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1.0 INTRODUCTION

The Municipality of Brighton is pleased to present its Annual Performance Report for wastewater treatment for the operating period of January 1 to December 31, 2003.

Brighton's Water Pollution Control Plant services a population of approximately 5,000 residents consisting of 2,400 residential and 200 commercial accounts. The Ontario Environmental Training Consortium Certification Office (OETC) classifies the Water Pollution Control Plant as Wastewater Treatment Class 1 and Wastewater Collection Class 2.

The Brighton Wastewater Pollution Control Plant operates under Certificate of Approval number 3-0521-99-006 issued by the Ministry of Environment.

CONTROL DOCUMENT INFORMATION

Type of Control Document	Number	Issue Date	Effluent Monitoring Requirements (Yes/No)	Effluent Reporting Requirements (Yes/No)
C of A Sewage Works	3-0521-99-006	7/09/99	YES	YES
C of A Sludge Drying Beds	3-0381-96-006	8/01/96	YES	YES
C of A Composting Site	A710120	2/05/97	N/A	N/A

2.0 CONTACT INFORMATION

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3.0 WASTEWATER TREATMENT PLANT DESCRIPTION & TREATMENT PROCESS

The sewage works in Brighton consists of:

- a 0.68 hectare aerated lagoon (lagoon #1) with two mechanical surface aerators. The effluent from the aeration lagoon passes through a chemical mixing chamber where alum is added before entering the waste stabilization pond;
- a 5.44 hectare waste stabilization pond (lagoon #2), and;
- a constructed wetland having a surface area of 6.2 hectare, located south of the existing waste stabilization pond consisting of Wetland Cell #1 (north cell) and Wetland Cell #2 (south cell) with alternating deep zones and vegetative terraces. The effluent from the constructed wetlands is continuous and discharges to a natural wetland that borders Presqu'île Bay located off the northeast shore of Lake Ontario;
- a 2-cell drying bed to service the existing sewage treatment lagoons; sludge that accumulates at the bottom of the lagoons in the treatment process is pumped to drying beds. The dried sludge may be utilized at the composting facility if testing meets the conditions noted in the Certificate of Approval. Rejected sludge/compost may be disposed of on agricultural land and/or lands associated with the sewage facility. There has been no sludge removed from the WPCP site to date.

The hydraulic capacity of the sewage works has been re-rated at 4,600 m³/day since the constructed wetlands were incorporated to the treatment system in the summer of 2000. A portion of raw sewage from the Brighton collection system flows by gravity to the aerated lagoon. The remainder of the sanitary system flow is collected at the Harbour Street Sewage Pumping Station where it is pumped through a forcemain to the WPCP. The pumping station is equipped with three dry well raw sewage pumps and a standby diesel generator that pumps the flow through a forcemain to the sewage treatment area.

Brighton's wastewater treatment system is a simple low-tech approach based on working with natural processes and energies. The raw wastewater enters the aerated lagoon where it is mixed and oxygenated. The added oxygen allows aerobic microorganisms to reduce organic matter and nutrients in the wastewater and reduce odour potential. The effluent from the aerated lagoon (lagoon #1) then passes through a mixing chamber where alum is added. The alum acts as a binding agent that aids in settling out phosphorus and suspended solids from the wastewater. The sewage then flows to the waste stabilization pond (lagoon #2) where the bound solids settle to the bottom and the organic portions are decomposed through microbial action. Dissolved materials such as nitrogen and phosphorous are used by green algae in the pond for cell growth. The effluent from the waste stabilization pond then enters the constructed wetland for final polishing, where the water is further filtered and cleansed.

The natural processes occurring in the lagoons and wetland system produce a good quality effluent that is monitored regularly by municipal staff. Lab results show some variability due to seasonal affects occurring in a natural treatment process such as temperature, plant growth, death and decay; these processes along with the presence of wildlife will affect the analytical results of the water quality at the lagoon and wetlands. The Certificate of Approval reflects changes with concentration limits for Ammonia increasing from November to April annually.

4.0 COMPLIANCE WITH TERMS AND CONDITIONS OF CERTIFICATE OF APPROVAL

4.1 Performance

4.1.1 *Wastewater Flow to the WPCP*

Certificate of Approval 2.(a) The Owner shall ensure that the flow of sewage into the sewage treatment works does not exceed the average daily flow of 4,600 m³/day for a period of any twelve (12) consecutive calendar months.

The average daily flow for 2003 was 3,117 m³/day, which represents 68% of the average day design capacity of 4,600 m³/day. The maximum annual daily flow for 2003 occurred on March 22, 2003 where precipitation and spring thaw contributed to peak flow of 9,439 m³/day. Peak monthly flow of 125,924 m³ occurred in May due to a high precipitation rate during that month. In 2002, the average daily flow was 3,092 m³/day, the maximum monthly flow in May was 141,812 m³ with a peak daily flow of 10,314 m³/day on May 14, 2002 due to heavy precipitation.

The total flow of wastewater to the treatment plant in 2003 was 1,139,036 m³, approximately 11% higher than the total flow for 2002 of 1,012,713 m³. High precipitation rates in November and December were contributing factors to increased annual flow.

Table I – Monthly Sewage In-flow to Treatment Plant

2003	Total Flow m ³	Avg. Flow m ³ /Day	Max. Day Flow m ³	% (Avg.Day/Design Capacity)
JAN	72,557	2,341	2,671	51%
FEB	68,753	2,455	3,782	53%
MAR	121,860	3,931	9,439	85%
APR	120,487	4,016	5,976	87%
MAY	125,924	4,062	6,735	88%
JUN	100,143	3,338	5,307	73%
JUL	74,838	2,414	2,542	52%
AUG	71,274	2,299	2,941	50%
SEP	68,544	2,285	2,963	50%
OCT	81,242	2,621	3,143	57%
NOV	109,618	3,654	4,709	79%
DEC	123,796	3,993	5,511	87%
ANNUAL	1,139,036	3,117	9,439	68%

See Appendix IV Monthly Flow Chart

4.1.2 Waste Stabilization Pond Effluent Quality

Certificate of Approval 2.(b) The owner shall design, construct and/or operate the sewage treatment works such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from the waste stabilization pond:

Table II – C of A Waste Stabilization Pond Effluent Parameters

Effluent Parameters	Concentration in Effluent	Loading in Effluent
CBOD ₅	30.0 mg/L	138.0 kg./day
Suspended Solids	40.0 mg/L	184.0 kg./day
Ammonia & Ammonium Nitrogen (May 1 to Oct. 30) ¹	14.0 mg/L¹	64.4 kg./day¹
(Nov. 1 to Apr. 30) ²	17.0 mg/L ²	78.2 kg./day ²
Total Phosphorus	1.0 mg/L	4.6 kg./day

Table III - Waste Stabilization Pond Effluent - Compliance to C of A 2.(b)

	CBOD ₅		Suspended Solids		Ammonia		Total Phosphorus	
	Conc.	Loading	Conc.	Loading	Conc.	Loading	Conc.	Loading
	mg/L	kg/day	mg/L	kg/day	Mg/L	Kg/day	mg/L	kg/day
JAN	11.40	26.69	25.50	59.70	17.65	41.32	1.58	3.70
FEB	13.88	34.08	21.75	53.40	15.24	37.41	1.99	4.89
MAR	7.05	27.71	17.25	67.81	10.14	39.86	0.85	3.34
APR	13.28	53.33	28.80	115.66	5.48	22.01	0.38	1.53
MAY	9.00	36.56	7.25	29.45	3.28	13.32	0.15	0.61
JUN	4.25	14.19	7.25	24.20	4.04	13.49	0.16	0.53
JUL	2.80	6.76	5.80	14.00	10.30	24.86	0.14	0.34
AUG	3.15	7.24	5.00	11.50	11.63	26.74	0.16	0.37
SEP	2.16	4.94	4.20	9.60	8.62	19.70	0.10	0.23
OCT	2.00	5.24	10.00	26.21	13.78	36.12	0.12	0.31
NOV	2.10	7.67	9.25	33.80	12.48	45.60	0.23	0.84
DEC	4.40	17.57	7.20	28.75	10.44	41.69	0.16	0.64
AVG	6.29	20.16	12.44	39.51	8.61	22.37	0.50	1.44
					11.91	37.98		

Waste Stabilization Pond Effluent Summary:

*Limits for Ammonia change from May to October (shaded area Table III) and Nov.-Apr.

*Noncompliance with respect to concentrations of CBOD₅ and Suspended Solids in the effluent is deemed to have occurred when the *average concentration of all samples* taken exceeds the corresponding concentration in Table II. CBOD₅ and Suspended Solids were both well below CofA limits in concentration and loading for the waste stabilization pond effluent.

*Non-compliance with respect to concentrations of (Ammonia + Ammonium) Nitrogen and Total Phosphorus in the effluent is deemed to have occurred when the *'monthly average'* concentration of the parameter listed in Table II is exceeded in any calendar month. Ammonia concentration in January slightly exceeded CofA limits. Total Phosphorus concentration in January and February exceeded CofA limits. Total Phosphorus loading limits slightly exceeded CofA limits in February.

*Appendix II and III also demonstrates results of these parameters.

*Remaining parameters listed in Table III were in compliance with C of A concentration and loading limits.

*Brighton's Certificate of Approval stipulates lower concentrations for ammonia to be met from May to October; however, the lagoon/wetland system demonstrates optimal ammonia reduction capability from April to September annually.

4.1.3 Wetland Effluent Quality

Certificate of Approval 5.(a) the Owner shall use best effort to operate the sewage treatment works with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from constructed wetland:

Table IV – C of A Constructed Wetland Effluent Objectives

Constructed Wetland Effluent Parameter	Concentration
CBOD ₅	15.0 mg/L
Suspended Solids	15.0 mg/L
Ammonia + Ammonium Nitrogen (May 1 to October 30) ¹	10.0 mg/L ¹
(November 1 to April 30) ²	15.0 mg/L ²
Total Phosphorus	0.80 mg/L

Table V Constructed Wetland Effluent Concentrations (mg/L)- Compliance to C of A 5.(a)

	CBOD ₅	Suspended Solids	Ammonia	Total Phosphorus m
JAN	6.15	9.25	17.68	0.72
FEB	8.63	10.25	15.91	1.26
MAR	7.35	13.28	10.84	0.78
APR	8.12	13.00	3.14	0.17
MAY	2.25	3.75	0.43	0.05
JUN	3.25	8.00	1.37	0.11
JUL	5.48	9.20	3.95	0.29
AUG	3.45	7.00	9.35	0.26
SEP	2.96	8.80	6.74	0.22
OCT	2.40	9.25	10.32	0.15
NOV	2.10	9.25	12.48	0.23
DEC	2.00	4.00	10.05	0.08
AVG	4.55	8.46	5.36	0.35
			11.44	

Note Objectives for Ammonia concentration limits are: 10mg/L May-Oct. and 15mg/L Nov.-April.

Wetland Effluent Summary:

- Monthly Average Ammonia objectives of 15.0 mg/L were not met in January and February.
- Monthly Average Total Phosphorus objectives of 0.80 not met in February with a concentration of 1.26 mg/L T.P. in the final effluent due to upset in treatment system from frozen Alum line.
- Monthly Average Ammonia objective of 10.0 mg/L was not met in October with a concentration of 10.32 in the wetland effluent.

Lack of sunlight, plant production, decreased temperatures and ice cover in winter months directly affects treatment capability of a natural treatment process. Algae and plants consume nitrogen and phosphorus in the wastewater; lack of this activity in winter months limits the reduction of Ammonia and Phosphorus in the final effluent. A large muskrat population as well as an increased population of waterfowl contributed to decreased water quality in the wetlands during summer months.

Certificate of Approval (5.)(b) stipulates that the geometric mean density of *E. Coli* should not exceed 200 organisms per 100 ml. for any calendar month. *E. coli* are sampled for on a monthly basis as per CofA. See **Tables VI and VII representing the weekly lab results of the Waste Stabilization Pond and Wetland Effluent including monthly *E. Coli*** results. *E. Coli* levels were above 200 organisms per 100 ml on five occasions in the lagoon and eight occasions in the wetland. The muskrat and bird population at the wetland was likely a major contributor to the increased levels.

4.2 Monitoring and Recording

Certificate of Approval 4.(a) Annual calibration of flow measuring devices was performed on September 16, 2003.

Certificate of Approval 4.(b)(c)(d) – Table VIII demonstrates compliance with frequency of sampling of raw sewage, waste stabilization pond effluent and wetland effluent.

Tables VI and VII provide weekly lab results of samples collected.

4.3 **Operation and Maintenance**

Certificate of Approval (5.)(c) stipulates that the Owner shall endeavour to operate the sewage treatment works such that the effluent will not contain any oil or other substance in amounts sufficient to create a visible film or sheen on the surface of the receiving waters and shall be essentially free of any floating material.

Occasional foaming was present where the wastewater is agitated such as at the bottom of outfalls or weirs; this appears to be a natural reaction which occurs mainly when high flows are encountered in early spring.

Certificate of Approval 6.(a) refers to proper maintenance of related equipment and appurtenances to operate sewage works, including funding for operator training.

An Operations and Maintenance Manual is in place at the Sewage Works. Operators have been involved in safety, wastewater treatment and collection training. Continuing education is promoted and supported by the municipality for wastewater treatment and collection as well as other health, safety, and technical related courses.

Certificate of Approval 7.(c) Flows through the Brighton Wastewater Treatment lagoons and wetlands are continuous.

Certificate of Approval 7.(d)(i) Summary of all monitoring data including an overview of the sewage treatment program.

See Tables VI and VII for weekly lab results. **Appendix I** – Sewage Treatment Plant Performance - demonstrates efficiency of each stage of the Brighton WPCP treatment system.

Certificate of Approval 7.(d)(ii) Interpretation of all monitoring and analytical data and comparison to the final effluent quality and quantity.

Appendix I Brighton WPCP Performance Summary details results and efficiency of the sewage treatment performance demonstrating pollutant removal rates from raw sewage concentrations through to final effluent for CBOD₅, Suspended Solids, Total Phosphorus, TKN and Ammonia.

Appendix I demonstrates the success of Brighton's WPCP natural treatment process, which includes:

- 93.5% CBOD₅ removal
- 94.4% removal of Suspended Solids
- 89.1% removal of Phosphorus
- 61.3% removal of Nitrogen
- 56.8% removal of Ammonia.

Appendix II demonstrates loading to the Waste Stabilization Pond. One exceedance of loading occurred in February 2003, with a monthly average of Total Phosphorus at 4.89 kg/day slightly higher than the limits of 4.60 kg/day.

Appendix III demonstrates charts representing concentrations from the waste stabilization pond effluent and final wetland effluent for CBOD₅, Suspended Solids, Ammonia and Total Phosphorus.

Certificate of Approval 7.(d)(iii) Summary of any final effluent quality assurance or control measures undertaken during the reporting period.

Receiving water quality was tested in October in Presqu'ile Bay. Results indicate that the effluent from the constructed wetland, which flows through the natural wetland and Presqu'ile Bay have no detrimental effect on the receiving water. See Lab Results for Presqu'ile Bay Table VII.

Certificate of Approval 7.(d)(iv) Summary of maintenance carried out on major structure, equipment, apparatus, mechanism forming part of the works.

- Sludge from the waste stabilization pond was pumped to the sludge drying beds in June. Brighton has acquired the consulting firm CH2M Hill to assist with sludge management options for 2004.
- Catchbasin cleaning was contracted out in May to assist with clearing mosquito larva to prevent West Nile Virus.

Certificate of Approval 7.(d)(v) Summary of any environmental or operating problems encountered and mitigative measures taken.

On Monday, January 27, 2003, the Brighton area experienced a power outage. As a result, the aerators were down for approximately 5 hours during which time they froze up. This also aggravated the problem with the frozen alum line, causing a total blockage. Mitigative measure for the frozen alum line included modifications to the electrical system so that a stand-by generator can power the alum tank heater and mixing chamber in the case of hydro disruptions.

Controlling the increasing muskrat population at the wetland became a concern this year with sections of reeds/cattail being destroyed and replaced by muskrat huts. Trappers were successful in removing approximately 400 muskrat in the fall. The wetlands were demonstrating decreased water quality in the summer months due to the muskrat activity, stirring up of sediments causing higher levels turbidity and decreased performance in reducing contaminants. Noticeable improvements in the wetland effluent quality were evident by November. CH2M Hill consultants prepared a study of Muskrat Management Strategies for Treatment Wetlands that included recommendations of annual trapping and habitat modifications such as water level alterations and trimming surrounding vegetation to enhance predation.

Several residents along Price St. E. in Brighton, located adjacent to Presqu'ile Bay, complained of odours from the Bay during summer months and felt that the wastewater discharge may be a contributing factor to the odours. Staff investigated complaints and found that there were no offensive odours from the lagoon or wetlands during their investigation dispersing to abutting areas. Advice was sought from the MOE Peterborough District Office and Public Health who both agreed that algae populations in the summer often have sewage-like odours at times along Lake Ontario. Also, John Pries, CH2M Hill, investigated the Bay area by canoe in the fall with no conclusive evidence but also suggested that a shallow bay such as Presqu'ile Bay would harbour

significant algae populations in the summer. The study may commence next summer when odours are evident in the Bay.

Certificate of Approval 7.(d)(vi) Summary of alterations, extensions or replacements in the process or operation of the works which are considered for implementation over the next reporting period.

In 2002, Ontario Parks requested that the Municipality of Brighton extend municipal water and sanitary sewer services into Presqu'ile Park to service the park office, campgrounds and other buildings. Extensions to the collections system commenced in spring of 2003 which included a new sewage pumping station and approximately 3.6 km. of sanitary sewer force main along Presqu'ile Parkway. Residential areas along Bayshore Road area at Presqu'ile Point and Lakehurst Street were surveyed for interest in extension of the water/sewer services. A majority of Lakehurst St. residents were in favour of extension of the water/sewer system; this project will commence in 2004 to this area. A majority of residents at Presqu'ile Point voted that they did not want water/sewer services to their area.

Certificate of Approval 7.(d)(iv) Summary of calibration and maintenance procedures conducted on all monitoring equipment.

Milltronics performed annual calibration of flow meters including in-flow, lagoon outflow, and wetland final outflow on September 16, 2003. Pumping station flows were calibrated by Metcon on October 15, 2003.

4.4 Reporting – Non-Compliance

Certificate of Approval 7.(b) In January and February, 2003 reports of non-compliance were made to the Ministry of Environment Peterborough District Office regarding exceedance of Total Phosphorus and Ammonia concentration in the Waste Stabilization Pond and Wetland effluent. This upset to the treatment system occurred due to a frozen Alum line. In January 2003, waste stabilization pond effluent exceeded the average monthly CofA limit of 17.0 mg/L with an average of 17.65 mg/L and Total Phosphorus exceeded the monthly average concentration of 1.0 mg/L with an average of 1.58 mg/L T.P. The wetland effluent also exceed CofA objectives of 15.0 mg/L Ammonia in January with a concentration of 17.68 mg/L, the Total Phosphorus concentration was below the Cof A objective of 0.80 mg/L. In February, problems with the frozen alum line continued and Total Phosphorus concentration in the Waste Stabilization Pond exceeded the CofA limit of 1.00 mg/L with a monthly average concentration of 1.99 mg/L in the effluent. The wetland effluent was also above objective limits of 0.80 mg/L with a concentration of 1.26 mg/L T.P. Modifications were made to the plumbing and electrical system at the plant to prevent the alum line from freezing including a stand-by generator so that power outages will not affect heat to the Alum tank.

Monthly Municipal Utility Monitoring Program (MUMPS) summaries were completed and forwarded to the MOE District office and the Environmental Monitoring & Reporting Branch. Annual performance reports for Brighton's Wastewater Treatment Plant are prepared and submitted to the MOE District Manager.

5.0 SLUDGE DRYING BEDS

Dried sludge removed from the waste stabilization pond was analyzed for metals in May and June 2003 to measure the quality for deposition options. Arena Creek which flows around the drying beds was tested upstream and downstream as per CofA, see results Table VI. Sludge analyses revealed that Chromium, Copper and Mercury did not meet the Interim Guidelines for the Production and Use of Aerobic Compost in Ontario, however did meet agricultural land application limits. Since composting the sludge was not an option and larger quantities of sludge is required to be removed from the lagoons, a consultant was hired to assist the municipality. Options for sludge management are currently under investigation with the assistance of CH2M Hill consultants. Sludge pumped from the waste stabilization pond to the drying beds was sampled and tested for metals for the purpose of utilizing the sludge as compost. Composite samples were taken from the drying bed as well as the stock pile and tested for the following metals:

Parameter	Date Tested		MOE Compost Guidelines	Agrl. Land Max. Limits	Agrl. Land Targets
	May 21, 2003	June 24, 2004			
Arsenic	1 mg/kg	2 mg/kg	10 mg/kg	170 mg/kg	35 mg/kg
Cadmium	1.0 mg/kg	<1 mg/kg	3 mg/kg	34 mg/kg	4 mg/kg
Chromium	108 mg/kg	168 mg/kg	50 mg/kg	2800 mg/kg	530 mg/kg
Cobalt	4 mg/kg	<1 mg/kg	25 mg/kg	340 mg/kg	77 mg/kg
Lead	<5 mg/kg	19 mg/kg	150 mg/kg	1100 mg/kg	220 mg/kg
Mercury	0.294 mg/kg	0.388 mg/kg	0.15 mg/kg	11 mg/kg	1.4 mg/kg
Molybdenum	1 mg/kg	<1 mg/kg	2 mg/kg	94 mg/kg	1.2 mg/kg
Nickel	22 mg/kg	40 mg/kg	60 mg/kg	420 mg/kg	80 mg/kg
Selenium	0.7 mg/kg	0.9 mg/kg	2 mg/kg	34 mg/kg	6 mg/kg
Zinc	113 mg/kg	237 mg/kg	500 mg/kg	4200 mg/kg	840 mg/kg
Copper	313 mg/kg	609 mg/kg	60 mg/kg	1700 mg/kg	380 mg/kg
pH	7.56				

6.0 CONCLUSION

The Brighton Water Pollution Control Plant has been successful in treating the wastewater utilizing the lagoons and wetlands through natural treatment processes. The final quality of the effluent may be influenced by a majority of environmental factors such as climate or wildlife. These factors must be considered when analyzing the data and performance of the effluent quality. Enhanced performance is exhibited during warmer months when nutrients are absorbed from the growth of vegetation and bacteria are most active. Wastewater effluent from the wastewater pollution control plant (WPCP) is tested at Caduceon Environmental Labs (formerly ETRL), a certified lab, on a weekly basis as per Certificate of Approval. Aside from the problem encountered in January and February with the frozen Alum line, the effluent quality from the lagoon and wetland site to Presqu'ile Bay has met and/or exceeded the majority of water contaminant limits and objectives set under the terms and conditions of the Certificate of Approval. The Municipality of Brighton is presently investigating sludge management options. Brighton is dedicated to achieving continuous improvement of its wastewater treatment system and being environmentally responsible to the quality of its receiving waters.