1.0 INTRODUCTION

The Municipality of Brighton is pleased to present its Annual Performance Report for sewage treatment works for the operating period of January 1 to December 31, 2001.

Brighton's Water Pollution Control Plant services a population of approximately 4700 residents consisting of 2072 residential and 206 commercial accounts. The Ontario Environmental Training Consortium (OETC) classifies the Water Pollution Control Plant as Class I Wastewater Treatment and Class II Wastewater Collection facility.

The Brighton Wastewater Pollution Control Plant operates under Certificate of Approval number 3-0521-99-006 issued by the Ministry of Environment. The composting program has not been initiated to date, therefore reporting for this program is not applicable at this time.

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	N/A	N/A
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 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 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 wetlands discharges to a natural wetland in Presqu'ile Bay and then Lake Ontario.

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. The majority of raw sewage from the Brighton collection system flows directly to the aerated lagoon; a lower section of the collection system is pumped to the treatment site. The Harbour Street Sewage Pumping Station is equipped with three 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 nature. The raw wastewater enters the aerated lagoon where the sewage mixes and dissolved oxygen freshens the wastewater. Organic matter and nutrients in the wastewater are used by microorganisms for cellular growth and reproduction. 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 and aids in settling out the solids from the wastewater. The sewage flows to the waste stabilization pond (lagoon #2) where heavy solids settle to the bottom, decompose, and are ingested by anaerobic bacteria. Suspended solids are stabilized by bacteria in suspension. 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 staff. Lab results are variable due to the seasonal factors that effect a natural treatment process. Effluent from lagoon #2 and the wetlands are tested and sent to ETRL, a certified lab, on a weekly basis.

The final effluent discharged from the wetland site to Presqu'ile Bay has met and/or exceeded the majority of water contaminant objectives set under the terms and conditions of the Certificate of Approval. The lagoon and wetlands attract an abundance of birds and other wildlife which affect the water quality results for concentrations of E. Coli. This is a difficult parameter to maintain due to the wildlife presence at the wetland, however it is tested as required by C of A.

4.0 COMPLIANCE WITH TERMS AND CONDITIONS OF CERTIFICATE OF APPROVAL

4.1 **Performance**

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 annual flow for 2001 was 2,777m^3/day.

Average monthly flow of sewage to sewage treatment works/cubic metres per day												
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
2652	3256	4367	3592	2721	2638	2112	2037	2104	2419	2444	2985	2777

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 effluents from the waste stabilization pond:

Waste Stabilization Pond 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) Nov. 1 to Apr. 30)	 ***14.0 mg/L*** 17.0 mg/L	 ***64.4 kg./day*** 78.2 kg./day
Total Phosphorus	1.0 mg/L	4.6 kg./day

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	7.95	21.22	13.50	35.80	16.42	43.55	0.59	1.56
FEB	8.10	26.37	28.30	92.14	12.80	41.68	0.76	2.47
MAR	7.40	32.32	25.00	109.18	11.10	48.47	0.71	3.10
APR	6.00	21.55	21.80	78.31	6.61	23.74	0.42	1.51
MAY	4.40	11.97	4.80	13.06	***9.30***	***25.31***	0.50	1.36
JUN	5.00	13.19	8.00	21.10	***13.43***	***35.43***	0.32	0.84
JUL	2.68	5.70	4.60	9.72	***12.12***	***25.60***	0.18	0.38
AUG	6.60	13.44	10.50	21.39	***6.99***	***14.24***	0.16	0.33
SEP	10.80	22.72	26.25	55.34	***10.94***	***23.02***	0.61	1.28
OCT	15.80	38.22	36.80	89.02	***12.26***	***29.66***	0.71	1.72
NOV	11.70	28.59	40.00	97.76	12.63	30.87	0.87	2.13
DEC	10.95	32.69	27.75	82.83	11.78	35.16	0.46	1.37
AVG	8.12	22.33	20.61	58.80	***10.84***	***25.54***	0.52	1.50
					11.89	37.25		

4.1 Performance cont'd…

2.(c)(i) Non-compliance with respect to concentrations of $CBOD_5$ and Suspended Solids in the effluent is deemed to have occurred when the average concentration of any of the parameters, as defined in the C of A, based on all samples taken in accordance with Condition No.4, exceeds its corresponding concentration in effluent specified in Subsection 2.(b).

2**.(c)(ii)** Non-compliance with respect to concentrations of (Ammonia and Ammonium) Nitrogen and Total Phosphorus in the effluent is deemed to have occurred when the monthly average concentration of the parameters, as defined in the C of A, based on all grab samples taken in accordance with Condition No.4, during any calendar month exceeds its corresponding concentration in effluent specified in Subsection 2.(b).

2.(c)(iii) Non-compliance with respect to total loading of $CBOD_5$ and Suspended Solids is deemed to have occurred when the annual average loading of any of the parameters, as defined in the C of A, based on all grab samples taken in accordance with Condition No. 4, during any twelve (12) consecutive calendar months, exceeds its corresponding total loading from effluent specified in Subsection 2.(b).

2.(c)(iv) Non-compliance with respect to total loading of Total Phosphorus is deemed to have occurred when the monthly average loading of any of the parameters, as defined in the C of A, based on all grab samples taken in accordance with Condition No. 4, during any twelve (12) consecutive calendar months, exceeds its corresponding total loading from effluent specified in Subsection 2.(b).

2.(c)(iv) Non-compliance with respect to total loading of (Ammonia + Ammonium) Nitrogen is deemed to have occurred when the monthly average loading of any of the parameters, as defined in the C of A, based on all grab samples taken in accordance with Condition No. 4, multiplied by the average daily flow over the seasonal period the sample was taken, exceeds its corresponding total loading from effluent specified in Subsection 2.(b).

- Refer to the following appendices for graphical presentation of compliance in this section:

Appendix I – C of A 2.(a) flow of sewage
Appendix II – C of A 2.(c)(i) average concentrations of $CBOD_5$.
Appendix III – C of A 2.(c)(i) average concentrations of Suspended Solids.
Appendix IV – C of A 2.(c)(ii) monthly average concentrations of Ammonia.
Appendix V – C of A 2.(c)(ii) monthly average concentrations of Total Phosphorus.
Appendix VI - C of A 2.(c)(iii) total loading of $CBOD^5$ as an annual average loading.
Appendix VII – C of A 2.(c)(iii) total loading of Suspended Solids as an annual average loading.
Appendix VIII – C of A 2.(c)(iv) total loading of Total Phosphorus.
Appendix IX – C of A 2.(c)(v) loading of (Ammonia + Ammonium) Nitrogen in the monthly average loading.

Certificate of Approval 3. – There were no incidences of diversion of flow from the sewage works as defined in the C of A during the period of this report.

4.2 **Monitoring and Reporting**

Certificate of Approval 4.(a) Annual calibration of flow measuring devices was performed in November of 2001. A copy of the report was sent to the Ministry of Environment District Office and is on file at the Brighton WPCP plant and Public Works offices.

Certificate of Approval 4.(b)(c)(d) – ***Appendix X*** demonstrates compliance with frequency of sampling of raw sewage, waste stabilization pond effluent and wetland effluent; non compliance with temperature readings at the waste stabilization pond and wetland occurred as temperatures were not taken on a continuous weekly basis throughout the year.

4.3 **Operation and Maintenance**

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:

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) (November 1 to April 30)	 10.0 mg/L 15.0 mg/L
Total Phosphorus	0.8 mg/L

Constructed Wetland Effluent Concentrations - Compliance to C of A 5.(a)

	$CBOD_5$ mg/L	Suspended Solids mg/L	Ammonia mg/L	Total Phosphorus mg/L
JAN	7.50	16.00	16.18	0.56
FEB	7.35	12.75	13.3	0.37
MAR	4.55	13.00	9.5	0.36
APR	3.96	9.25	3.65	0.18
MAY	2.28	2.80	***0.97***	0.08
JUN	2.20	6.25	***5.45***	0.06
JUL	2.20	3.60	***7.01***	0.08
AUG	2.25	5.65	***4.21***	0.12
SEP	7.80	5.50	***7.39***	0.39
OCT	3.90	9.50	***9.97***	0.34
NOV	2.40	8.50	10.85	0.36
DEC	4.60	10.75	10.34	0.28
AVG	4.25	8.63	***8.24***	0.27

Results for wetland parameters are objectives only and will assist in establishing limits once the 5-year monitoring timeframe is complete. Results of Appendix XII reveal weekly results of $CBOD_5$ tests were all within the C of A objective. Optimum results occurred, as expected, in the warmer months between April to September. Results of Appendix XIII reveal suspended solids to be over the objective limit of 15 mg/L on 8 events. Results in November prompted a meeting between operators regarding proper sampling techniques. Appendix XIV revealed higher ammonia level during winter months. Lack of sunlight and decreased temperatures directly affects the amount of algae in the lagoons. Algae and plants consume nitrogen and phosphorus in the wastewater; lack of this activity in winter months will increase the levels of Ammonia and Phosphorus. In January and February of 2001, Brighton experienced extraordinary cold temperatures and heavy snowfall; in November and December of 2001, the winter was fairly mild compared to the previous year's. Appendix XV revealed Total Phosphorus readings meeting objectives except for the two week period in November where several parameters were high; this may be explained by poor sampling technique or a slug containing higher concentrations working through the system.

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. The concentration of E. Coli in both lagoons has been erratic and difficult to control due to the wildlife present at both locations. See ***Appendix XVI and XVII representing the weekly lab results of the Waste Stabilization Pond and Wetland Effluent including monthly E. Coli*** results. The lagoons and wetland are home to many birds, amphibians and mammals including nesting swans, ducks, geese, as well as frogs, snakes, and snapping turtles. Other sitings include muskrat, fox, rabbits, groundhog, coyotes, raccoons, deer and beaver. In October and November extraordinary large flocks of red winged blackbirds inhabited the wetland area which would have an effect on the quality of effluent from the wetland.

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.

There is foaming at outfalls occurring on a intermittent basis. In May 2001, a sample of collapsed foam was taken and sent to lab for analysis. Also, inquiries were made to consultants regarding the foaming. The most probable cause of the foam is due to incomplete digestion of organic material which may occur during cold temperatures. The biological activity at the lagoons and wetland decrease with colder temperatures, which may cause this phenomenon to occur. The foaming has mainly been noted during spring thaw, where the problem may persist for a few weeks.

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

A Operations and Maintenance Manual is in place at the Sewage Works. Also, operators have been involved in continuous training in regards to safety and waste treatment courses. A variety of programs have been scheduled for staff such as confined space awareness, air quality monitoring, health and safety courses. Continuing education is promoted and supported by the municipality for wastewater treatment and collection as well as other related courses.

4.4 **Reporting**

Certificate of Approval 7.(b) There was no reportable exceedance of concentration in any parameters noted in the C of A for the waste stabilization pond effluent in 2001.

Certificate of Approval 7.(c) There was no reportable occurrence of bypasses from the Brighton WPCP.

Certificate of Approval 7.(d)(i) Summary of all monitoring data including an overview of the sewage treatment program. ***Appendix XVIII Sewage Treatment Plant Performance*** demonstrates efficiency of each stage of the Brighton WPCP treatment system.

Certificate of Approval 7.(d)(i) Summary and overview of sewage treatment process.

Appendix XVIII notes the efficiency of the Brighton WPCP. The $CBOD_5$ removal from the waste stabilization pond was 81.1% with the final effluent from constructed wetland having a 90.6% removal rate. Suspended Solids removal exemplified similar results with 77.1% removal from waste stabilization pond and 90.5% removal from final effluent at constructed wetland. Removal of Phosphorus from the waste stabilization pond was 84.8% and 92.3% from final effluent at constructed wetland. Ammonia reduction was 41.5% from waste stabilization pond and 57.5% from constructed wetland. All calculations were based on annual average concentrations and removal from the monthly raw sewage lab results. Increased reduction occurs during warmer months due to greater biological activity.

The Municipality is dedicated to continuous improvement in it's sewage treatment process. New weekly forms are being utilized to ensure improvement in recording weekly temperatures, monitoring, and maintenance items. Improvements in record keeping and reporting with the Ministry of Environment, keeps staff updated on information and changes requested by Ministry staff. Alum shipments are accompanied by Certificate of Analysis; quantity and quality of any incoming chemicals are kept on file along with Material Safety Data Sheets.

New V-notch weirs were installed in November 2001 for incoming effluent to the wetlands for increased accuracy in flow measurements. Flow measuring devices were calibrated in conjunction with the V-notch weirs being installed. Hydroelectricity was installed to the first stage of the wetland for the flow monitoring equipment; the final effluent flow monitoring devices still rely on batteries for power.

Sludge from the waste stabilization pond was pumped to the sludge drying beds a total of four times during the warmer months. Staff measured sludge depth and cleared out excessive duckweed growing in the waste stabilization pond in July and August. The need to make improvements in removing sludge from the waste stabilization pond is acknowledged by the Municipality and the Public Works Committee will be discussing options.

5.0 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 is influenced by a majority of environmental factors such as climate and wildlife. These factors must be considered when analyzing the data and performance of the effluent quality. The wetlands were incorporated into the treatment system in the summer of 2000, which gives Brighton another 3 ½ years to prove the efficiency and create working limits for the final wetland effluent.

APPENDICES

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