated plant effluent and exiting the plant through the plant outfall, upstream of the final effluent sampling point.

The plant continued with various capital projects. Notable projects included: PLC Migration, Secondary Treatment Upgrades, West Substation Upgrades, Operations Centre Upgrades, New ECS Site Office, Odour Control Phase 1 Implementation, Digesters 9 and 10 Cleaning and Upgrades, Digesters 2 and 3 Cleaning, HVAC Upgrades, Primary Pumping and Scum Systems Upgrades, and Waste Gas Burner Upgrades. A variety of scheduled, preventative, predictive and reactive maintenance activities was performed, including annual calibration of effluent monitoring equipment.

Total annual consumption of potable water, hydro, and natural gas was 287,036 m<sup>3</sup>, 45 M kWh, and 2.1M scm, respectively. Plant direct operating cost for 2019 totalled \$16.7M. In 2019, the Humber Treatment Plant had a staffing compliment of 60 employees. As of December 31<sup>st</sup>, 2019, there were five health and safety incidents and two lost time days due to work related injuries in 2019.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	i
TABLE OF CONTENTS.....	iii
GLOSSARY OF ABBREVIATIONS .....	vi
1 INTRODUCTION .....	1
2 PLANT PROCESS OVERVIEW .....	2
2.1 Influent .....	2
2.2 Preliminary Treatment .....	2
2.3 Primary Treatment .....	2
2.4 Secondary Treatment.....	2
2.5 Final Effluent .....	3
2.6 Solids Handling .....	3
3 PROCESS SUMMARY .....	5
3.1 Process Parameters.....	5
3.2 Biosolids Management.....	8
3.3 Chemical Usage .....	8
3.4 Bypasses, Overflows, Spills, and Abnormal Discharge Events .....	8
3.4.1 Bypasses.....	8
3.4.2 Overflows .....	10
3.4.3 Spills .....	10
3.4.4 Abnormal Discharge Events .....	10
3.5 Complaints.....	10
3.6 Effluent Quality Assurance and Control Measures .....	11
3.7 Odour Reduction Plan .....	11
4 CAPITAL PROJECTS.....	12
5 MAINTENANCE .....	14
6 UTILITIES .....	15

7	ADMINISTRATION .....	16
7.1	Operations and Maintenance Costs.....	16
7.2	Human Resources.....	17
7.3	Occupational Health & Safety .....	17
7.4	Staff Training and Development .....	18
7.5	Utility Operator Certification .....	19
7.6	MECP/MOL Correspondence .....	19

## APPENDICIES

APPENDIX A – Plant Schematic

APPENDIX B – Influent and Effluent 2018 Performance Charts

APPENDIX C – Historical Performance Data

APPENDIX D – Influent and Effluent Metal Concentrations

APPENDIX E – Digested Sludge Analysis

APPENDIX F – Odour Reduction Plan

APPENDIX G – Maintenance Activities

APPENDIX H – Staff Training Courses

## LIST OF TABLES

Table 1: Final Effluent Parameters.....	5
Table 2: Process Summary .....	6
Table 3: Chemical Usage and Chemical Cost Summary .....	8
Table 4: Bypass Summary .....	9
Table 5: Spills Summary .....	10
Table 6: Capital Projects .....	12
Table 7: Summary of Regulated Monitoring Equipment Calibration and Maintenance.....	14
Table 8: Average Unit and Total Utility Cost.....	15
Table 9: Plant Staffing .....	17
Table 10: Wastewater Treatment Certificates .....	19
Table 11: Correspondence submitted to the MECP and MOL.....	20

## LIST OF FIGURES

Figure 1: Annual Utility Consumption (Water, Hydro, Gas) .....	15
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Figure 2: Operations and Maintenance Cost Breakdown.....	16
Figure 3: Humber Treatment Plant Health & Safety Injury Summary.....	18

## GLOSSARY OF ABBREVIATIONS

AAC	Annual Average Concentration
BOD5	Five-Day Biochemical Oxygen Demand
CBOD5	Five-Day Carbonaceous Biochemical Oxygen Demand
CEU	Continuing Education Units
CFU	Colony Forming Units
DAF	Dissolved Air Flotation
E. Coli	Escherichia Coli
ECA	Environmental Compliance Approval
Fe	Iron
HTP	Humber Treatment Plant
HP	Horsepower
HRT	Hydraulic Retention Time
kg	kilogram
kWh	Kilowatt-hour
MAC	Monthly Average Concentration
MGMD	Monthly Geometric Mean Concentration
MWh	Megawatt-hour
m <sup>3</sup>	Cubic metre
m <sup>3</sup> /day	Cubic metre per day
mA	Milliamps
mg/L	Milligrams per litre
mL	Millilitre
ML	Megalitre (million litres)
MECP	Ministry of the Environment, Conservation and Parks
Q	Flow Rate
RAS	Return Activated Sludge
SBS	Sodium Bisulphite
scm	Standard Cubic Meters
SS	Suspended Solids
TRC	Total Residual Chlorine
TP	Total Phosphorus
TRS	Total Residual Sulphate
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
TWAS	Thickened Waste Activated Sludge
µg/L	Micrograms per litre
WAS	Waste Activated Sludge

**Definitions**

$$\text{Percent Removal (\%)} = 1 - \frac{\text{Concentration (Final)}}{\text{Concentration (Initial)}}$$

$$\text{Aeration Loading} = \left( \frac{\text{kg cBOD}}{\text{m}^3 \text{ aeration capacity}} \right) = \frac{(Q_{\text{Primary Effluent}} + Q_{\text{RAS}}) \times [\text{cBOD}_{5\text{primary effluent}}]}{V_{\text{aeration Tanks}}}$$

$$\text{Solids Capture (\%)} = \frac{\text{Centrifuge Feed TS} - \text{Centrate TSS}}{\text{Centrifuge Feed TS}} \times 100$$



## 1 INTRODUCTION

The Humber Treatment Plant is one of four wastewater treatment facilities operated by the City of Toronto under the responsibility of the Wastewater Treatment section of Toronto Water. The facility is located at 130 The Queensway, on the border of the old City of Toronto and former City of Etobicoke near the mouth of the Humber River. This area contains an estimated connected population of 685,000. The Humber Treatment Plant has a rated capacity of 473,000 m<sup>3</sup> per day or 473 ML/day.

Major treatment processes and equipment include screening and grit removal, primary treatment, secondary treatment, phosphorus removal with ferrous chloride, final effluent disinfection using sodium hypochlorite, and final effluent dechlorination using sodium bisulphite. Solids handling processes include stabilization by anaerobic digestion. The solids stabilized in these processes are primary (or raw) sludge as well as waste activated sludge thickened using high speed centrifuges. Treated effluent is discharged to Lake Ontario. Sludge (stabilized and non-thickened waste activated sludge) is transferred to the Ashbridges Bay Treatment Plant for disposal via the Mid-Toronto Interceptor (MTI). Numerous auxiliary systems are required for the proper operation of plant processes and include potable water, process water, HVAC, SCADA, electrical power distribution, natural gas, and, instrument air. Odour control is achieved by treating air through biofilters and granular activated carbon (GAC) filters located throughout the plant.

The Ministry of the Environment, Conservation and Parks (MECP) has classified the Humber Treatment Plant as a Class IV wastewater treatment facility under Regulation 129/04. The facility operates under Amended Environmental Compliance Approval No. 9032-ABZNYQ (July 21, 2016).

This report is a summary of plant operations and performance in 2019. Highlights of the report include a discussion of effluent quality and summaries of plant operations and maintenance, chemical and utility consumption, capital projects, operational costs and human resources.

## 2 PLANT PROCESS OVERVIEW

A description of the plant process is included below. A Plant process flow diagram is available in Appendix A. Additional information on the plant's process can be found on the City of Toronto website<sup>1</sup>.

### 2.1 Influent

Wastewater from the Queensway Sanitary Trunk Sewer and Humber Sanitary Trunk Sewer flows to the plant to a common influent channel. A portion of the Humber Treatment Plant sewershed consists of combined sanitary and storm sewers, causing plant influent to be sensitive to wet weather events.

### 2.2 Preliminary Treatment

Raw wastewater enters the Headworks for grit and screenings removal. Bar screens with 12 mm openings remove rags and debris. Ferrous chloride is applied to the distribution conduits to the Grit system for the first stage of phosphorous removal. Grit is removed in grit vortex chambers and aerated grit channels. The removed grit and screenings are hauled to a sanitary landfill site.

### 2.3 Primary Treatment

Primary Treatment occurs in the Primary Clarification Tanks, where the flow velocity of the wastewater is reduced to allow heavier solids to settle to the bottom and lighter solids float to the top. There are 11 Primary Clarification Tanks. Sludge collectors in the tanks sweep the settled sludge, called primary or raw sludge, into sludge hoppers. Floating solids called scum are collected from the top of the water and swept into scum hoppers. The primary sludge and scum is then pumped out for further treatment and the wastewater, called primary effluent, continues onto secondary treatment.

### 2.4 Secondary Treatment

The primary effluent receives secondary treatment through a conventional, suspended biomass activated sludge process in the Aeration Tanks. The mixed liquor consists of primary effluent mixed with return activated sludge (RAS), which is removed from the Final Clarification Tanks and contains micro-organisms that naturally occur in wastewater and

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<sup>1</sup> <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/>

facilitate its degradation. In the presence of oxygen, these micro-organisms break down organic material in the wastewater. Air is supplied to the Aeration Tanks through nine electrically driven blowers. There are a total of eight Aeration Tanks each equipped with fine bubble dome diffusers. Ferrous chloride is applied at the end of the aeration tanks prior to the Final Clarification Tanks for the second and final stage of phosphorous removal.

The mixed liquor from the Aeration Tanks flows to 21 large quiescent Final Clarification Tanks, where the Activated Sludge is allowed to settle. A controlled quantity of this sludge is returned to the Aeration Tanks as RAS in order to maintain a sufficient biomass concentration. The excess is removed as Waste Activated Sludge (WAS) and thickened using centrifuges.

## 2.5 Final Effluent

Sodium Hypochlorite is used to disinfect and kill pathogens in the final effluent. Sodium Bisulphite (SBS) is added after disinfection to remove excess chlorine (dechlorinate) from the wastewater; helping to protect the aquatic environment. The final effluent is discharged to Lake Ontario. The plant uses direct measurement of Total Residual Chlorine (TRC), in the final effluent for monitoring and compliance.

## 2.6 Solids Handling

Primary sludge and scum, from the Primary Clarification Tanks, is first fed into primary anaerobic digesters. Secondary sludge (WAS), from the Secondary Clarification Tanks, is thickened through centrifugation before it is also fed into primary digesters, where it undergoes the same process as primary sludge. Centrifugation reduces the volume of sludge by separating solids from liquid. The Thickening process consists of seven centrifuges. Unthickened WAS may also be pumped directly to the Ashbridges Bay Treatment Plant via the MTI.

Anaerobic digestion is the biological degradation (stabilization) of organic materials (sludge and scum) in the absence of oxygen – it reduces volume of solids, destroys pathogens and mitigates sludge odour. The process produces digester gas, made up predominantly of methane. This gas is used as a supplementary fuel for plant needs, including process and space heating and the generation of electricity via two cogeneration engines, thereby reducing the plant's operating costs and carbon footprint. The digesters are operated in the mesophilic temperature range (34 – 38°C). The target operating temperature for the digesters is 36°C.

The resulting anaerobically digested sludge (biosolids) is subsequently transferred to the secondary digesters for storage, until it is ultimately transferred to the Ashbridges Bay Treatment Plant via the MTI for further treatment.

### 3 PROCESS SUMMARY

#### 3.1 Process Parameters

In 2019, the Humber Treatment Plant continued to produce a high quality effluent. A summary of key final effluent parameters against the ECA objectives and limits are shown in Table 1. Regulated parameters are highlighted. Influent and effluent performance charts are available in Appendix B. Historical performance data is included in Appendix C.

Table 1: Final Effluent Parameters

Parameter	cBOD <sub>5</sub> (mg/L)	TSS (mg/L)	TP (mg/L)	Total Residual Chlorine (mg/L)	E-Coli (count/ 100mL)	pH	
						Min	Max
January	5.8	8.7	0.5	0.011	76	6.9	7.4
February	6.9	9.5	0.5	0.009	104	6.8	7.1
March	6.3	9.3	0.4	0.006	92	6.8	7.2
April	4.5	6.8	0.3	0.006	159	6.5	7.5
May	4.2	7.2	0.3	0.004	40	6.5	6.9
June	5.2	9.0	0.4	0.011	147	6.4	6.9
July	4.9	9.3	0.5	0.007	21	6.4	6.8
August	5.2	10.9	0.5	0.012	67	6.7	7.1
September	4.9	12.0	0.5	0.013	74	6.7	7.4
October	6.0	12.4	0.6	0.014	83	6.5	7.7
November	5.0	11.3	0.4	0.008	52	6.7	7.4
December	5.4	9.9	0.3	0.006	85	6.7	7.4
Annual Average	5.4	9.7	0.4	0.009	83	6.9	
Loading (kg/d) <sup>1</sup> Removal Efficiency <sup>2</sup> (%)	1681	3042	139.5	N/A	N/A	N/A	
	97%	97%	92%	N/A	N/A	N/A	
ECA Requirements <sup>4, 5</sup>							
Effluent Objective	AAC: 15.0	AAC: 15.0 mg/L	MAC: 0.9 mg/L	MAC: 0 mg/L	MGMD: 150	6.5-8.5	
Effluent Limit	AAC: 25.0	AAC: 25.0mg/L	MAC: 1.0 mg/L	MAC: 0.02 mg/L	MGMD: 200	6.0-9.5	
Average Waste Loading Limit <sup>1</sup>	N/A	N/A	AAL: 473.0 kg/d	N/A	N/A	N/A	

<sup>1</sup> Loading is calculated based on the flow rates as provided in Table 2.

<sup>2</sup> cBOD = 0.8 \* BOD assumed for removal efficiency calculations

<sup>3</sup> Referenced from Amended Environmental Compliance Approval No. 9032-ABZNYQ, issued on July 21, 2016.

<sup>4</sup> AAC refers to Annual Average Concentration, MAC refers to Monthly Average Concentration, MGMD refers to Monthly Geometric Mean Density, and AAL refers to Annual Average Daily Loading.

Influent and Final effluent concentrations of 11 select heavy metals have been included in Appendix D. Any discharge into City sewers must meet the sewer use By-law limits. Final effluent concentrations are presented to assess the treatment plant's removal capacity.

A summary of the annual averages of process parameters over the past three years are shown in Table 2.

Table 2: Process Summary

Parameter	Units	2019	2018	2017
Flow <sup>1</sup>	ML/day	313.9	286.1	331.7
Total Annual Flow <sup>1</sup>	ML	114,566	104,417	121,062
Influent Parameters				
Total Suspended Solids (TSS)	mg/L	293.3	280.8	301.2
Biochemical Oxygen Demand (BOD <sub>5</sub> )	mg/L	247.6	247.8	255.2
Total Phosphorus (TP)	mg/L	5.3	5.2	5.3
Preliminary Treatment				
Grit and Screenings	Tonnes/day	3.7	4.1	2.1
Primary Treatment				
TSS	mg/L	89.8	95.7	102.0
cBOD <sub>5</sub>	mg/L	152.1	140.9	118.3
Secondary Treatment				
Aeration Loading	kg CBOD <sub>5</sub> /m <sup>3</sup> .day	0.52	0.44	0.41
Mixed Liquor Suspended Solids	mg/L	3,109	2,839	2,842
Solids Handling				
Primary Sludge Treated	m <sup>3</sup> /day	2,564	2,627	2,814
Primary Sludge TS	%	1.5	2.1	1.9
Primary Sludge TVS	%	69.2	76.7	73.6
WAS to Thickening	m <sup>3</sup> /day	5,107	3,697	3,776
WAS SS	mg/L	9,302	9,499	8,806
TWAS TS	%	3.5	3.7	4.6
TWAS TVS	%	76.6	74.9	77.6
TWAS Treated	m <sup>3</sup> /day	549	961	697 <sup>2</sup>
Digester Gas Volume	m <sup>3</sup> /day	23,852	26,717	26,248

<sup>1</sup> Flow monitoring is provided by influent flow meters. There are no effluent flow meters due to infrastructure limitations. There is no appreciable difference between influent and effluent flow rates at the Humber Treatment Plant.

<sup>2</sup> A data quality error resulted in the over reporting of TWAS Treated in the 2017 report. The correct value was 697 m<sup>3</sup>/day rather than 715 m<sup>3</sup>/day.

In 2019, the total annual influent flow increased by 9.7% as compared to 2018. Over the past 5 years, sewage flow to Humber Treatment Plant remained relatively stable, with increases seen in 2019 and 2017, years associated with wet weather and high levels in Lake Ontario. The TP concentrations of the sewage have remained relatively constant over the last 5 years, while the TKN, BOD5 and TSS have decreased slightly.

In 2019 final effluent TSS concentrations decreased by 12% while TP concentrations and loading rates decreased by 28% and 22% respectively. This increased removal efficiency for both TSS and TP is due to improved process control and ongoing plant-wide upgrades.

Total residual chlorine (TRC) in the final effluent decreased by 14% with respect to 2018 levels due to dechlorination process optimization. The objective for TRC is given as non-detect. The MECP gives a regulatory method detection limit (RMDL) of 0.01 mg/L for the recommended amperometric method. The Humber treatment plant uses an alternate approved method (colourimetric) for which the MECP does not give a RMDL but which has a lower measurement range, as specified by the manufacturer, of 0.002 mg/L. This allows for more significant figures to be reported. Considering the RMDL of 0.01 mg/L, the Humber Treatment Plant met the objective for TRC in all months.

Final effluent pH remained within the objective range at all times except for in June and July. The plant remained within pH limit ranges at all times.

In 2019 E.coli increased by 22% in comparison to 2018. The plant exceeded effluent objectives in all months but April but was within the effluent limits at all times.

In 2019 the volume of TWAS treated by anaerobic digestion had decreased by 43% from the volume reported in 2018. The value reported in 2018 was an estimate due to an equipment issue. The equipment was fully functional in 2019.

The amount of biogas that was produced in the digesters decreased by 11% from 2018. This decrease in production is consistent with a lower total volume of TWAS fed to digestion during 2019, as well as reduced available digester volume due to capital improvement projects.

In 2019, the Humber Treatment Plant encountered no chronic operating problems, and continued to produce a high quality effluent which surpassed requirements of the effluent objectives as described in Condition 6 of the plant's ECA except in the case of effluent E. coli and pH, where the limit was met at all times. This was achieved through continuous improvement in operations and maintenance of treatment processes, and infrastructure

delivery. The plant also met Federal Government WSER requirements for un-ionized ammonia and acute toxicity.

### 3.2 Biosolids Management

The flow projections for 2020 do not exceed the plant rated capacity of 473 ML/day and are expected to generate a sludge volume that will be +/- 5% of the volume generated in 2019.

All sludge generated at the Humber Treatment Plant is transferred to the Ashbridges Bay Treatment Plant for further treatment. The sludge generated (WAS and biosolids) during 2019 averaged 3,958 m<sup>3</sup>/day (67 dry tonnes per day). A summary of the digested sludge parameter analysis is included in Appendix E.

### 3.3 Chemical Usage

Several chemicals are used during the treatment process at the plant. Table 3 outlines the chemical consumption for the current and previous years. Costs listed are plus applicable taxes.

Table 3: Chemical Usage and Chemical Cost Summary

Process	Chemical		2019	2018	2017
Phosphorus Removal	Ferrous Chloride as Fe	Dosage as Fe (mg/L)	5.6	6.8	4.8
		Consumption (tonnes as Fe)	639.7	714.2	583.6
		Cost (\$)	511,770.00	571,366.24	391,091.66
Disinfection	Sodium Hypochlorite (12% w/v)	Dosage as Cl (mg/L)	4.42	5.67	6.06
		Consumption (m3)	3798.3	4442.3	5505.0
		Cost (\$)	648,042.00	724,981.00	729,079.85
Dechlorination	Sodium Bisulphite (38 w/w)	Dosage (mg/L)	2.21	2.74	2.58
		Consumption (tonnes)	666.3	753.5	820.4
		Cost (\$)	143,917.00	162,757.00	186,203.40
Thickening	Polymer	Dosage (mg/L)	0	0	0
		Consumption (kg/d)	0	0	0
		Cost (\$)	-	-	-

### 3.4 Bypasses, Overflows, Spills, and Abnormal Discharge Events

#### 3.4.1 Bypasses

There were 19 bypass events in 2019. The total volume of bypass flow was 444 ML, or 0.39% of the annual flow. A bypass is defined as a diversion of sewage around one or more unit



processes within the plant with the diverted sewage flows being returned to the plant treatment train upstream of the final effluent sampling location, and discharging to the environment through the plant outfall. All bypass flow received preliminary, primary treatment, nutrient removal, as well as disinfection and dechlorination and exit the plant through the plant outfall upstream of the final effluent sampling point. Each instance was reported to the MECP Spills Action Center and recorded into the plant's Monthly report. Secondary bypasses occur due to high wet weather flows that exceed the plant's secondary treatment capacity. Total precipitation in the Toronto area<sup>2</sup> was 908 mm in 2019, a 1% decrease from 2018.

*Table 4: Bypass Summary*

Date	Start of Event	End of Event	Active Duration <sup>1</sup> (hr)	Duration (hr)	Volume (m <sup>3</sup> )
February 4-5, 2019	23:30	1:30	2	2	2,599
March 14-15, 2019	21:10	4:20	7.2	7.2	24,383
March 30, 2019	13:50	23:15	5.4	5.4	16,555
March 31, 2019	14:47	15:30	0.8	0.8	1,727
April 14, 2019	21:46	1:15	3.5	3.5	40,204
April 19, 2019	14:45	16:25	1.7	1.7	5,419
April 20, 2019	12:25	20:05	5.0	7.7	16,877
April 26, 2019	7:35	12:55	5.3	5.3	23,868
May 1, 2019	18:30	20:40	2.2	2.2	9,520
May 3, 2019	18:30	20:40	4.5	4.5	10,087
May 25, 2019	18:45	21:25	2.7	2.7	23,828
June 10, 2019	19:55	20:20	0.33	0.33	55
June 20, 2019	19:50	23:30	3.7	3.7	35,985
July 17, 2019	10:35	20:47	7.10	10.2	69,573
August 17, 2019	15:45	17:10	1.4	1.4	8,332
October 16, 2019	8:45	9:50	1.1	1.1	2,920
October 27, 2019	4:15	12:33	4.4	4.4	42,424
October 31, 2019	15:35	21:50	6.25	6.25	95,650
December 14, 2019	11:45	14:10	2.25	2.25	14,228

<sup>1</sup> In wet weather the plant may bypass intermittently. The active duration is the period for which the bypass was actively occurring, whereas the duration is the total duration for the event.

<sup>2</sup> Adapted from [http://climate.weather.gc.ca/historical\\_data/search\\_historic\\_data\\_e.html](http://climate.weather.gc.ca/historical_data/search_historic_data_e.html), Toronto City Station

### 3.4.2 Overflows

There were no overflow events at the Humber Treatment Plant in 2019. An overflow is defined as a discharge to the environment from the plant at a location other than the plant outfall or into the plant outfall downstream of the final effluent sampling station.

### 3.4.3 Spills

There were three spills reported to the MECP in 2019; they are summarized in Table 5 below. A spill is defined within the meaning of Part X of the Environmental Protection Act.

*Table 5: Spills Summary*

Date	Duration (hr)	Volume (m <sup>3</sup> )	Nature of event	Description
01-Feb-19	0.08	N/A	Digester gas release	Digester 9 gas release due to local power interruption
28-Feb-19	0.33	N/A	Digester gas release	Digester gas build-up in system due to process equipment isolation and maintenance
19-Dec-19	1	Estimated 50 - 100 L	Digester sludge spill	Digester 7 sludge spill due to clogged overflow pipe

### 3.4.4 Abnormal Discharge Events

There were no abnormal discharge events at the Humber Treatment Plant in 2019.

## 3.5 Complaints

The Humber Treatment Plant received six complaints related to odour and two complaints related to noise. The odour complaints were received on July 8th, 2019, August 3rd, 2019, September 9th, 2019, September 19th, 2019 and September 24th, 2019. In multiple cases the investigation did not identify any unusual odours, so no corrective action was warranted. In other two instances, the odours were suspected to be related to primary and final tank cleanings. The noise complaints occurred on March 24th, 2019 and March 27th, 2019. The cause of both noise complaints was determined and the issues were swiftly corrected.

All complaints were recorded, investigated by Toronto Water Staff, reported to the MECP, and followed up on with the complainant.

A table of correspondence related to complaints can be found in Section 7.6.

### **3.6 Effluent Quality Assurance and Control Measures**

Analytical tests to monitor required parameters are performed by the Toronto Water Laboratory which is accredited to ISO/IEC 17025 by Canadian Association for Laboratory Accreditation Inc. Plant operation and performance is monitored by licensed operators as well as by the facility management team. Standard Operation Procedures, emergency plans, equipment preventative and predictive maintenance, and a network of support staff, help ensure a rapid and effective response to issues, and maintain the high quality of the effluent and biosolids. A hybrid Quality and Environmental and Health and Safety Management System is also in development and will be reported on in future Annual Reports.

### **3.7 Odour Reduction Plan**

As per Section 8 (4) of the Humber Treatment Plant Amended ECA – Air No. 0858-AEXNV7 issued July 12, 2017, a review of the Odour Reduction Plan summarizing the work progress in 2019, including activities to reduce emissions of odour and total reduced sulphur, the estimated emissions reduction for each activity, and the schedule for completion of each activity can be found in Appendix F.

## 4 CAPITAL PROJECTS

Under Toronto Water's capital program, the Humber Treatment Plant commenced or continued with the capital works projects and studies listed in Table 6 in 2018.

*Table 6: Capital Projects*

Project Name	Project Description	Project Stage (Dec 31, 2019)
Odour Control Upgrades	Preliminary treatment process improvements and odour control system replacement including construction of two new biofilters.	Complete
West Substation Upgrades	Electrical Upgrades to existing substation.	Complete
ECS Site Office	Prefabricated Building to accommodate City project staff on site.	Complete
Digester 2&3 Cleaning	Clean out of digesters 2 and 3.	Construction
Secondary Process Upgrades	Refurbishment of south aeration system including expanded return activated sludge pumping station, new plant water pumping station, new phosphorus removal system.	Construction
HVAC Upgrades	Refurbishment of HVAC system and potable water system.	Construction
PLC Platform Upgrade	Replacement of outdated control hardware for reliability.	Construction
Primary Pumping and Scum	Upgrade of north primary treatment sludge and scum systems.	Construction
TW Operations Centre	Expansion of the operations centre to meet current and future needs.	Construction
Waste Gas Burner Upgrades	Replacement of existing waste gas burners to meet regulations and improve proves efficiency.	Construction
Services Upgrades	A comprehensive project to rehabilitate and upgrade plant wide process and maintenance support services at the HTP. This will include, the plant hot water system, HVAC, digesters, sludge thickening, south primary treatment, headhouse,	Design

Project Name	Project Description	Project Stage (Dec 31, 2019)
	north grit, new maintenance shop, secondary treatment and other miscellaneous required upgrades	
Flood Protection Study	Study to determine the adequacy of current flood protection measures	Study
Building Condition Assessment	Study to determine the condition of building on site in order to plan maintenance projects and capital upgrades.	Study
Wet Weather Flow Study	Study to identify ways to handle increased flows and higher lake levels, as well as decrease the quantity and increase the quality of bypass flows.	Study

## 5 MAINTENANCE

Staff from the Humber Treatment Plant performed a variety of scheduled, preventative, predictive and reactive maintenance activities on a diverse spectrum of equipment. Equipment availability and reliability ensures operational requirements are achieved.

The annual calibration and maintenance records of flow meters and on-line analysers for regulated parameters was completed in 2019, and found to be within acceptable limits. A summary of effluent monitoring equipment calibration and maintenance performed in 2019 is included in Table 7.

*Table 7: Summary of Regulated Monitoring Equipment Calibration and Maintenance*

Calibration and/or Maintenance Record	Completion Date
Influent Flow Meter THR-PLT-FIT-2001A - Verification	April 2, 2019
Aeration Flow Meter THR-AER-FIT-0602 - Verification	Dec 17, 2019
Aeration Flow Meter THR-AER-FIT-0702 - Verification	Dec 17, 2019
Aeration Flow Meter THR-AER-FIT-0802 - Verification	Dec 17, 2019
Effluent pH analyzer THR-EPS-AIT-0055 - Calibration	February 5, 2019 / August 7, 2019
Effluent pH analyzer THR-EPS-AIT-0055 - Verification	February 5, 2019 / August 7, 2019
Effluent temperature analyzer THR-EPS-TIT-0053 - Verification	March 15, 2019 / September 11, 2019
HACH DR3900 Spectrophotometer THR-ELS-INQ-3900 - Calibration	January 23, 2019

In 2019, there were a total of 11,675 work orders completed; refer to Appendix G for a summary of maintenance activities as per Conditions 10(6)(c) of the ECA. None of the maintenance activities undertaken at the plant fell under Limited Operational Flexibility; as a result, no Notices of Modifications were submitted to the Water Supervisor as per Condition 10(6)(j) of the ECA. Regular safety inspections and preventative maintenance was performed on the life safety systems at the plant in 2019.

## 6 UTILITIES

A summary of monthly utility consumption for the previous three years at Humber Treatment Plant is provided in *Figure 1*. Table 8 below summarizes the total cost and average unit cost for water, hydro, and natural gas. Total annual consumption of potable water, hydro, and natural gas was 287,036 m<sup>3</sup>, 49.8M kWh, and 2.5M m<sup>3</sup>, respectively.

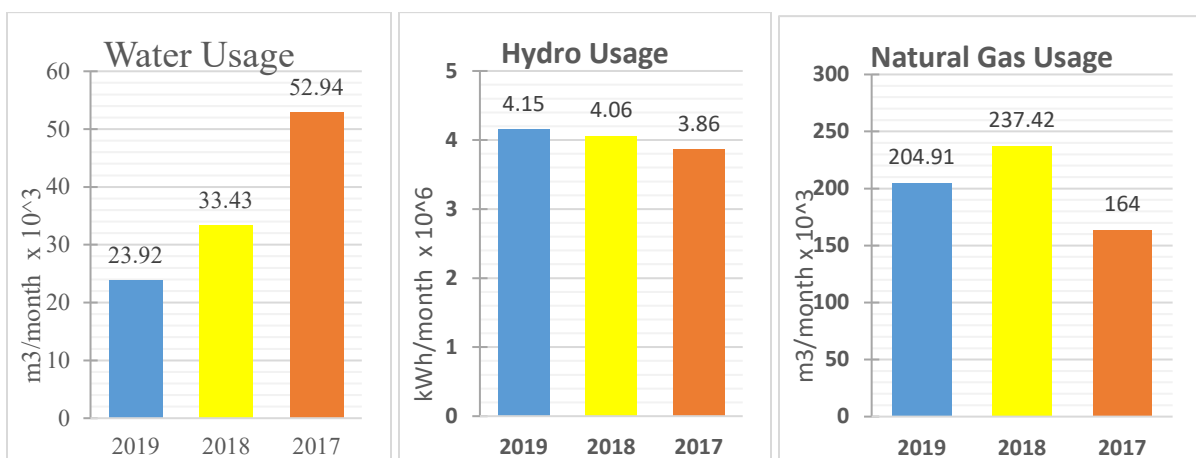


Figure 1: Annual Utility Consumption (Water, Hydro, Gas)

Table 8: Average Unit and Total Utility Cost

Utility	2019	2018	2017
Water Unit Cost (\$/m <sup>3</sup> )	4.12	4.00	3.81
Water Total Cost (\$/year)	1.18M	1.61M	2.42M
Hydro Unit Cost (\$/kWh)	0.11	0.10	0.10
Hydro Total Cost (\$/year)	5.35M	4.84M	4.43M
Natural Gas Unit Cost (\$/m <sup>3</sup> )	0.22	0.23	0.24
Natural Gas Total Cost (\$/year)	545,350	648,304	470,741

The significant decrease in water consumption reported is the result of a malfunctioning billing metre. The meter is expected to be repaired in 2020 and unbilled water consumption reflected at that time.

## 7 ADMINISTRATION

### 7.1 Operations and Maintenance Costs

The 2019 plant direct operational costs are broken down into five categories: Salaries and Benefits, Materials and Supplies, New Equipment, Services and Rents, and Inter-Divisional Charges. Materials and Supplies is further segregated into Utilities, Machine & Equipment Parts, Chemicals and Other Materials and Supplies. A breakdown of annual operations and maintenance costs for the past three years is illustrated in Figure 2 . Overall, operational costs decreased 11.8% from 2018.

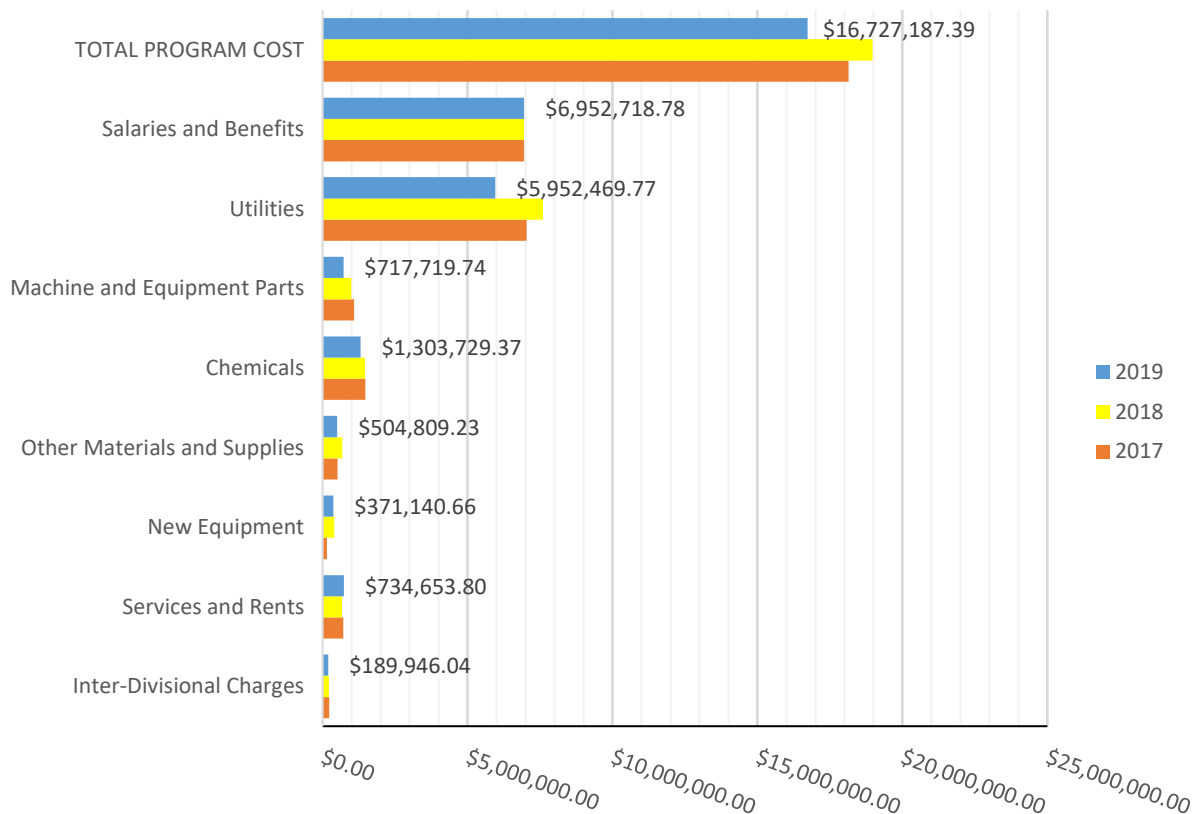


Figure 2: Operations and Maintenance Cost Breakdown



## 7.2 Human Resources

Plant Staffing at the Humber Treatment Plant in 2019 is shown in Table 9.

*Table 9: Plant Staffing*

Position	Number of FTE <sup>1</sup>
Plant Manager	1
Senior Engineer	2
Area Supervisors	4
Electrical & Instrumentation Specialist	1
Plant Technicians	16
Industrial Millwrights	19
Electrical Instrumentation Control Technicians	7
Wastewater Treatment Plant Workers	6
Support Assistant/Materials Management	3
Engineering Technologist	1
<b>Total FTE Positions</b>	<b>60</b>

<sup>1</sup> FTE refers to Full Time Equivalent staff. Seasonal staff are considered 0.5 FTE staff.

## 7.3 Occupational Health & Safety

Continuous efforts are made to ensure a safe working environment at the Humber Treatment Plant. The Joint Health and Safety Committee (JHSC) assists management in resolving issues through regular meetings and monthly workplace inspections. Plant Health and Safety statistics for the Humber Treatment Plant are included in Figure 3.

As of December 31, 2019, there were five health and safety incidents, and a total of 2 lost time days due to work related injuries.

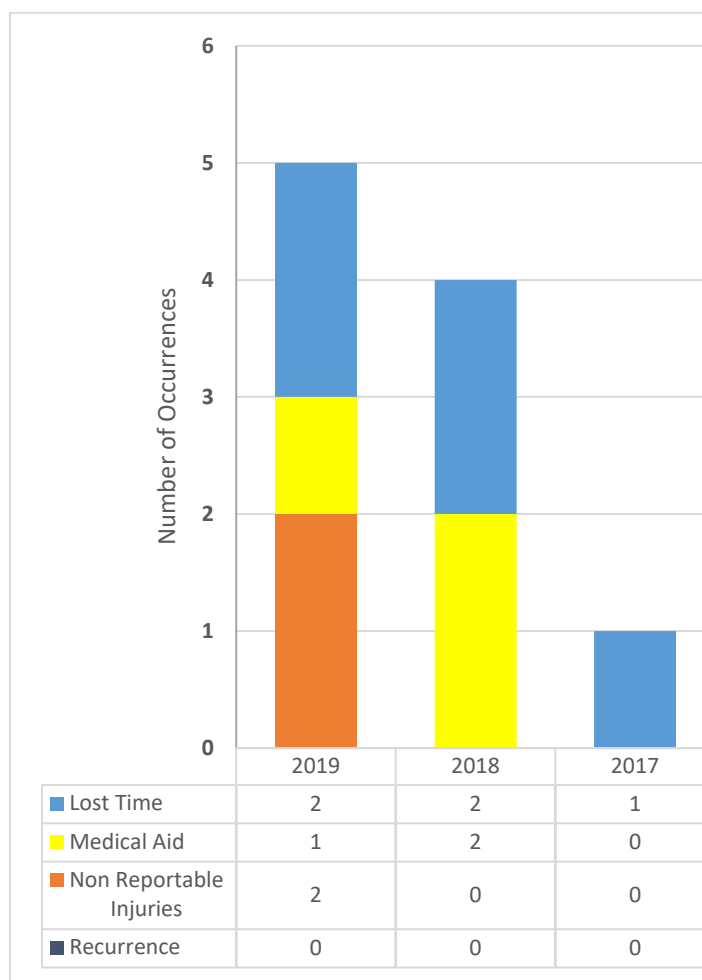


Figure 3: Humber Treatment Plant Health & Safety Injury Summary

## 7.4 Staff Training and Development

The Strategic Planning and Workforce Development unit of Toronto Water facilitates a comprehensive training program for all staff.

Training attended by Humber Treatment Plant operations and skilled trades staff in 2019 includes the list of courses shown in Appendix E. Some of these courses were eligible for Continuing Education Units (CEU's) from the Ontario Environmental Training Consortium (OETC). Additional training related to the start-up and commissioning of new equipment/systems installed as part of the capital program was provided as required.

## 7.5 Utility Operator Certification

Toronto Water trains and provides the required resources to ensure all operators achieve and maintain Class IV certifications. In addition, all skilled trade positions are required to achieve and maintain a Class I operator's licence. As part of this initiative, general operational/process training was delivered in order to prepare staff for any certification examination that they need to write. Table 10 summarizes the status of operator certification at the Humber Treatment Plant in 2019.

*Table 10: Wastewater Treatment Certificates*

Class Level	Number of Licenses
Class IV	16
Class III	4
Class II	2
Class I	14
O.I.T.	15
Total	51

## 7.6 MECP/MOL Correspondence

There were no orders issued by either the Ministry of the Environment, Conservation and Parks (MECP) or the Ministry of Labour (MOL).

Reports were submitted to the MECP for the six odour complaints and two noise complaints received at the plant in 2019. Reports for the 19 bypass events that occurred were also submitted. Table 11 summarizes the correspondence submitted to the MECP and MOL for the Humber Treatment Plant. Correspondence related to spills and bypasses can be referenced in sections 3.4.3 and 3.4.1.

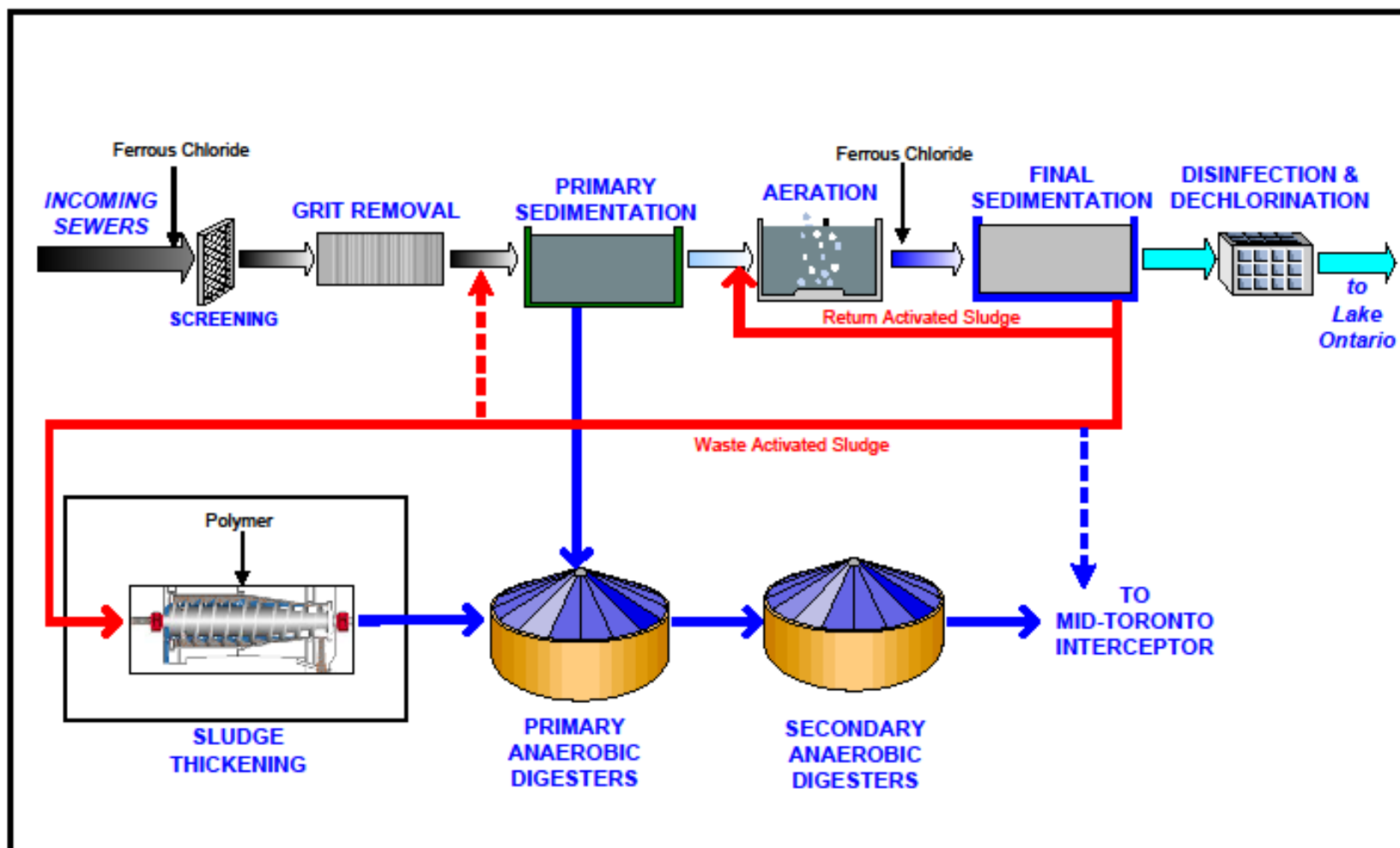
*Table 11: Correspondence submitted to the MECP and MOL*

Event Date	Type	Description	Resolution	Resolution Date
<b>24-Mar-19</b>	Noise	A resident complained of continuous humming noise since March 21.	Plant Technician determined cause of humming to be due to exhaust fan that was experiencing mechanical issues. The fan was shut down and replaced by the standby unit. The resident was satisfied that the noise had ceased.	25-Mar-19
<b>27-Mar-19</b>	Noise	The resident who had called to complain about a continuous humming noise on march 24, 2019, called back to notify the plant that the noise had returned. The faulty fan had been turned back on.	The plant Technician promptly shut down the fan. The fan was then locked out to prevent further operation until the issue was fixed. The resident was once again satisfied with the resolution.	27-Mar-19
<b>8 &amp; 9-July-19</b>	Odour	A resident complained of an offensive odour that was not typical.	The plant Technician who investigated the complaint could not observe abnormal plant odours. Two possible causes were identified. 1) Final Tank 11 draining and cleaning, 2) Two Empty Grit bins near Final Tank 11. The resident was satisfied that the smell had ceased.	10-Jul-19
<b>03-Aug-19</b>	Odour	Resident complained of odour throughout the previous night. The odour was described as still present, but less intense by the time of the call at 7:40 AM	The plant Technician who investigated the complaint did not observe abnormal plant odours. As a result, cause could not be identified and the resident was notified.	03-Aug-19

Event Date	Type	Description	Resolution	Resolution Date
03-Aug-19	Odour	Resident complained of odour throughout the previous night. The odour was described as still present, but less intense by the time of the call at 8:15 AM	The plant Technician who investigated the complaint did not observe abnormal plant odours. As a result, cause could not be identified and the resident was notified.	03-Aug-19
09-Sep-19	Odour	A resident complained via email about an odour which seemed stronger than usual.	The plant Technician did not detect any unusual odour but determined that it could be due to Final Tank 11 and/or Final Tank 5 having been drained and/or empty. The resident was informed that the cleaning of the tanks would be completed within a week.	10-Sep-19
19-Sep-19	Odour	A resident complained of an odour.	The plant Technician did not observe the odour and informed the resident that no unusual odour was present.	19-Sep-19
24-Sep-19	Odour	A resident complained of an odour.	The plant Technician did not detect any unusual odour but determined that the draining and cleaning of Primary Tank 1 was a possible cause. The resident was informed that odours should be alleviated once the cleaning was complete.	24-Sep-19
<b>Consent Letters</b>				
N/A				
<b>Notice of Start-up</b>				
N/A				
<b>MECP Inspection</b>				
No Inspection				
<b>MOL Correspondence</b>				
N/A				

## APPENDIX A – Plant Schematic

## APPENDIX A – Plant Schematic

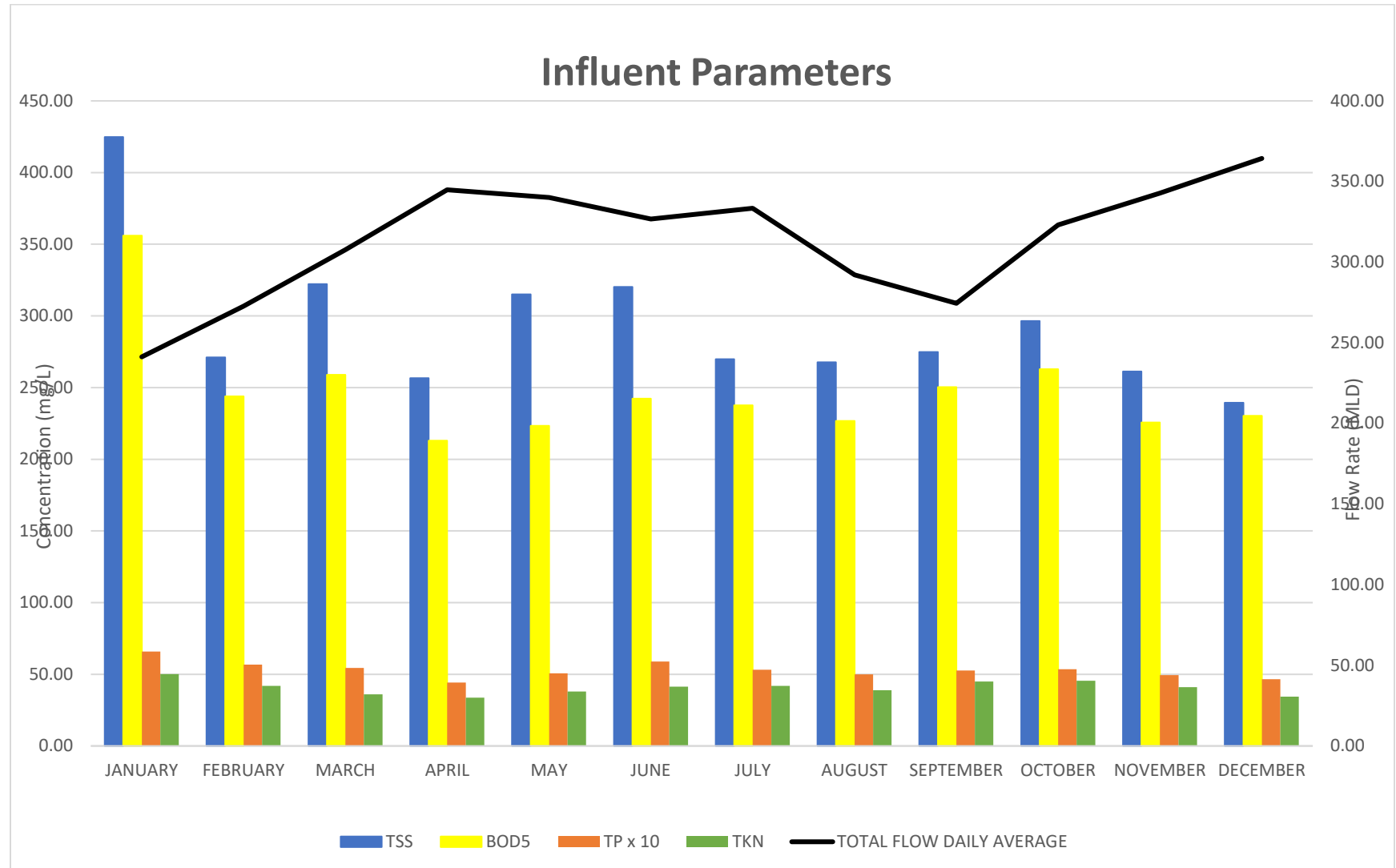


Process Flow Diagram for Humber Wastewater Treatment Plant

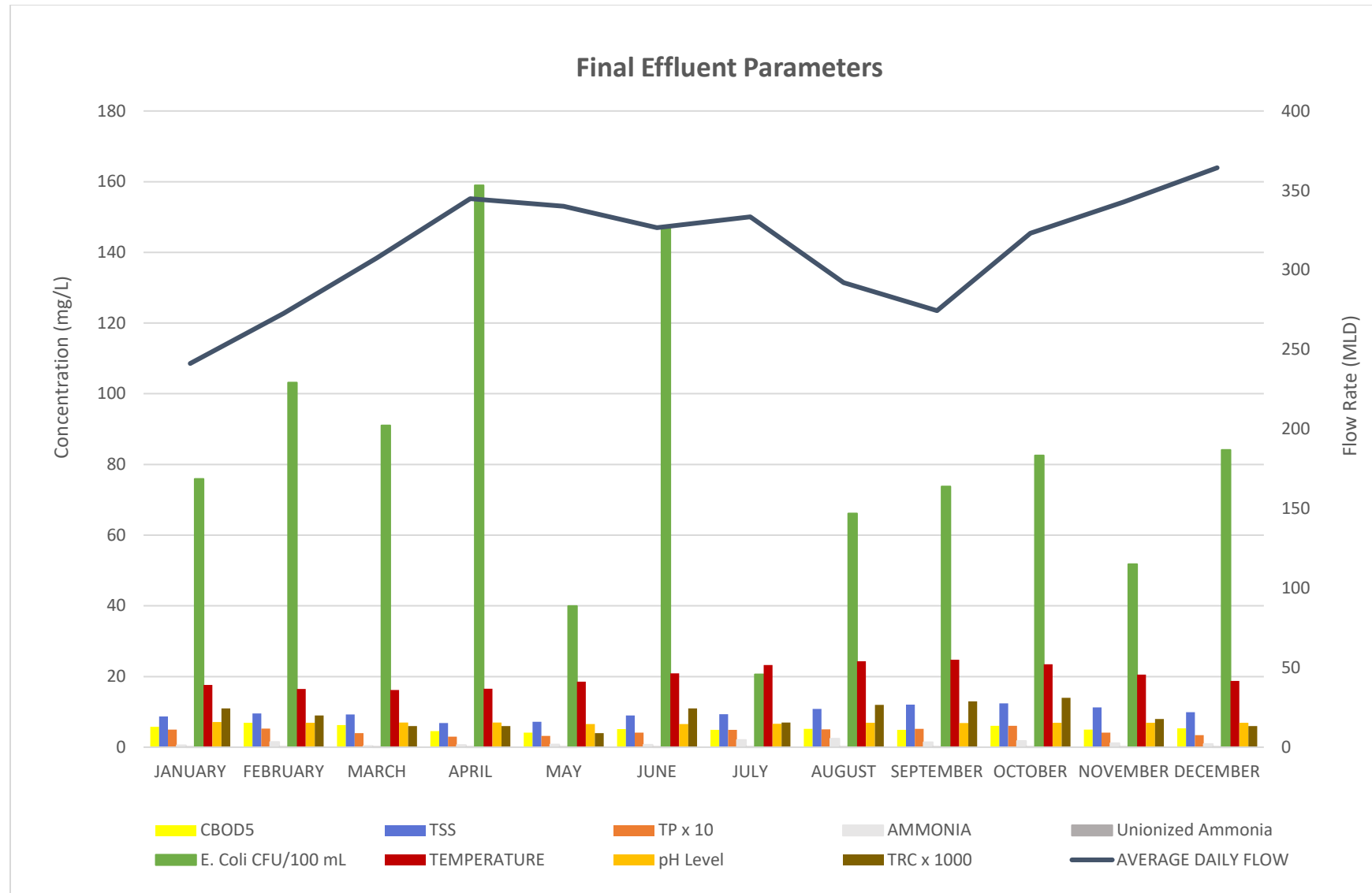
## APPENDIX B – Influent and Effluent 2019 Performance Charts



## APPENDIX B – Influent and Effluent 2019 Performance Charts



## APPENDIX B – Influent and Effluent 2019 Performance Charts



## APPENDIX C – Historical Performance Data

## APPENDIX C – Historical Performance Data

	Units	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2019
<b>Influent Parameters</b>												
Flow	ML/day	313.9	286.1	331.7	257.3	269	280.5	312	287.5	379	362	300
Total Annual Flow	ML	114566	104417	121,062	94168	98174	102364	113709	105444	137971	132289	113060
Total Suspended Solids (TSS)	mg/L	293.3	280.8	301.2	331	369	356	318	405	446	290	354
Biochemical Oxygen Demand (BOD <sub>5</sub> )	mg/L	247.6	247.8	255.2	299	318	295	238	261	267	250	212
Total Phosphorus (TP)	mg/L	5.3	5.2	5.3	5.8	5.8	5	4.4	4.9	5.1	4.8	4.6
Total Kjeldahl Nitrogen (TKN)	mg/L	40.6	40.0	39.8	45.2	42.7	38.4	39.31	43.42	40.4	35.17	35.9
<b>Preliminary Treatment</b>												
Grit and Screenings	tonnes/day	3.7	4.1	2.1	1.6	2.2	2.1	3.4	1.8	2.2	14.5	2.4
<b>Primary Treatment</b>												
TSS	mg/L	90	96	102	94	97	101	151	148	126	100	97
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	mg/L	152.1	140.9	118.3	158	156	138	142	160	145	139	106
<b>Secondary Treatment</b>												
Aeration Loading	kg CBOD <sub>5</sub> / m <sup>3</sup> .day	0.52	0.44	0.41	0.38	0.39	0.37	0.4	0.47	0.57	0.45	0.32
Mixed Liquor Suspended Solids	mg/L	3109	2839	2,842	2953	2838	2998	2885	2151	2741	2384	2238
<b>Final Effluent</b>												
Final Effluent Daily Average Flow	ML/day	312	285	321	257	268	276	306	288	380	361	308
TSS	mg/L	10	11	13	13	11	12	13	15.7	13.1	11.8	14
TSS Loading Rate	kg/day	3042	3157	4,322	3341	2952	3306	4050	4523	4970	4194	4200
cBOD <sub>5</sub>	mg/L	5.4	5.9	6.6	5.7	5.4	4.8	6.0	6.0	7.6	6.1	7.0
cBOD <sub>5</sub> Loading Rate	kg/day	1681	1678	2,202	1465	1449	1322	1869	1728	2880	2209	2100
TP	mg/L	0.44	0.60	0.80	0.70	0.77	0.67	0.65	0.64	0.40	0.50	0.70
TP Loading Rate	kg/day	140	178	250	180	210	210	202	184	166	179	210
Escherichia Coli (E. Coli)	CFU/100 mL	82.9	67.8	72	29	52	30	31	26	51	46	24
pH	-	6.9	7.0	8.0	7.2	7.4	7.0	7.0	7.0	7.6	7.5	7.3
Total Residual Chlorine	mg/L	0.0089	0.0065	SBS (P) / 0.009	SBS (P)	SBS (P)	SBS (P)	-	-	-	-	-
Total Kjeldahl Nitrogen (TKN)	mg/L	2.7	3.3	3.2	2.66	2.2	2.1	2.0	3.2	5.8	4.3	9.7
Total Ammonia Nitrogen	mg/L	1.2	1.7	1.6	1.2	1.4	0.9	0.7	1.0	3.0	5.4	6.6
Temperature	degrees Celsius	20	20	15.8	17.6	18.9	18.7	20.0	21.0	19.6	20.3	19.5

## APPENDIX C – Historical Performance Data

	Units	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2019
<b>Solids Handling</b>												
Primary Sludge Treated	m <sup>3</sup> /day	2,564	2,627	2,813	2689	2723	3495	2639	2532	2368	2661	3100
Primary Sludge Total Solids (TS)	%	1.5	2.1	1.9	-	-	-	-	-	-	1.69	2.19
Primary Sludge Total Volatile Solids (TVS)	%	69.2	76.7	73.6	-	-	-	-	-	-	78.7	71.29
Waste Activated Sludge (WAS) to Thickening	m <sup>3</sup> /day	5,107	3,697	3,776	3573	3135	3782	2984	3779	4536	4794	3960
WAS SS	mg/L	9,302	9,499	8,806	8630	9448	8863	10391	9012	7580	6877	7078
Thickened WAS (TWAS) TS	%	3.5	3.7	4.6	4	4.2	4.4	5.3	4.7	4.7	4.1	4.80%
TWAS VS	%	76.6	74.9	77.6	75	78.6	78	79	78.7	78.9	82.2	81%
TWAS Treated	m <sup>3</sup> /day	548.63	961.16	714	598	350	512	464	726	739	937	850
Digested Solids to ABTP	DT/day	64.6	72.9	80.0	59.0	57	64	57	54	48	39.1	40.6
WAS to ABTP	DT/day	2.7	4.9	4.9	5.0	17	11.7	5.8	1.7	4.7	4	14.8
Digester Gas Generated	10 <sup>3</sup> m <sup>3</sup> /day	23.9	26.7	26.2	28.1	25.4	24.6	20.3	21.3	17.5	15.6	15.5

## APPENDIX D – Influent and Effluent Metal Concentrations

## APPENDIX D – Influent and Effluent Metal Concentrations

*Influent (Daily Composite tested once/month for metals)*

Parameter	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	<i>0.005</i>	<i>0.002</i>	0.00834	<i>0.002</i>	0.133	1.5	0.00688	0.0765	<i>0.00005</i>	0.0104	0.189
February	<i>0.005</i>	<i>0.002</i>	0.0066	<i>0.002</i>	0.0989	1.24	0.00523	0.0653	<i>0.00005</i>	0.00734	0.143
March	<i>0.005</i>	<i>0.002</i>	0.00448	<i>0.002</i>	0.0631	1.09	0.00671	0.0625	<i>0.00005</i>	0.00674	0.0999
April	<i>0.005</i>	<i>0.002</i>	0.00742	<i>0.002</i>	0.0782	1.07	0.00515	0.0707	<i>0.00005</i>	0.00708	0.115
May	<i>0.005</i>	<i>0.002</i>	0.0067	<i>0.002</i>	0.0969	1.5	0.00645	0.0716	<i>0.00005</i>	0.00636	0.137
June	<i>0.005</i>	<i>0.002</i>	0.00704	<i>0.002</i>	0.105	1.74	<i>0.0025</i>	0.0728	<i>0.00005</i>	0.00797	0.189
July	<i>0.005</i>	<i>0.002</i>	0.00605	<i>0.002</i>	0.102	1.5	<i>0.0025</i>	0.067	<i>0.00005</i>	0.00854	0.153
August	<i>0.005</i>	<i>0.002</i>	0.00538	<i>0.002</i>	0.168	1.27	<i>0.0025</i>	0.0705	<i>0.00005</i>	0.00895	0.144
September	<i>0.005</i>	<i>0.002</i>	0.00602	<i>0.002</i>	0.102	1	<i>0.0025</i>	0.0636	<i>0.00005</i>	0.00942	0.135
October	<i>0.005</i>	<i>0.002</i>	0.00757	<i>0.002</i>	0.115	1.01	<i>0.0025</i>	0.0619	<i>0.00005</i>	0.00907	0.165
November	<i>0.005</i>	<i>0.002</i>	0.00637	<i>0.002</i>	0.0983	1.83	<i>0.0025</i>	0.112	<i>0.00005</i>	0.00744	0.145
December	<i>0.005</i>	<i>0.002</i>	0.0127	<i>0.002</i>	0.0774	0.935	<i>0.0025</i>	0.0604	<i>0.00005</i>	0.00745	0.104
<b><i>Annual Average</i></b>	<b><i>0.005</i></b>	<b><i>0.002</i></b>	<b>0.007056</b>	<b><i>0.002</i></b>	<b>0.10315</b>	<b>1.307</b>	<b><i>0.0040</i></b>	<b>0.071233</b>	<b><i>0.00005</i></b>	<b>0.00806</b>	<b>0.1432</b>

Data in red italics is half the MDL.

## APPENDIX D – Influent and Effluent Metal Concentrations

*Final Effluent (Daily Composite tested once/month for metals)*

Parameter	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.0247	0.406	<i>0.0025</i>	0.028	<i>0.00005</i>	0.00625	0.0373
February	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.0105	0.358	<i>0.0025</i>	0.037	<i>0.00005</i>	0.005	0.0371
March	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.00923	0.287	<i>0.0025</i>	0.0511	<i>0.00005</i>	0.00557	0.0324
April	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.00906	0.301	<i>0.0025</i>	0.0458	<i>0.00005</i>	0.00651	0.0343
May	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.00802	0.37	<i>0.0025</i>	0.0508	<i>0.00005</i>	<i>0.0025</i>	0.0304
June	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.00868	0.426	<i>0.0025</i>	0.0506	<i>0.00005</i>	<i>0.0025</i>	0.0365
July	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.00968	0.483	<i>0.0025</i>	0.0497	<i>0.00005</i>	0.00608	0.0325
August	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.0123	0.653	<i>0.0025</i>	0.0521	<i>0.00005</i>	0.0075	0.0312
September	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.0129	0.669	<i>0.0025</i>	0.0517	<i>0.00005</i>	0.00793	0.0324
October	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.0173	0.73	<i>0.0025</i>	0.0505	<i>0.00005</i>	0.00636	0.0369
November	<i>0.005</i>	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>	0.0128	0.75	<i>0.0025</i>	0.0499	<i>0.00005</i>	0.00601	0.0402
December	<i>0.005</i>	<i>0.002</i>	0.0074	<i>0.002</i>	0.00928	0.495	<i>0.0025</i>	0.0451	<i>0.00005</i>	0.00592	0.0336
<b>Annual Average</b>	<b><i>0.005</i></b>	<b><i>0.002</i></b>	<b>0.002450</b>	<b><i>0.002</i></b>	<b>0.01204</b>	<b>0.4940</b>	<b><i>0.0025</i></b>	<b>0.04686</b>	<b><i>0.00005</i></b>	<b>0.005678</b>	<b>0.03457</b>

Data in red italics is half the MDL.



## APPENDIX E – Digested Sludge Analysis

## APPENDIX E – Digested Sludge Analysis

	Arsenic	Cadmium	Cobolt	Chromium	Copper	Mercury	Molybdenum	Nickel	Lead	Selenium	Zinc
<i>Limit (1)</i>	<i>170</i>	<i>34</i>	<i>340</i>	<i>2800</i>	<i>1700</i>	<i>11</i>	<i>94</i>	<i>420</i>	<i>1100</i>	<i>34</i>	<i>4200</i>
<b>January</b>	2.4	1.5	4.2	57.4	577.5	0.4	7.5	24.8	23.3	3.2	518.6
<b>February</b>											
<b>March</b>											
<b>April</b>	2.2	0.7	3.4	34.3	540.4	0.1	5.8	20.1	27.9	1.9	364.5
<b>May</b>	2.5	1.1	4.3	41.9	919.4	0.4	7.0	23.7	57.3	2.6	481.5
<b>June</b>	2.4	1.0	3.9	41.7	510.6	0.4	8.1	19.6	23.6	2.7	464.6
<b>July</b>											
<b>August</b>	0.8	0.8	3.8	45.7	2962.4	0.4	8.4	23.1	29.6	2.9	2932.3
<b>September</b>											
<b>October</b>	5.02	0.96	4.77	58.21	1258.71	0.84	9.50	25.67	25.47	6.97	1203.98
<b>November</b>											
<b>December</b>											
<b>Annual Average</b>	2.6	1.02	4.06	46.5	1128	0.42	7.72	22.8	31.2	3.38	994

All values are expressed in terms of mg metal / kg digested sludge dry weight

(1) As per MOECC regulations for sludge utilization on agricultural lands. All sludge from HTP received further treatment at Ashbridges Bay Treatment Plant

## APPENDIX F – Odour Reduction Plan

# **Humber Treatment Plant**

## **Odour Reduction Report**



Prepared by:

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March 31, 2020

## Table of Contents

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Table of Figures.....	1
Purpose .....	2
Scope.....	3
Background .....	3
Odour Control Equipment .....	3
Process Upgrades.....	4
2019 Progress .....	4
Odour Reductions Achieved in 2019 .....	8
Complaints Received in 2019.....	9
Next Steps .....	9
Appendix A: Odour Reduction Plan .....	10

## Table of Figures

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Figure 1: The Central Biofilter fans .....	5
Figure 2: The GAC Unit.....	6
Figure 3: The South Biofilter .....	6
Figure 4 The new headhouse loading bay (left) and screenings conveyor systems (right) .....	7
Figure 5: The North Grit Building loading bay has been commissioned .....	8

## Purpose

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This report is intended to detail the progress of the implementation of the Odour Reduction Plan, as required under Environmental Compliance Approval No. 1937-9Z4RSE (the ECA), issued September 3, 2015. A copy of the Odour Reduction Plan can be found in

## Scope

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The scope of this report is to detail the progress of the installation of the *Proposed Equipment*, in the ECA which will impact odours at the plant.

The ECA also lists equipment which is not expected to have an impact on odour at the plant. This includes modifications to the aeration tanks, the disinfection facility, and the decommissioning of existing odour control equipment. As they are not anticipated to have any impact on odour, they are beyond the scope of this report.

## Background

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In 2010, the City of Toronto (the City) hired Stantec Consulting Inc. (Stantec) to provide engineering design, construction administration and post construction services of odour control facilities to drastically reduce nuisance odours at the facility's property line and beyond. This included several upgrades to process equipment and odour handling facilities at the plant.

### Odour Control Equipment

A central component of the Odour Control Project is the construction of a centralized Biofilter to control emissions from the Headhouse and South Grit Building, the North Grit Building, and the north primary tanks influent and effluent channels. The biofilter includes:

- Four cells, 15.5 m by 32.2 m, with an organic media depth of 1.22 m
- An irrigation system
- Two separate 2.2 m stacks extending 4.2 m above grade, with a maximum flow rate of 19.8 m<sup>3</sup>/s

In addition to the centralized biofilter, a second biofilter has been constructed at the south end of the south primary tanks. This biofilter treats air from the influent and effluent channels of the south primary tanks and will consist of:

- 3 cells, 8 m by 5.5 m, with an organic media depth of 1.22 m
- An irrigation system
- An open area discharge, with a maximum volumetric discharge of 2.36 m<sup>3</sup>/s

The third odour reducing component of the project includes a granular activated carbon (GAC) scrubber unit, which treats air from the Headhouse screen room. The GAC unit has:

- 45 m<sup>3</sup> of GAC
- A maximum discharge rate of 16 m<sup>3</sup>/s, through a 1.21 m stack, located 4 m above grade

## Process Upgrades

The Headhouse and South Grit Building has undergone extensive renovations to ensure process reliability, as well as ensure that odours are contained and treated. The work in this area includes:

- Replacement of 2 bar screens to increase reliability and enable them to be enclosed at all times
- Replacement of the conveyor system to increase reliability and enable them to be enclosed at all times
- Modifications to the vortex system replace the classifiers and air lift system with a grit pumping system and merge the grit slurry handling with the north grit facility
- Decommission 4 general building exhaust systems
- Installation of a new truck loading bay for screenings
- Installation of a standby diesel generator to ensure continuous operation of critical equipment
- Construction of a new electrical building

### North Grit Building

- Upgrades to the grit tanks to use a screw conveyor for grit removal
- Installation of new grit handling pumps, hydrocyclones and classifiers
- Installation of a new grit handling facility and loading bay
- Construction of a new electrical building

Additionally, the project scope included decommissioning the existing HVAC and odour control equipment and allowing the aeration tanks to vent to atmosphere.

The project was tendered in late 2013, and the order to commence issued to Walsh Construction Canada (WCC) on April 14, 2014. The contract value is \$58,640,220, with an original contract completion date of February 6, 2017. The completion date has been extended, and the project is expected to be completed by the second quarter of 2019. WCC, Stantec, and the City have been actively working to construct the works in an accordance with the tender documents and schedules, however the project continues to experience delays.

## 2019 Progress

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In 2019, work on the Odour Control Project was completed. All equipment is now running under the full control of the plant. The central biofilter fans and ductwork can be seen in Figure 1. Note, the biofilter is located underground.





Figure 1: The Central Biofilter fans

The GAC unit continues to run and is currently treating building air from the headhouse at its intended capacity or 6 air changes per hour. Foul air is now being extracted from process equipment and treated through the central biofilter. (Figure 2).



Figure 2: The GAC Unit

The construction of the south biofilter has been completed and has been commissioned. (Figure 3). A biomass has been established in the filter, which should result in a 20% reduction in odours at the property line. Odour reductions will be confirmed by source testing which is currently being scheduled.



Figure 3: The South Biofilter

All major upgrades have been completed and have been commissioned. These include:

- Two new bar screens and associated conveyor systems
- A new loading bay (Figure 4).
- Three north grit tanks
- The north grit loading bay, including classifiers and conveyors, (Figure 5).
- Six south grit vortexes
- Air handling equipment, including and testing and balancing of the system



Figure 4 The new headhouse loading bay (left) and screenings conveyor systems (right)





Figure 5: The North Grit Building loading bay has been commissioned

## Odour Reductions Achieved in 2019

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The GAC unit was commissioned in 2016 and was placed in its intended mode of operation. Overall, this should result in a 10% reduction in odour at the fence line.

The south biofilter was commissioned in the first quarter of 2017, and is currently treating the foul air from the influent and effluent troughs and channels of the south primary tanks. This should have resulted in a 20% decrease in odours at the property line. This will be confirmed by source testing upon completion of the project.

The central biofilter is has been commissioned and is running. This should result in a 60% reduction of odours at the fence line.

All outstanding items are now complete, and source testing is being scheduled.

## Complaints Received in 2019

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Six odour complaints were received in 2019. All complaints were investigated and reported to the Water Supervisor as per the requirements in the ECA. Most complaints could not be attributed to any cause, and on 3 occasions, the cause was suspected to be tank cleaning activities.

## Next Steps

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Source testing is scheduled to begin in early 2020.

## Appendix A: Odour Reduction Plan

Location	Plan	Percent Odour Reduction	Current Progress	Target date
Headhouse and South Grit	Replace remaining 2 bar screens to increase reliability and enable them to be enclosed at all times	20%	Complete	
	Replace conveyor system to increase reliability and enable them to be enclosed at all times		Complete	
	Modify vortex system to no longer require the classifiers or an air lift system in this location		Complete	
	Decommission 4 general building exhaust systems		Complete	
	New centralized biofilter to treat foul process air		Complete	
	Construction of a standby diesel generator		Complete	
	New Activated Granular Carbon Unit to extract and treat foul building air	10%	Complete	
North Grit Building	Collection and treatment of emissions from the 3 aerated grit tanks through the new centralized biofilter	20%	Complete	
	Collection and treatment of emissions from the grit tank room and loading bay areas through the centralized biofilter		Complete	
	Decommission existing general building ventilation system		Complete	
	Decommission the existing exhaust system for aerated grit tanks		Complete	
North Primary Tanks	Installation of covers over the influent and effluent channels, effluent weirs, and overflow channel	20%	Complete	
	Treatment of foul air from below the covers through a new centralized biofilter		Complete	
South Primary Tanks	Installation of covers over the influent and effluent troughs	20%	Complete	
	Treatment of foul air from below the covers through a new south primary biofilter		Complete	
Aeration Tanks	New aeration piping and diffusers	N/A	Construction	N/A
	New ventilation scheme that will involve vent stacks to allow air to discharge to the atmosphere		Construction	N/A
Disinfection Facility	New Sodium Hypochlorite Tanks (1-3)	N/A	Complete	
	New Sodium Hypochlorite Tanks (4-8)		Complete	
	New welding fume hood		Complete	
	New standby diesel generator		Complete	
	Decommission chlorine gas scrubbers		Complete	
Air Scrubbers/ Ozone	Decommission air scrubbers and ozone building	N/A	Complete	N/A

Updated February 28, 2019 by V. Szonda

## APPENDIX G – Maintenance Activities

## **APPENDIX G – Maintenance Activities**

### **Solids Handling (Work Area 1)**

Work Area 1 includes WAS thickening centrifuges, anaerobic digesters and gas collection, compression, and burner systems. A total of 2502 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 1 in 2019:

- **Monthly activities**
  - Valve exercises
    - Centrate pump valves
    - Centrifuge feed pump and flushing water valves
    - Digester scum feed valves
    - Digester sampling valves
    - Digester sludge recirculation valves
    - MTI Line isolation valves
    - TWAS Transfer Pump valves
    - Waste gas burner pressure regulating valves
  - Scum Tanks and hoppers, chute and paddle cleaning
  - Inspections
    - Sealing oil reservoir tank
    - Standby gas compressor inspection and operational testing
    - Portable eyewashes, fire extinguishers and first aid kits
- **Quarterly activities**
  - Scum tanks and hoppers cleaning
  - Inspections
    - Waste gas burners
    - TWAS transfer pumps
    - MTI transfer pumps
    - Centrate transfer pump
    - Centrifuge feed pumps
    - Sludge recirculating pump
    - Hot water recirculating pump
    - Digester gas compressor and accumulator
  - Centrifuge motor bearing vibrational analysis
- **Bi-annual activities**
  - Centrate pump valve exercises
  - Digester flame arrestors and gas stack valve cleaning
  - Lubrication
    - Sludge transfer and recirculation pumps bearings
    - MTI transfer pump bearings
    - Digester gas booster compressor bearings
    - Actuator valve stems
    - TWAS transfer pump motor



## APPENDIX G – Maintenance Activities

- MTI transfer pump motor and bearings
  - Inspections:
    - Digester dome valves
    - Digester gas stack valves and flame arrestors
    - Natural gas pilot pressure regulating valve
    - Digester valves
    - Waste gas burners
- **Annual activities**
  - Valve Exercises
    - Scum Tank, hopper and pump valves
    - Sludge flowmeter valves
    - Centrifuge isolation valves
    - Waste gas header isolation valves (including lubrication)
    - Waste gas burner valves
    - Digester routing and sample valves (including lubrication)
    - Scum valves (including inspection)
    - TWAS feed valves (including lubrication)
    - Digester discharge valves (including inspection)
    - Condensate and sediment tank valves (including inspection)
  - Cleaning
    - Condensate and sediment tanks (including inspection)
    - Digester Gas burner regulating valves (including calibration)
  - Inspections/maintenance:
    - Centrate pump valve isolation exercise and drive sheaves
    - Digester gas compressors and boosters (including lubrication)
    - Standby gas compressor
    - Centrifuge flushing valves and flexible chute connections
    - Centrifuge feed pumps isolation and flushing valve exercises.
    - Sludge recirculation and transfer pumps and valves
    - Coffin box valves (including lubrication)
    - WAS storage tank mixers
    - Backflow preventers
    - MTI transfer pumps
    - TWAS pumps
- **Miscellaneous activities**
  - 2000 hour centrifuge inspection and lubrication on CF-4051 CF-4041, CF-4071
  - 4000 hour centrifuge lube oil filter change and oil reservoir level check CF-4031.
  - 3 year TWAS pump back plate and lobes inspection

## Liquid Primary Treatment (Work Area 2)

## APPENDIX G – Maintenance Activities

Work Area 2 encompasses preliminary treatment processes including influent bar screens, aerated grit chambers, vortex grit chambers, and primary clarifiers. A total of 2766 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 2 in 2019:

- Bi-weekly inspection and lubrication of bar screen switch and bushings
- **Monthly activities**
  - North Plant bridge lubrication
  - Inspections
    - Grit blowers air inlet and inverter filters (including replacement)
    - Scum transfer pump
    - Vortex slewing gear (including lubrication)
    - Portable eyewashes, fire extinguishers and first aid kits
    - AED and SCBA
  - 2 month bar screen pillow block lubrication
  - 2 month plant wide SCBA training exercise
- **Quarterly activities**
  - Grit pump pinch valves inspection
  - Bar screen carriage drive chains lubrication
  - Ultrasonic testing of vortex pumps, grit pumps and scum pumps
  - Vibrational testing of sludge pumps and vortex blowers
- **Bi-annual activities**
  - Valve exercises
    - Grit channel sluice gates (including lubrication)
    - Primary sluice gates (including lubrication)
    - Vortex sluice gates (including lubrication)
  - Inspection
    - Ultrasonic testing of vortex pumps
    - Bar screen conveyers and compactors
    - Grit and screenings conveyors
    - Conveyor and scum collector gear box oil analysis
    - Grit de-watering pump
    - Classifiers and cyclones
    - Vortex pumps
    - Primary scum pump (including lubrication)
    - Sludge transfer pump seal water line
    - Ladders
  - Scum collector cleaning and lubrication
  - Preliminary treatment bypass valve stem lubrication
- **Annual activities**
  - Sludge pumps and header isolation valve exercises
  - Scum and sludge long and cross collector gearbox lubrication check

## **APPENDIX G – Maintenance Activities**

- Inspections
  - Primary collector drives
  - Primary cross collector gear box lubrication
  - North primary bridges
  - Sludge transfer pumps (and valve exercise).
  - Backflow preventer
  - Grit tank conveyor
  - Primary sluice gate inlet and actuator (including lubrication)
- **Miscellaneous activities**
  - Sludge pumps and header isolation valve exercises
  - Chain repair on CM-0102, CM-0201, CM-0302 and CM-0402
  - Drain replacement on CMP-0150
  - Feedbox rubber replacement on CYC-1931

### **Support Services (Work Area 3)**

Work Area 3 includes support services around the plant, process air blowers, and the electrical system. A total of 4018 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 2 in 2019:

- **Weekly activities**
  - Inspections
    - Emergency generator
    - Dechlorination analyzers
    - Chlorine analyzer probe check (including cleaning)
  - Monitor of air compressor motor temperature
  - Biweekly verification of boiler low level trip circuits
- **Monthly activities**
  - Inspections
    - Boiler exhaust valve actuator (visual)
    - Screen channel level alarms
    - Air dryers and receivers
    - Blower and blower air inlet filters
    - Substation
    - Plant wide emergency lighting
    - Sprinkler system alarm and fire water valves
    - Control room paging modulator alarm system
    - Portable eyewashes, fire extinguishers and first aid kits
  - Cleanings
    - Bio-filter beds (Summer months)
    - Venturi ports
    - Chlorine analyzer probe (including calibration)

## APPENDIX G – Maintenance Activities

- Repositioning of cogeneration engine crankshaft
- Test and verify emergency generator on load
- Elevator guide door cleaning and testing
- **Quarterly activities**
  - Inspections
    - 600 V MCC room
    - Gallery cooling water pumps
    - Waste gas burners
    - Phosphorus removal system pumps
    - Glycol pumps
    - Primary loop hot water pumps and PRVs
  - Glycol pump gland filter replacement
  - Vibrational testing of hot water recirculation pump motor bearings
- **Bi-annual activities**
  - Inspections
    - Dechlorination pump VFD drives, cabinets and fans
    - Plant wide supply and exhaust fans (including cleaning)
    - Electrical and mechanical generators
    - Chilled water pumps and skid
    - Control panels
    - WAS and sludge pumps (including motor bearing lubrication)
    - Sludge thickening scrubbers
    - Air compressor (including cleaning)
    - Gallery Air curtain
    - Glycol skids
    - Pneumatic positioner air filters
    - WAS pump and motor (including bearing lubrication)
    - Plant wide air handling unit and HVAC (including maintenance)
  - Calibrations/Verifications
    - Temperature transmitters
    - pH, DO analyzers
    - Raw sludge densitometer (including cleaning)
    - Hazardous gas detectors, alarms and portable gas meters
    - Control valves and actuators
    - Blower discharge and bypass valves
    - Blower axial trip alarms
  - Lubrication of hot water recirculation pumps
  - Digester gas compressor building ventilation fan testing
  - Testing of the blower motor bearings and auxiliary oil pump.
- **Annual activities**
  - Inspections
    - Gas compressor flow, pressure and temperature circuits
    - Heat tracing on sodium bisulphate piping and waste gas burners
    - Waste gas burner instrumentation

## **APPENDIX G – Maintenance Activities**

- Glycol pressure relief valve and skid
  - RAS and WAS pump motor and VFD
  - Sludge recirculation pumps and instrumentation
  - Digester gas boosters and instrumentation
  - Hot water recirculation pumps
  - Centrifuge electrical and instrumentation checks
- Calibrations/Verifications
  - Digester pump discharge and seal oil water switches
  - Digester PLC, RPU functionality testing
  - Primary collector shutdown torque switch
  - RAS, WAS, primary sludge and waste gas burner flow meters
  - Effluent sampling pump flow transmitter
  - Scum transfer pump control panel and instrumentation
  - Digester floating cover sensor
  - TWAS and WAS storage level transmitter sensors
  - Final effluent disinfection transmitters
  - Palace pier level switches
  - Sludge recirculation pumps and instrumentation
  - Bar screen rake drive motor emergency shutdown circuit
  - Digester dome and tank instrumentation
- Maintenance/cleaning
  - Plant wide wall and roof mounted exhaust fans
  - TWAS pump motor (including calibration)
  - Centrate pump motor and pressure switches
- Electrical and instrumentation checks of centrifuges and gas compressor
- **Miscellaneous Activities**
  - 2 year 600 V switchgear circuit breaker and bus checks
  - 2 year centrate pump motor temperature reading
  - 2 year replacement of air compressor and receiver PSVs (C-2511, C-2512, C-2513)
  - 2 year calibration of sludge transfer pump and instrumentation
  - 2 year primary treatment sluice gate actuator batter replacement

### **Liquid Secondary Treatment (Work Area 4)**

Work Area 4 encompasses secondary treatment processes including aeration, phosphorus removal and final clarification. A total of 2389 work orders were closed in this work area in 2019. The following maintenance on major structures, equipment, apparatus, mechanism or thing forming the Works was completed by Work Area 2 in 2019:

- **Monthly activities**
  - Inspections
    - Effluent sampling pumps

## APPENDIX G – Maintenance Activities

- Portable eyewashes, fire extinguishers and first aid kits
  - WAS and RAS pumps
  - Plant water backwash air regulator seat
  - Sodium Hypochlorite tanks (detection holes and stave joints)
  - Final clarifying tanks scum collector mechanisms
  - Air driers and receivers
  - Filtered plant water pumps, piping and isolation valves
  - Sodium hypochlorite sump drain valve exercises
- **Quarterly activities**
  - Cleaning of sodium hypochlorite dosing pump inlet strainer
  - Inspections
    - Air driers and receivers
    - Plant water sump pump
    - Plant water filter cell trash basket
    - trainer brushes and blades on dechlorination discharge line
    - Effluent discharge mixers lubricant level
  - Lubrication of filtered plant water pumps and motors
  - Vibrational testing
    - RAS, WAS and filtered plant water pumps
    - Aeration blowers and cogeneration burner fans (including oil analysis)
- **Bi-annual activities**
  - Scum pump lubrication, hopper flushing water solenoid verification and seal inspection
  - Inspections
    - Sodium hypochlorite control valve
    - Scum and sludge collector gearbox oil level
    - Final clarifying tanks drainage pumps
    - Chlorine analyzer sample line
    - Air compressor (including cleaning)
  - Scum tank cleaning and trough flushing
  - Testing of sodium bisulphate containment area level switch
  - Verification/calibration of chlorine gas analyzer
- **Annual activities**
  - Lubricate and exercise filtered plant water pump isolation valves
  - Lubrication of final clarifying tanks inlet gate valve stem and inspect actuator oil level
  - Inspections
    - Backflow preventers
  - Replacement of process air regulator diaphragm
- **Weekly activities**
  - Sodium hypochlorite delivery
  - Sodium bisulphite delivery (bi-weekly)
  - Inspections
    - Declorination sample pump and buffer chamber and gear oil level

## **APPENDIX G – Maintenance Activities**

- Final effluent sample pumps
  - Sump pumps
- Inspection of suction and discharge pressure for dechlorination pumps

## APPENDIX H – Staff Training Courses



Training attended by Humber Treatment Plant operations and skilled trades staff in 2019 includes the list of courses below.

Technical and Health and Safety:

- Variable Frequency Drives
- AC & Condensing Units / Air Distribution System
- Activated Sludge
- Activity and Process Cost Management
- Air Purifying Respirators
- Arc Flash for Non-Qualified Persons
- Asbestos Awareness
- Aeration Tank 5 Auto Start-up Process Training
- Backflow Prevention Awareness
- Basic Spill Response
- Basic Vibrations Analysis
- Building Reliance While Facing Adversity in Work and Life
- Waste Gas Burners
- Centrifugal and Positive Displacement Pump Operation
- Chainsaw Safety and Awareness
- Class III/IV Exam Preparation
- Classroom Review of Common Wear Items for Plant Machinery
- Conductors
- Confined Space Awareness
- Confined Space Rescue
- Confined Space Rescue Upgrade
- Conflict Resolution and Negotiation Skills
- Content Server – eDOCs
- Critical Pump Maintenance, Packing and Mechanical Seals
- Cross Connection Specialist Backflow Tester Certification
- Musculo-Skeletal Disorder Overview,
- Construction Contractor Safety management Program
- General Emergency Response Plan
- Training for Wastewater Treatment Plant Technicians
- Designated Substances
- Designated Substances awareness
- Digesters and the Sludge Digestion Process
- ECS Building Orientation
- Electrical Awareness
- Electrical Safety for District Operators and Maintenance Operators

- Electrical Safety for Maintenance Staff
- Electrical Safety in the Workplace
- Emergency First Aid Level "A" CPR
- Fall Protection Awareness
- Fall Protection in an Industrial Work Setting
- Final Clarifiers Operations and Maintenance Training
- Fire Extinguisher Training
- Fire Hydrant and Valve – Operation, Inspection, Maintenance and Installation
- Fundamentals of Ladder Safety Awareness
- Health and Safety Aspects of Contracts for Services
- Health and Safety Competency for Front-line Supervisors
- Hot Work Permit System Awareness
- HTP Headhouse and North Grit HVAC, BAS, and Gas Detection
- Incident Reporting
- Industrial Maintenance Technician – Mechanical and Electrical
- Joint Health and Safety Committee (JHSC) Certification Training – Refresher
- Lock out, Tag out and Test Awareness
- Logbook Entries
- MMR – Self Contained Breathing Apparatus
- Mould Awareness
- On the job: Humber WWTP Co-Gen System Operation
- On the job: Humber WWTP Digestion Process Major Components
- On the job: Humber WWTP Primary Process Major Components
- On the job: Humber WWTP Screening and Odour Control Process
- On the job: Humber WWTP Sludge Thickening Major Components
- On the job: Humber WWTP Sludge Thickening Process Overview
- On the job: Humber WWTP Solids Work Area Overview
- Preliminary and Odour Control Treatment
- Project Management: An Introduction
- Rigging Safety Awareness
- Scaffold Safety
- South Scum System Equipment Training
- Standard First Aid – Level "C" CPR and AED
- Tailgate – Cold Stress
- Tailgate – Corporate Security – Surviving an Active Shooter
- Tailgate - Hazard Identification and Reporting
- Tailgate – Injury Reporting
- Tailgate – Psychosocial Program and Risk Assessments
- Tailgate – Sewage Works and Surface Water Spill Response Awareness
- Toronto Public Service New Employee Orientation

- Traffic Control and Traffic Control Person
- Traffic Control Roadway Work
- Transportation of Dangerous Goods
- Trenching and Excavation Awareness
- Valve Actuator
- Violence in the Workplace
- Water Systems Repairs: Introduction to Oxy-Acetylene Cutting and Stick Welding
- West Substation RPU's
- WMS Avantis Workshop
- Working at Heights
- Working at Heights Refresher
- Xylem Submersible Pumps Training

Other Training:

- Coping with Shift Work
- Customer Care Centre Information
- Emotional Intelligence and Interpersonal Awareness
- Five Ways to Boost a Teams Culture
- Toronto Water Manager and Supervisor Employee Engagement Initiatives Workshop
- Management Summit: Engaging Employees and Building a Positive Workplace Culture
- Managing through a Labour Disruption
- Preparing to Move into Supervision
- Respect in our workplace
- Sharing Knowledge for Success
- Success Factors – Managers with Direct Reports
- Wellness and Resiliency