C.C. Tatham & Associates Ltd.
Consulting Engineers

3879 TOWN LINE
MARCHMONT SUBDIVISION

Township of Severn

Functional Servicing and Preliminary Stormwater Management Report

prepared by:

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prepared for:

High Level Construction Ltd.

November 2017

CCTA File 315836

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1 Introduction

C.C. Tatham & Associates Ltd. (CCTA) has been retained by High Level Construction Ltd. to prepare a Functional Servicing and Preliminary Stormwater Management (SWM) Report in support of a Draft Plan of Subdivision for a nineteen-lot rural residential subdivision located in the Township of Severn.

1.1 Site Description

The Draft Plan of Subdivision is proposed for a vacant forested property. The property is bounded by existing residential dwellings fronting onto Millwood Road to the north, Town Line to the west, an existing residential dwelling and forested area to the south and an existing forested area and residential dwelling to the east.

A Key Plan illustrating the site location is shown on the Preliminary Grading and Servicing Plan (Drawing GS-1) included at the back of this report.

1.2 Objectives

The primary objectives of this report are to assess the feasibility of the proposed development with respect to servicing and stormwater management (SWM) and to ensure satisfactory information on these items is presented in support of the proposed Draft Plan of Subdivision. This will involve an evaluation of potable water supply, sanitary sewage treatment and disposal and drainage and SWM. Opportunities and constraints will be evaluated and a preferred plan recommended.

1.3 Guidelines and Background Reports

This report was prepared recognizing provincial guidelines on water resources and the environment, and studies including the following publications:

- Low Impact Development Stormwater Management Planning and Design Guide (CVC and TRCA, 2010);
- Erosion and Sediment Control Guideline for Urban Construction (GGHACA, 2006);
- The Ministry of Environment Stormwater Management Practices Planning and Design Manual (2003); and
- Ontario Ministry of the Environment Procedure D-5-4, Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment.

The following reports pertaining to the site have also been prepared in support of the proposed Draft Plan:

- Hydrogeological Study Proposed Residential Development, 3879 Town Line (Soil Engineers Ltd., Revised April 2017);
- Soil Investigation for residential development, 3879 Town Line (Soil Engineers Ltd., August 2016);
- Traffic Review, 3879 Town Line Subdivision, (C.C. Tatham & Associates Ltd., November 2017).

A DVD containing the above reports is included at the back of this report.

1.4 Proposed Development Summary

The proposed rural residential development consists of nineteen residential lots located on the east side Town Line in the Township of Severn. The Draft Plan of Subdivision has been prepared by MHBC Planning and is included at the back of this report.

Potable water will be drawn from individual wells located on each lot.

Wastewater will be collected and treated via individual septic systems on each lot.

Both wells and septic systems will be developed by individual lot owners and will be approved through the building permit process.

The information contained in the Hydrogeological Assessment Report prepared by Soil Engineers Ltd. provides further detail on the proposed well and septic system designs and briefly described in Section 4.

2 Background Information

Information regarding the existing topography, ground cover and drainage patterns was obtained through a review of relevant background studies, detailed topographic survey, base mapping and was confirmed during site visits.

2.1 Topography and Existing Drainage Conditions

The site is located in the headwaters of the North River. A detailed topographic survey of the site was completed by CCTA in December 2015. The survey indicates surface runoff sheet flows across the site from south to north into an existing drainage outlet (Outlet 1) and from west to east into an existing wetland located on the east portion of the site (Outlet 2), with grades ranging between 1 and 10%. A 1.7 ha external drainage area, located south of the site, sheet flows across the west portion of the site to Outlet 1. A 3.0 ha external drainage area, located south east of the site, sheet flows to the existing wetland located at Outlet 2.

Existing drainage patterns are depicted on the appended Pre-Development and External Drainage Plans (Drawings DP-1 and EX-1).

2.2 Hydrogeological Investigations

Subsurface soil investigations were completed by Soil Engineers Ltd. on July 27, 2016 and documented in their report dated April 2017.

The investigation included a subsurface exploration program by means of drilling four boreholes across the site to depths ranging from 6.3 to 7.8 m below ground. The boreholes were systematically logged and representative soil samples were collected for laboratory analysis. Each borehole was equipped with a 50 mm diameter PVC standpipe and screen for groundwater monitoring. The borehole logs revealed a 0.2 to 0.3 m thick layer of topsoil underlain by a 0.5 m to 1.1 m thick layer of fine to medium grained sand, underlain by 2.2 to 2.7 m layer of silty sand till and then sandy silt till to the maximum investigated depth of 7.8 m.

Groundwater levels were measured on three occasions from August 5 to August 26, 2016 and ranged between 1.0 m and 2.9 m below ground, with fluctuations ranging from 0.4 m to 0.8 m during the monitoring period.

Additional details are available in the Soil Engineers Ltd. report.

2.3 Geotechnical Investigation

A soil investigation was completed by Soil Engineers Ltd. and is documented in their report dated August 2016.

The field work consisted of drilling four boreholes within the proposed alignment of the future road. Sub-surface soil conditions are detailed in the soil investigation report, including noted groundwater levels.

Based on the characteristics of the revealed soils, recommendations are provided in the report including removal of topsoil, compaction of excavated materials, engineered fill for site grading, foundations, underground services and pavement construction.

3 Grading

Existing drainage patterns will be maintained to the extent possible. The proposed roads have been designed with a rural cross section in accordance with the Township of Severn's typical rural road cross section detail, including a paved shoulder on the westbound lane for pedestrians. Runoff from the west portion of the site will drain uncontrolled to the north, in a drainage easement between two proposed lots via an enhanced grass swale and will outlet from the site via the existing drainage outlet (Outlet 1). The east portion of the site will drain to a proposed wet SWM facility which will outlet to an existing wetland area located within the east limit of the site. Preliminary road and ditch elevations are shown on Drawing GS-1 attached at the back of this report.

4 Servicing

As municipal services are unavailable to service the site and each lot is of sufficient size, each dwelling will be serviced by individual wells and septic systems. The proposed wells, septic systems and lot grading will be developed by individual lot owners in conjunction with their specific site development and will be approved through the building permit process. The drilled wells and septic systems will be privately owned, operated and maintained. Individual water treatment systems in compliance with Ontario Regulation 170 are required to treat raw well water. Septic systems are required to be in accordance with Part 8 of the Ontario Building Code.

The hydrogeological report prepared by Soil Engineers Ltd. provides an account of the observed hydrogeological conditions related to water supply and sewage treatment. A review of the existing water wells within a 500 m radius of the site (186 in total) confirm well depths between 5.5 m and 86 m and well yields between 3,600 and 927,000 L/day. The majority of the nearby domestic water wells are screened between 25 m and 62 m below grade suggesting that plentiful well yields can be developed for wells in this depth range.

The nitrate loading mass balance calculations confirm a total of 30 lots can be accommodated on the site, based on construction of individual tertiary sewage treatment systems, while remaining below the Ontario Drinking Water Standard of 10 mg/L whereas the use of conventional sewage systems would exceed the Ontario Drinking Water Standard and therefore are not recommended.

5 Roadways and Transportation

A proposed municipal road having a 20.0 m wide right-of-way (Township Standard) will provide access to and through the proposed subdivision. The ditches on either side of the road will range in depth between 0.75 m and 1.20 m. A permanent cul-de-sac has been specified at the east limit of the site and the westbound lane is to be paved for pedestrians.

The proposed road will consist of a 6.6 m wide asphalt surface over a granular base constructed in accordance with Township Standards, as shown on Drawing GS-1. The depth of asphalt and granular materials are confirmed in the geotechnical investigation.

A traffic review has been undertaken by CCTA and is available under separate cover.

The intersection of Highway 12 with Town Line will continue to provide acceptable operating conditions, and Town Line will operate at 67% or less of its projected capacity including traffic from the subject site. Therefore the road network and intersection will have excess capacity to accommodate additional future growth within the area. No improvements are required as the sight lines exceed MTO requirements.

In the future, the road will be assumed by the Township which will undertake routine maintenance and snow plowing.

6 Utilities

Town Line is currently serviced with overhead hydro on the east side. It is assumed that the existing hydro is adequate to service the proposed development. This will be confirmed at the final design stage.

Union Gas was contacted and confirmed gas is available on Town Line. It is assumed the existing gas infrastructure is adequate to service the proposed development. This will also be confirmed at the final design stage.

Bell and Rogers have been contacted but have not confirmed, as of the date of this report, what communications plant (telephone, cable TV, coaxial cable, etc.) is available to service the proposed development. However, based upon the adjacent residential dwellings, it is assumed that communications plant exists and will be available to service the proposed development. This will be confirmed at the final design stage.

7 Proposed Drainage Conditions

7.1 Design Criteria

Issues to be addressed and criteria to be met regarding drainage and stormwater management on the site are summarized as follows:

- The site will be developed in accordance with Township and MOECC guidelines and criteria;
- Post to pre-development peak flow control is required at each outlet for all design storms up to and including the 100-year storm;
- MOECC "Enhanced" level water quality control is required; and
- Safe conveyance of storm flows from the site and all areas draining onto the site is required, for all storms up to and including the Regional (Timmins) Storm event.

7.2 Proposed Development

The proposed development includes nineteen rural residential lots. An increase in impervious cover will occur with the addition of roads, driveways and rooftops which will increase peak flows and overall runoff volume generated at the site.

The existing condition drainage areas, patterns and outlets will generally be maintained in the proposed condition. The west portion of the site will drain north to an existing drainage outlet (Outlet 1) located between two existing lots and which drains north to the Millwood Road south ditch. The east portion of the site will drain east and outlet to an existing wetland (Outlet 2) and ultimately the North River. Minor and major flows from the site will be conveyed in ditches to each outlet. Runoff from the building rooftops will discharge to pervious areas to promote at-source infiltration.

7.3 Existing Condition Hydrologic Analysis

A Visual OTTHYMO hydrologic model has been developed to quantify existing condition peak flow rates from the site.

The catchment delineations for the site area were completed based on detailed topographic survey information. Catchment delineations for external areas draining through the site from the south were completed based on 2.0 m contour mapping available from the County's website. Land uses were established based on field reconnaissance and our review of online aerial photography. The land uses and soil information were used to establish modified curve numbers (CN*) and other catchment parameters used in the hydrologic model. The time to peak values for the catchment areas were calculated using the Bransby Williams and Airport Methods for runoff coefficients "C" greater than and less than 0.4 respectively.

A summary of all catchment parameters established for the existing condition hydrologic model is included in Appendix A.

Peak flows for storms up to and including the 100-year storm events were calculated for the 4-hour Chicago and 24-hour SCS design storms generated using the Atmospheric Environment Service Orillia Brain gauge (6115820) as well as for the Regional (Timmins) storm. Detailed calculations and Visual OTTHYMO modelling output are included in Appendix A with the results summarized below in Table 1. The digital hydrologic model files are included on the DVD at the back of this report.

Table 1: Existing Conditions Peak Flow Summary

Design Storm	Catchment Ext.1 1.7 ha (m^3/s)		Catchment 101 3.6 ha (m^3/s)		Outlet 1 Existing CSP (Ext.1 + 101) 5.3 ha (m^3/s)		Catchment Ext. 2 3.0 ha (m^3/s)		Catchment 102 4.5 ha (m^3/s)		Catchment 103 2.6 ha (m^3/s)		Outlet 2 (Ext. 2+102+103) 10.1 ha (m^3/s)	
	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS
25 mm	0.004	-	0.003	-	0.007	-	0.002	-	0.002	-	0.001	-	0.006	-
2-Year	0.009	0.013	0.007	0.011	0.015	0.023	0.005	0.008	0.006	0.009	0.003	0.004	0.014	0.021
5-Year	0.018	0.023	0.016	0.020	0.033	0.042	0.012	0.015	0.014	0.018	0.007	0.008	0.032	0.040
10-Year	-	0.031	-	0.029	-	0.058	-	0.020	-	0.025	-	0.012	-	0.056
25-Year	0.038	0.042	0.036	0.041	0.073	0.082	0.026	0.029	0.032	0.035	0.015	0.017	0.073	0.080
100-Year	0.060	0.062	0.059	0.062	0.116	0.123	0.042	0.043	0.053	0.054	0.025	0.025	0.119	0.121
Regional (Timmins)	0.122	-	0.176	-	0.297	-	0.144	-	0.190	-	0.098	-	0.430	-

8 Proposed SWM Plan

An understanding of specific issues, constraints and opportunities pertaining to the site was gained through an analysis of relevant background information.

Opportunities for maximizing the effective use of the control measures are discussed in this section.

8.1 Lot Level Source Controls

Potential lot level control measures include roof leaders directed to grassed areas or soakaway pits. These measures provide both quality and quantity benefits, including infiltration enhancement and provision of peak flow reductions, as well as partial pollutant removal.

The use of lot level controls is recommended for the site and will be considered at the final design stage as deemed appropriate.

8.2 Conveyance Controls

Conveyance controls include low-sloped grass swales and pervious pipe systems. These systems can be very effective for reducing runoff volumes, increasing groundwater recharge and improving water quality.

The use of conveyance controls are recommended for the site and will be considered at the final design stage as deemed appropriate.

8.3 End of Pipe Controls

Potential end-of-pipe facilities include extended detention wet ponds, dry ponds and constructed wetlands. End of pipe facilities are typically recommended for larger sites where there is sufficient area available.

End-of-pipe facilities will be considered at the final design stage.

8.4 Preferred SWM Strategy

A multi-stage approach to providing water quality and quantity control is proposed including the use of roof leaders directed to pervious front and rear lot areas (at-source control) combined with enhanced flat-bottom grass swales (conveyance control) and a wet SWM facility (end of pipe control). The SWM strategy will also provide appropriate erosion control as necessary at each outlet.

8.4.1 Water Quantity Control

A hydrologic analysis of the post development condition was completed utilizing the single event Visual OTTHYMO Hydrologic Model. Peak flow rates for the 100-year storm events were calculated for the 4-hour Chicago and 24-hour SCS design storms generated using the Orillia Brain gauge as well as for the Regional (Timmins) storm.

A summary of all catchment parameters established for the post development hydrologic model is included in Appendix A.

Peak runoff rates at each outlet are shown in Table 2 and the results of the modelling are attached in Appendix B. The digital hydrologic model files are included on the DVD at the back of this report.

Table 2: Proposed Conditions Peak Flow Summary

Design Storm	Outlet 1 (Ext. 1 + 201) 4.24 ha Uncontrolled (m^3/s)		Outlet 2 (Ext.2+202+203) 11.16 ha Uncontrolled (m^3/s)		Outlet 2 (Ext.2+202+203) 11.16 ha Controlled (m^3/s)	
	CHI	SCS	CHI	SCS	CHI	SCS
25 mm	0.008 (0.007)	-	0.016 (0.006)	-	0.004 (0.006)	-
2-Year	0.017 (0.015)	0.024 (0.023)	0.033 (0.014)	0.045 (0.021)	0.010 (0.014)	0.013 (0.021)
5-Year	0.034 (0.033)	0.043 (0.042)	0.066 (0.032)	0.080 (0.040)	0.027 (0.032)	0.025 (0.040
10-Year	-	0.058 (0.058)	-	0.109 (0.056)	-	0.049 (0.056)
25-Year	0.073 (0.073)	0.079 (0.082)	0.141 (0.073)	0.150 (0.080)	0.062 (0.073)	0.070 (0.080)
100-Year	0.114 (0.116)	0.116 (0.123)	0.221 (0.119)	0.221 (0.121)	0.100 (0.119)	0.105 (0.121)
Regional (Timmins)	0.181 (0.297)	-	0.624 (0.430)	-	0.624 (0.430)	-

Notes: (0.477) refers to existing condition peak flow rate.

As shown in Table 2, the proposed condition uncontrolled peak flows directed to Outlet 1 are between 1 and 2 L/s more in the 25 mm to 5 yr. CHI & SCS storm events and between 0 to 2 L/s less than existing conditions in the 10 yr. CHI & SCS storm events. This was achieved by reducing the total drainage area directed to Outlet 1 from 5.3 ha to 4.2 ha. As a result, water quantity controls are not required at Outlet 1. This will be confirmed again at the final design stage.

At Outlet 2, proposed condition uncontrolled peak flows are shown to increase compared to existing and will require water quantity controls. A wet extended detention SWM facility is proposed to control runoff from Catchment 202. Preliminary stage-storage-discharge data was input into the "route reservoir" command of the hydrologic model to confirm the volume of storage required and the size of the pond block. Specific details relating to the pond outlet control structure will be determined at the final design stage.

The hydrologic model confirms approximately 518 m^3 of active storage is required to attenuate peak flows at or below existing whereas the proposed pond has approximately 724 m^3 of active storage including an additional 0.5 m of freeboard as illustrated on Drawing GS-1.

The total peak flows directed to Outlet 2, which consist of controlled peak flows from the pond (Catchment 202) combined with uncontrolled peak flows from external catchment Ext.2 and Catchment 103 are reduced from existing.

The hydrologic modeling will be confirmed again at the final design stage to confirm the ultimate design will not increase peak flows from the site, at each outlet, compared to existing.

8.4.2 Water Quality Control

Water quality control for the development will be provided in the wet extended detention SWM facility and enhanced grass swale between Lots 2 and 3. Both will be designed to remove a minimum of 80% TSS from runoff.

Outlet 1 - Enhanced flat-bottom ditches

Impaired runoff from the road and driveways that are located in Catchment 201 will be directed to the road ditches and an enhanced grass swale located between Lots 2 and 3. The enhanced grass swale will be located in a 6.0 m wide drainage easement to allow for future maintenance. Enhancement of the swale by incorporating a 0.5 m wide flat-bottom is proposed to reduce the velocity of runoff and promote filtering and settling of sediment and pollutants.

Enhanced grassed swales are effective at providing water quality treatment provided the maximum flow velocity does not exceed 0.5 m/s during a 4 hour, 25 mm storm event. The calculated enhanced grass swale velocity during the 25 mm storm event was determined to be 0.44 m/s, assuming the total drainage area from Catchment 201 contributes runoff to the swale. Typically enhanced grass swales are effective for treatment of runoff from drainage areas up to 2.0 ha. Although Catchment 201 has a total area of 2.54 ha, the total area that will direct runoff to the enhanced grass swale, including road and driveways will be less than 2.0 ha. On this basis, the enhanced grass swale is appropriate for the provision of enhanced level water quality treatment of runoff from Catchment 201.

Outlet 2 - Wet Extended Detention SWM Facility

Catchment 202 (5.56 ha) has a weighted level of imperviousness of approximately 11%. As per MOECC requirements 88.5 m^3/ha is required for water quality treatment of which 48.5 m^3/ha is required for the permanent pool volume and the larger of 40 m^3/ha or the 25 mm runoff volume released over a minimum of 24 hours, is required for extended detention. The 25 mm storm event runoff volume from Catchment 202 was determined to be 67 m^3, whereas 40 m^3/ha equates to 222 m^3. The corresponding permanent pool and extended detention volumes required for water quality control are 270 m^3 and 222 m^3 respectively whereas 970 m^3 of permanent pool and 413 m^3 (at an active storage depth of 0.3 m) of extended detention storage are available. It is noted that the extended detention volume makes up a small portion of the overall pond active storage volume.

Water quality calculations demonstrating how the proposed SWM plan will achieve MOECC enhanced level water quality treatment are included in Appendix A.

Due to the nature of the proposed development consisting of estate sized lots and a low overall percent impervious cover, the majority of runoff from the rooftops and driveways will be handled at source with minimal runoff reaching the road ditches during frequent storm events. Roof downspouts directed to pervious landscaped areas (as opposed to the driveway) will be specified on each lot and will have the effect of reducing the overall runoff volume and increasing infiltration. This will also have the effect of improving the water quality treatment efficiency of the ditches, reducing the potential for erosion within the site and downstream of the site, and reducing the long term operation and maintenance requirements by the Township.

In summary, the proposed water quality SWM plan for the site consisting of an enhanced grass swale (Outlet 1), a wet SWM facility (Outlet 2), and at source controls including directing roof downspouts to pervious landscaped areas throughout the site (Outlets 1 and 2) will exceed the MOECC requirements for enhanced level water quality control.

8.5 Stormwater Conveyance

Minor and major system drainage will be conveyed in the road ditches and drainage easement ditches to the intended outlets. The road ditch and enhanced grass swale capacity calculations are included in Appendix A and confirm each have sufficient capacity to safely convey all storms up to and including the Regional (Timmins) Storm event.

The capacity of the existing drainage outlet at Outlet 1 will be determined at the final design stage to confirm sufficient capacity exists for safe conveyance of the Regulatory storm from the site to the Millwood Road right-of-way.

Road cross culverts will be sized to convey the peak runoff rate from storms up to and including the 25-year storm. Driveway culverts will be designed with minimum 5-year storm peak flow capacity and will be minimum 300 mm diameter CSP culverts.

Runoff from the small external drainage area to the south will be maintained through the site, unchanged from the existing condition.

Culvert sizing calculations will be provided at the final design stage.

9 Siltation and Erosion Plan

Siltation and erosion controls will be implemented for all construction activities, including topsoil stripping, material stockpiling, road construction and grading operations. A detailed erosion and sediment control plan for the site will be prepared with the final design and will include the following:

- All erosion control devices will be specified in accordance with the Erosion and Sediment Control Guideline for Urban Construction (Greater Golden Horseshoe Area Conservation Authorities, December 2006);
- Silt control fences will be erected before any grading operations to control sediment movement;
- A construction vehicle entrance will be constructed for the proposed road with a stone mud mat to reduce off-site tracking of material;
- Regular inspection of control measures will be instituted and repairs will be made as necessary;
- Temporary swales and check dams will be constructed to control runoff during construction by lowering velocities and promoting settling of particulates; and
- Long term siltation and erosion control will be enhanced with a revegetation strategy for disturbed areas.

10 Conclusion and Recommendations

The proposed development will consist of nineteen rural residential lots. Existing drainage patterns will be maintained, with stormwater conveyed via open ditches to the existing outlets. A treatment train approach to water quality control is proposed consisting of directing rooftop runoff to pervious front and rear lot areas, an enhanced grass swale, and a wet extended detention SWM facility. Erosion protection of the enhanced ditches is not deemed necessary since the velocities are below the anticipated erosion threshold for grass lined ditches. Water quantity controls are not required at the north outlet (Outlet 1) since proposed condition peak flows are either slightly below or slightly above existing peak flows. Water quantity control, provided in the wet extended detention SWM facility is proposed upstream of Outlet 2 to control post development peak flows to existing condition peak flow rates.

The proposed development will be serviced with private individual tertiary sewage systems. Water supply will be provided by individual drilled wells. The proposed wells, septic systems and lot grading will be developed by individual lot owners in conjunction with their specific site development and will be approved through the building permit process.

Existing overhead hydro and gas are available on Town Line and the capacity of both to service the proposed development will be confirmed during final design. The availability of communications plant (i.e telephone, cable TV, coaxial cable etc.) will also be confirmed during final design.

Siltation and erosion control will be provided with the proper construction mitigation efforts. Long-term erosion control will be enhanced with an effective revegetation strategy.

Detailed design of these systems will be provided at the final design stage but the work completed to date confirms that appropriate site servicing and stormwater management can be provided.

Authored by: Jeremy Ash, B.Sc.Eng., P.Eng.
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Reviewed by: Tim Collingwood, B.A.Sc., P.Eng.
Director, Manager – Orillia Office

Appendix A:
SWM Calculations

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

Project:	Marchmont Subdivision
File No.:	315836
Date:	Sep-17
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

Marchmont Subdivision

EXISITING CONDITION

Catchment External 1 **Area** 1.7 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	1.7	1	0.82	0.48	32	0.76	0.45	49	0		38	0.06	0.04	65	0.06	0.04	100	0	0	50	43.16471
	#N/A	#N/A	#N/A	#N/A					#N/A			#N/A	0		#N/A			#N/A			#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	**1.7**	**1**	**0.82**	**0.4823529**		**0.76**	**0.4470588**		**0**	**0**		**0.06**	**0.035294**		**0.06**	**0.035294**		**0**	**0**		**43.2**
																								CN*(AMC II)	**40.6**
																								CN*(AMC III)	**61.1**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	272.00	m
Minimum Catchment Elevation	269	m
Catchment length	93	m
Catchment Slope	3.2%	
Catchment Area	1.7	ha
Time of Concentration (Minutes)	**3.98**	
Time of Concentration (Hours)	**0.07**	
Time to Peak (2/3 x Time of Concentration)	**0.04**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	272	m
Minimum Catchment Elevation	269	m
Catchment length	93	m
Catchment Slope	3%	
1	1.7	ha
Time of Concentration (Minutes)	**20.55**	
Time of Concentration (Hours)	**0.34**	
Time to Peak (2/3 x Time of Concentration)	**0.23**	

Time to Peak	**0.23 hrs**

Initial Abstraction	**7.2 mm**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2

Runoff Coefficient	**0.14**

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.138	#N/A	#N/A	#N/A	#N/A

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Marchmont Subdivision

EXISITING CONDITION

Catchment External 2 **Area** 3.0 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	3	1	2.4	0.80	32	0.6	0.20	49	0	0	38		0	65	0	0	100		0	50	35.4
	#N/A	#N/A	#N/A	#N/A					#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	3	1	2.4	0.8		0.6	0.2		0	0		0	0		0	0		0	0		35.4
																								CN*(AMC II)	31.6
																								CN*(AMC III)	51.6

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	273.00	m
Minimum Catchment Elevation	263.1	m
Catchment length	394.9	m
Catchment Slope	2.5%	
Catchment Area	3	ha
Time of Concentration (Minutes)	**16.78**	
Time of Concentration (Hours)	**0.28**	
Time to Peak (2/3 x Time of Concentration)	**0.19**	

Time to Peak	**0.54 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	273	m
Minimum Catchment Elevation	263.1	m
Catchment length	394.9	m
Catchment Slope	3%	
Catchment Area	3	ha
Time of Concentration (Minutes)	**48.60**	
Time of Concentration (Hours)	**0.81**	
Time to Peak (2/3 x Time of Concentration)	**0.54**	

Initial Abstraction	**9.0 mm**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2

Runoff Coefficient	**0.08**

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.084	#N/A	#N/A	#N/A	#N/A

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

Project:	Marchmont Subdivision
File No.:	315836
Date:	Sep-17
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

Marchmont Subdivision

EXISITING CONDITION

Catchment 101 **Area** 3.6 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	3.6	1	3.5	0.97	32	0.1	0.03	49	0	0	38		0	65		0	100	0	0	50	32.47222
	#N/A	#N/A	#N/A	#N/A					#N/A			#N/A	0		#N/A			#N/A			#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	**3.6**	**1**	**3.5**	**0.9722222**		**0.1**	**0.0277778**		**0**	**0**		**0**	**0**		**0**	**0**		**0**	**0**		**32.5**
																								CN*(AMC II)	**28.2**
																								CN*(AMC III)	**47.5**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	270.12	m
Minimum Catchment Elevation	264.36	m
Catchment length	177	m
Catchment Slope	3.3%	
Catchment Area	3.6	ha
Time of Concentration (Minutes)	**7.01**	
Time of Concentration (Hours)	**0.12**	
Time to Peak (2/3 x Time of Concentration)	**0.08**	

Time to Peak	**0.33 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	270.12	m
Minimum Catchment Elevation	264.36	m
Catchment length	177	m
Catchment Slope	3%	
Catchment Area	3.6	ha
Time of Concentration (Minutes)	**29.95**	
Time of Concentration (Hours)	**0.50**	
Time to Peak (2/3 x Time of Concentration)	**0.33**	

Initial Abstraction	**9.9 mm**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2

Runoff Coefficient	**0.08**

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.0806	#N/A	#N/A	#N/A	#N/A

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

Project:	Marchmont Subdivision
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Checked By:	JA
Subject:	Hydrologic Parameters

Marchmont Subdivision

EXISITING CONDITION

Catchment 102 **Area** 4.5 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
				Type	Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	4.5	1	4.4	0.98	32	0.1	0.02	49	0	0	38		0	65	0	0	100		0	50	32.37778
	#N/A	#N/A	#N/A	#N/A					#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	4.5	1	4.4	0.977777778		0.1	0.0222222		0	0		0	0		0	0		0	0		32.4
																								CN*(AMC II)	28.1
																								CN*(AMC III)	47.3

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	266.73 m
Minimum Catchment Elevation	262.71 m
Catchment length	280 m
Catchment Slope	1.4%
Catchment Area	4.5 ha
Time of Concentration (Minutes)	**12.77**
Time of Concentration (Hours)	**0.21**
Time to Peak (2/3 x Time of Concentration)	**0.14**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	266.73 m
Minimum Catchment Elevation	262.71 m
Catchment length	280 m
Catchment Slope	1%
Catchment Area	4.5 ha
Time of Concentration (Minutes)	**49.36**
Time of Concentration (Hours)	**0.82**
Time to Peak (2/3 x Time of Concentration)	**0.55**

Time to Peak	**0.55 hrs**

Initial Abstraction	**9.9 mm**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2

Runoff Coefficient	**0.08**

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.0804	#N/A	#N/A	#N/A	#N/A

C.C. Tatham & Associates Ltd.
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Collingwood Bracebridge Orillia Barrie Ottawa

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Marchmont Subdivision

EXISITING CONDITION

Catchment 103 **Area** 2.6 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	2.6	1	2.6	1	32		0	49	0	0	38		0	65	0	0	100		0	50	32
	#N/A	#N/A	#N/A	#N/A					#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	2.6	1	2.6	1		0	0		0	0		0	0		0	0		0	0		32.0
																								CN*(AMC II)	27.6
																								CN*(AMC III)	46.8

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	263.82 m
Minimum Catchment Elevation	261.51 m
Catchment length	306 m
Catchment Slope	0.8%
Catchment Area	2.6 ha
Time of Concentration (Minutes)	**16.77**
Time of Concentration (Hours)	**0.28**
Time to Peak (2/3 x Time of Concentration)	**0.19**

Time to Peak	**0.71 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	263.82 m
Minimum Catchment Elevation	261.51 m
Catchment length	306 m
Catchment Slope	1%
Catchment Area	2.6 ha
Time of Concentration (Minutes)	**63.82**
Time of Concentration (Hours)	**1.06**
Time to Peak (2/3 x Time of Concentration)	**0.71**

Initial Abstraction	**10.0 mm**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2

Runoff Coefficient	**0.08**

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.08	#N/A	#N/A	#N/A	#N/A

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Checked By:	JA
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Marchmont Subdivision

EXISITING CONDITION

Catchment 201 **Area** 2.54 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
				Type	Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	2.54	1	0.96	0.38	32	1.23	0.48	49	0		38	0.05	0.02	65	0.30	0.12	100		0	50	48.9563
	#N/A	#N/A	#N/A	#N/A			0		#N/A			#N/A	0		#N/A			#N/A			#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	2.54	1	0.96	0.377952756		1.2294	0.4840157		0	0		0.04776	0.018803		0.30284	0.119228		0	0		49.0
																								CN*(AMC II)	47.3
																								CN*(AMC III)	67.4

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	272.250	m
Minimum Catchment Elevation	264.36	m
Catchment length	406	m
Catchment Slope	2%	
Catchment Area	2.54	ha
Time of Concentration (Minutes)	**18.46**	
Time of Concentration (Hours)	**0.31**	
Time to Peak (2/3 x Time of Concentration)	**0.21**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	272.25	m
Minimum Catchment Elevation	264.36	m
Catchment length	406	m
Catchment Slope	2%	
Catchment Area	2.54	ha
Time of Concentration (Minutes)	**47.31**	
Time of Concentration (Hours)	**0.79**	
Time to Peak (2/3 x Time of Concentration)	**0.53**	

Time to Peak	**0.53 hrs**

Initial Abstraction	**6.5 mm**

Runoff Coefficient	**0.20**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2
Wetland	12

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	0.6	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.2032	#N/A	#N/A	#N/A	#N/A

C.C. Tatham & Associates Ltd.
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Collingwood Bracebridge Orillia Barrie Ottawa

Project:	Marchmont Subdivision
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Checked By:	JA
Subject:	Hydrologic Parameters

Marchmont Subdivision

EXISITING CONDITION

Catchment 202 **Area** 5.56 ha

Rain Gauge: Orillia Brain
100-yr 24hr SCS Rainfall Depth: 98.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Gravel			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
tisl	TIOGA	A	Sand Loam	1	5.56	1	1.25	0.23	32	3.61	0.65	49	0	0	38	0.11	0.02	65	0.59	0.11	100		0	50	50.85262
	#N/A	#N/A	#N/A	#N/A			0		#N/A	0.00		#N/A	0		#N/A						#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
	#N/A	#N/A	#N/A	#N/A	0		0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0		#N/A	0
				Totals	5.56	1	1.253	0.2253597		3.61395	0.6499912		0	0		0.10697	0.019239		0.58608	0.10541		0	0		50.9
																								CN*(AMC II)	47.1
																								CN*(AMC III)	67.2

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	272.400	m
Minimum Catchment Elevation	261.67	m
Catchment length	540.4	m
Catchment Slope	2%	
Catchment Area	5.56	ha
Time of Concentration (Minutes)	**22.62**	
Time of Concentration (Hours)	**0.38**	
Time to Peak (2/3 x Time of Concentration)	**0.25**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	272.52	m
Minimum Catchment Elevation	262.2	m
Catchment length	442	m
Catchment Slope	2%	
Catchment Area	5.56	ha
Time of Concentration (Minutes)	**46.90**	
Time of Concentration (Hours)	**0.78**	
Time to Peak (2/3 x Time of Concentration)	**0.52**	

Time to Peak	**0.52 hrs**

Initial Abstraction	**5.8 mm**

Woods	10
Meadows	8
Gravel	3
Lawns	5
Impervious	2
Wetland	12

Runoff Coefficient	**0.19**

Landuse Type	Soil Series				
	tisl	0	0	0	0
	1	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.08	#N/A	#N/A	#N/A	#N/A
Gravel	0.6	0.6	#N/A	#N/A	#N/A
Pasture/Lawn	0.1	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.09	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.1947	#N/A	#N/A	#N/A	#N/A

C.C. Tatham & Associates Ltd.
Consulting Engineers

Collingwood Bracebridge Orillia Barrie Ottawa

Project :	**Marchmont Subdivision**
File No.	**315836**
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Designed By:	**HY**
Checked By:	**JA**
Subject:	**Impervious and Gravel Area Calculations**

Impervious Area Calculations

Soil Type: Tioga Sand Loam

201	**Area (ha)**	
Gravel	0.05	199 m road x 1.2 m wide gravel shoulders, both sides
Impervious	0.30	199 m x6.6 m wide + houses (assume 185 m2 each)+ 10 m long x 6 m wide driveways
202	**Area (ha)**	
Gravel	0.11	1.2 m wide gravel shoulders along 280 m+94m road length + circle
Impervious	0.59	(280+94) m x 6.6 m road width + circle + 12 houses (assume 185 m2 each)+ 10 m long x 6 m wide driveways

C.C. Tatham & Associates Ltd. Consulting Engineers Collingwood Bracebridge Orillia Barrie Ottawa	Project:	Marchmont Subdivision	Date:	Sep-17
	File No.:	315836	Designed By:	HY
	Subject:	Water Quality Calculations	Checked By:	JA

Catchment 201 - Enhanced Grass Swale

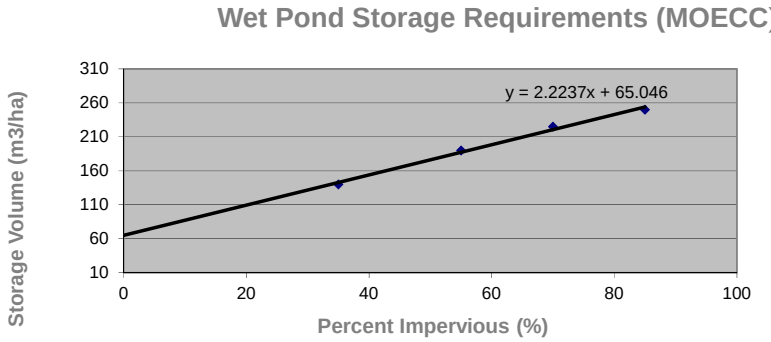
Manning's Equation

N	0.035		A	0.018 m^2
Depth of enhanced grass swale	0.031	m	P	0.696 m
Bottom width of enhanced grass swale	0.5	m		
side slope (H:V)	3		Q max	0.009 m^3/s
Slope	0.038		V max	0.494 m/s

$Q_{25\,mm}$ (Provided from VO2) 0.008 m^3/s

$V_{25\,mm}$ (calculated) 0.44 m/s

Catchment 202 - Wet SWM Pond



MOE Water Quality Storage Volumes

Table 3.2 Values

% imp	storage (m^3/ha)
35	140
55	190
70	225
85	250

Catchment imperviousness:	11%
Total storage volume:	88.5 m^3/ha
Extended detention volume:	40.0 m^3/ha
Contributing area:	5.56 ha
Required permanent pool volume:	269.6 m^3
Extended detention volume (40 m^3/ha):	222.4 m^3
25mm storm runoff	67.1 m^3
Total Water Quality Storage Volume Provided:	969.5 m^3

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Collingwood Bracebridge Orillia Barrie Ottawa

Project :	**Marchmont Subdivision**
File No.	**315836**
Date:	**Sep-17**
Designed By:	**HY**
Checked By:	**JA**
Subject:	**Wet Pond Stage-Volume Table**

Wet SWM Pond Stage-Volume Table

Elevation	Depth	Area	Accum. Area	Volume	Accum. Dead Volume	Accum. Active Volume	Accum. Total
(m)	(m)	(m^2)	(m^2)	(m^3)	(m^3)	(m^3)	(m^3)
261.05	0.00	0.0	694.0	0.0	0.0	0.00	0.0
261.15	0.10	50.2	744.2	71.9	71.9	0.00	71.9
261.25	0.20	51.9	796.1	77.0	148.9	0.00	148.9
261.35	0.30	53.7	849.7	82.3	231.2	0.00	231.2
261.45	0.40	55.4	905.1	87.7	318.9	0.00	318.9
261.55	0.50	57.2	962.3	93.4	412.2	0.00	412.2
261.65	0.60	58.9	1021.2	99.2	511.4	0.00	511.4
261.75	0.70	60.7	1081.8	105.1	616.5	0.00	616.5
261.85	0.80	62.4	1144.2	111.3	727.8	0.00	727.8
261.95	0.90	64.1	1208.4	117.6	845.4	0.00	845.4
262.05	1.00	65.9	1274.3	124.1	969.5	0.00	969.5
262.15	1.10	67.6	1341.9	130.8	0.0	130.8	1100.3
262.25	1.20	69.4	1411.3	137.6	0.0	268.4	1238.0
262.35	1.30	71.1	1482.5	144.7	0.0	413.1	1382.7
262.45	1.40	72.9	1555.3	151.9	0.0	565.0	1534.5
262.55	1.50	74.6	1630.0	159.3	0.0	724.2	1693.8
262.65	1.60	76.4	1706.4	166.8	0.0	891.0	1860.6
262.75	1.70	78.1	1784.5	174.5	0.0	1065.6	2035.1
262.85	1.80	79.9	1864.4	182.4	0.0	1248.0	2217.6
262.95	1.90	81.6	1946.1	190.5	0.0	1438.5	2408.1
263.05	2.00	83.4	2029.5	198.8	0.0	1637.3	2606.8

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Collingwood Bracebridge Orillia Barrie Ottawa

Project :	**Marchmont Subdivision**
File No.	**315836**
Date:	**Sep-17**
Designed By:	**HY**
Checked By:	**JA**
Subject:	**Storm water conveyance Calculations**

Road Ditch						
Ditch side slope	3.00	:1		A	2.43	m^2
slope	0.01			P	5.69	m
n	0.03			R	0.43	
Bottom width	0.00					
Height	0.90			Q	4.59	m^3/s
Typical Grass Swale						
Ditch side slope	3.00	:1		A	0.75	m^2
slope	0.005			P	3.16	m
n	0.03			R	0.24	
Bottom width	0.00					
Height	0.50			Q	0.68	m^3/s
Enhanced grass swale						
Ditch side slope	3.00	:1		A	0.345	m^2
slope	0.037			P	2.40	m
n	0.04			R	0.14	
Bottom width	0.50					
Height	0.30			Q	0.52	m^3/s

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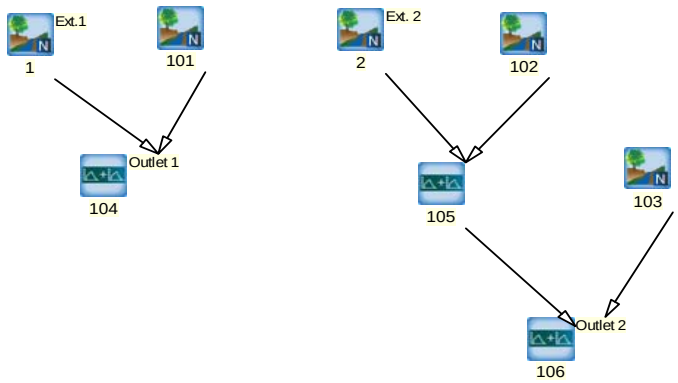
Project:	Marchmont Subdivision
Date:	Sep-2017
File No.:	315836
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Model Schematic

Marchmont Subdivision Property
Existing Hydrologic Model Schematic



Nashyd		Route Pipe		Duhyd	
Standhyd		Route Channel		Diverthyd	
Addhyd		Route Reservoir			

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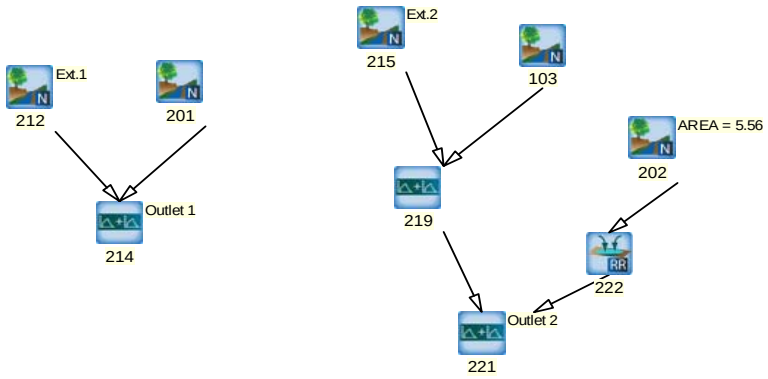
Project:	Marchmont Subdivision
Date:	Sep-2017
File No.:	315836
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Model Schematic

Marchmont Subdivision Property
Proposed Hydrologic Model Schematic



1	Nashyd	1	Route Pipe	1	Duhyd
1	Standhyd	1	Route Channel	1	Diverthyd
1	Addhyd	1	Route Reservoir		

```
================================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO

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                  *****  S U M M A R Y   O U T P U T  *****


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  Summary filename: C:\Users\HYu\Desktop\315836\315836~1.SEP\Existing - SCS.sum


DATE: 13/09/2017                          TIME: 12:10:47 PM

USER:


COMMENTS: _____________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                 5.0
      [ Ptot= 46.51 mm ]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .01 12.08   1.96  .04    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .01 12.00   3.73  .08    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .00 12.58   1.89  .04    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .01 12.42   1.95  .04    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .01 12.33   2.39  .05    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
      ADD [0101 + 0001]  0104  3  5.0    5.30     .02 12.00   2.53  n/a    .000
*
      ADD [0102 + 0002]  0105  3  5.0    7.50     .02 12.33   2.12  n/a    .000
*
      ADD [0103 + 0105]  0106  3  5.0   10.10     .02 12.42   2.06  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                 5.0
      [ Ptot= 60.36 mm ]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .02 12.08   3.64  .06    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .02 12.00   6.61  .11    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .01 12.58   3.53  .06    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .02 12.33   3.63  .06    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .01 12.33   4.38  .07    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
      ADD [0101 + 0001]  0104  3  5.0    5.30     .04 12.00   4.59  n/a    .000
*
      ADD [0102 + 0002]  0105  3  5.0    7.50     .03 12.33   3.93  n/a    .000
*
      ADD [0103 + 0105]  0106  3  5.0   10.10     .04 12.42   3.82  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                 5.0
      [ Ptot= 69.52 mm ]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .03 12.08   5.02  .07    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .03 12.00   8.89  .13    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .01 12.58   4.87  .07    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .02 12.33   5.00  .07    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .02 12.33   5.99  .09    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
      ADD [0101 + 0001]  0104  3  5.0    5.30     .06 12.00   6.26  n/a    .000
*
      ADD [0102 + 0002]  0105  3  5.0    7.50     .05 12.33   5.39  n/a    .000
*
      ADD [0103 + 0105]  0106  3  5.0   10.10     .06 12.42   5.26  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                 5.0
      [ Ptot= 81.07 mm ]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .04 12.08   7.04  .09    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .04 12.00  12.17  .15    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02 12.50   6.84  .08    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .04 12.33   7.01  .09    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .03 12.33   8.33  .10    .000
```

```
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
     ADD [0101 + 0001]  0104  3  5.0    5.30     .08 12.00   8.68  n/a    .000
*
     ADD [0102 + 0002]  0105  3  5.0    7.50     .06 12.33   7.54  n/a    .000
*
     ADD [0103 + 0105]  0106  3  5.0   10.10     .08 12.33   7.36  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                   5.0
     [ Ptot= 89.74 mm ]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .05 12.08   8.75  .10    .000
     [CN=28.2         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .05 12.00  14.90  .17    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02 12.50   8.50  .09    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .04 12.33   8.72  .10    .000
     [CN=28.1         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .04 12.33  10.32  .12    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
     ADD [0101 + 0001]  0104  3  5.0    5.30     .10 12.00  10.73  n/a    .000
*
     ADD [0102 + 0002]  0105  3  5.0    7.50     .08 12.33   9.36  n/a    .000
*
     ADD [0103 + 0105]  0106  3  5.0   10.10     .10 12.33   9.14  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                   5.0
     [ Ptot= 98.31 mm ]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .06 12.08  10.61  .11    .000
     [CN=28.2         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .06 11.92  17.82  .18    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .03 12.50  10.31  .10    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .05 12.33  10.56  .11    .000
     [CN=28.1         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .04 12.33  12.45  .13    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
     ADD [0101 + 0001]  0104  3  5.0    5.30     .12 12.00  12.92  n/a    .000
*
     ADD [0102 + 0002]  0105  3  5.0    7.50     .10 12.33  11.32  n/a    .000
*
     ADD [0103 + 0105]  0106  3  5.0   10.10     .12 12.33  11.06  n/a    .000
*
 FINISH

================================================================================================================
```

```
================================================================================================

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      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
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      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO

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                  *****  S U M M A R Y   O U T P U T  *****


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  Summary filename: C:\Users\HYu\Desktop\315836\315836~1.SEP\Existing - Chicago.sum


DATE: 13/09/2017                          TIME: 2:54:15 PM

USER:


COMMENTS: _____________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                6.0
      [ Ptot= 24.97 mm ]
      fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\CHIC25MM.4HR
      remark: 25 mm 4-hr Chicago storm
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .00  2.17    .81  .03    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .00  2.42    .34  .01    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .00  2.67    .45  .02    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .00  2.67    .34  .01    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .00  2.92    .33  .01    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0108  1  5.0    3.60     .01  2.33    .77  .03    .000
      [CN=47.5         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0107  1  5.0    1.70     .01  2.17   1.75  .07    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0113  1  5.0    2.60     .00  2.92    .74  .03    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0110  1  5.0    4.50     .01  2.67    .76  .03    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0109  1  5.0    3.00     .01  2.67   1.00  .04    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0115  1  5.0    1.70     .01  2.00    .80  .03    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .12]
*
      ADD [0001 + 0101]  0104  3  5.0    5.30     .01  2.25    .49  n/a    .000
*
      ADD [0002 + 0102]  0105  3  5.0    7.50     .00  2.67    .38  n/a    .000
*
      ADD [0105 + 0103]  0106  3  5.0   10.10     .01  2.75    .37  n/a    .000
*
      ADD [0108 + 0107]  0111  3  5.0    5.30     .01  2.25   1.08  n/a    .000
*
      ADD [0110 + 0109]  0112  3  5.0    7.50     .01  2.67    .86  n/a    .000
*
      ADD [0113 + 0112]  0114  3  5.0   10.10     .01  2.75    .83  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM               12.0
      [ Ptot= 33.30 mm ]
      fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi2-4.stm
      remark: * Orillia Chicago 2 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .01  2.25   1.70  .05    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .01  2.42    .82  .02    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .01  2.67   1.03  .03    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .01  2.67    .81  .02    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .00  2.92    .79  .02    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0108  1  5.0    3.60     .02  2.42   1.80  .05    .000
      [CN=47.5         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0107  1  5.0    1.70     .02  2.25   3.61  .11    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0113  1  5.0    2.60     .01  2.92   1.74  .05    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0110  1  5.0    4.50     .01  2.67   1.79  .05    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0109  1  5.0    3.00     .01  2.67   2.25  .07    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0115  1  5.0    1.70     .01  2.08   1.68  .05    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .12]
*
      ADD [0001 + 0101]  0104  3  5.0    5.30     .01  2.25   1.10  n/a    .000
*
      ADD [0002 + 0102]  0105  3  5.0    7.50     .01  2.67    .90  n/a    .000
*
      ADD [0105 + 0103]  0106  3  5.0   10.10     .01  2.75    .87  n/a    .000
*
      ADD [0108 + 0107]  0111  3  5.0    5.30     .03  2.25   2.38  n/a    .000
*
      ADD [0110 + 0109]  0112  3  5.0    7.50     .03  2.67   1.97  n/a    .000
*
      ADD [0113 + 0112]  0114  3  5.0   10.10     .03  2.75   1.91  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************
```

```
 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                12.0
     [ Ptot= 44.71 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi5-4.stm
     remark: * Orillia Chicago 5 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .02  2.17   3.42  .08    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .02  2.33   1.78  .04    .000
     [CN=28.2         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .01  2.67   2.18  .05    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .01  2.67   1.77  .04    .000
     [CN=28.1         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .01  2.83   1.72  .04    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0108  1  5.0    3.60     .03  2.33   3.84  .09    .000
     [CN=47.5         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0107  1  5.0    1.70     .04  2.17   7.03  .16    .000
     [CN=61.0         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0113  1  5.0    2.60     .01  2.83   3.73  .08    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0110  1  5.0    4.50     .03  2.67   3.81  .09    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0109  1  5.0    3.00     .03  2.67   4.66  .10    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0115  1  5.0    1.70     .02  2.00   3.38  .08    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .12]
*
     ADD [0001 + 0101]  0104  3  5.0    5.30     .03  2.25   2.31  n/a    .000
*
     ADD [0002 + 0102]  0105  3  5.0    7.50     .03  2.67   1.93  n/a    .000
*
     ADD [0105 + 0103]  0106  3  5.0   10.10     .03  2.67   1.88  n/a    .000
*
     ADD [0108 + 0107]  0111  3  5.0    5.30     .07  2.25   4.86  n/a    .000
*
     ADD [0110 + 0109]  0112  3  5.0    7.50     .06  2.67   4.15  n/a    .000
*
     ADD [0113 + 0112]  0114  3  5.0   10.10     .07  2.67   4.04  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                12.0
     [ Ptot= 63.42 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi25.stm
     remark: *Orillia Chicago 25 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .04  2.17   7.35  .12    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .04  2.33   4.09  .06    .000
     [CN=28.2         ]
     [ N = 3.0:Tp  .33]
*
```

```
  **  CALIB NASHYD       0002  1  5.0    3.00     .03  2.58   4.90  .08    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .03  2.67   4.07  .06    .000
     [CN=28.1         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02  2.83   3.97  .06    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0108  1  5.0    3.60     .08  2.33   8.57  .14    .000
     [CN=47.5         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0107  1  5.0    1.70     .08  2.17  14.44  .23    .000
     [CN=61.0         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0113  1  5.0    2.60     .03  2.83   8.34  .13    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0110  1  5.0    4.50     .07  2.58   8.51  .13    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0109  1  5.0    3.00     .06  2.58  10.12  .16    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0115  1  5.0    1.70     .05  2.00   7.26  .11    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .12]
*
     ADD [0001 + 0101]  0104  3  5.0    5.30     .07  2.25   5.14  n/a    .000
*
     ADD [0002 + 0102]  0105  3  5.0    7.50     .06  2.58   4.40  n/a    .000
*
     ADD [0105 + 0103]  0106  3  5.0   10.10     .07  2.67   4.29  n/a    .000
*
     ADD [0108 + 0107]  0111  3  5.0    5.30     .15  2.25  10.45  n/a    .000
*
     ADD [0110 + 0109]  0112  3  5.0    7.50     .12  2.58   9.16  n/a    .000
*
     ADD [0113 + 0112]  0114  3  5.0   10.10     .15  2.67   8.95  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                12.0
     [ Ptot= 78.51 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi100.stm
     remark: *Orillia Chicago 100 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .06  2.17  11.43  .15    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .06  2.33   6.58  .08    .000
     [CN=28.2         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .04  2.58   7.80  .10    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .05  2.58   6.55  .08    .000
     [CN=28.1         ]
     [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02  2.83   6.39  .08    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0108  1  5.0    3.60     .12  2.33  13.47  .17    .000
     [CN=47.5         ]
     [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0107  1  5.0    1.70     .12  2.17  21.73  .28    .000
     [CN=61.0         ]
     [ N = 3.0:Tp  .23]
```

```
*
  **  CALIB NASHYD       0113  1  5.0    2.60     .05  2.83  13.14  .17    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0110  1  5.0    4.50     .11  2.58  13.39  .17    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0109  1  5.0    3.00     .09  2.58  15.70  .20    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0115  1  5.0    1.70     .08  2.00  11.29  .14    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .12]
*
      ADD [0001 + 0101]  0104  3  5.0    5.30     .12  2.25   8.13  n/a    .000
*
      ADD [0002 + 0102]  0105  3  5.0    7.50     .10  2.58   7.05  n/a    .000
*
      ADD [0105 + 0103]  0106  3  5.0   10.10     .12  2.67   6.88  n/a    .000
*
      ADD [0108 + 0107]  0111  3  5.0    5.30     .23  2.25  16.12  n/a    .000
*
      ADD [0110 + 0109]  0112  3  5.0    7.50     .20  2.58  14.31  n/a    .000
*
      ADD [0113 + 0112]  0114  3  5.0   10.10     .24  2.67  14.01  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                12.0
      [ Ptot=193.00 mm ]
      fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\TIMMINS.12
      remark: TIMMINS REGIONAL 12 HOUR DURATION STORM
*
  **  CALIB NASHYD       0001  1  5.0    1.70     .07  7.00  61.69  .32    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0101  1  5.0    3.60     .10  7.08  40.39  .21    .000
      [CN=28.2         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0002  1  5.0    3.00     .08  7.25  46.14  .24    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0102  1  5.0    4.50     .10  7.25  40.24  .21    .000
      [CN=28.1         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .05  7.50  39.43  .20    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0108  1  5.0    3.60     .18  7.08  72.26  .37    .000
      [CN=47.5         ]
      [ N = 3.0:Tp  .33]
*
  **  CALIB NASHYD       0107  1  5.0    1.70     .12  7.00  99.04  .51    .000
      [CN=61.0         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0113  1  5.0    2.60     .10  7.42  70.99  .37    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0110  1  5.0    4.50     .19  7.25  71.93  .37    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .55]
*
  **  CALIB NASHYD       0109  1  5.0    3.00     .14  7.25  80.18  .42    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0115  1  5.0    1.70     .08  7.00  60.94  .32    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .12]
*
      ADD [0001 + 0101]  0104  3  5.0    5.30     .17  7.00  47.22  n/a    .000
*
      ADD [0002 + 0102]  0105  3  5.0    7.50     .18  7.25  42.60  n/a    .000
*
      ADD [0105 + 0103]  0106  3  5.0   10.10     .23  7.33  41.78  n/a    .000
*
      ADD [0108 + 0107]  0111  3  5.0    5.30     .30  7.00  80.85  n/a    .000
*
      ADD [0110 + 0109]  0112  3  5.0    7.50     .33  7.25  75.23  n/a    .000
*
      ADD [0113 + 0112]  0114  3  5.0   10.10     .43  7.25  74.14  n/a    .000
*
 FINISH

================================================================================================
```

```
================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO

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                    *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.2.4\voin.dat
  Output  filename: C:\Users\HYu\Desktop\315836\315836~1.SEP\Proposed - SCS.out
  Summary filename: C:\Users\HYu\Desktop\315836\315836~1.SEP\Proposed - SCS.sum


DATE: 13/09/2017                          TIME: 12:31:37 PM

USER:


COMMENTS: _____________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                    5.0
      [ Ptot= 46.51 mm ]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .01 12.00   3.73  .08    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .01 12.33   4.95  .11    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .03 12.33   5.07  .11    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .00 12.58   1.89  .04    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .01 12.33   2.39  .05    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0224  1  5.0    5.56     .03 12.33   5.07  .11    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    3.00     .01 12.33   2.39  .05    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0227  1  5.0    2.60     .00 12.58   1.89  .04    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
      ADD [0212 + 0201]  0214  3  5.0    4.24     .02 12.08   4.46  n/a    .000
*
      RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .00 20.33   4.74  n/a    .000
      {ST=   .02 ha.m }
*
      ADD [0103 + 0215]  0219  3  5.0    5.60     .01 12.42   2.16  n/a    .000
*
      ADD [0223 + 0227]  0225  3  5.0    5.60     .01 12.42   2.16  n/a    .000
*
      ADD [0222 + 0219]  0221  3  5.0   11.16     .01 12.50   3.44  n/a    .000
*
      ADD [0224 + 0225]  0226  3  5.0   11.16     .04 12.33   3.61  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                    5.0
      [ Ptot= 60.36 mm ]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .02 12.00   6.61  .11    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .03 12.33   8.59  .14    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .06 12.33   8.74  .14    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .01 12.58   3.53  .06    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .01 12.33   4.38  .07    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0224  1  5.0    5.56     .06 12.33   8.74  .14    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    3.00     .01 12.33   4.38  .07    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0227  1  5.0    2.60     .01 12.58   3.53  .06    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
      ADD [0212 + 0201]  0214  3  5.0    4.24     .04 12.08   7.80  n/a    .000
*
      RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .02 13.75   8.40  n/a    .000
      {ST=   .02 ha.m }
*
      ADD [0103 + 0215]  0219  3  5.0    5.60     .02 12.42   3.98  n/a    .000
*
      ADD [0223 + 0227]  0225  3  5.0    5.60     .02 12.42   3.98  n/a    .000
*
      ADD [0222 + 0219]  0221  3  5.0   11.16     .03 13.50   6.19  n/a    .000
*
      ADD [0224 + 0225]  0226  3  5.0   11.16     .08 12.33   6.35  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      MASS STORM                    5.0
      [ Ptot= 69.52 mm ]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .03 12.00   8.89  .13    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .03 12.33  11.45  .16    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .08 12.25  11.61  .17    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .01 12.58   4.87  .07    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .02 12.33   5.99  .09    .000
```

```
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0224  1  5.0    5.56     .08 12.25  11.61  .17    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    3.00     .02 12.33   5.99  .09    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0227  1  5.0    2.60     .01 12.58   4.87  .07    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
      ADD [0212 + 0201]  0214  3  5.0    4.24     .06 12.08  10.43  n/a    .000
*
      RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .03 13.42  11.27  n/a    .000
     {ST=   .03 ha.m }
*
      ADD [0103 + 0215]  0219  3  5.0    5.60     .03 12.42   5.47  n/a    .000
*
      ADD [0223 + 0227]  0225  3  5.0    5.60     .03 12.42   5.47  n/a    .000
*
      ADD [0222 + 0219]  0221  3  5.0   11.16     .05 12.92   8.36  n/a    .000
*
      ADD [0224 + 0225]  0226  3  5.0   11.16     .11 12.33   8.53  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
     --------------------
     MASS STORM                 5.0
     [ Ptot= 81.07 mm ]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .04 12.00  12.17  .15    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .05 12.33  15.52  .19    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .11 12.25  15.68  .19    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02 12.50   6.84  .08    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .03 12.33   8.33  .10    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0224  1  5.0    5.56     .11 12.25  15.68  .19    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    3.00     .03 12.33   8.33  .10    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0227  1  5.0    2.60     .02 12.50   6.84  .08    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
      ADD [0212 + 0201]  0214  3  5.0    4.24     .08 12.08  14.18  n/a    .000
*
      RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .04 13.42  15.35  n/a    .000
     {ST=   .04 ha.m }
*
      ADD [0103 + 0215]  0219  3  5.0    5.60     .04 12.42   7.64  n/a    .000
*
      ADD [0223 + 0227]  0225  3  5.0    5.60     .04 12.42   7.64  n/a    .000
*
      ADD [0222 + 0219]  0221  3  5.0   11.16     .07 12.67  11.48  n/a    .000
*
      ADD [0224 + 0225]  0226  3  5.0   11.16     .15 12.33  11.65  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************
```

```
  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
     --------------------
     MASS STORM                 5.0
     [ Ptot= 89.74 mm ]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .05 12.00  14.90  .17    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .06 12.33  18.88  .21    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .13 12.25  19.05  .21    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02 12.50   8.50  .09    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .04 12.33  10.32  .12    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0224  1  5.0    5.56     .13 12.25  19.05  .21    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    3.00     .04 12.33  10.32  .12    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0227  1  5.0    2.60     .02 12.50   8.50  .09    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
      ADD [0212 + 0201]  0214  3  5.0    4.24     .10 12.08  17.29  n/a    .000
*
      RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .05 13.42  18.71  n/a    .000
     {ST=   .04 ha.m }
*
      ADD [0103 + 0215]  0219  3  5.0    5.60     .06 12.42   9.47  n/a    .000
*
      ADD [0223 + 0227]  0225  3  5.0    5.60     .06 12.42   9.47  n/a    .000
*
      ADD [0222 + 0219]  0221  3  5.0   11.16     .09 12.67  14.08  n/a    .000
*
      ADD [0224 + 0225]  0226  3  5.0   11.16     .18 12.33  14.24  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
     --------------------
     MASS STORM                 5.0
     [ Ptot= 98.31 mm ]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .06 11.92  17.82  .18    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .07 12.25  22.44  .23    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .15 12.25  22.61  .23    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .03 12.50  10.31  .10    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .04 12.33  12.45  .13    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0224  1  5.0    5.56     .15 12.25  22.61  .23    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
```

```
 **  CALIB NASHYD       0223  1  5.0    3.00     .04 12.33  12.45  .13    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
 **  CALIB NASHYD       0227  1  5.0    2.60     .03 12.50  10.31  .10    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
     ADD [0212 + 0201]  0214  3  5.0    4.24     .12 12.08  20.59  n/a    .000
*
     RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .05 13.42  22.27  n/a    .000
     {ST=   .05 ha.m }
*
     ADD [0103 + 0215]  0219  3  5.0    5.60     .07 12.42  11.46  n/a    .000
*
     ADD [0223 + 0227]  0225  3  5.0    5.60     .07 12.42  11.46  n/a    .000
*
     ADD [0222 + 0219]  0221  3  5.0   11.16     .11 12.67  16.84  n/a    .000
*
     ADD [0224 + 0225]  0226  3  5.0   11.16     .22 12.33  17.01  n/a    .000
*
 FINISH

================================================================================================================
```

```
================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO

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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.2.4\voin.dat
  Output  filename: C:\Users\HYu\Desktop\315836\315836~1.SEP\Proposed - Chicago.out
  Summary filename: C:\Users\HYu\Desktop\315836\315836~1.SEP\Proposed - Chicago.sum


DATE: 13/09/2017                          TIME: 12:26:22 PM

USER:


COMMENTS: _____________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                6.0
      [ Ptot= 24.97 mm ]
      fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\CHIC25MM.4HR
      remark: 25 mm 4-hr Chicago storm
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .01  2.58   1.13  .05    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .00  2.17    .81  .03    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .00  2.67    .45  .02    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .00  2.92    .33  .01    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .01  2.58   1.21  .05    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    1.70     .01  2.17   1.76  .07    .000
      [CN=61.1         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0224  1  5.0    2.54     .01  2.58   2.41  .10    .000
      [CN=67.4         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0227  1  5.0    5.56     .03  2.58   2.57  .10    .000
      [CN=67.2         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0230  1  5.0    2.60     .00  2.92    .74  .03    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0226  1  5.0    3.00     .01  2.67   1.00  .04    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0233  1  5.0    5.56     .01  2.58   1.21  .05    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0236  1  5.0    2.60     .00  2.92    .33  .01    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0232  1  5.0    3.00     .00  2.67    .45  .02    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0239  1  5.0    5.56     .03  2.58   2.57  .10    .000
      [CN=67.2         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0238  1  5.0    3.00     .01  2.67   1.00  .04    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0242  1  5.0    2.60     .00  2.92    .74  .03    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
      ADD [0201 + 0212]  0214  3  5.0    4.24     .01  2.33   1.00  n/a    .000
*
      ADD [0215 + 0103]  0219  3  5.0    5.60     .00  2.75    .39  n/a    .000
*
      RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .00  4.92    .89  n/a    .000
      {ST=   .01 ha.m }
*
      ADD [0223 + 0224]  0225  3  5.0    4.24     .02  2.33   2.15  n/a    .000
*
      RESRVR [ 2 : 0227] 0231  1  5.0    5.56     .01  4.17   2.25  n/a    .000
      {ST=   .01 ha.m }
*
      ADD [0230 + 0226]  0228  3  5.0    5.60     .01  2.75    .88  n/a    .000
*
      ADD [0236 + 0232]  0234  3  5.0    5.60     .00  2.75    .39  n/a    .000
*
      ADD [0238 + 0242]  0240  3  5.0    5.60     .01  2.75    .88  n/a    .000
*
      ADD [0219 + 0222]  0221  3  5.0   11.16     .00  2.83    .64  n/a    .000
*
      ADD [0231 + 0228]  0229  3  5.0   11.16     .01  3.50   1.56  n/a    .000
*
      ADD [0233 + 0234]  0235  3  5.0   11.16     .02  2.58    .80  n/a    .000
*
      ADD [0239 + 0240]  0241  3  5.0   11.16     .03  2.58   1.72  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM               12.0
      [ Ptot= 33.30 mm ]
      fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi2-4.stm
      remark: * Orillia Chicago 2 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .01  2.58   2.32  .07    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .01  2.25   1.70  .05    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .01  2.67   1.03  .03    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .00  2.92    .79  .02    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .02  2.58   2.42  .07    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    1.70     .02  2.25   3.62  .11    .000
      [CN=61.1         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0224  1  5.0    2.54     .02  2.58   4.80  .14    .000
```
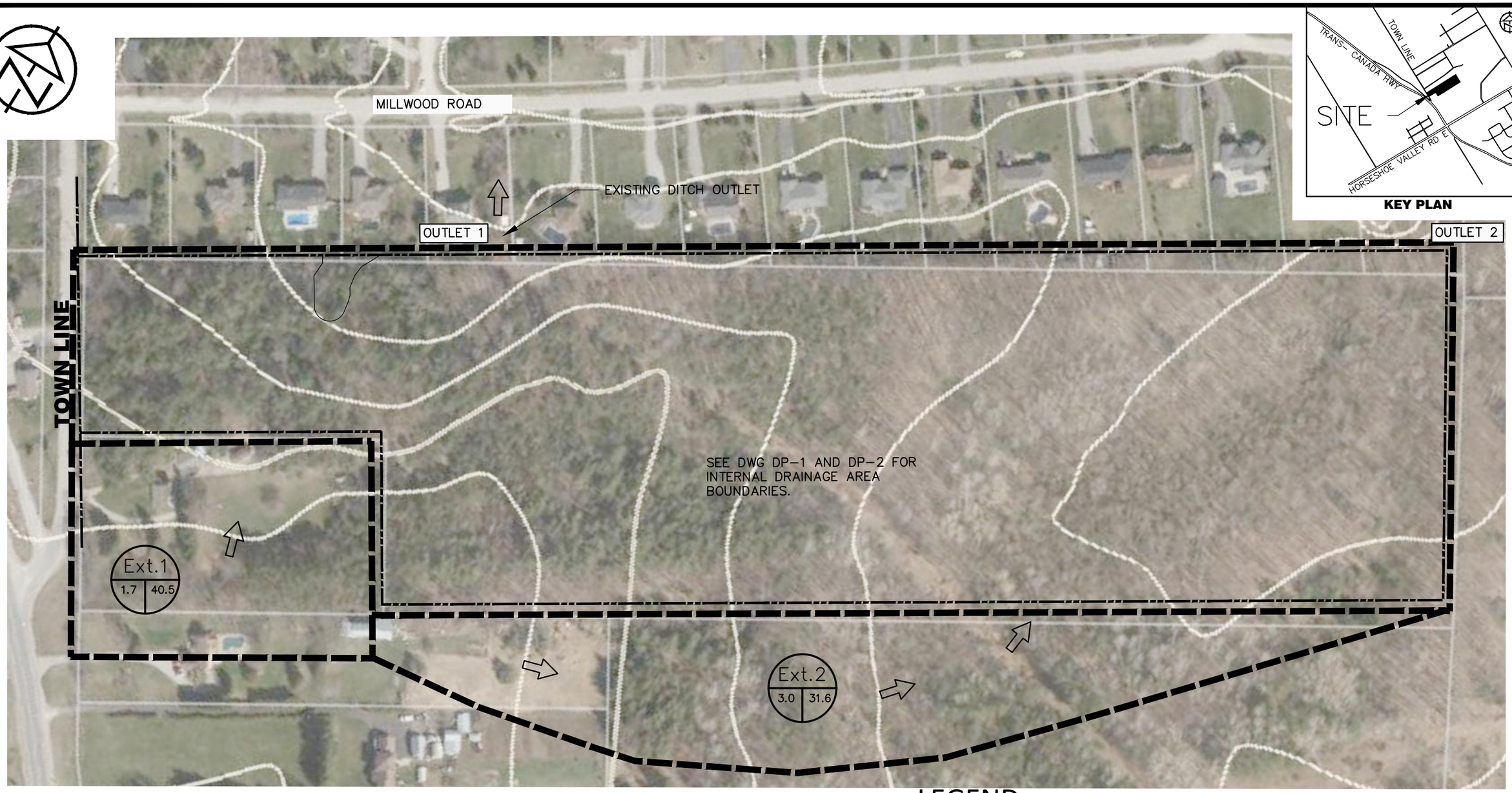

```
     [CN=67.4         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0227  1  5.0    5.56     .05  2.58   4.99  .15    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0230  1  5.0    2.60     .01  2.92   1.74  .05    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0226  1  5.0    3.00     .01  2.67   2.25  .07    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0233  1  5.0    5.56     .02  2.58   2.42  .07    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0236  1  5.0    2.60     .00  2.92    .79  .02    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0232  1  5.0    3.00     .01  2.67   1.03  .03    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0239  1  5.0    5.56     .05  2.58   4.99  .15    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0238  1  5.0    3.00     .01  2.67   2.25  .07    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0242  1  5.0    2.60     .01  2.92   1.74  .05    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
     ADD [0201 + 0212]  0214  3  5.0    4.24     .02  2.42   2.07  n/a    .000
*
     ADD [0215 + 0103]  0219  3  5.0    5.60     .01  2.75    .92  n/a    .000
*
     RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .01  4.25   2.10  n/a    .000
     {ST=   .01 ha.m }
*
     ADD [0223 + 0224]  0225  3  5.0    4.24     .04  2.42   4.33  n/a    .000
*
     RESRVR [ 2 : 0227] 0231  1  5.0    5.56     .02  3.92   4.67  n/a    .000
     {ST=   .02 ha.m }
*
     ADD [0230 + 0226]  0228  3  5.0    5.60     .02  2.75   2.01  n/a    .000
*
     ADD [0236 + 0232]  0234  3  5.0    5.60     .01  2.75    .92  n/a    .000
*
     ADD [0238 + 0242]  0240  3  5.0    5.60     .02  2.75   2.01  n/a    .000
*
     ADD [0219 + 0222]  0221  3  5.0   11.16     .01  3.42   1.50  n/a    .000
*
     ADD [0231 + 0228]  0229  3  5.0   11.16     .03  3.08   3.34  n/a    .000
*
     ADD [0233 + 0234]  0235  3  5.0   11.16     .03  2.67   1.66  n/a    .000
*
     ADD [0239 + 0240]  0241  3  5.0   11.16     .07  2.58   3.50  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                12.0
     [ Ptot= 44.71 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi5-4.stm
     remark: * Orillia Chicago 5 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .02  2.58   4.55  .10    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .02  2.17   3.42  .08    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .01  2.67   2.18  .05    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .01  2.83   1.72  .04    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .05  2.58   4.67  .10    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    1.70     .04  2.17   7.06  .16    .000
     [CN=61.1         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0224  1  5.0    2.54     .04  2.58   9.07  .20    .000
     [CN=67.4         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0227  1  5.0    5.56     .10  2.58   9.30  .21    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0230  1  5.0    2.60     .01  2.83   3.73  .08    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0226  1  5.0    3.00     .03  2.67   4.66  .10    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0233  1  5.0    5.56     .05  2.58   4.67  .10    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0236  1  5.0    2.60     .01  2.83   1.72  .04    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0232  1  5.0    3.00     .01  2.67   2.18  .05    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0239  1  5.0    5.56     .10  2.58   9.30  .21    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0238  1  5.0    3.00     .03  2.67   4.66  .10    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0242  1  5.0    2.60     .01  2.83   3.73  .08    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
     ADD [0201 + 0212]  0214  3  5.0    4.24     .03  2.33   4.10  n/a    .000
*
     ADD [0215 + 0103]  0219  3  5.0    5.60     .02  2.67   1.96  n/a    .000
*
     RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .01  3.92   4.35  n/a    .000
     {ST=   .02 ha.m }
*
     ADD [0223 + 0224]  0225  3  5.0    4.24     .07  2.33   8.26  n/a    .000
*
     RESRVR [ 2 : 0227] 0231  1  5.0    5.56     .03  3.83   8.98  n/a    .000
     {ST=   .03 ha.m }
*
     ADD [0230 + 0226]  0228  3  5.0    5.60     .04  2.67   4.22  n/a    .000
*
     ADD [0236 + 0232]  0234  3  5.0    5.60     .02  2.67   1.96  n/a    .000
*
     ADD [0238 + 0242]  0240  3  5.0    5.60     .04  2.67   4.22  n/a    .000
*
     ADD [0219 + 0222]  0221  3  5.0   11.16     .03  3.08   3.15  n/a    .000
*
     ADD [0231 + 0228]  0229  3  5.0   11.16     .06  3.00   6.59  n/a    .000
*
     ADD [0233 + 0234]  0235  3  5.0   11.16     .07  2.58   3.31  n/a    .000
*
     ADD [0239 + 0240]  0241  3  5.0   11.16     .14  2.58   6.75  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
```

```
     READ STORM                 12.0
     [ Ptot= 63.42 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi25.stm
     remark: *Orillia Chicago 25 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .04  2.58   9.53  .15    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .04  2.17   7.35  .12    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .03  2.58   4.90  .08    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02  2.83   3.97  .06    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .10  2.58   9.68  .15    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    1.70     .08  2.17  14.49  .23    .000
     [CN=61.1         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0224  1  5.0    2.54     .09  2.58  18.02  .28    .000
     [CN=67.4         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0227  1  5.0    5.56     .19  2.58  18.28  .29    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0230  1  5.0    2.60     .03  2.83   8.34  .13    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0226  1  5.0    3.00     .06  2.58  10.12  .16    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0233  1  5.0    5.56     .10  2.58   9.68  .15    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0236  1  5.0    2.60     .02  2.83   3.97  .06    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0232  1  5.0    3.00     .03  2.58   4.90  .08    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0239  1  5.0    5.56     .19  2.58  18.28  .29    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0238  1  5.0    3.00     .06  2.58  10.12  .16    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0242  1  5.0    2.60     .03  2.83   8.34  .13    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
     ADD [0201 + 0212]  0214  3  5.0    4.24     .07  2.33   8.66  n/a    .000
*
     ADD [0215 + 0103]  0219  3  5.0    5.60     .04  2.67   4.47  n/a    .000
*
     RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .03  3.83   9.36  n/a    .000
     {ST=   .03 ha.m }
*
     ADD [0223 + 0224]  0225  3  5.0    4.24     .14  2.33  16.61  n/a    .000
*
     RESRVR [ 2 : 0227] 0231  1  5.0    5.56     .06  3.75  17.96  n/a    .000
     {ST=   .06 ha.m }
*
     ADD [0230 + 0226]  0228  3  5.0    5.60     .09  2.67   9.29  n/a    .000
*
     ADD [0236 + 0232]  0234  3  5.0    5.60     .04  2.67   4.47  n/a    .000
*
     ADD [0238 + 0242]  0240  3  5.0    5.60     .09  2.67   9.29  n/a    .000
*
     ADD [0219 + 0222]  0221  3  5.0   11.16     .06  3.00   6.91  n/a    .000
*
     ADD [0231 + 0228]  0229  3  5.0   11.16     .13  2.92  13.61  n/a    .000
*
     ADD [0233 + 0234]  0235  3  5.0   11.16     .14  2.58   7.07  n/a    .000
*
     ADD [0239 + 0240]  0241  3  5.0   11.16     .28  2.58  13.77  n/a    .000
*
  ***************************
  ** SIMULATION NUMBER:   5 **
  ***************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     ---------------------
     READ STORM                 12.0
     [ Ptot= 78.51 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\orchi100.stm
     remark: *Orillia Chicago 100 Year, 4 Hour Storm
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .07  2.58  14.61  .19    .000
     [CN=47.3         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .06  2.17  11.43  .15    .000
     [CN=40.5         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .04  2.58   7.80  .10    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .02  2.83   6.39  .08    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .16  2.58  14.77  .19    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    1.70     .12  2.17  21.80  .28    .000
     [CN=61.1         ]
     [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0224  1  5.0    2.54     .13  2.58  26.61  .34    .000
     [CN=67.4         ]
     [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0227  1  5.0    5.56     .29  2.50  26.88  .34    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0230  1  5.0    2.60     .05  2.83  13.14  .17    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0226  1  5.0    3.00     .09  2.58  15.70  .20    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0233  1  5.0    5.56     .16  2.58  14.77  .19    .000
     [CN=47.1         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0236  1  5.0    2.60     .02  2.83   6.39  .08    .000
     [CN=27.6         ]
     [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0232  1  5.0    3.00     .04  2.58   7.80  .10    .000
     [CN=31.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0239  1  5.0    5.56     .29  2.50  26.88  .34    .000
     [CN=67.2         ]
     [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0238  1  5.0    3.00     .09  2.58  15.70  .20    .000
     [CN=51.6         ]
     [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0242  1  5.0    2.60     .05  2.83  13.14  .17    .000
     [CN=46.8         ]
     [ N = 3.0:Tp  .71]
*
     ADD [0201 + 0212]  0214  3  5.0    4.24     .11  2.33  13.33  n/a    .000
*
     ADD [0215 + 0103]  0219  3  5.0    5.60     .07  2.67   7.14  n/a    .000
*
     RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .05  3.75  14.45  n/a    .000
```

```
     {ST=   .05 ha.m }
*
     ADD [0223 + 0224]  0225  3  5.0    4.24     .22  2.33  24.68  n/a    .000
*
     RESRVR [ 2 : 0227] 0231  1  5.0    5.56     .10  3.67  26.56  n/a    .000
     {ST=   .09 ha.m }
*
     ADD [0230 + 0226]  0228  3  5.0    5.60     .14  2.67  14.51  n/a    .000
*
     ADD [0236 + 0232]  0234  3  5.0    5.60     .07  2.67   7.14  n/a    .000
*
     ADD [0238 + 0242]  0240  3  5.0    5.60     .14  2.67  14.51  n/a    .000
*
     ADD [0219 + 0222]  0221  3  5.0   11.16     .10  3.00  10.78  n/a    .000
*
     ADD [0231 + 0228]  0229  3  5.0   11.16     .20  2.92  20.51  n/a    .000
*
     ADD [0233 + 0234]  0235  3  5.0   11.16     .22  2.58  10.94  n/a    .000
*
     ADD [0239 + 0240]  0241  3  5.0   11.16     .42  2.58  20.67  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                12.0
     [ Ptot=193.00 mm ]
     fname : C:\Users\HYu\Desktop\315836\315836 Otthymo - Rev. September 12, 2017\Design Storms\TIMMINS.12
     remark: TIMMINS REGIONAL 12 HOUR DURATION STORM
*
  **  CALIB NASHYD       0201  1  5.0    2.54     .11  7.25  74.08  .38    .000
      [CN=47.3         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0212  1  5.0    1.70     .07  7.00  61.69  .32    .000
      [CN=40.5         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0215  1  5.0    3.00     .08  7.25  46.14  .24    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0103  1  5.0    2.60     .05  7.50  39.43  .20    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0202  1  5.0    5.56     .25  7.25  74.17  .38    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0223  1  5.0    1.70     .12  7.00  99.23  .51    .000
      [CN=61.1         ]
      [ N = 3.0:Tp  .23]
*
  **  CALIB NASHYD       0224  1  5.0    2.54     .18  7.17 112.43  .58    .000
      [CN=67.4         ]
      [ N = 3.0:Tp  .53]
*
  **  CALIB NASHYD       0227  1  5.0    5.56     .39  7.17 112.61  .58    .000
      [CN=67.2         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0230  1  5.0    2.60     .10  7.42  70.99  .37    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0226  1  5.0    3.00     .14  7.25  80.18  .42    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0233  1  5.0    5.56     .25  7.25  74.17  .38    .000
      [CN=47.1         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0236  1  5.0    2.60     .05  7.50  39.43  .20    .000
      [CN=27.6         ]
      [ N = 3.0:Tp  .71]
*
  **  CALIB NASHYD       0232  1  5.0    3.00     .08  7.25  46.14  .24    .000
      [CN=31.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0239  1  5.0    5.56     .39  7.17 112.61  .58    .000
      [CN=67.2         ]
      [ N = 3.0:Tp  .52]
*
  **  CALIB NASHYD       0238  1  5.0    3.00     .14  7.25  80.18  .42    .000
      [CN=51.6         ]
      [ N = 3.0:Tp  .54]
*
  **  CALIB NASHYD       0242  1  5.0    2.60     .10  7.42  70.99  .37    .000
      [CN=46.8         ]
      [ N = 3.0:Tp  .71]
*
     ADD [0201 + 0212]  0214  3  5.0    4.24     .18  7.08  69.11  n/a    .000
*
     ADD [0215 + 0103]  0219  3  5.0    5.60     .13  7.33  43.02  n/a    .000
*
     RESRVR [ 2 : 0202] 0222  1  5.0    5.56     .15  9.75  73.85  n/a    .000
     {ST=   .14 ha.m }
*
     ADD [0223 + 0224]  0225  3  5.0    4.24     .29  7.08 107.14  n/a    .000
*
     RESRVR [ 2 : 0227] 0231  1  5.0    5.56     .22  9.58 112.29  n/a    .000
     {ST=   .20 ha.m }
*
     ADD [0230 + 0226]  0228  3  5.0    5.60     .24  7.33  75.91  n/a    .000
*
     ADD [0236 + 0232]  0234  3  5.0    5.60     .13  7.33  43.02  n/a    .000
*
     ADD [0238 + 0242]  0240  3  5.0    5.60     .24  7.33  75.91  n/a    .000
*
     ADD [0219 + 0222]  0221  3  5.0   11.16     .26  9.25  58.38  n/a    .000
*
     ADD [0231 + 0228]  0229  3  5.0   11.16     .42  9.17  94.04  n/a    .000
*
     ADD [0233 + 0234]  0235  3  5.0   11.16     .38  7.25  58.54  n/a    .000
*
     ADD [0239 + 0240]  0241  3  5.0   11.16     .62  7.25  94.20  n/a    .000
*
 FINISH

================================================================================================
```



KEY PLAN

LEGEND

Ext.2 (3.0 / 31.6)

- DRAINAGE AREA ID
- CURVE NUMBER(CN*)
- AREA (ha.)

SUBJECT PROPERTY BOUNDARY

DRAINAGE AREA BOUNDARY

FLOW DIRECTION

MAPPING FROM COUNTY OF SIMCOE ONLINE GIS.

CONTRACT DRAWINGS

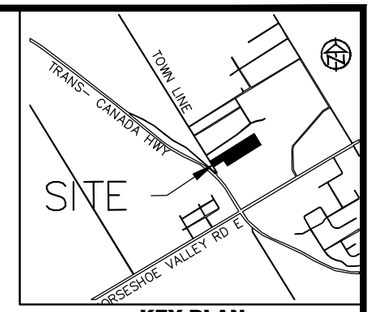
CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

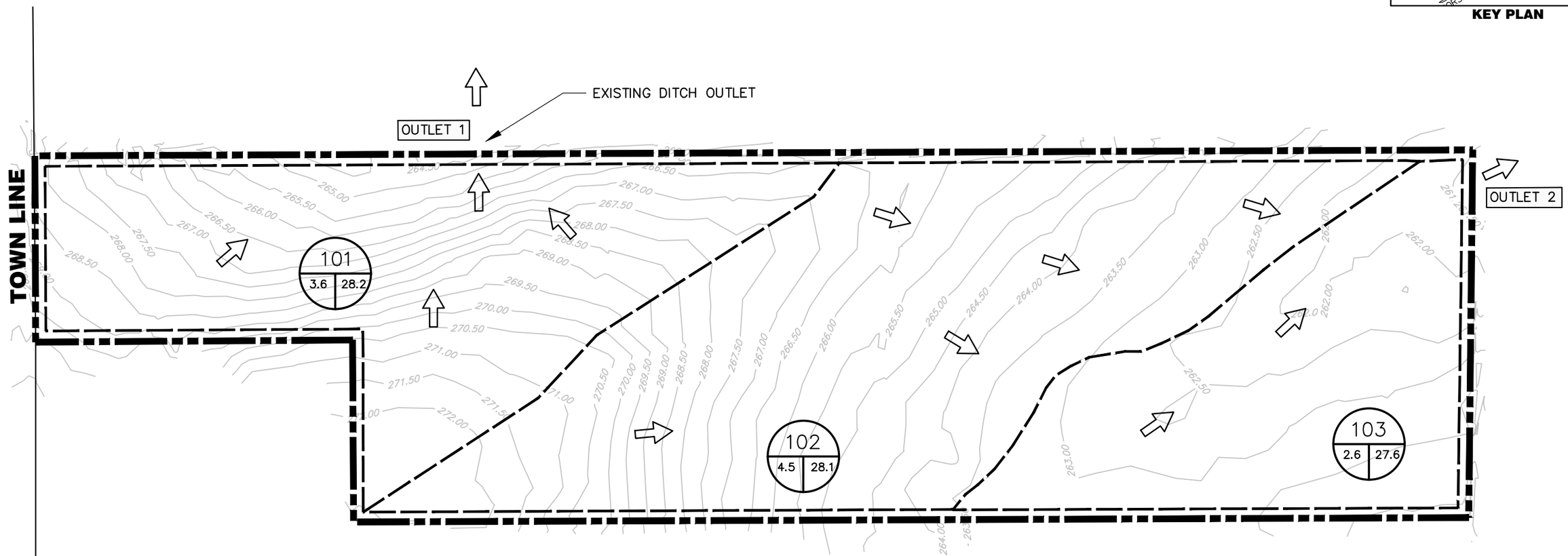
3879 TOWN LINE MARCHMONT SUBDIVISION TOWNSHIP OF SEVERN EXTERNAL DRAINAGE PLAN

DWG. No. **EX-1**

SCALE: 1:2000	DRAWN: HY	DATE: JULY, 2017	JOB NO. 315836



KEY PLAN

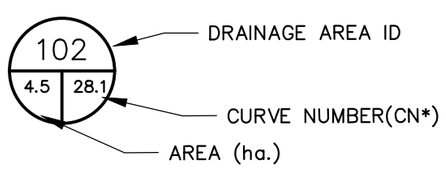


LEGAL INFORMATION FROM PLAN 51R–16559 BY DEARDON, STANTON, STONES AND STRONGMAN LTD. DATED DECEMBER 16, 1987. TOPOGRAPHIC SURVEY BY CCTA ON DECEMBER 13–17, 2015

CONTRACT DRAWINGS

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

LEGEND



PROPERTY BOUNDARY

EXISTING DRAINAGE AREA BOUNDARY

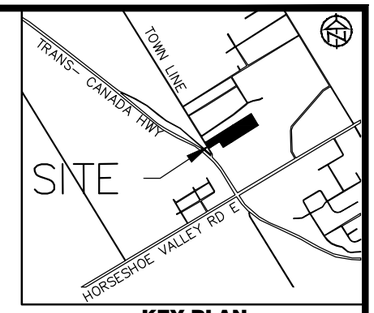
FLOW DIRECTION

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

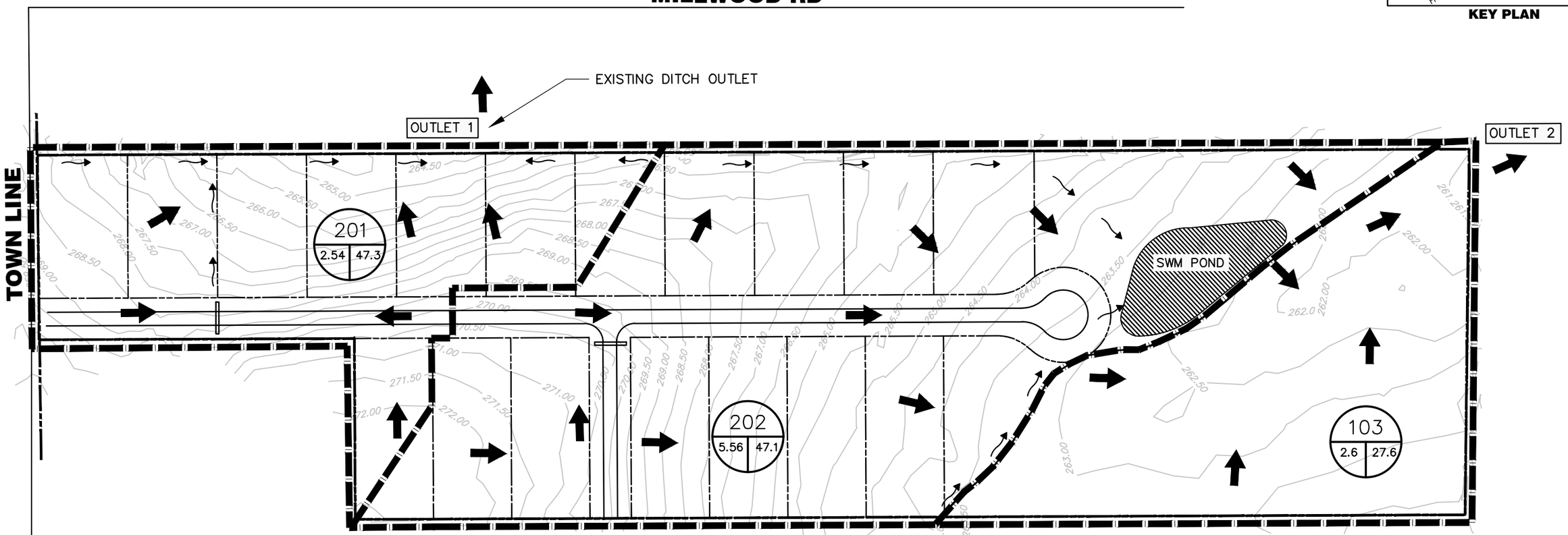
3879 TOWN LINE
MARCHMONT SUBDIVISION
TOWNSHIP OF SEVERN
PREDEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-1**

SCALE: 1:2000	DRAWN: HY	DATE: JULY, 2017	JOB NO. 315836



KEY PLAN



LEGEND

- PROPOSED CULVERT
- 202 / 5.3 / 47.4 — DRAINAGE AREA ID / CURVE NUMBER(CN*) / AREA (ha.)
- PROPOSED SWALE
- PROPERTY BOUNDARY
- PROPOSED DRAINAGE AREA BOUNDARY
- FLOW DIRECTION

LEGAL INFORMATION FROM PLAN 51R–16559 BY DEARDON, STANTON, STONES AND STRONGMAN LTD. DATED DECEMBER 16, 1987. TOPOGRAPHIC SURVEY BY CCTA ON DECEMBER 13–17, 2015

CONTRACT DRAWINGS

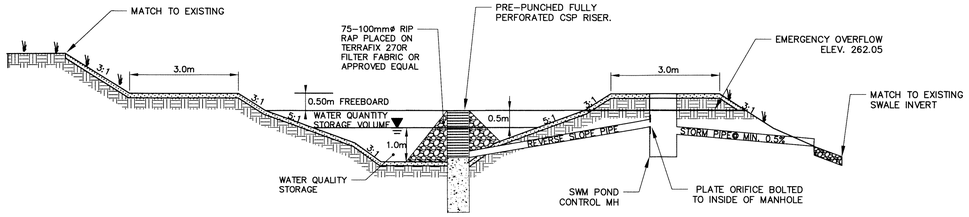
CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

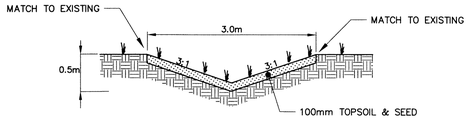
3879 TOWN LINE
MARCHMONT SUBDIVISION
TOWNSHIP OF SEVERN
POS DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-2**

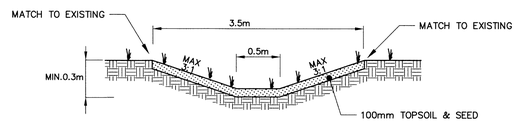
SCALE: 1:2000	DRAWN: HY	DATE: JULY, 2017	JOB NO. 315836



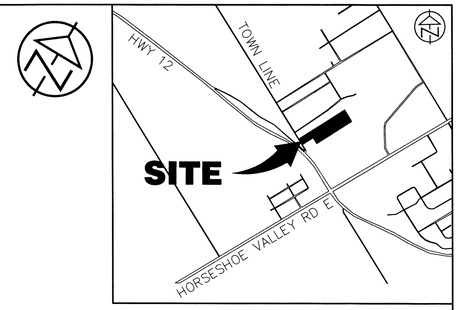
POND SECTION A–A'
NTS



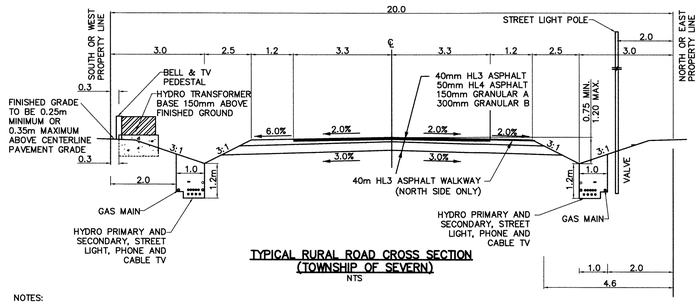
TYPICAL GRASSED SWALE SECTION
NTS



ENHANCED GRASSED SWALE SECTION
NTS



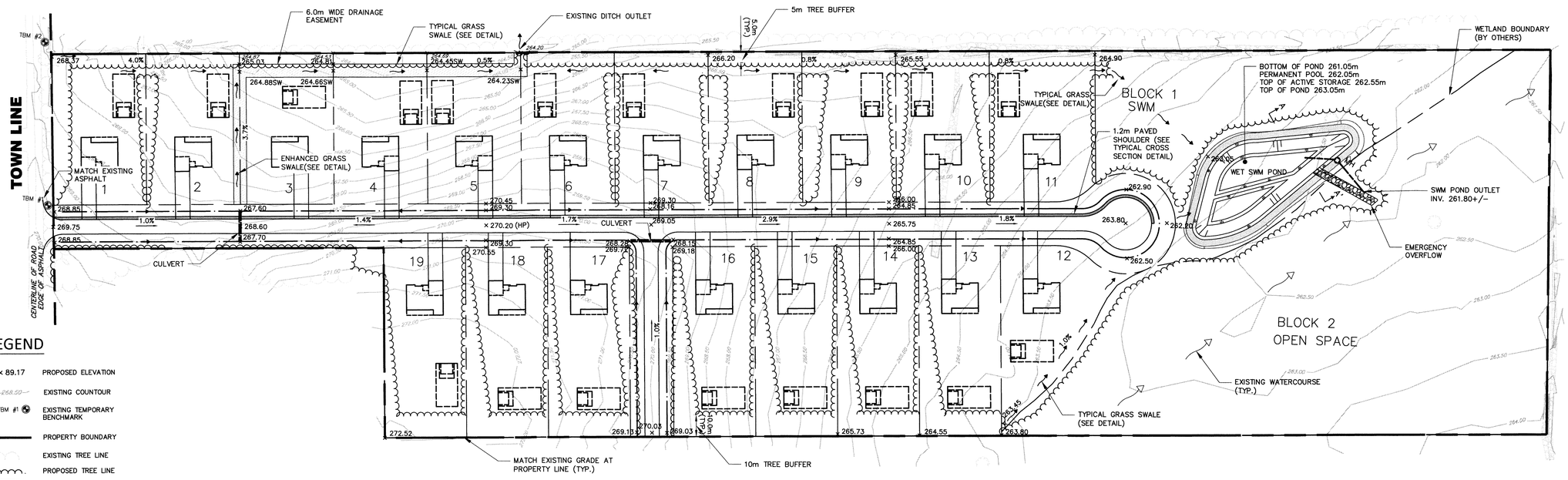
KEY PLAN
N.T.S.



TYPICAL RURAL ROAD CROSS SECTION
(TOWNSHIP OF SEVERN)
NTS

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
2. MINIMUM PAVEMENT AND ROAD STRUCTURE DESIGN AS PER TOWNSHIP OF SEVERN ENGINEERING CRITERIA OR AS PER GEOTECHNICAL INVESTIGATION RECOMMENDATION.
3. DITCH GRADE TO BE MIN. 0.5%, MAX. 6.0% AND RESTORED WITH 100mm TOPSOIL & SOD.
4. ALL SERVICE LOCATIONS SHOWN ARE FOR GUIDELINE PURPOSES ONLY AND MAY DEVIATE AS PER THE DIRECTION OF THE TOWNSHIP WHEN STANDARD LOCATION CANNOT BE ACHIEVED.



LEGEND

- × 89.17 — PROPOSED ELEVATION
- EXISTING COUNTOUR
- TBM #1 — EXISTING TEMPORARY BENCHMARK
- PROPERTY BOUNDARY
- EXISTING TREE LINE
- PROPOSED TREE LINE
- PROPOSED DRAINAGE EASEMENT

LEGEND

CONTRACT DRAWINGS

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

TBM INFORMATION

TBM#1 NAIL AND WASHER IN HYDRO POLE LOCATED ON EAST SIDE OF TOWN LINE. ELEVATION 270.068.

TBM#2 NAIL AND WASHER IN HYDRO POLE LOCATED ON EAST SIDE OF TOWN LINE. ELEVATION 207.066.

LEGAL INFORMATION FROM PLAN 51R–16559 BY DEARDON, STANTON, STONES AND STRONGMAN LTD. DATED DECEMBER 16, 1987.

TOPOGRAPHIC SURVEY COMPLETED BY C.C.TATHAM & ASSOCIATES LTD. ON DECEMBER 13–17 2015.

NO.	REVISIONS	DATE	INITIAL

APPROVED

LICENSED PROFESSIONAL ENGINEER
T. S. COLLINGWOOD
24/11/17
PROVINCE OF ONTARIO

3879 TOWN LINE
MARCHMONT SUBDIVISION
TOWNSHIP OF SEVERN

PRELIMINARY GRADING AND SERVICING PLAN

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie Ottawa

SCALE: 1:1000		JOB NO.	315836
DESIGN: JA	CHECKED:	DWG.	**GS-1**
DRAWN: HY	DATE: JULY. 2017		