Granite Engineering Services

a division of 1709425 Ontario Limited

PRELIMINARY STORMWATER MANAGEMENT REPORT

Project #:	**2018-0017**
Report #:	**2020-0605-010**
Date:	**June 5, 2020**
Project Address:	**1240 Anderson Line, Township of Severn**

Prepared for:

Cipponeri Holdings Inc.

Prepared by:

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1.0 INTRODUCTION

Granite Engineering Services (GES), in consultation with Plan Muskoka, has been retained by Cipponeri Holdings Inc. to prepare a Preliminary Stormwater Management (SWM) Report in support of a Draft Plan of Subdivision for a residential development on the property currently known as 1240 Anderson Line in Coldwater in the Township of Severn. This report is to be read in conjunction with the GES project drawing set in Appendix B.

1.1 SITE DESCRIPTION

The site for the proposed Draft Plan of Subdivision at 1240 Anderson Line in the Township of Severn consists of a parcel of land that is 6.14 ha in area that is currently defined as Settlement Living Area per the Township of Severn Official Plan. A large portion of the property is currently being cultivated for agricultural use; the current farm field is spread over the proposed site as well as the adjoining property to the southeast, 1358 Anderson Line. The rest of the property consists of a wooded area with a thin strip of trees combined with tall grasses and shrubs along the northern and the eastern edges of the site; the southwest section of the property has a larger wooded area that is part of a designated wetland, approximately 0.45 ha. A municipal drain, Medonte Drain #1, runs along the northly and northwesterly site boundaries and discharges into the Coldwater River,. Immediately adjacent to the site's northern properly line (across Medonte Drain #1) there is an existing residential area along Donlands Crescent.

The site is currently accessed off Anderson Line which is primarily a rural road that runs along the western edge of the Town of Coldwater. Downtown Coldwater is a short distance away and is accessed via Gray Street which is about 200 m to the northwest via Anderson Line. A key plan for the project site is included on each of the drawings in Appendix B.

1.2 PROPOSED DEVELOPMENT BRIEF

The proposed residential development consists of 42 residential lots; a larger lot for a proposed 3 storey retirement facility; a smaller lot for the stormwater management pond facility; and all are located on the proposed road (Street A) which will be accessed from Anderson Line. The lots will be serviced with potable (town) water through a water main running along the proposed road, while wastewater will be collected in sanitary sewers (to town sewers) along the same. The area

of the site that is part of the wetland will be left undisturbed in addition to a minimum 13.0 m buffer along the edge of the municipal drain as per suggested in the Environmental Impact Study and requested by Township staff.

1.3 OBJECTIVE

The primary objective of this report is to assess the feasibility of the proposed subdivision development with respect to stormwater management. GES has developed this stormwater management plan to ensure the water quality leaving the site for Coldwater River is maintained at a desired level. This will be achieved by evaluating and recommending measures to address both the quantity and the quality of stormwater runoff on the site. This will ensure peak flows are controlled and prevent sediment and other contaminants from being transported off-site into the municipal drain. Existing and proposed drainage conditions will be assessed, and site constraints identified.

1.4 REFERENCE GUIDELINES & SUPPORTING REPORTS

This report was prepared in accordance with provincial and municipal guidelines including the following resources:

- *Stormwater Management Planning and Design Manual*, Ministry of Environment, Conservation and Parks, (2003),
- *Township of Severn Engineering Design Criteria*, (2014),
- *Erosion & Sediment Control Guideline for Urban Construction*, Greater Golden Horseshoe Area Conservation Authorities, (2006).

2.0 EXISTING SITE CONDITIONS

The existing site at 1240 Anderson Line is 6.14 ha in area with approximately 5.29 ha currently cultivated for agricultural use. The remainder of the property are wooded areas with a variety of trees, shrubs, and grasses forming a strip between the farm field and Anderson Line on the east side of the property and between the cultivated area and Medonte Drain #1 on the north and northwesterly boundaries. The wooded area in the southwest section of the property is identified as a wetland and will be left undisturbed. The farm field continues to the southeast into the adjacent property known as 1358 Anderson Line. Medonte Drain #1 crosses under Anderson Line and runs along the northly and northwesterly property lines of the site to the property's southern point. It continues beyond the site boundary and eventually discharges into the Coldwater River. See Drawing A-1 in Appendix B for existing site conditions.

Information regarding existing topography, ground cover and drainage patterns were obtained through relevant background studies, a detailed topographic survey, base mapping and site visits. A detailed topographic survey of the site and the adjacent property, 1358 Anderson Line, was completed by Sperling Land Surveyors on January 7, 2019.

2.1 EXISTING DRAINAGE CONDITIONS

Based on the topographic survey, it was determined that surface runoff naturally flows across the cultivated portion of the site in a westerly direction. A portion of this runoff flows directly into Medonte Drain #1 as sheet flow (Outlet 1) while the remaining runoff flows into the wetland area (Outlet 2). A 3.99 ha internal drainage area and a 0.55 ha external drainage area in the northern corner of 1358 Anderson Line contribute runoff to Outlet 1. A 1.69 ha internal drainage area and a 2.92 external drainage area in the northern portion of the adjacent property contribute runoff to Outlet 2 at the wetland. The area of the wetland on-site is 0.45 ha. Much of the runoff from the wetland will eventually enter the municipal drain off-site through existing smaller ditches. The site has a very gentle slope that is less than 0.5 % across all internal and external catchment areas.

The existing drainage patterns and existing catchment areas are displayed in Drawing DP-1 in Appendix B. Existing flow calculations were completed using the SCS method for a 24-hour storm. They are summarized in Table 1 and are provided in more detail in Appendix A.

Table 1. Existing Condition Peak Flows Summary

Catchment	Area (ha)	1/100 Year (m^3/s)	1/25 Year (m^3/s)	1/10 Year (m^3/s)	1/5 Year (m^3/s)	25 mm (m^3/s)
Ext.1	0.55	0.112	0.085	0.067	0.053	0.002
101	3.99	0.796	0.604	0.475	0.373	0.014
Outlet 1 (Ext. 1 + 101)	4.54	0.908	0.689	0.543	0.426	0.016
Ext. 2	2.92	0.594	0.452	0.357	0.282	0.011
102	1.69	0.340	0.259	0.204	0.160	0.006
Outlet 2 (Ext. 2 + 202)	4.61	0.934	0.711	0.561	0.442	0.017
103 (Wetland)	0.45	0.032	0.022	0.015	0.011	0.000

2.2 GEOTECHNICAL INVESTIGATION

A geotechnical investigation for the proposed site at 1240 Anderson Line was completed by Soils Engineers Ltd. and is presented in their report dated February 2020.

Their field work consisted of 13 boreholes. Nine were taken on-site and four were taken in the northern part of the adjacent property, 1358 Anderson Line. The soil conditions and the groundwater table locations are noted in the report. The results showed that the site's soil consists predominantly of clay below the topsoil layer at the surface.

Based on the findings of the soil analysis, the report provides recommendations including for site preparation, foundations, underground services and structures, pavement design, parameters for the SWM pond and procedures for excavation and backfilling.

A copy of the geotechnical investigation will be provided with the submission of this report.

3.0 PROPOSED DEVELOPMENT

The proposed subdivision development consists of 42 residential lots and a larger lot for a proposed 3 storey retirement facility accessed from a proposed road currently referred to as Street A that runs perpendicular to Anderson Line. The proposed road will be approximately 318 m in length.

The retirement facility will be accessed off a cul-de-sac at end of the proposed road. The road will have a 20.0 m right-of-way and an 8.0 m wide asphalt surface with sidewalks on both sides. Its cross section will follow the Township of Severn's Standard Drawing No. 203 for local residential roads. The proposed road will run uphill from Anderson Line for approximately half of its length before switching to run downhill for the rest of its length. This results in a high point on Street A approximately at the midpoint of its length. Lots will be serviced with sanitary sewers and a watermain running under the proposed road. Rainwater from the road will be collected in storm sewers. An area to the southwest of the 3 storey building has been reserved for a stormwater management pond. Finally, a 10.0 m to 15.0 m buffer will be provided between Medonte Drain #1 and the area allowed to be constructed on for the lots on the northwest side of the proposed road.

The proposed development is outlined in Drawing A-2 found in Appendix B.

4.0 PROPOSED STORMWATER MANAGEMENT PLAN

The main objective of GES's stormwater management strategy is to minimize the effects of runoff due to the proposed development by ensuring the quality of water entering the municipal drain. This includes ensuring post-development peaks flow at outlets do not exceed the pre-development peak flows for the 1/100 year 24-hour storm and implementing water quality control measures in accordance with the Ministry of Environment, Conservation and Parks' (MOE) guidelines.

4.1 PROPOSED DRAINAGE CONDITIONS

The aim of the proposed grading plan is to generally maintain the pre-development drainage conditions. However, due to the near flat topography at the site, this is not always possible. Additionally, infiltration facilities were considered unfeasible for water quantity and quality control on the site due to the prevalence of clay with a low percolation rate. Impervious area is added to the site in the form of the proposed road, buildings, parking lot and driveways. However, due to the existing clay soil, runoff amount on the site was already relatively high.

For the proposed development, the runoff from the back part of the lots on the northwest side of Street A will flow directly into Medonte Drain #1 (Outlet 1-A). The runoff from the northeastern half of Street A, along with the front half of the adjacent lots on both sides of the road will be conveyed by storms sewers through an oil and grit separator (OGS) and will discharge into

Medonte Drain #1 where the northern point of the property meets Anderson Line (Outlet 1-B). The stormwater from the remaining impervious areas will be directed to a stormwater management wet pond on a lot adjacent to the undisturbed wetland area on one side and the retirement facility on the other. These areas include the southwestern half of the Street A along with the stormwater from the roof of the 3 storey retirement facility and its parking lot. Stormwater will be conveyed to the pond via storm sewers (Outlet 1-C). The outlet of the SWM pond will be to Medonte Drain #1.

The runoff from the back part of the lots on the southeast side of Street A along with the runoff form the external drainage areas will flow to a grassed swale and will be conveyed along the southeast boundary of the property to be discharge to the wetland area (Outlet 2). In addition, there is a small landscaped area in the proposed retirement facility's parking lot where stormwater will be stored on-site in depression areas for evaporation or infiltration.

In summary, Outlet 1 is stormwater discharging to Medonte Drain #1 and Outlet 2 to the undisturbed wetland area. The proposed drainage areas are displayed in Drawing DP-2 and stormwater management measures are presented in Drawing SS-1 in Appendix B.

4.2 WATER QUANTITY CONTROL

Post-development peak flows were analysed using the SCS method for the 24-hour storm up to the 1/100 year frequency to ensure that they do not exceed the pre-development flows from Table 1. The outlet peak flows are summarized in Table 2 below. A more detailed summary including flow calculations for each catchment is provided in Appendix A.

Table 2. Proposed Outlets Peak Flow Summary

Outlet	Contributing Catchments	1/100 Year (m^3/s)	1/25 Year (m^3/s)	1/10 Year (m^3/s)	1/5 Year (m^3/s)	25mm (m^3/s)
Outlet 1-A	201	0.234	0.176	0.137	0.107	0.004
Outlet 1-B	202	0.263	0.208	0.170	0.140	0.008
Outlet 1-C	203 & 204	0.445	0.352	0.289	0.237	0.014
Outlet 1		0.942 (0.908)	0.736 (0.689)	0.596 (0.543)	0.484 (0.426)	0.026 (0.016)
Outlet 2	Ext.1, Ext.2 & 205	0.929 (0.934)	0.705 (0.711)	0.555 (0.561)	0.437 (0.442)	0.017 (0.017)

* numbers in brackets are existing peak flow rates from Table 1

As shown in Table 2, the existing peak flows for Outlet 2 discharging to the wetland area are less than the post-development flows. Therefore, water quantity controls are not required at Outlet 2 so long as the swale is designed to convey the 1/100 year maximum peak flow of 0.929 m^3/s. The swale is sized to ensure this condition is met. Rock check dams will be implemented at intervals throughout the length of the swale to reduce the flow velocity and to provide additional water quality benefits. This will be confirmed again and finalized at the final design stage.

The results presented in Table 2 show that for Outlet 1, the proposed flows are slightly greater than the existing flows with a difference of 0.058 m^3/s for the 1/5 year storm. Therefore, water quantity control measures are required at Outlet 1. This will be done by providing water quantity storage in a stormwater management wet pond facility and controlling the pipe flow at Outlet 1-C to ensure that the existing flows into the municipal drain are not exceeded. The wet pond will provide 520 m^3 of storage above the permanent pool and will include an overflow spillway to Medonte Drain #1 for emergency events. Specific details regarding the pond inlet and outlet control will be determined and confirmed at the final design stage.

4.3 WATER QUALITY CONTROL

Water quality control measures for the proposed development include oil and grit separators and a wet pond facility to treat stormwater from impervious areas that discharge into Medonte Drain #1 (Outlet 1). Additionally, an enhanced grass swale has been designed to convey runoff to the proposed wetland area (Outlet 2).

Runoff from the proposed road and parking lot will be treated with oil and grit separators (OGS) before being discharged at Outlets 1-B and 1-C. They will be specified to remove a minimum of 80% of total suspended solids from runoff. The models of the two OGSs will be specified at the final design stage.

A stormwater management wet pond will also serve as a water quality control measure for the runoff headed to Medonte Drain #1 to allow the settlement of suspended solids to present sedimentation in the drain. It serves catchments 203 and 204 as Outlet 1-C. These catchments combine to be 1.91 ha in area with approximately 62% impervious area. Based on a normal protection level, 154.5 m^3 of permanent pool volume was required. A normal protection level was deemed acceptable due to pre-treatment of runoff through the OGS. Based on 40.0 m^3/ha, 76.4 m^3

of extended detention is required. However, the runoff from catchments 203 and 204 for the 25 mm storm is 201 m^3, so this is the governing value. A 160 m^3 permanent pool volume is provided along with 520 m^3 of additional storage plus a 0.3 m freeboard.

A grassed swale will convey runoff from catchments 205, Ext. 1 and Ext. 2 to the wetland area at Outlet 2. Although this swale will not service impervious areas, the swale will feature enhancements to improve water quality. The includes having a 1.0 m flat bottom and having a flow velocity less than 0.5 m/s during the 25 mm storm event as recommended in the MOE *SWM Planning & Design Manual* section on performance enhancements for providing effective water quality treatment in grassed swales. The maximum flow velocity for the grassed swale during the 25 mm storm event was determined to be 0.22 m/s. Additionally, rock check dams will be implemented at specified intervals along the length of the swale to promote settlement of suspended solids, evaporation and to reduce flow velocity. Rock check dam spacing and sizing will be specified at the final design stage.

Water quality calculations and design parameters for the SWM wet pond and for grassed swales were based on guidelines from the MOE *SWM Planning & Design Manual*. The water quality calculations for the SWM pond as well as water flow calculations for the swale are provided in Appendix A. The proposed wet pond and swale are shown in Drawing SS-1 in Appendix B. All calculations will be confirmed again at the final design stage to ensure the desired water quality goals are achieved.

4.4 STORM SEWERS

Storm sewer design will conform to Township of Severn Engineering Design Criteria standards. Stormwater will be treated through OGS facilities before discharging to Medonte Drain #1 (Outlet 1-B) and to the SWM wet pond (Outlet 1-C). Preliminary grading shows the implementation of storm sewers will be feasible for the proposed development with imported fill. Due to the gentle change in existing grade at the site, storm sewers will run near the minimum allowed slope. Full storm sewer design will be completed during the final design stage when the road and parking lot elevations can be finalized. See Drawing SS-1 in Appendix B for preliminary storm sewer, maintenance hole, catch basin and OGS layout.

4.5 LOT LEVEL CONTROL MEASURES

In addition to the larger scale water quantity and quality controls described above, lot level control measures will be considered at the final design stage. These measures could include rooftop storage, reduced lot grading where possible and roof leaders directed to soakaway pits or vegetated areas. It is noted that the usefulness of infiltration based measures may be limited for this project due the low percolation rate of clay. However, this will be fully evaluated at the final design stage.

5.0 EROSION AND SEDIMENT CONTROLS

Erosion and sedimentation can have major detrimental effects on surrounding areas including degradation of water quality. Therefore, erosion and sediment controls will be implemented for all construction activities with the objective of preventing sediment migration into adjacent properties, natural vegetative areas, or existing water courses. A detailed erosion and sediment control plan for the project site will be prepared for the final design and will include the following:

- All erosion and sediment control measures will conform to the *Erosion & Sediment Control Guideline for Urban Construction,* GGHACA, (2006) and *Township of Severn Engineering Design Criteria*, (2014),
- Installation of silt fencing around the perimeter of the project site prior to the start of construction which will remain until construction is complete and all areas have stabilized,
- A vehicle entrance with a mud mat will be constructed to reduce the amount of material inadvertently being transported off-site,
- The temporary implementation of measures to reduce runoff velocity, promote the settling of particles on-site and to prevent the generation of airborne particles during construction,
- Regular inspection policies for erosion and sediment control measures,
- Phasing of construction when possible,
- A revegetation strategy for disturbed areas.

6.0 CONCLUSION

The proposed development consists of a proposed road to provide access to 42 residential lots and a lot containing a 3 storey retirement facility complete with an accommodating parking lot. The existing drainage patterns will be maintained where possible. However, this was not always possible due to the proposed development layout and existing topography. Stormwater will be directed to Medonte Drain #1 (Outlet 1) via storm sewers or direct runoff and to the existing wetland area via an enhanced grassed swale (Outlet 2). Outlet 1 requires water quantity and quality control measures to be implemented. Oil and grit separators and a wet pond facility will serve to provide the desired level of water quality control while the outlet structure design for the wet pond will ensure that post-development maximum flow rate at Outlet 1 does not exceed existing conditions. Water quantity control is not required at Outlet 2. The proposed water quality measure for Outlet 2 is an enhanced grassed swale that conveys runoff to the outlet. The swale design includes a 1.0 m flat bottom and rock check dams to promote settlement of solids, evaporation and to reduce velocity.

This report shows that the proposed development is feasible with respect to stormwater management considerations. Detailed design of the proposed stormwater management measures and facilities will be completed during final design phase of the project.

If there are situations relating to the project that GES was not made aware of, they should be immediately brought to our attention to ensure the correctness of the information presented in this report and the integrity of the design for this project.

If you have any questions or concerns, please do not hesitate to call us at 705-640-0401.

Thank you,

Paul Brunskill, P.Eng.

APPENDIX A

STORMWATER MANAGEMENT CALCULATIONS

GES Design Sheet

Project Number 2018-0017
Date April 23, 2020
Client Cipponeri Holdings Ltd.
Address 1240 Anderson Line
Title Existing Drainage Areas
Designer SJK

* Refer to Drawing DP-1 for visual representation of existing drainage areas.

Existing Conditions

Catchment	Hydrological Soil Group	Soil Texture	Total Area	Woodlands				Cultivated				Wetland/SWM Pond				Average CN	Runoff Coefficent
				Area	Percent	CN	R.C.	Area	Percent	CN	R.C.	Area	Percent	CN	R.C.		
Ext. 1	D	Clay/Clay Loam	0.55	0	0	77	0.35	0.55	1.00	86	0.55	0	0	50	0.05	86.0	0.55
Ext. 2	D	Clay/Clay Loam	2.92	0	0	77	0.35	2.92	1.00	86	0.55	0	0	50	0.05	86.0	0.55
101	D	Clay/Clay Loam	3.99	0.32	0.080	77	0.35	3.67	0.920	86	0.55	0	0.000	50	0.05	85.3	0.53
102	D	Clay/Clay Loam	1.69	0.07	0.041	77	0.35	1.62	0.959	86	0.55	0	0.000	50	0.05	85.6	0.54
103	D	Clay/Clay Loam	0.45	0	0.000	77	0.35	0	0.000	86	0.55	0.45	1.000	50	0.05	50.0	0.05

Catchment	Initial Abstraction
Ext. 1	7.0
Ext. 2	7.0
101	7.2
102	7.1
103	12.0

Type	Ia
Woods	10
Pasture	8
Cultivated	7
Lawns	5
Wetlands	12
Impervious	2

Time of Concentration Calculations

Bransby Williams Formula (Runoff coeff. greater than 0.40)

Catchment	Ext. 1	Ext. 2	101	102	103
Area (ha)	0.55	2.92	3.99	1.69	0.45
Runoff coeff.	0.55	0.55	0.53	0.54	0.05
Max. Elevation	180.47	180.57	180.20	179.70	179.00
Min. Elevation	179.69	179.00	179.34	178.92	178.73
Length (m)	169	493	368	312.00	128
Slope (%)	0.46	0.32	0.23	0.25	0.21
tc (min)	12	32	24	22	11
tc (hr)	0.20	0.53	0.41	0.37	0.18
Time to Peak (hr)	0.13	0.35	0.27	0.25	0.12

Airport Formula (Runoff coeff. less than 0.40)

Catchment	Ext. 1	Ext. 2	101	102	103
Area (ha)	0.55	2.92	3.99	1.69	0.45
Runoff coeff.	0.55	0.55	0.53	0.54	0.05
Max. Elevation	180.47	180.57	180.20	179.70	179.00
Min. Elevation	179.69	179.00	179.34	178.92	178.73
Length (m)	169	493	368	312.00	128
Slope (%)	0.46	0.32	0.23	0.25	0.21
tc (min)	30	58	57	51	65
tc (hr)	0.50	0.97	0.95	0.85	1.08
Time to Peak (hr)	0.34	0.65	0.64	0.57	0.72

GES Design Sheet

Project Number	2018-0017
Date	April 23, 2020
Client	Cipponeri Holdings Ltd.
Address	1240 Anderson Line
Title	Existing Outlet Flow & Runoff
Designer	SJK

Maximum Flow (m^3/s)

Catchments	100-yr	25-yr	10-yr	5-yr	25mm
Ext. 1	0.112	0.085	0.067	0.053	0.002
Ext. 2	0.594	0.452	0.357	0.282	0.011
101	0.796	0.604	0.475	0.373	0.014
102	0.340	0.259	0.204	0.160	0.006
103	0.032	0.022	0.015	0.011	0.000

Total 24-hour runoff (m^3)

Catchments	100-yr	25-yr	10-yr	5-yr	25mm
Ext. 1	468.3	356.6	282.3	223.6	30.0
Ext. 2	2486.2	1893.0	1498.8	1187.4	159.4
101	3335.1	2531.0	1997.8	1577.5	204.3
102	1425.3	1083.4	856.4	677.3	89.2
103	151.0	102.9	74.1	53.3	2.8

Outlet #1

Direct Runoff to Municipal Drain
Catchments: Ext. 1 & 101

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.908	0.689	0.543	0.426	0.016
Total 24-hour runoff (m^3)	3803.4	2887.6	2280.1	1801.1	234.3

Outlet #2

Direct Runoff to Wetland
Catchments: Ext. 2 & 102

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.934	0.711	0.561	0.442	0.017
Total 24-hour runoff (m^3)	3911.5	2976.4	2355.2	1864.7	248.7

GES Design Sheet

Project # 2018-0017
Date April 23, 2020
Client Cipponeri Holdings Ltd.
Address 1240 Anderson Line
Title Proposed Drainage Areas
Designer SJK

* Refer to Drawing DP-2 for visual representation of proposed drainage areas.

Proposed Conditions

Catchment	Soil Group	Soil Texture	Total Area	Woodlands				Lawns				Cultivated				Impervious				Wetland/SWM Pond				Avg. CN	Runoff Coeff.
				Area	%	CN	R.C.	Area	%	CN	R.C.	Area	%	CN	R.C.	Area	%	CN	R.C.	Area	%	CN	R.C.		
Ext. 1	D	Clay/Clay Loam	0.55	0	0.00	77	0.35	0	0.00	81	0.35	0.55	1	86	0.55	0	0.00	98	0.95	0	0.00	50	0.05	86.0	0.55
Ext. 2	D	Clay/Clay Loam	2.92	0	0.00	77	0.35	0	0.00	81	0.35	2.92	1	86	0.55	0	0.00	98	0.95	0	0.00	50	0.05	86.0	0.55
201	D	Clay/Clay Loam	1.24	0.35	0.28	77	0.35	0.7	0.56	81	0.35	0	0.0	86	0.55	0.19	0.15	98	0.95	0	0.00	50	0.05	82.5	0.44
202	D	Clay/Clay Loam	1.13	0	0.00	77	0.35	0.44	0.39	81	0.35	0	0.0	86	0.55	0.69	0.61	98	0.95	0	0.00	50	0.05	91.4	0.72
203	D	Clay/Clay Loam	1.11	0	0.00	77	0.35	0.43	0.39	81	0.35	0	0.0	86	0.55	0.68	0.61	98	0.95	0	0.00	50	0.05	91.4	0.72
204	D	Clay/Clay Loam	0.80	0	0.00	77	0.35	0.3	0.38	81	0.35	0	0.0	86	0.55	0.5	0.63	98	0.95	0	0.00	50	0.05	91.6	0.73
205	D	Clay/Clay Loam	1.22	0	0.00	77	0.35	1.22	1.00	81	0.35	0	0.0	86	0.55	0	0.00	98	0.95	0	0.00	50	0.05	81.0	0.35
206	D	Clay/Clay Loam	0.45	0	0.00	77	0.35	0	0.00	81	0.35	0	0.0	86	0.55	0	0.00	98	0.95	0.45	1.00	50	0.05	50.0	0.05
207	D	Clay/Clay Loam	0.19	0	0.00	77	0.35	0.19	1.00	81	0.35	0	0.0	86	0.55	0	0.00	98	0.95	0	0.00	50	0.05	81.0	0.35

Catchment	Ia
Ext. 1	7.0
Ext. 2	7.0
201	6.0
202	3.2
203	3.2
204	3.1
205	5.0
206	12.0
207	5.0

Type	Ia
Woods	10
Pasture	8
Cultivated	7
Lawns	5
Wetlands	12
Impervious	2

GES Design Sheet

Project Number	2018-0017
Date	April 23, 2020
Client	Cipponeri Holdings Ltd.
Address	1240 Anderson Line
Title	Proposed Summary & Outlets
Designer	SJK

Maximum Flow (m^3/s)

Catchments	100-yr	25-yr	10-yr	5-yr	25mm
Ext. 1	0.112	0.085	0.067	0.053	0.002
Ext. 2	0.594	0.452	0.357	0.282	0.011
201	0.234	0.176	0.137	0.107	0.004
202	0.263	0.208	0.170	0.140	0.008
203	0.258	0.204	0.167	0.137	0.008
204	0.187	0.148	0.121	0.100	0.006
205	0.223	0.168	0.131	0.102	0.004
206	0.032	0.022	0.015	0.011	0.000
207	0.035	0.026	0.020	0.016	0.001

Total 24-hour runoff (m^3)

Catchments	100-yr	25-yr	10-yr	5-yr	25mm
Ext. 1	468.3	356.6	282.3	223.6	30.0
Ext. 2	2486.2	1893.0	1498.8	1187.4	159.4
201	988.9	746.4	586.7	461.6	61.6
202	1124.1	882.6	719.6	588.6	117.6
203	1105.0	867.8	707.6	578.9	115.8
204	800.3	629.0	513.3	420.3	84.9
205	952.3	717.5	563.4	443.1	61.3
206	151.0	102.9	74.1	53.3	2.8
207	148.3	111.7	87.7	69.0	9.6

Proposed Summary & Outlets (Continued)
*broken down by outlet and area contributing

Outlet #1-A

Direct Runoff to Municipal Drain
Catchments: 201

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.234	0.176	0.137	0.107	0.004
Total 24-hour runoff (m^3)	988.9	746.4	586.7	461.6	61.6

Outlet #1-B

Storm Sewer to Municipal Drain
Catchments: 202

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.263	0.208	0.170	0.140	0.008
Total 24-hour runoff (m^3)	1124.1	882.6	719.6	588.6	117.6

Outlet #1-C

Storm Pond to Outlet
Catchments: 203 & 204

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.445	0.352	0.289	0.237	0.014
Total 24-hour runoff (m^3)	1905.3	1496.8	1220.9	999.2	200.7

Outlet #1

Storm Pond to Outlet
Catchments: 203 & 204

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.942	0.736	0.596	0.484	0.026
Total 24-hour runoff (m^3)	4018.3	3125.8	2527.1	2049.4	380.0

Outlet #2

Swale to Wetland
Catchments: Ext. 1, Ext. 2 & 205

	100-yr	25-yr	10-yr	5-yr	25mm
Maximum Flow (m^3/s)	0.929	0.705	0.555	0.437	0.017
Total 24-hour runoff (m^3)	3906.8	2967.1	2344.5	1854.1	250.8

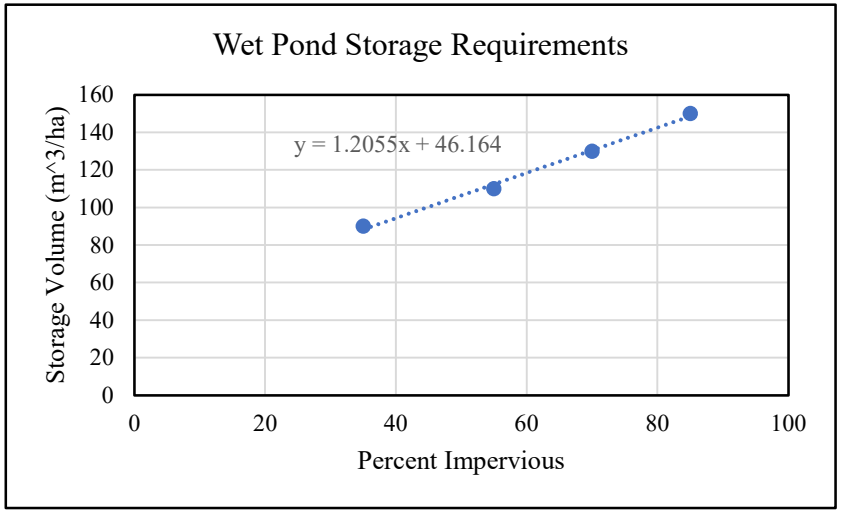
GES Design Sheet

Project Number	2018-0017
Date	April 23, 2020
Client	Cipponeri Holdings Ltd.
Address	1240 Anderson Line
Title	SWM Pond
Designer	SJK

Catchments 204 & 203 - Wet Pond

% impervious	storage (m^3/ha)
35	90
55	110
70	130
85	150

* from Table 3.2 of from the MOE SWM Planning & Design Manual



Protection Level	Normal
Percent Impervious (%)	62
Storage Volume (m^3/ha)	120.9
Extended Detention Volume (m^3/ha)	40.0
Contributing Area (ha)	1.91
Storage Volume (m^3)	230.93
Extended Detention Volume (m^3)	76.4
Required Permanment Pool (m^3)	154.5
25 mm storm (m^3)	200.7

Permanent Pool Vol. Provided (m^3)	160.5
Additional Storage Vol. Provided (m^3)	520.8
Total Volume (m^3)	681.3

GES Design Sheet

Project Number	2018-0017
Date	April 23, 2020
Client	Cipponeri Holdings Ltd.
Address	1240 Anderson Line
Title	Swale Conveyance Calculations
Designer	SJK

Catchments 205 & Ext. 1 - Grassed Swale

Max. 100-yr flow (m^3/s) : 0.929

side slope (m:1)	3	A	1.7
swale slope (m/m)	0.0029	P	4.8
n	0.035	R	0.35
bottom width (m)	1		
water height (m)	0.600	Q	1.285
top width (m)	4.600	V	0.765

Max. 25mm storm flow (m^3/s) : 0.017

side slope (m:1)	3	A	0.1
swale slope (m/m)	0.0029	P	1.4
n	0.035	R	0.05
bottom width (m)	1		
water height (m)	0.064	Q	0.017
top width (m)	1.387	V	0.222

n=manning's coefficient (-)
A=area of the channel (m^2)
P=wetted perimeter (m)
R=hydraulic radius (m)
Q=channel flow (m^3/s)
V=channel velocity (m/s)

Q = (A/n)*R^(2/3)*S^(0.5)
V = Q/A

APPENDIX B

GES PROJECT DRAWINGS