TORONTO Water

HUMBER
WASTEWATER TREATMENT PLANT

2017 Annual Report

March 31, 2018

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^3/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 2017 was 331.7 ML/day. Influent concentrations of Biochemical Oxygen Demand (BOD), Total Phosphorus (TP) and Total Suspended Solids (TSS) averaged 255 mg/L, 5.3 mg/L and 301 mg/L, respectively.

Humber Treatment Plant achieved the following effluent quality and loading rates in 2017 in comparison to ECA limits:

	ECA[1]	2017 Final Effluent
Total Suspended Solids (TSS)	25 mg/L	13 mg/L
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	25 mg/L	6.6 mg/L
Total Phosphorus (TP)	1 mg/L	0.8 mg/L
Escherichia Coli (E. Coli)[2]	200 CFU/100mL	72 CFU/100 mL
pH	6.0-9.5	7.5
Total Chlorine Residual (TRC) (Dechlorination)	0.02 mg/L	SBS Presence detected[3] / 0.009 mg/L
TP Loading Rate	473 kg/day	250 kg/day

[1] Referenced from Condition 6 & 7 of ECAs.

[2] Arithmetic mean of monthly geometric mean data.

[3] SBS Presence detected. The presence of Bisulphite Residual confirms a TCR of 0.0mg/L.

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 2017, An average of 4330 m^3/day of waste activated sludge was removed from the system. Of this, 3,776 m^3/day was thickened and stabilized prior to transfer and 553 m^3/day was transferred directly. An average of 85 dry tonnes of biosolids and waste activated sludge was transferred per day.

Ferrous chloride consumption for phosphorus removal was 4.82 tonnes as iron (Fe)[1] per 1000ML wastewater treated. There was no polymer consumption for waste activated sludge (WAS) thickening. Total sodium hypochlorite (12%) consumption for disinfection totalled 45.47 per 1000 ML. Sodium Bisulphite (SBS) (38%) consumption for effluent dechlorination totalled 5.21 m^3 per 1000 ML.

[1] A mathematical error resulted in the underreporting of ferric/ferrous chloride usage in the 2016 report. The correct value was 855 tonnes as Fe, rather than 189 tonnes. The total cost of the chemicals were reported correctly.

There were 17 bypass occurrences in 2017 where each occurrence received preliminary, primary treatment, nutrient removal, as well as disinfection before exiting the plant through the plant outfall, downstream 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, Main Substation Upgrades, Cogeneration Facility, Odour Control Phase 1 Implementation, Digester 9 and 10 cleaning and Upgrades, and HVAC 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 635,302m^3, 46.4M kWh, and 2.0M m^3, respectively. Plant operating cost for 2017 totalled $18.1M. In 2017, the Humber Treatment Plant had 68.5 employees. As of March 31st, 2018, there are 2 health and safety incidents and 5 lost time days due to work related injuries in 2017.

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GLOSSARY OF ABBREVIATIONS

AAC	Annual Average Concentration
BOD_5	Five-Day Biochemical Oxygen Demand
$CBOD_5$	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
m3	Cubic metre
m3 /day	Cubic metre per day
mA	Milliamps
mg/L	Milligrams per litre
mL	Millilitre
ML	Megalitre
MOECC	Ministry of Environment and Climate Change
Q	Flow Rate
RAS	Return Activated Sludge
SBS	Sodium Bisulphite
SBS (P)	Sodium Bisulphite Presence
SS	Suspended Solids
TCR	Total Chlorine Residual
TP	Total Phosphorus
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

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

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

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

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^3 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, 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 and Climate Change (MOECC) 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 2017. 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[2].

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 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.

[2] *https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/*

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. As required by Condition (9)(5) of the ECA, SBS was being monitored as a surrogate to Total Chlorine Residual (TCR). Presence of Bisulphite residual confirms that chlorine has been removed to a level of 0.0 mg/L TCR. Starting in November 2017 the plant switched to direct measurement of TCR.

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^{o}C). The target operating temperature for the digesters is 36^{o}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. 2017 PROCESS SUMMARY

3.1. Process Parameters

In 2017, 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	$cBOD_5$ (mg/L)	TSS (mg/L)	TP (mg/L)	Chlorine Residual (mg/L)[5]	E Coli (count/100mL)
January	6.8	14.3	0.9	SBS (P)	29
February	9.5	16.2	0.8	SBS (P)	99
March	7.8	13.4	0.7	SBS (P)	42
April	8.5	12.3	1.0	SBS (P)	152
May	8.7	14.1	0.8	SBS (P)	90
June	6.0	14.0	0.7	SBS (P)	65
July	4.8	12.4	0.5	SBS (P)	40
August	5.7	15.3	0.8	SBS (P)	45
September	3.7	8.5	0.6	SBS (P)	73
October	4.4	9.8	0.7	SBS (P)	88
November	5.7	10.3	0.7	0.005	56
December	8.0	16.0	0.9	0.013	86
Annual Average	6.6	13.0	0.8	SBS/ 0.009	72
Loading (kg/d)	2202	4322	250.2	N/A	N/A
Removal Efficiency[1] (%)	97%	96%	85%	N/A	N/A
ECA Requirements[2,3]					
Effluent Objective[1, 4]	AAC: 15 mg/L	AAC: 15 mg/L	MAC: 0.9 mg/L	MAC: 0 mg/L	MGMD: 150 CFU/100 mL
Effluent Limit[1, 4]	AAC: 25 mg/L	AAC: 25 mg/L	MAC: 1 mg/L	MAC: 0.02 mg/L	MGMD: 200 CFU/100 mL
Average Waste Loading Limit[1, 4]	N/A	N/A	473 kg/d	N/A	N/A

[1] cBOD = 0.8 * BOD assumed for removal efficiency calculatons
[2]Referenced from Amended Environmental Compliance Approval No. 9032-ABZNYQ, issued on July 21, 2016.
[3] The ECA effluent objective and limit for pH is 6.5 to 8.5 and 6.0 to 9.5 respectively, inclusive, at all times. Effluent pH in 2017 was within the required objective and limit.
[4]AAC refers to Annual Average Concentration, MAC refers to Monthly Average Concentration, and MGMD revers to Montly Geometric Mean Density
[5] The test for Chlorine Residual was SBS precence for January – October, and Ultra-Low Chlorine Residual from November onwards, to allow for better precision and control.

Influent and Final effluent concentrations of ten 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	2017	2016	2015
Influent Parameters				
Flow	ML/day	331.7	257.3	269.0
Total Annual Flow	ML	121,062	94,168	98,174
Total Suspended Solids (TSS)	mg/L	301	331	369
Biochemical Oxygen Demand (BOD_5)	mg/L	255	299	318
Total Phosphorus (TP)	mg/L	5.3	5.8	5.8
Preliminary Treatment				
Grit and Screenings	Tonnes/day	2.1	1.6	2.2
Primary Treatment				
TSS	mg/L	102	94	97
cBOD5	mg/L	118	158	156
Secondary Treatment				
Aeration Loading	kg $CBOD_5/m^3$.day	0.41	0.38	0.39
Mixed Liquor Suspended Solids	mg/L	2,842	2,953	2,838
Solids Handling				
Primary Sludge Treated	m^3/day	2,814	2,689	2,723
Primary Sludge TS	%	1.9	2.0	1.7
Primary Sludge TVS	%	73.6	70.6	71.6
WAS to Thickening	m^3/day	3,776	3,573	3,135
WAS SS	mg/L	8806	8,630	9,448
TWAS TS	%	4.6	4.0	4.2
TWAS TVS	%	77.6	75.0	78.6
TWAS Treated	m^3/day	715	598	530

In 2017, the Humber Treatment Plant encountered no abnormal 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. This was achieved through continuous improvement in operations and maintenance of treatment processes, and infrastructure delivery. The plant also met Federal Government effluent monitoring requirements for un-ionized ammonia and acute toxicity.

3.2. Biosolids Management

In 2017, the daily average inflow to the Humber Treatment Plant was 331.7 ML/day. The flow projections for 2018 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 given volume for 2017.

All sludge generated at the Humber Treatment Plant is transferred to the Ashbridges Bay Treatment Plant for further treatment. The sludge generated during 2017 averaged 4330 m^3/day (85 dry tonnes per day).

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 year based on 1000ML of water treated in the facility for the past three years. Costs listed are plus applicable taxes.

Table 3: Chemical Usage Summary

Process	Chemical	2017 Usage (/1000ML treated)	2017 Unit Cost	2016 Usage (/1000ML treated)	2016 Unit Cost	2015 Usage (/1000ML treated)	2015 Unit Cost
Phosphorus Removal	Ferrous Chloride as Fe	4.82 tonnes	$903/ tonne Fe	9.08 tonnes	$903/ tonne Fe	5.40 tonnes	$815/ tonne Fe
Disinfection	Sodium Hypochlorite	45.47 m^3	$132/$m^3$	50.17 m^3	$129/$m^3$	48.12 m^3	$128/$m^3$
Dechlorination	Sodium Bisulphite	5.21 m^3	$293/$m^3$	4.39 m^3	$293/$m^3$	4.21 m^3	$285/ m^3
WAS Thickening	Polymer	0.00 tonnes	-	0.00	-	0.00	-

Ferrous chloride usage was higher than normal in 2016 because of an optimization trial. Dosing levels returned to normal in 2017.

3.4. Bypasses, Overflows and Spills

3.4.1. Bypasses

There were 17 bypass events in 2017. The total volume of bypass flow was 1083 ML, or 0.89% of the annual flow. All bypass flow received preliminary, primary treatment, nutrient removal, as well as disinfection and exit the plant through the plant outfall downstream of the final effluent sampling point. Each instance was reported to the MOECC 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[3] was 784 mm in 2017, a 36% increase from 2016.

Table 4: Bypass Summary

Date	Duration (hr)	Volume (m^3)
January 10, 2017	6.5	44,377
January 12, 2017	2.9	14,878
February 25, 2017	2.2	22,611
March 1, 2017	7.3	34,893
March 25, 2017	0.5	329
April 4, 2017	3	38,176
April 6, 2017	13.3	78,867
April 20, 2017	3.8	27,288
April 30, 2017	1.75	10,293
May 1, 2017	11.8	105,900
May 4, 2017	32.5	512,834
May 25, 2017	12.5	87,152
June 17, 2017	2	6,751
June 23, 2017	10.6	78,031
June 30, 2017	0.75	412
July 20, 2017	4.1	6,751
August 4, 2017	3.5	13,542

3.4.2. Overflows

There were no overflow events at the Humber Treatment Plant in 2017. An overflow is defined as a discharge to the environment from the plant at a location other than the plant outfall downstream of the final effluent sampling station.

3.4.3. Spills

There were six spills reported to the MOECC in 2017. They are summarized in Table 5 below.

[3] *Adapted from http://climate.weather.gc.ca/historical_data/search_historic_data_e.html, Toronto City Station*

Table 5: Spills Summary

Date	Duration (hr)	Volume (m^3)	Nature of event	Description
March 23, 2017	N/A	N/A	Digester Gas Spill	Mechanical failure of an aged gasket. Measures to stop the leak were in place less than 3 hours after it was discovered.
May 15, 2017	0.5	N/A	Digester Gas Spill	Equipment failed to start leading to pressure build up and subsequent venting of digester to atmosphere. Failure to start was linked to a power isolation to accommodate construction activities.
June 23, 2017	1	N/A	Sewage Spill	A dislodged coverplate allowed the overflow of sewage from the influent sewer onto the paved road and catchbasins inside the plant. Clean up included the cleanout of affected catchbasins[1].
August 21, 2017	1	N/A	Digester Gas Spill	A scrubber isolation valve failed and digester vented to the atmosphere. Valve repairs completed the same day.
October 25, 2017	0.05	N/A	Digester Gas Spill	Power failure resulted in the shutdown of equipment and subsequent pressure build up lead to venting of digester to atmosphere.
September 6, 2017	2	N/A	Digester Gas Spill	Support system shut down to accommodate construction caused equipment failure and subsequent pressure build up lead to venting of digester to atmosphere.

[1] Catchbasins within the plant exit the plant via the plant outfall upstream of the final effluent sampling locations.

3.5. Complaints

The Humber Treatment Plant received 4 complaints related to odour. These complaints were received on March 25th, July 5th, and August 18th and 31st. All complaints were recorded, investigated by Toronto Water Staff, and followed up on with the complainant. In each case the investigation did not identify any unusual odours, so no corrective action was warranted.

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

3.6. Effluent Quality Assurance or 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 plant technicians 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.

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 2017, 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 2017.

Table 6: Capital Projects

Project Name	Project Description	Project Stage (Dec 31, 2017)
Cogeneration Upgrades	Refurbishment of cogeneration system to allow use of methane for the generation of electricity and heat.	Construction
Digester 9&10 Rehabilitation	Clean out and repair of digesters 9 and 10 including replacement of gas huts and some mechanical equipment	Construction
Odour Control Upgrades	Preliminary treatment process improvements and odour control system replacement including construction of two new biofilters.	Construction
Premise Isolation	Instillation of two new backflow preventers for premise isolation and new potable water flow meters	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
West Substation Upgrades	Electrical Upgrades to existing substation	Construction
ECS Site Office	Prefabricated Building to accommodate City project staff on site	Design
HVAC Upgrades	Refurbishment of HVAC system and potable water system.	Design
PLC Platform Upgrade	Replacement of outdated control hardware for reliability	Design
Primary Pumping and Scum	Upgrade of north primary treatment sludge and scum systems	Design
TW Operations Centre	Refurbishment of Administration Building	Design
Waste Gas Burner Upgrades	Replacement of existing waste gas burners to meet regulations and improve proves efficiency	Design
Ammonia Based DO Control	Pilot of a new control system for aeration based on ammonia concentration.	Pilot

Blowers Upgrade	Study to determine the state of the current blower system and identify upgrade needs.	Study
Building Condition Assessment	Study to determine the condition of building on site in order to plan maintenance projects and capital upgrades.	Study
Flood Protection Study	Study to determine the adequacy of current flood protection measures	Study

5. MAINTENANCE

Staff from the Humber Treatment Plant performed a variety of scheduled, preventative, predictive and reactive maintenance 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 2017, and found to be within acceptable limits. A summary of effluent monitoring equipment calibration and maintenance performed in 2017 is included in Table 7.

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

Calibration and/or Maintenance Record	Completion Date
Influent Flow Meter THR-PLT-FIT-1012 - Verification	October 18th , 2017
Influent Flow Meter THR-PLT-FIT-2000 - Verification	November 7th, 2017
Aeration Flow Meter THR-AER-FIT-0602 - Verification	March 23rd, 2017
Aeration Flow Meter THR-AER-FIT-0702 - Verification	March 23rd, 2017
Aeration Flow Meter THR-AER-FIT-0802 - Verification	March 23rd, 2017
Effluent pH analyzer THR-EPS-AIT-0055 - Calibration	April 11th, 2017 and September 14th, 2017
Effluent pH analyzer THR-EPS-AIT-0055 - Verification	April 11th, 2017 and September 14th, 2017
Effluent temperature analyzer THR-EPS-AIT-0053 - Verification	April 11th, 2017 and November 17th, 2017

Under condition 10(6) (j) of the ECA, related to Limited Operability Flexibility, no Notices of Modifications to Sewage Works were submitted to the Water Supervisor, the MOECC, as no work performed in 2017 fell under Schedule B of the ECA.

The Humber Treatment Plant work areas include all major and auxiliary processes. The following is a summary of significant maintenance activities completed in 2017; these are maintenance activities as per Conditions 10(6) (c) of the ECA.

5.1. Solids Handling (Work Area 1)

Work Area 1 includes WAS thickening centrifuges, anaerobic digesters and gas collection, compression, and burner systems. A total of 2001 work orders were closed in this work area in 2017. The following maintenance was completed in 2017 for Work Area 1.

Regularly scheduled (WMS) maintenance work completed:

- Digesters and gas system:
  - All digester dome pressure and vacuum relief valves (PVRV) inspected and cleaned.
  - All digester flame arresters inspected and cleaned.
  - Digester overflow coffins regularly cleaned.
  - Gas compressor and gas boosters serviced.
  - Maintenance of all digester sludge heating hot water pumps.

- Maintained flare system including rotation of pressure relief valves.
- Cleaned and re-installed burner flame arresters and thermal valves.
- Maintained fuel gas compressors for Cogen.

- Sludge thickening centrifuges:
  - Centrifuge maintenance.
  - Replaced sun-wheel bearings on several centrifuges every 4000 run hours as per manufacturer's recommendation.
- Safety:
  - Testing and calibration of all WA-1 back-flow preventers (with documentation).
  - All emergency eyewash station equipment tested weekly and serviced.
  - All Fire extinguishers inspected and serviced if necessary.
  - All first aid kits maintained.

Process specific maintenance projects:

- Digesters and Gas System:
  - Several sludge valves replaced, and onyx rings replaced or repaired.
  - Digester gas and natural gas pipe chase inspected and maintained.
  - Gas domes repaired.
  - Repaired and overhauled digester gas mixing compressors, including machining of compressor housing and rotors.
  - Repaired gas compressor mounting frames.
  - Performed vibration analysis on gas compressors. Laser coupling alignments was performed on motors and compressors.
  - Replaced gas compressor piping gaskets.
  - Installed piping insulation.
  - Installed system to improve gas compressor lube oil delivery.
  - Installed pressure indicator isolation valves to facilitate servicing of these instruments.
  - Installed thermowells for compressor discharge temperature indicators.
  - Overhauled all digester recirculation and transfer pumps associated with Digester 9 and 10.

- Sludge thickening centrifuges.
  - Flushed MTI Lines.
  - Modified torque arms (as suggested by manufacturer) on several centrifuge back-drive input shafts.
  - Dismantled centrifuge for repair and overhaul by manufacturer.
  - Over-hauled Vogelsang TWAS pumps.
  - Removal and replacement of WAS and TWAS mixers.
  - Identified and removed failed Variable Frequency Drives (VFDs) for repair.
  - Installed new desiccant breathers.

- Safety:
    - Installed wooden bridges to improve safety when walking in the area of gas piping.
    - Installed partitions in the gas cylinder storage compound.

- General area maintenance projects:
    - Painted tunnel floors to maintain a clean working environment.

5.2. Liquid Primaries (Work Area 2)

Work Area 2 encompasses preliminary treatment processes including influent bar screens, aerated grit chambers, vortex grit chambers, and primary clarifiers. A total of 1940 work orders were closed in this work area in 2017. The following maintenance was completed in 2017 for Work Area 2.

Regularly Scheduled (WMS) Maintenance Work completed:

- Headworks:
    - Sluice gates maintained, lubricated and exercised. Replacement of drive sleeves.
    - Bar screen lubricated. Replacement of chute and shock absorbers. Rake mechanism maintained.
    - Influent channel maintenance, including degritting.
    - Compactor wear bar replacement.
    - Screw Conveyer lubricated. Replacement of wear liners, oil and shaftless screws.
    - Vortex lubricated and classifier inspected.
    - Vortex blower lubricated, alignment checks and filter replacement.
    - Grit pumps, grit valves, tanks and conveyer system maintained.
- Primary Tanks:
    - Primary bridge drive lubricated and alignment checked. Wear parts replaced.
    - Scum and sludge pumps lubricated and inspected.
    - Valves and piping inspected.
- Safety:
    - Testing and calibration of all WA-2 back-flow preventers (with documentation).
    - All emergency eyewash station equipment tested weekly and serviced.
    - All Fire extinguishers inspected and serviced if necessary.
    - All first aid kits maintained.

Process specific maintenance projects:

- Headworks:
    - Replacement of bar screen compactor tube and bearing change.
    - Rebuild of trailer conveyer.
    - Vortex main drive replacement.
- Primary Tanks:
    - Lube optimization.
    - Installation of dessicant breathers
    - Replacement of cross collector chain and flights
    - Valve replacement and rebuild.

- Scum trough maintained.
- South primary influent channel air headers and air diffusers repaired.
- Replacement of two scum hoppers.
- Replacement of one scum pump.

General area maintenance projects:

- Sump pump preventative maintenance.
- Repair and rebuild of backflow preventers.

5.3. Support Services (Work Area 3)

Work Area 3 includes support services around the plant, process air blowers, and the electrical system. A total of 4071 work orders were closed in this work area in 2017. The following maintenance was completed in 2017 for Work Area 3.

Regularly scheduled (WMS) maintenance work completed:

- Inspection, maintenance and corrective repairs of the following process instrumentation:
  - Disinfection/Dechlorination analyzers.
  - Turbidity analyzer.
  - DO probes.
  - Raw Sludge densitometer.
  - Flow meters.
  - pH analyzer.
  - Temperature probe.
- Inspection, maintenance and corrective repairs of the following safety instrumentation:
  - Gas detectors.
  - Waste gas burner instrumentation.
- Inspection, maintenance and corrective repairs of the following services:
  - Electrical and power equipment
  - HVAC systems

Instrumentation and process maintenance projects:

- Upgrade of instrumentation for Digesters 9 and 10.
- Upgrade of instrumentation for Digester 7 and 8 compressors.
- Modified inlet filters for North Blowers.
- Repair of Blower BL-1411.
- Repair of three check valves for North Blowers.
- Upgrade of Secondary Scum Tank level sensors.
- Sludge and Scum pumping control system upgrades.
- North Blowers Filter rooms repair.
- Waste Gas Burners PLC program modification.
- Sludge Thickening GAC odour control units drip traps modification.
- Instillation of grinder pump on South Scum system.
- Addition of current readers to two bar screens.
- Low Lift Pumps wiring modification to optimise Filtered Plant Water operation.

Support systems maintenance projects:

- Trailer Stand-By Generator repair.
- Upgrade of two Unilux boilers gas boosters.
- Boilers set point optimisation for best coordination with Cogeneration.
- Digester pressure switch resetting to provide better fuel switch-over for four plant boilers.
- New welding receptacles installation.
- Modification of gas monitoring system in Head House.

General maintenance projects:

- Replaced lights with LED bulbs throughout the plant
- New telephone installation.

5.4. Liquid Secondaries (Work Area 4)

Work Area 4 encompasses secondary treatment processes including aeration, phosphorus removal and final clarification. A total of 1962 work orders were closed in this work area in 2017. The following maintenance was completed in 2017 for Work Area 4:

Regularly scheduled (WMS) maintenance work completed:

- Lubricated all mechanical components.
- Safety:
    - Testing and calibration of all WA-4 back-flow preventers (with documentation).
    - All emergency eyewash station equipment tested weekly and serviced.
    - All Fire extinguishers inspected and serviced if necessary.
    - All first aid kits maintained.

Process specific maintenance projects:

- Phosphorus removal:
    - Completed repairs to phosphorus removal system (overhauled various diaphragm dosing pumps).
    - Inspected and repaired ferrous feed lines to Aerator Tanks # 1-4.
- Aeration Tanks:
    - Rebuild various Waste Activated Sludge Pumps to original manufactures specs.
    - Modified control valves on aeration tanks # 4 & 5.
- Secondary Clarifiers:
    - Modifications and upgrades carried out on various scum systems.
    - Overhauled Final Settling Tanks 11, 12, 15.
    - Overhauled inlet sluice gates on Final Tanks 6, 7, 8.
- Plant Water:
    - Continued with repairs to flushing water lines and feeder lines throughout Work Area 4.
    - Overhauled and rebuild Low Lift Feed Pump 0001.
    - Rebuild of Filtering Cells # 2 & 3 in the Filter Flushing Water Building.

- Cleaned, inspected and changed sand for Cells 1 & 4 in the Filter Flushing Water Building.

General area maintenance projects:

- Modifications carried out on various work area sump pits.
- Maintained & expanded 5S areas in the North Finals.

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 635,302m^3, 46.4M kWh, and 2.0M m^3, respectively.

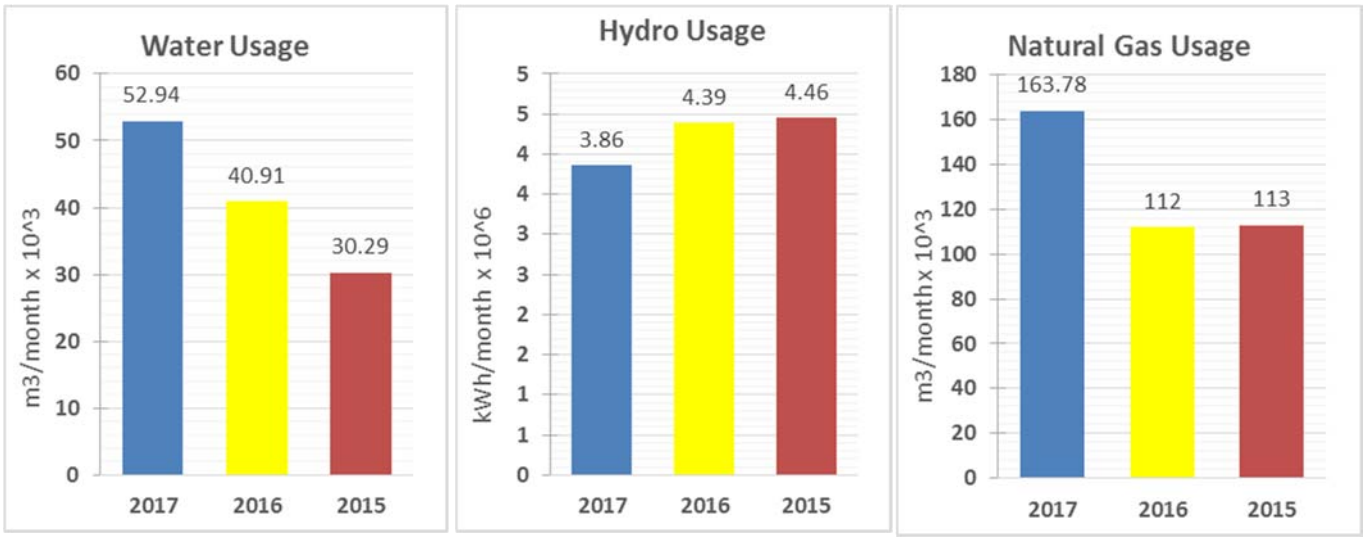


Figure 1: Annual Utility Consumption (Water, Hydro, Gas)

Table 8: Average Unit and Total Utility Cost

Utility	2017	2016	2015
Water Unit Cost ($/$m^3$)	3.81	3.63	3.31
Water Total Cost ($/year)	2.42M	1.78M	1.20M
Hydro Unit Cost ($/kWh)	0.10	0.11	0.09
Hydro Total Cost ($/year)	4.43M	5.59M	5.02M
Natural Gas Unit Cost ($/$m^3$)	0.24	0.24	0.26
Natural Gas Total Cost ($/year)	470,741	317,335	352,692

There was a 29% increase in potable water consumption in 2017. New potable water flow metres were installed in 2017.

The 12% decrease in hydro consumption and 21% decrease in hydro cost are attributable to the cogeneration system commissioned in mid-2017. As one of the two cogeneration engines is operated on natural gas, total natural gas consumption increased by 47% over the previous year. As

a result of the operating strategy for the cogeneration system the combined total cost of hydro and natural gas was reduced by 17% in 2017.

7. ADMINISTRATION

7.1. Operations and Maintenance Costs

The 2017 plant operational costs are broken down into five (5) 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 2016 and 2017 annual operations and maintenance costs is illustrated in Figure 2 . Overall, operational costs increased by 0.9% from 2016.

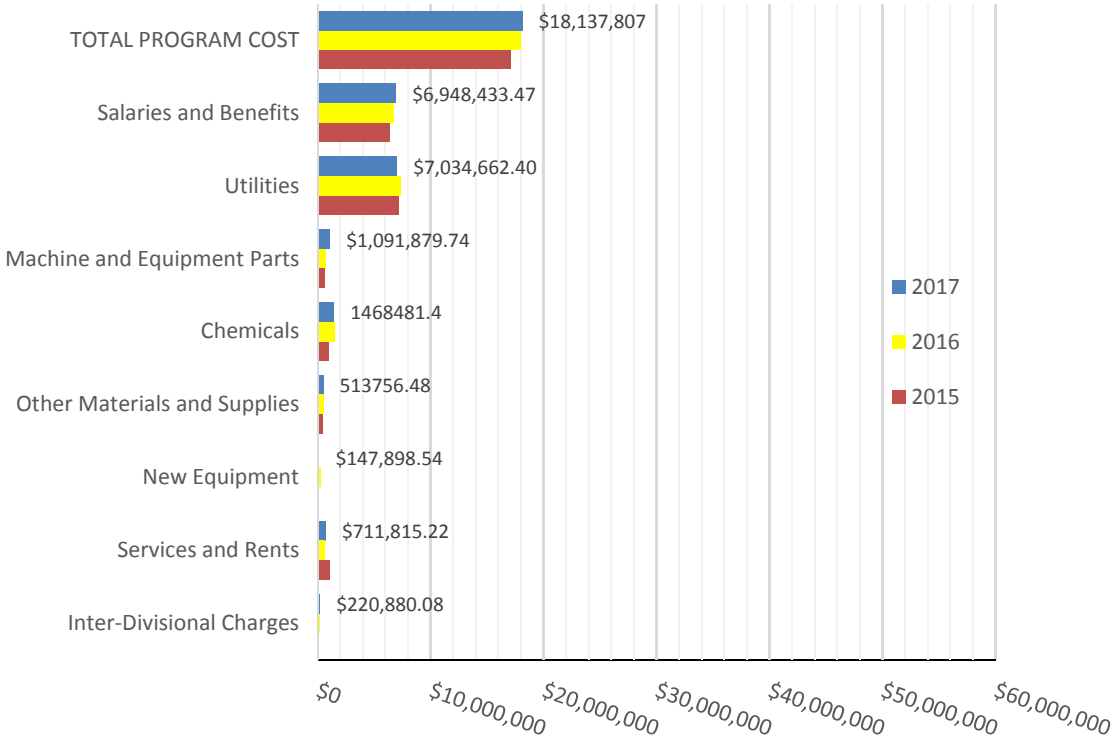


Figure 2: Operations and Maintenance Cost Breakdown

7.2. Human Resources

Plant Staffing at the Humber Treatment Plant in 2017 is shown in Table 9.

Table 9: Plant Staffing

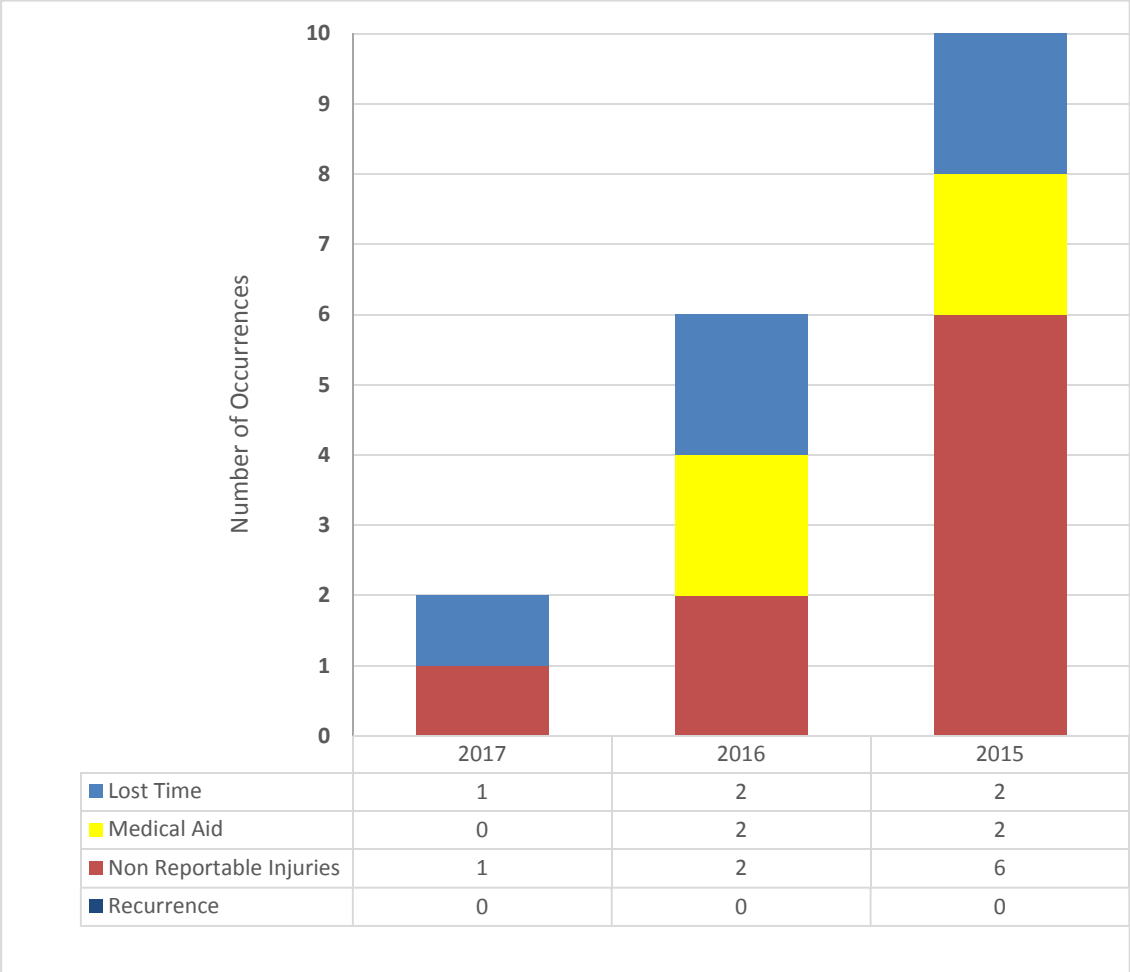
Position	Number of FTE[1]
Plant Manager	1
Senior Engineer	2
Area Supervisors	4
Electrical & Instrumentation Specialist	1
Electricians	3
Plant Technicians	20
Industrial Millwrights	20
Electrical Instrumentation Control Technicians	6
Wastewater Treatment Plant Workers	7
Support Assistant/Materials Management	3
Engineering Technologist	1
Seasonal Temporary	1.5
Total FTE Positions	**69.5**

[1] 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 March 31, 2018, there were a total of 5 lost time days due to work related injuries.



	2017	2016	2015
Lost Time	1	2	2
Medical Aid	0	2	2
Non Reportable Injuries	1	2	6
Recurrence	0	0	0

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 programs that expands the abilities of the staff, resulting in better service to the public.

All Humber Treatment Plant operations and skilled trades staff attended training which was held at various Toronto Water facilities. Courses were eligible for Continuing Education Units (CEU's) from the Ontario Environmental Training Consortium (OETC). The Humber Treatment Plant offered its operation and skilled trade staff the following training courses in 2017. Training to support the capital program was provided as required.

a) Technical and Health and Safety Training:

- 2015 Ontario electrical safety code (26th edition) new and amended requirements general level 1
- Backflow prevention awareness (2016-2018)
- Centrifugal and positive displacement pump operation
- Cogen SCADA (Humber cogeneration)
- Conductors (2016-2018)
- Industrial maintenance technician (IMT) certification
- Kohler emergency generator installation (Humber odour control and process upgrades)
- Logbook entry (2017-2019)
- Machinery installation using laser based measurement
- Mathematics for operators: module 2 (2016-2018)
- MMR - self-contained breathing apparatus
- Shaftless spiral screw conveyors and controls (Humber odour control and process upgrades)
- Submersible pumps (Humber backflow)
- Thomson power systems TS880 automatic transfer switch (Humber odour control and process upgrades)
- Transportation of dangerous goods (2016-2018)
- Wastewater plant technician process training
- Air purifying respirators (2017)
- Arc flash for non-qualified persons
- Asbestos awareness
- Confined space awareness 1/2 day (2016-2018)
- Confined space entry & rescue training awareness
- Confined space rescue - 2 day
- Distracted driving
- Electrical safety for district operations & maintenance operators (2016-2018)
- Emergency first aid level 'a' CPR (2016-2018)
- Hazard identification and reporting (august 2017 tailgate)
- Health and safety competency for front-line supervisors: one-day refresher
- Hot work permit system awareness (2016-2018)
- Incident management team training (EHSC)
- Incident reporting (2017)
- In-service health & safety orientation
- Joint health and safety committees - (JHSC) certification training part I - Basic
- Joint health and safety committees - (JHSC) certification training part II - Workplace Specific Hazard Training
- Level "C" CPR renewal (2016-2018)
- Lock out, tag out & test awareness (2016-2018)
- Lockout, tag out and test awareness
- MMR - self-contained breathing apparatus
- Overhead crane safety
- Rigging safety awareness (2016-2018)

- Safety in a high voltage environment (2016-2018)
- Scaffolding awareness course (2016-2018)
- Standard first aid - level "C" CPR & AED - 2 day (2016-2018)
- WHMIS 1988 training
- WHMIS 2015 training
- WHMIS: introduction
- Worker health and safety awareness in 4 steps
- Working at heights (2016-2018)
- Working at heights training (2016-2018)
- Working with wastewater
- Workplace violence awareness

Other Training:

- AODA - customer service standard
- AODA - IASR AODA - IASR transportation standard
- AODA - IASR design of public spaces standard
- AODA - IASR employment standard
- AODA - IASR general requirements
- AODA - IASR information and communications standard training
- AODA – Ontario Human Rights Code
- Applying the public sector value chain to engage employees
- Asking the right questions
- Assign training to your staff
- Business process improvement: an introduction
- Communicate for impact during change
- Conflict resolution and negotiation skills
- Content server - edocs
- Coping with shift work (2016-2018)
- Corporate orientation for new TPS employees
- Creating a culture of trust for exceptional customer service
- Creating exceptional customer experiences
- Customer service excellence for the internal customer
- Developing resilience in the face of change
- Effectively using social media
- Emotional intelligence and workplace effectiveness
- Engaging stakeholders in change
- Enhancing work satisfaction through active engagement
- Essential financial planning for retirement
- Feedback: the key to engagement
- Human rights in the workplace
- Improving your grammar
- Leadership skills for non-managers
- Managing human rights and responding to complaints

- Managing the duty to accommodate in employment and service provision
- Mastering the change framework
- Outlook 2013: all about outlook 2013
- Positive space Toronto - module 1
- Preparing to move into supervision
- Project management: methodology
- Protecting privacy on the job
- Respect in our workplace
- Responding to workplace harassment: what you need to know
- Staffing: general principles and practices
- The business of environmental compliance
- The role of the manager during change
- The Toronto public service by-law elearning
- Toronto water orientation
- Transition to manager I: developing your plan
- TW emergency plan awareness (tailgate may 2017)
- Understanding your leadership capacity & how emotions play a part
- Violence in the workplace
- Watermain tapping and repair (2016-2018)
- WMS Avantis workshop

7.5. Utility Operator Certification

Toronto Water has incorporated the requirement of a Class I operating licence for all skilled trade job profiles at Wastewater Treatment facilities. As part of this initiative, general operational/process training was delivered in order to prepare staff for the certification examination. Table 9 summarizes the status of operator certification at the Humber Treatment Plant in 2017.

Table 9: Wastewater Treatment Certificates

Class Level	Licensed
Class IV	16
Class III	3
Class II	4
Class I	10
O.I.T.	18
Total	**51**

7.6. MOECC/MOL Correspondence

There were no orders issued by the Ministry of the Environment and Climate Change (MOECC). There was one order from the Ministry of Labour (MOL) regarding lock out/ tag out procedures. Corrective action was taken immediately. Additional correspondence with the MOL involved

verifying the previous abatement of some lead and asbestos in a construction area. The issue was resolved swiftly.

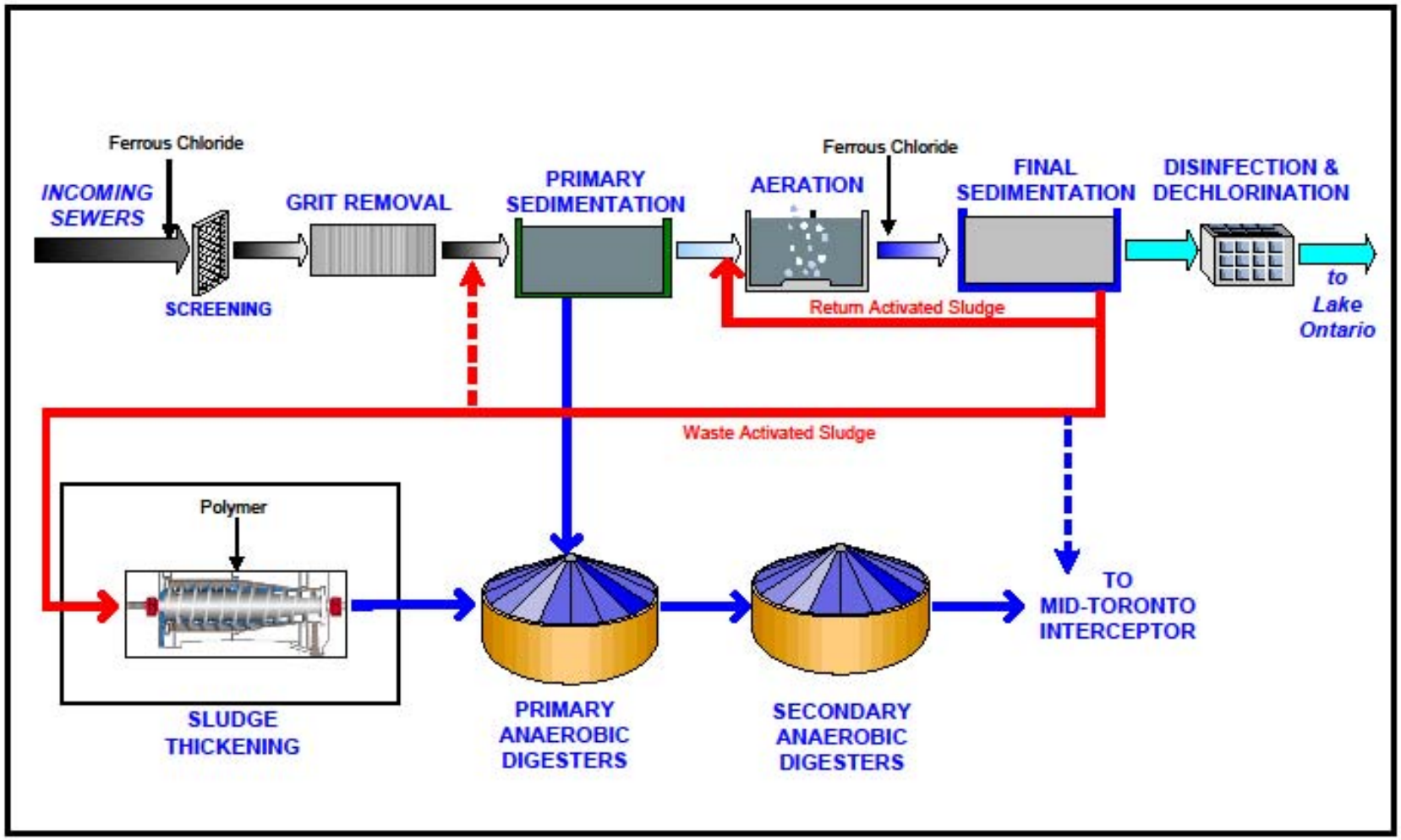
Reports were submitted to the MOECC for the four odour complaints received at the plant in 2017, as well as the 17 bypass events. Table 10 summarizes the additional correspondence submitted to the MOECC for the Humber Treatment Plant.

Table 10: Correspondence submitted to the MOECC

Date	Type	Description
March 27th, 2017	Communication regarding an odour complaint	Communicated with Melissa Hills, MOECC Inspector. An odour complaint was received on March 25th. An investigation revealed that there were no unusual odours at the plant.
March 24th, 2017	10 Day Report as per Amended ECA	Written report regarding release of digester gas on March 23rd.
May 29th, 2017	10 Day Report as per Amended ECA	Written report regarding release of digester gas on May 15th.
July 7th, 2017	Communication regarding an odour complaint	Communicated with Shannon Boland, MOECC Inspector. An odour complaint was received on July 5th. An investigation revealed that the odour did not originate from the plant. Wastewater Collection investigated the local sewers as well.
July 10th, 2017	10 Day Report as per Amended ECA	Written report regarding release of raw sewage on June 23rd.
August 22nd, 2017	Communication regarding an odour complaint	Communicated with Shannon Boland, MOECC Inspector. An odour complaint was received on August 18. An investigation revealed that there were no unusual odours at the plant.
August 31st, 2017	Communication regarding an odour complaint	Communicated with Shannon Boland, MOECC Inspector. An odour complaint was received on August 31. An investigation revealed that there were no unusual odours at the plant.
September 14th, 2017	10 Day Report as per Amended ECA	Written report regarding release of digester gas on August 31th.
September 20th, 2017	10 Day Report as per Amended ECA	Written report regarding release of digester gas on September 6th.

Date	Type	Description
November 7th, 2017	10 Day Report as per Amended ECA	Written report regarding release of digester gas on October 25th.
Consent Letters		
August 23rd, 2017	Director Consent Letter	Request for Consent – Possible release of digester gas during repairs to a digester gas withdraw line.
September 6th, 2017	Director Consent Letter	Consent Granted – Planned release of digester gas to facilitate repairs on digester gas withdraw line.
Notice of Start up Notice of Start up		
N/A	N/A	N/A
MOE Inspection		
No Inspection		

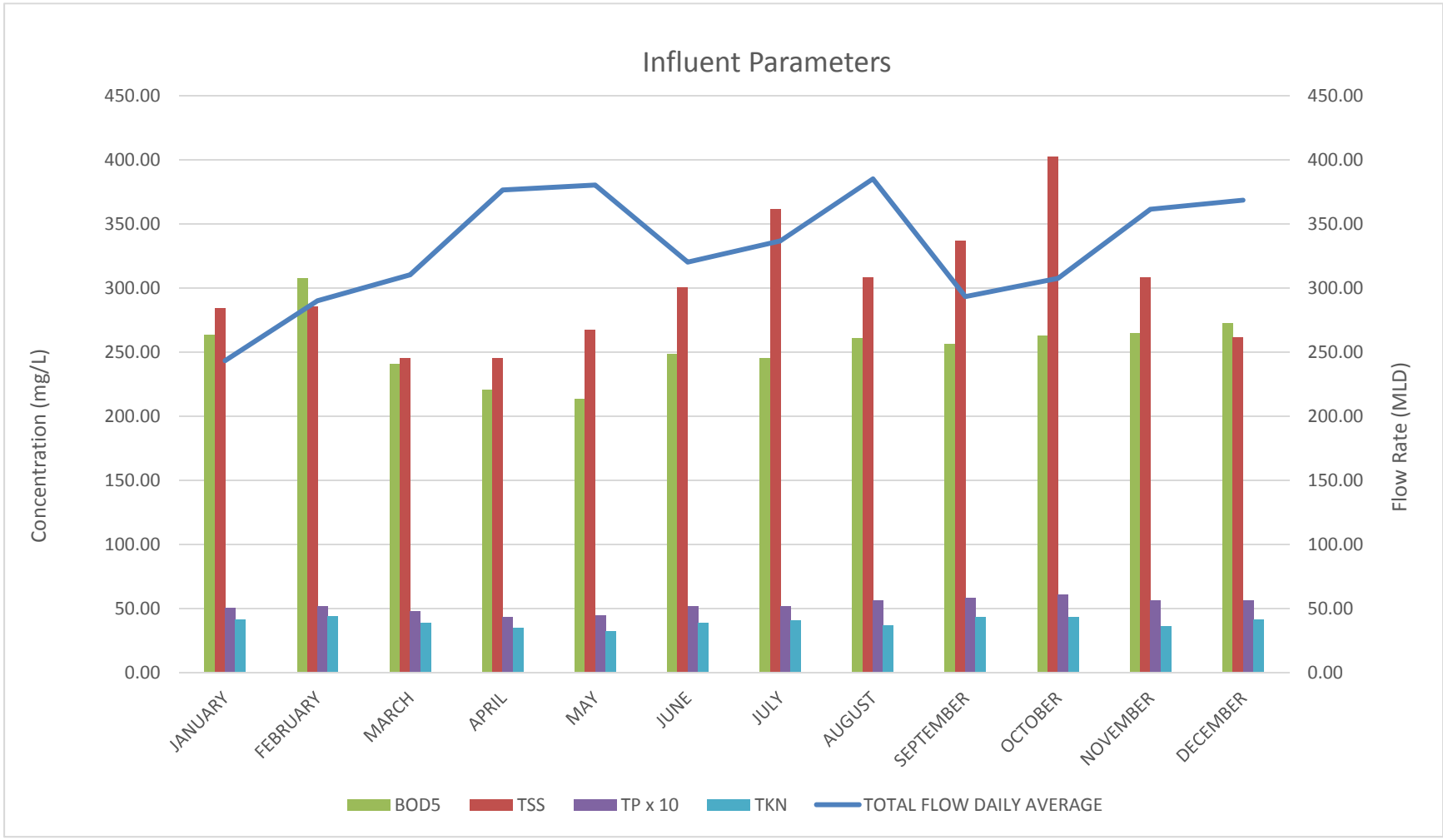
APPENDIX A –
Plant Schematic



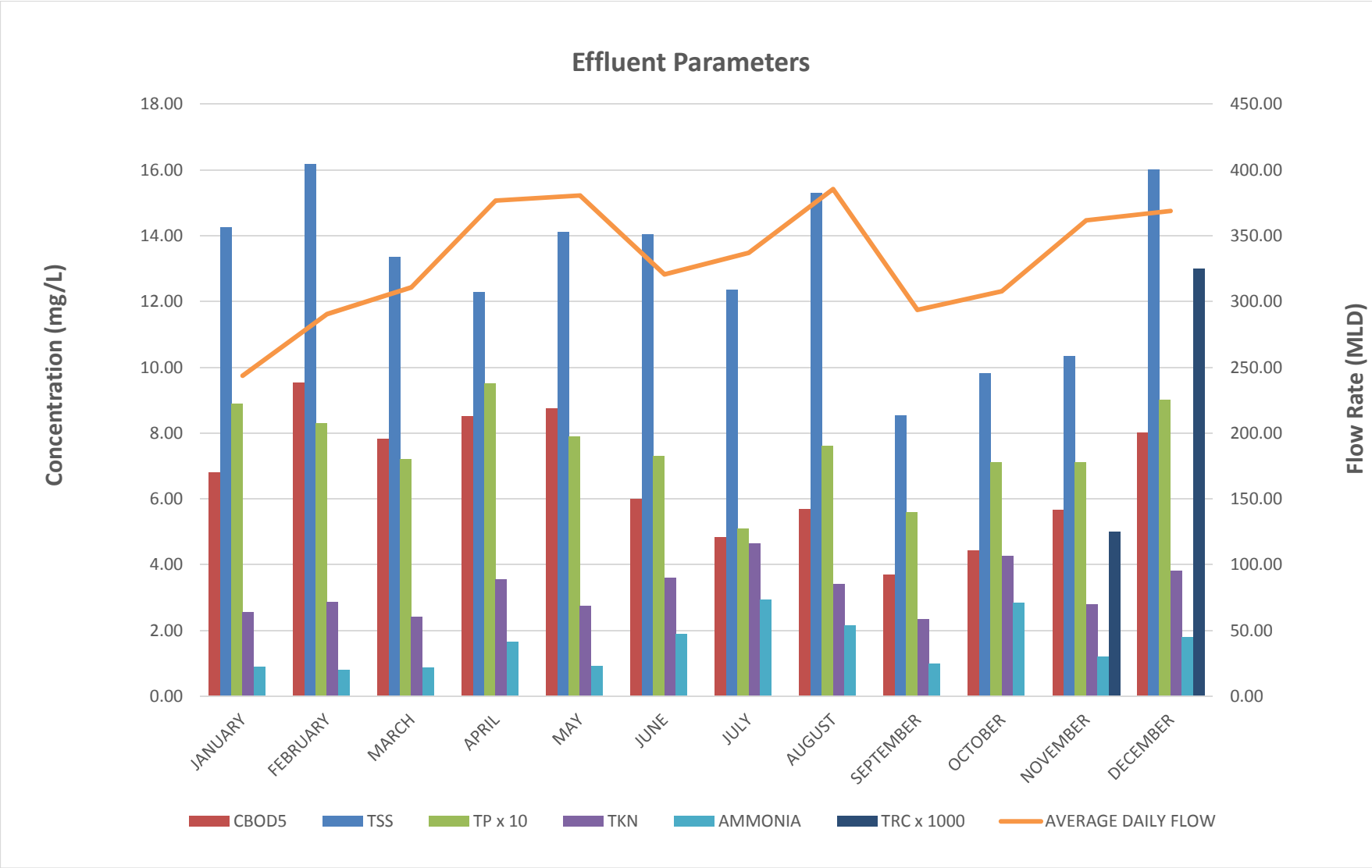
Process Flow Diagram for Humber Wastewater Treatment Plant

APPENDIX B –
Influent and Effluent 2017
Performance Charts

APPENDIX B: INFLUENT AND EFFLUENT 2017 PERFORMANCE CHARTS

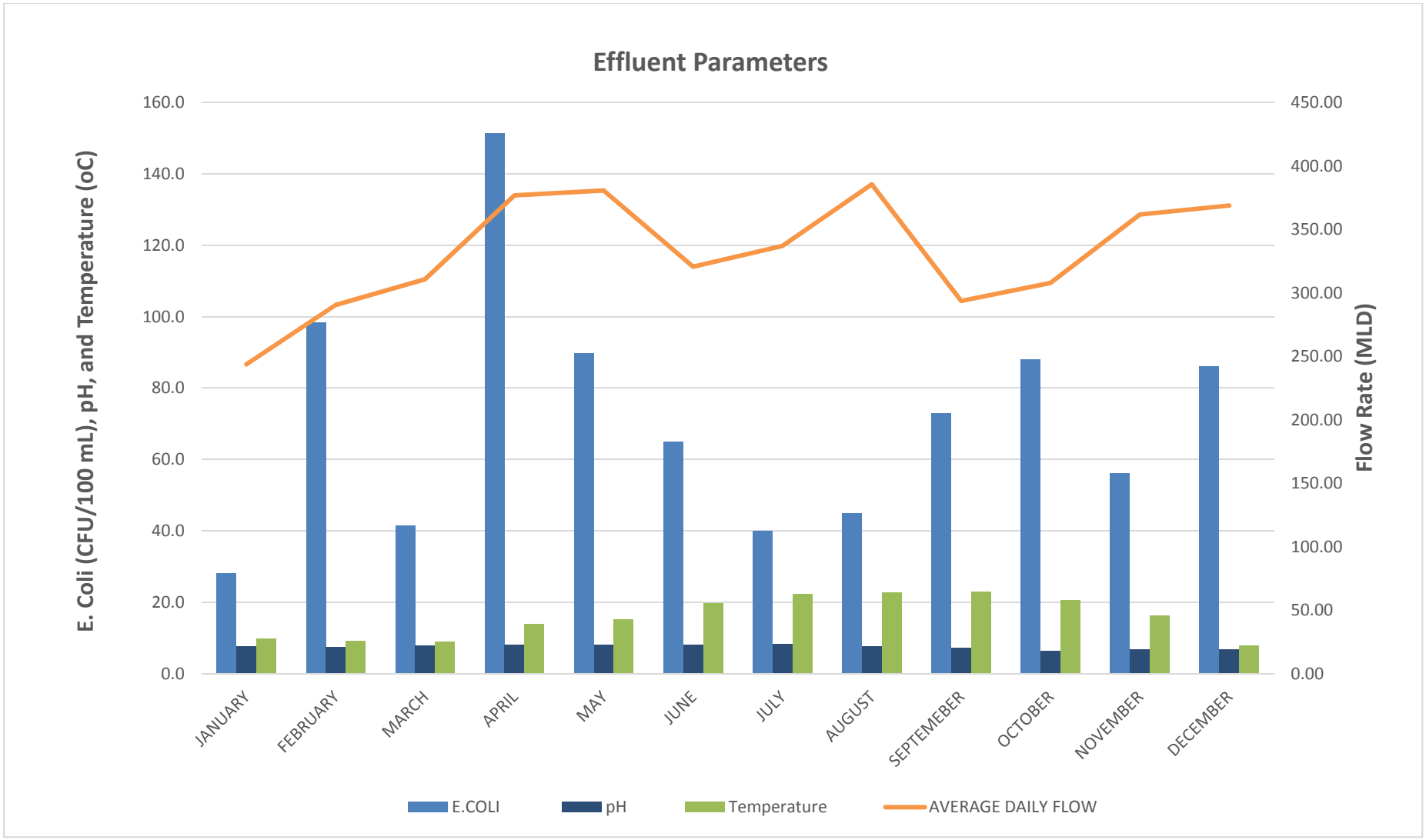


APPENDIX B: INFLUENT AND EFFLUENT 2017 PERFORMANCE CHARTS



Note: The test for TCR was SBS presence for January October, and Ultra-Low Chlorine Residual from November onwards

APPENDIX B: INFLUENT AND EFFLUENT 2017 PERFORMANCE CHARTS



APPENDIX C –
Historical Performance Data

APPENDIX C: HISTORICAL PERFORMANCE DATA

	Units	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Influent Parameters												
Flow	ML/day	331.7	257.3	269	280.5	312	287.5	379	362	300	331.3	301.3
Total Annual Flow	ML	121,062	94168	98174	102364	113709	105444	137971	132289	113060	121266	
Total Suspended Solids (TSS)	mg/L	301.2	331	369	356	318	405	446	290	354	322.8	200
Biochemical Oxygen Demand (BOD_5)	mg/L	255.2	299	318	295	238	261	267	250	212	164.1	150
Total Phosphorus (TP)	mg/L	5.3	5.8	5.8	5	4.4	4.9	5.1	4.8	4.6	4.8	4.5
Preliminary Treatment												
Grit and Screenings	Tonnes/day	2.1	1.6	2.2	2.1	3.4	1.8	2.2	14.5	2.4	2.7	2.4
Primary Treatment												
TSS	mg/L	102	94	97	101	151	148	126	100	97	104	96
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	mg/L	118.3	158	156	138	142	160	145	139	106	117	127.5
Secondary Treatment												
Aeration Loading	kg $CBOD_5/m^3$.day	0.41	0.38	0.39	0.37	0.4	0.47	0.57	0.45	0.32	0.36	0.33
Mixed Liquor Suspended Solids	mg/L	2,842	2953	2838	2998	2885	2151	2741	2384	2238	1292	1275
Final Effluent												
TSS	mg/L	13	13	11	12	13	15.7	13.1	11.8	14	15.5	16.6
cBOD5	mg/L	6.6	5.7	5.4	4.8	6	6	7.6	6.1	7	6	7.3
TP	mg/L	0.8	0.7	0.77	0.67	0.65	0.64	0.4	0.5	0.7	0.7	0.7
Escherichia Coli (E. Coli)	CFU/100 mL	72	29	52	30	31	26	51	46	24	14	9
pH		8	7.2	7.4	7	7	7	7.6	7.5	7.3	7	6.9
TP Loading Rate	kg/day	250	180	210	210	202	184	166	179	210	232	211
SS Loading Rate	kg/day	4,322	-			4050	4523	4970	4194	4200	5138	5002
cBOD5 Loading Rate	kg/day	2,202	-			1869	1728	2880	2209	2100	1989	2200
Total Chlorine Residual	mg/L	SBS (P) / 0.009	SBS - (P)	SBS - (P)	SBS (P)	-			-		-	-
Solids Handling												
Primary Sludge Treated	m^3/day	2,813	2689	2723	3495	2639	2532	2368	2661	3100	2920	
Primary Sludge Total Solids (TS)	%	1.9	-			-	-	-	1.69	2.19	1.84	
Primary Sludge Total Volatile Solids (TVS)	%	73.6	-			-	-	-	78.7	71.29	76%	
Waste Activated Sludge (WAS) to Thickening	m^3/day	3,776	3573	3135	3782	2984	3779	4536	4794	3960	3780	
WAS SS	mg/L	8,806	8630	9448	8863	10391	9012	7580	6877	7078	5676	
Thickened WAS (TWAS) TS	%	4.6	4	4.2	4.4	5.3	4.7	4.7	4.1	4.80%	4.30%	
TWAS VS	%	77.6	75	78.6	78	79	78.7	78.9	82.2	81%	79.80%	
TWAS Treated	m^3/day	714	598	350	512	464	726	739	937	850	940	
Digested Solids to ABTP	DT/day	80	59	57	64	57	54	48	39.1	40.6	38.8	37.7
WAS to ABTP	DT/day	4.8	5	17	11.7	5.8	1.7	4.7	4.0	14.8	24.9	32.9
Digester Gas Generated	10^3 m^3/day	26.2	28.1	25.4	24.6	20.3	21.3	17.5	15.6	15.5	23.2	20.5

APPENDIX D –
Influent and Effluent Metal Concentrations

APPENDIX D: INFLUENT AND EFFLUENT METAL CONCENTRATIONS

Parameter	**Arsenic**	**Cadmium**	**Chromium**	**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
January	*0.005*	*0.002*	0.00945	0.108	1.26	0.00563	0.0717	0.000186	0.00874	0.198
February	*0.005*	*0.002*	0.00741	0.0995	1.25	*0.0025*	0.0773	0.00007	0.00821	0.204
March	*0.005*	*0.002*	0.0083	0.092	0.912	0.00531	0.0652	0.000079	0.00682	0.2
April	*0.005*	*0.002*	0.00671	0.0964	0.912	*0.0025*	0.0645	0.000099	0.00557	0.165
May	*0.005*	*0.002*	0.0089	0.0803	1.21	*0.0025*	0.0691	*0.00005*	0.00661	0.185
June	*0.005*	*0.002*	0.0105	0.098	1.34	0.00506	0.0737	*0.00005*	0.00748	0.229
July	*0.005*	*0.002*	0.0102	0.114	1.15	*0.0025*	0.0653	*0.00005*	0.00853	0.256
August	*0.005*	*0.002*	0.00809	0.1	1.24	0.00552	0.0636	*0.00005*	0.00952	0.217
September	*0.005*	*0.002*	0.00659	0.111	1.33	*0.0025*	0.0673	0.000233	0.0096	0.286
October	*0.005*	*0.002*	0.0131	0.116	1.24	0.0059	0.066	*0.00005*	0.00835	0.277
November	*0.005*	*0.002*	0.0117	0.133	1.16	*0.0025*	0.0643	*0.00005*	0.00906	0.216
December	*0.005*	*0.002*	0.0126	0.108	1.19	*0.0025*	0.0614	*0.00005*	0.0137	0.301
Annual Average	*0.005*	*0.002*	0.00946	0.105	1.18	0.00374	0.0675	0.0000848	0.00852	0.228

Parameter	**Arsenic**	**Cadmium**	**Chromium**	**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
January	*0.005*	*0.002*	*0.002*	0.0214	0.501	*0.0025*	0.039	*0.00003*	0.00699	0.0514
February	*0.005*	*0.002*	*0.002*	0.0177	0.553	*0.0025*	0.031	*0.00003*	0.0064	0.0524
March	*0.005*	*0.002*	*0.002*	0.0176	0.549	*0.0025*	0.0572	*0.00003*	0.00576	0.0551
April	*0.005*	*0.002*	*0.002*	0.0213	0.418	*0.0025*	0.0487	*0.00003*	<0.005	0.0524
May	*0.005*	*0.002*	*0.002*	0.0141	0.612	*0.0025*	0.0487	*0.00005*	<0.005	0.0469
June	*0.005*	*0.002*	*0.002*	0.0112	0.722	*0.0025*	0.0579	*0.00005*	0.0054	0.0461
July	*0.005*	*0.002*	*0.002*	0.0124	0.707	*0.0025*	0.0613	*0.00005*	0.00671	0.0491
August	*0.005*	*0.002*	*0.002*	0.0156	0.901	*0.0025*	0.0492	*0.00005*	0.00628	0.0448
September	*0.005*	*0.002*	*0.002*	0.0181	1.19	*0.0025*	0.0572	*0.00005*	0.00664	0.06
October	*0.005*	*0.002*	*0.002*	0.0134	0.59	*0.0025*	0.0501	*0.00005*	0.00598	0.0722
November	*0.005*	*0.002*	*0.002*	0.0146	0.542	*0.0025*	0.0463	*0.00005*	0.00611	0.0449
December	*0.005*	*0.002*	*0.002*	0.02	0.853	*0.0025*	0.0557	*0.00005*	0.0065	0.0656
Annual Average	*0.005*	*0.002*	*0.002*	0.0165	0.678	*0.0025*	0.0502	0.000035	0.00628	0.0534

Data in red italics is half the MDL.

APPENDIX E –
Digested Sludge Metal Analyses

APPENDIX E DIGESTED SLUDGE METAL ANALYSES

	Arsenic	Cadmium	Cobalt	Chromium	Copper	Mercury	Molybdenum	Nickel	Lead	Selenium	Zinc
Limit (1)	*170*	*34*	*340*	*2800*	*1700*	*11*	*94*	*420*	*1100*	*34*	*4200*
January	-	-	-	-	-	-	-	-	-	-	-
February	-	-	-	-	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-	-	-	-	-
April	-	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-	-
June	3.4	1.3	6.1	66.6	638	0.493	7.44	20.5	28.8	2.8	903
July	3.1	0.8	5.2	62.9	560	0.414	8.18	22.5	23.8	3.2	782
August	-	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-	-
October	1.8	1.2	5.8	84.4	602	0.579	10.15	24.1	46.0	3.0	1267
November	-	-	-	-	-	-	-	-	-	-	-
December	0.83	1.0	5.0	56.8	593	0.484	6.51	21.5	26.4	1.8	727
Annual Average	2.3	1.08	5.53	67.7	598	0.49	8.07	22.2	31.3	2.71	920

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 Report

Humber Treatment Plant
Odour Reduction Report

Prepared by:

Vanessa Szonda, P.Eng
Senior Engineer, Toronto Water

March 31, 2018

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Purpose

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 Appendix A: Odour

Scope

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

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^3/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^3/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^3 of GAC
- A maximum discharge rate of 16 m^3/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 to April 10, 2018, however that completion date is not likely to be met. 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.

2017 Progress

In 2017, work on the Odour Control Project continued, and significant progress was made. The central biofilter has been essentially completed and is running under the control of the contractor. The vast majority of the ductwork has been completed, and

the balancing and commissioning of the system is expected to be completed in the coming months. The central biofilter fans and ductwork can be seen in Figure 1. Note, the biofilter is located underground.

Figure 1: The Central Biofilter

The GAC unit continues to run and is currently treating building air from the headhouse at its full capacity. This is a temporary mode of operation, as the final configuration will see foul air being extracted from process equipment and treated through the central biofilter. (Figure 2). Upon full commissioning of the central biofilter, temporary ductwork will be demolished and the GAC unit will be placed in permanent mode – which provides 6 air changes per hour for the headhouse screen room.

Figure 2: The GAC Unit

The construction of the south biofilter has been completed 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 upon completion of the project.

Figure 3: The South Biofilter

Process upgrades have continued, including the installation of two new bar screens and conveyor systems, as well as a new loading bay (Figure 4). This system is currently being commissioned. All three north grit tanks and the north grit loading bay, including classifiers and conveyors, have been completed and commissioned (Figure 5). All six south grit vortexes have been completed and commissioned, and all grit is being processed in the north grit loading facility (Figure 6). Air handling equipment is being brought online, and testing and balancing of the systems is expected to be completed in the coming months.

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

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

Figure 6 Vortex Grit Removal Equipment

Odour Reductions Achieved in 2017

The GAC unit was commissioned in 2016, and is currently treating 16 m^3/s per hour of foul air from the Headhouse and North Grit Buildings. This is a temporary mode of operation, and the actual odour reductions have not been modelled, therefore odour reductions cannot be quantified.

The south biofilter was commissioned in the first quarter of 2017, and is currently treating the foul air from the influent and effluent toughs 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 currently being operated by the contractor, and commissioning activities have begun. Once all of the foul air connections are completed, and the system is tested and balanced, source testing for the system can begin.

Complaints Received in 2017

Four odour complaints were received in 2017. All complaints were investigated and reported to the Water Supervisor as per the requirements in the ECA. A copy of the complaint reports can be found in Appendix B: Odour Complaints.

Next Steps

The City continues to work with Stantec and WCC to move forward with the project. Construction and commissioning of process equipment is ongoing, and the project is expected to be completed by the mid-2018. It is anticipated that all three odour control facilities will be fully completed, commissioned and running in permanent mode by that time.

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		50%	**01-Jul-18**
	New centralized biofilter to treat foul process air		95%	**01-Jul-18**
	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		0%	**01-Jul-18**
	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	
	Decomission chlorine gas scrubbers		Complete	
Air Scrubbers/Ozone	Decommission air scrubbers and ozone building	N/A	Complete	N/A

Updated March 17, 2017 by V. Szonda

Appendix B: Odour Complaints

Humber Treatment Plant

TORONTO Water

130 The Queensway
Etobicoke, Ontario M8Y 1H9

Environmental Compliance Approval 1937-9Z4RSE

March 27, 2017

York-Durham District Office
230 Westney Rd. S.
5th floor
Ajax ON L1S 7J5

Attn: Melissa Hills

Re: Humber Treatment Plant Odour Complaint

Dear Ms. Hills,

On Saturday, March 25, 2017 at approximately 11:00 am, the Humber Treatment Plant received an odour complaint by phone to our control room, indicating that an excrement odour was coming from the plant. The Operator in Charge investigated the complaint and did not find any unusual odour.

Two attempts have been made to contact the complainant, however both were unsuccessful. Odour control upgrades are ongoing to mitigate odour issues at the plant. The odour complaint report form is attached.

Should you have any questions, please do not hesitate to contact me. Best regards.

TORONTO Water

Humber Treatment Plant

130 The Queensway
Etobicoke, Ontario M8Y 1H9

Environmental Compliance Approval 1937-9Z4RSE

July 7, 2017

York-Durham District Office
230 Westney Rd. S.
5th floor
Ajax ON L1S 7J5

Attn: Shannon Boland

Re: Humber Treatment Plant Odour Complaint

Dear Ms. Boland,

On Wednesday, July 5, 2017 at approximately 2:40 pm, the Humber Treatment Plant received an odour complaint by phone to our control room, indicating that a foul odour had been detected the previous evening between 10 pm and 3:30 am. The caller indicated that this is a recurring thing. The Operator in Charge was unable to investigate the complaint as the issue was over.

Wastewater collection was contacted to determine whether or not it is possible that local sewers are causing the issue. They are currently investigating whether any remedial actions are appropriate.

The complainant has been contacted and a voice message was left. Odour control upgrades are ongoing to mitigate odour issues at the plant. The odour complaint report form is attached.

Should you have any questions, please do not hesitate to contact me.

Best regards.

Humber Treatment Plant

TORONTO Water

130 The Queensway
Etobicoke, Ontario M8Y 1H9

Environmental Compliance Approval 1937-9Z4RSE

August 22, 2017

York-Durham District Office
230 Westney Rd. S.
5th floor
Ajax ON L1S 7J5

Attn: Shannon Boland

Re: Humber Treatment Plant Odour Complaint

Dear Ms. Boland,

On Friday, August 18, 2017 at approximately 9:02 am, the Humber Treatment Plant received an odour complaint by phone to our control room, indicating that an unbearable odour had been detected the past few days. The caller indicated that it is particulary bad in the overnight hours.

The Operator in Charge investigated the complaint, but did not discover anything out of the ordinary had occured over the last several days that might have cause the unusual odour.

At this point there are no remedial actions that the Plant can take, and the complainant has been contacted and the situation explained. Odour control upgrades are ongoing to mitigate odour issues at the plant. The odour complaint report form is attached.

Should you have any questions, please do not hesitate to contact me.

Best regards.

TORONTO Water

Humber Treatment Plant

130 The Queensway
Etobicoke, Ontario M8Y 1H9

Environmental Compliance Approval 1937-9Z4RSE

August 31, 2017

York-Durham District Office
230 Westney Rd. S.
5th floor
Ajax ON L1S 7J5

Attn: Shannon Boland

Re: Humber Treatment Plant Odour Complaint

Dear Ms. Boland,

On Thursday, August 31, 2017 at 8:20 pm, the Humber Treatment Plant received an odour complaint by phone to our control room. The Operator in Charge investigated the complaint and did not find any unusual odour.

The complainant was contacted, and was informed of the plant's ongoing odour control project, which will help mitigate odour issues at the plant. The odour complaint report form is attached.

Should you have any questions, please do not hesitate to contact me. Best regards.