APPENDIX J

Sample Operation & Maintenance Report

SWM Pond Maintenance Costs

Name of Subdivision

File No.

Date:

SWM Facility Operation and Maintenace Costs

Based on Table 7.5 MOE 2003

	A	B	C	D	
Type of Maintenance	**Maintenance Interval (yrs)**	**Unit**	**Unit Price**	**Quantity**	**Annual Cost =(C x D) / A**
Litter Removal	1	ha	$ 2,000	0.88	$ 1,760
Grass Cutting	1	ha	$ 250	0.88	$ 220
Weed Control	1	ha	$ 2,500	0.88	$ 2,200
Vegetation Maintenance (Aquatic/ Shoreline Fringe)	5	ha	$ 3,500	0.20	$ 137
Vegetation Maintenance (Upland/Flood Fringe)	5	ha	$ 1,000	0.20	$ 41
Sediment Removal (vacuum truck or manual)	15	m^3	$ 120	1019	$ 8,148
Sediment Testing (lab tests on quality)	15	each	$ 3,000	1	$ 200
Sediment Disposal (off-site landfill)	15	m^3	$ 300	1019	$ 20,370
Sediment Disposal and Landscaping (on-site)	n/a	m^3	$ 5	-	-
Inspection (Inlet/Outlet, etc.)	1	each	$ 100	4	$ 400
Pervious Pipe cleanout (flushing)	5	m	$ 1	10	$ 2
Pervious Pipe cleanout (Radial Washing)	5	m	$ 2	10	$ 4

Total Annual Operation and Maintenance Costs= $ 33,490

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Issues and Revisions Registry

Identification	Date	Description of issued and/or revision
Draft Report		For internal review
Draft Report		For client review

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1 Introduction

_____ [Consultant] was retained by _____ (the 'Owner') to undertake the detailed engineering design in support of the _____ [Development], located in the Town of Ayr, Regional Municipality of Waterloo (the 'Region'). As part of the detailed design, a stormwater management (SWM) wet pond facility was proposed to accommodate runoff from the subdivisions, as detailed within the _____ [existing SWM Report]. Within the appendices of this SWM report, an Operations & Maintenance Manual was provided, based on the design volumes of the pond.

The purpose of the following report is to provide a stand-alone Operations & Maintenance manual outlining the operation and maintenance procedures for the subject stormwater management wet pond.

2 Site Location

The _____ Subdivision (Draft Plan No. ####, Registered M Plan No. ####) is located within the Town of Ayr, _____ [description location]. Refer to the Location Plan provided as **Figure 1** following this report.

3 Pond Description

The _____ Subdivision consists primarily of _____ [description of subdivision]. Stormwater runoff from the _____ Subdivision, as well as runoff received from external areas, is accommodated by a stormwater management wet pond facility located at the southwest corner of the NAME subdivision. The total ### ha pond block is situated _____ relative to _____ [Subdivision]. The Town approved design drawings for the SWM Pond are enclosed for reference with this report as **Drawings ### – ####.** Permits and Approvals related to the SWM Pond are provided in **Appendix A**.

A total ### ha drainage area is tributary to the SWM Pond (including external areas), with an average imperviousness of ###%. Refer to **Figures STM-01 and STM-02** enclosed with this report, depicting the post-development drainage areas. The Level 1 Enhanced protection storage volume requirement for ### % impervious is ### m^3/ha, of which ## m^3/ha is the extended detention, leaving ### m^3/ha as the permanent pool requirement in order to achieve 80% removal of total suspended solids (TTS). As such, a permanent pool volume of #### m^3 is required. The constructed SWM Pond provides a total permanent pool volume of #### m^3 and is therefore sufficiently sized in order to provide 80% removal of Total Suspended Solids.

The pond outlet consists of a ### m x ### m concrete box [or other type of structure] outlet control structure. A hickenbottom [or other type] structure fitted with a ### mm diameter reverse-slope pipe conveys flows to the control manhole, where a ### mm diameter orifice (installed at an invert elevation of #### m) controls the extended detention within the pond. A ## m x ## m ditch inlet catch basin (DICB1) and a ##m x ## m ditch inlet catch basin (DICB2) are installed at grate invert elevations of #### m and #### m, respectively. A concrete orifice control wall is constructed within the ## m x ## m box structure [or other type], to provide erosion control (as discussed above) and quantity control of the pond. The concrete orifice control wall houses the ### mm diameter orifice (as mentioned above) as well as a ## m x ## m rectangular orifice at an invert elevation of #### m. **Drawing ####** enclosed with this report depicts details of the orifice control wall. Additionally, a ### m spillway is provided along the ____ side of the pond at an average invert elevation of ##### m.

4 Cleanout Frequency

According to Table 6.3 of the *Ministry of Environment (MOE) SWM Planning & Design (SWMPD) Manual*, the yearly sediment loading for ### % imperviousness is ### m^3/ha of drainage area, resulting in ### m^3/year of sediment accumulation for the ### ha area (### m^3/ha x ### ha = ### m^3/year). Two (2) approaches were considered for calculating the cleanout frequency of the pond. The first calculates the number of years of sediment accumulation which would reduce the sediment forebay volume by 50%, and the second calculates the number of years of sediment accumulation which would reduce the overall permanent pool such that the TSS removal efficiency is reduced by 5% from 80% to 75%.

4.1 Reduction of Sediment Forebay Volume by 50%

The sediment forebay should be able to accumulate sediment for at least 10 years before its volume is reduced by 50% and cleanout is required. The pond provides a sediment forebay volume of #### m^3. Based on the estimated sediment loading rate, established in **Section 4** above, it would take approximately ## years before the sediment forebay volume is reduced by 50% to ### m^3 (#### m^3/ ### m^3/year = ## years).

4.2 Reduction of TSS Removal Efficiency by 5%

The SWM Pond was designed to provide Enhanced (Level 1) Protection as defined by the Ministry of the Environment, Conservation, and Parks (MOECP) Stormwater Management Planning and Design Manual (2003), requiring an 80% removal of Total Suspended Solids (TSS). Therefore, reduction of the sediment removal efficiency by 5% would result in an overall 75% TSS removal efficiency being provided by the SWM Pond. Interpolating between the values provided in MOECP Table 3.2, a 75% TSS removal efficiency (for a tributary drainage area with a ### % imperviousness) requires a ### m^3/ha storage volume. Since 40 m^3/ha of this storage volume is to be accommodated by the extended detention portion of the pond, the remaining ### m^3/ha storage volume requirement is to be provided within the permanent pool portion of the pond. As such, a #### m^3 permanent pool volume (#### ha x ### m^3/ha = ##### m^3) would provide a 75% TSS removal.

The SWM Pond provides a total #### m^3 permanent pool volume. Therefore, in order for the TSS removal efficiency to be reduced by 5% (to an overall 75% TSS removal efficiency), the permanent pool volume would need to be reduced by #### m^3 (#### m^3 – #### m^3 = #### m^3). Based on the annual sediment loading rate of ### m^3/year, it would take approximately ## years for the permanent pool volume to be reduced such that a 5% reduction in TSS removal efficiency occurs.

4.3 Recommended Clean-out Frequency

Based on calculations presented in **Section 4.1** above, it would take approximately ## years for sediment accumulation to reduce the available pond forebay volume by 50%. Calculations presented within **Section 4.2**, determined that it would take approximately ## years for sediment accumulation to reduce the TSS removal efficiency of the pond by 5%. It is therefore recommended that pond cleanouts take place a minimum of once every ## years in order to maintain both the volume capacity of the pond forebay and overall sediment removal capacity within the pond.

4.4 Sediment Removal Operations

Prior to commencing maintenance and sediment removal operations, all applicable permits shall be obtained.

During maintenance and sediment removal operations it is recommended that inflows be diverted around the pond. The pond can then be dewatered via gravity flow to the normal water level of ### m via the ### mm diameter orifice. For the remaining water in the pond which is below the normal water level, portable pumps can be used to facilitate dewatering. The pond forebay is to be pumped from the proposed dewatering sump located in the pond forebay, as shown on **Drawings ####** and **####**. If dewatering of the pond wet cell is required for maintenance purposes, the wet cell can be dewatered by the use of pumps as well, from the hickenbottom structure.

Given space restrictions, there is no area available for spreading and drying of the sediment. In addition, drying sediment may cause odours which are undesirable given adjacent residential land uses. As such, it is recommended that sediment could be removed from the pond by means of an excavator and loaded onto sealed dump trucks to be disposed of at an approved disposal site. Alternatively, sediment could be removed by use of a vacuum truck and disposed of at an approved disposal site. The use of polymer flocculants could reduce the trucking costs by significantly reducing the slump of the sediment.

5 Inspections & Maintenance

Maintenance is an important aspect of SWM pond performance. One of the main reasons for SWM pond failures and/or poor performance is a lack of regular maintenance and cleanout operations.

5.1 Inspections

During the first two (2) years of operation, the facility should be inspected after every significant storm event to ensure proper functioning (average is about four (4) inspections per year). After this initial time period, and confirmation that the wet pond is operating as intended, frequency of inspections may be lessened to once per year (annually). However, if such factors such as upstream development occur, more frequent inspections may need to be carried out due to the potential operation problems this could incur. An inspection report should be filled out during each inspection and kept on file.

5.2 Maintenance Operations

SWM pond inspections determine the extent of required maintenance activities. **Table 4.1** below (adapted from Table 6.1 of the MOECP Stormwater Management Planning and Design Manual, 2003) provides a checklist of typical operation and maintenances activities to be completed for the wet pond.

Table 4.1 Maintenance Checklist

Item No.	Operation or Maintenance Activity	Wet Pond	Table
1	Inspection	■	4x / year for 2 years; after 2 years inspect annually
2	Grass Cutting	□	As Required

Table 4.1 Maintenance Checklist

Item No.	Operation or Maintenance Activity	Wet Pond	Table
3	Weed Control	■	Annually
4	Upland Vegetation Replanting	□	As Required
5	Shoreline Fringe and Flood Fringe Vegetation Replanting	□	As Required
6	Aquatic Vegetation Replanting	□	As Required
7	Removal of Accumulated Sediments	■	Every 15 years
8	Trash Removal	■	Remove trash once during the spring, then based on observation

■ *Normally Required*

□ *May be Required*

5.3 Grass Cutting

Generally, it is recommended that grass-cutting be limited or eliminated around SWM ponds since allowing grass to grow tends to enhance water quality and provide other benefits for wet facilities. For instance, short grass around a wet SWM pond provides an ideal habitat for nuisance species such as geese. Allowing the grass to grow is an effective means of deterring geese.

If grass cutting is required by the Town of Whitchurch-Stouffville, the grass around the SWM pond should not be cut to the edge of the permanent pool. As a safety precaution, cutting should be done parallel to the water with grass clippings being blown upland to reduce the potential for organic loadings to the pond.

5.4 Weed Control

Weeds are generally defined as any kind of vegetation which is unwanted in a particular area. Weeding should be done by hand to prevent the destruction of surrounding vegetation. The use of herbicides and insecticides should be prohibited near the SWM ponds since they create water quality problems. The use of fertilizer should also be restricted to minimize the nutrient loading to the downstream receiving waters.

5.5 Plantings

Upland and flood fringe plantings are generally stable and should require minimum maintenance or re-establishment. Shoreline fringe areas are subject to harsher conditions as a result of the frequent wetting and drying associated with this zone. It is anticipated that vegetation in the aquatic and shoreline fringe zones will require some replanting or enhancement during the first two (2) years of operation of the facility.

5.6 Trash Removal

Trash removal is an integral part of the SWM pond maintenance. Generally, a "spring clean-up" is required to remove trash from all surfaces of the pond. Trash removal is then performed as required based on observation during regular inspections.

6 Annual Maintenance Cost Estimates

The average annual operation and maintenance costs for the pond was calculated to be **$ ####** (see **Appendix C**) which translates to $#####/ha of drainage area. These costs were based on Table 7.5 of the *MOECP 2003 SWMPD Manual*, and do not include costs associated with surveying the sediment depths which would be required prior to sediment removal operations.

The bulk of the annual operation and maintenance cost is associated with the removal and disposal of sediment which would take place approximately once every ## years, but budget provisions should be set on an annual basis to ensure the availability of funds at the time the cleanout is performed.

7 Conclusion

The implementation of a comprehensive operation and maintenance program is an integral part of the design of wet SWM pond and maintenance of minimum permanent pool volumes is required for the proper functioning of the facilities.

Inspections of the pond facility should be carried out after every significant storm event during the first two (2) years of operation and on a yearly basis after that period.

The recommended cleanout frequency for the SWM Pond is ## years. This is the time at which the volume of the sediment forebay is expected to be reduced by 50%, and this will also avoid large cleanout operations involving the whole pond.