CALEDON DEVELOPMENT #2 L.P.
REPORT NUMBER: 12M-00011-01-SWM

STORMWATER MANAGEMENT REPORT

MAYFIELD WEST PHASE 2 – SWM POND #6

MARCH 20, 2020

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PROJECT NO.: 12M-00011-01-SWM
DATE: MARCH 20, 2020

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1 INTRODUCTION

1.1 OVERVIEW

WSP Canada Group Limited (WSP) has been retained by Caledon Development #2 L.P. (CD2) to provide civil engineering services associated with the development of their subject property located within the Mayfield West Phase 2 (MW2) Secondary Plan Area.

The MW2 lands is a proposed mixed-use settlement area north of Mayfield Road, between Chinguacousy Street and Hurontario Street, in the Town of Caledon, ON. The subject site is located within the north-central portion of the MW2 lands, and consists of development proposed as part of the approved Stage 1 works, as well as future anticipated Stage 2 expansion. It is understood that the MW2 Secondary Plan was adopted by Council of the Town of Caledon as Official Plan Amendment (OPA) 222, in November 2015.

Overall development of MW2 lands is guided by the Mayfield West Comprehensive Environmental Impact Study and Management Plan (CEIS & MP) prepared by AMEC (November 2012) and Mayfield West Phase 2 Functional Servicing Report (FSR) prepared by Urbantech Consulting (December 2018). These documents set out preliminary design specifications for each of the SWM facilities throughout the development area. These requirements are discussed further in the subsequent 'Design Criteria' section of this report.

There is an existing watershed divide running through the MW2 lands (and through the CD2 subject site), with the northern part draining to Etobicoke Creek, and the southern part draining to Fletcher's Creek.

Approved plans show the southern portion of the subject site draining to the south (in order to maintain the existing drainage divide) to a proposed wet pond (SWM Pond #2, to be designed by others) and the north part of the site draining northwards to another wet pond (SWM Pond #6), which is proposed adjacent to Etobicoke Creek and will be constructed as part of the CD2 development.

This SWM report presents the detailed design information for the SWM Pond #6 and should be read in conjunction with the Urbantech's FSR for MW2 Lands.

1.2 BACKGROUND DOCUMENTS

Several reports and studies have been produced to date to support the development proposals and the MW2 OPA process. The key documents, which will be referenced through detailed design development of SWM proposals for the CD2 site, are listed below:

- MW2 Draft Functional Servicing Report (FSR) (Urbantech Consulting, December 2018);
- MW2 Environmental Impact Statement / Environmental Implementation Report (EIS/EIR), Hensel Design Group Inc. & Team (HGD, March 2019);
- Mayfield West Comprehensive Environmental Impact Study and Management Plan (EIS & MP), Part C: Detail Analysis and Implementation (AMEC, 2014);
- Etobicoke Creek Synthesis Study (AMEC, 2014);
- Regional Storm SWM Assessment for MW2 Secondary Plan Within Fletcher's Creek Watershed, Memorandum for Town of Caledon (AMEC, 2013); and
- Huttonville and Fletcher's Creek Subwatershed Study (AMEC, 2011).

With respect to specific design standards for SWM facilities, the following sources will be referenced:

- Town of Caledon Development Standards, Policies and Guidelines (January 2009);

- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment, Conservation and Parks (MECP) (March 2003);
- Low Impact Development Stormwater Management Planning and Design Guide, Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC) (2010);
- Guidance for Activities in Redside Dace Protected Habitat, Ontario Ministry of Natural Resources and Forestry (MNRF) (March 2016);
- Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitats (MNRF, July 2014).

1.3 DESIGN CRITERIA

Urbantech's FSR (December 2018) sets out the SWM strategy proposed for the development and the target design criteria for each individual pond. This section summarizes the requirements that will have implications on the design of storm infrastructure and SWM systems within the CD2 lands.

Water Balance

MW2 lands are required to maintain the existing water balance and groundwater recharge under the future land use conditions.

An Environmental Impact Statement / Environmental Implementation Report (EIS/EIR) was prepared by Hensel Design Group Inc. (HDG, March 2019) and Low Impact Development (LID) measures such as downspout disconnection, additional topsoil depth, vegetated swales and infiltration trenches are proposed to maintain infiltration at the site.

The design of the infiltration trenches within the CD2 lands is documented in a memorandum titled "LID Infiltration Trenches – Caledon Development #2 L.P." (WSP, August 2, 2019)

Water Quality Control:

Water quality control with Enhanced Level (Level 1) of Protection or 80% TSS removal is required for the proposed development area, as recommended in Urbantech's FSR (December 2018) and defined in the Stormwater Management Practices Planning and Design Manual (MECP, March 2003).

Erosion and Water Quantity Control:

The design criteria for erosion and flood control aimed at providing extended detention for erosion control and peak flow reduction for flood control (to existing rates or lower).

The SWM Pond #6 is located within Etobicoke Creek Sub-watershed and the erosion and quantity control targets are established in AMEC's EIS & MP report.

Erosion control criteria are the attenuation of a unitary volume of 325 m^3 per impervious hectare and a unitary release rate of 0.00031 m^3/s per hectare.

Quantity control for the subject lands will be based on the attenuation of the 25-year peak flow to an unitary release rate of 0.006 m^3/s per hectare, and the 100-year flow to an unitary release rate of 0.035 m^3/s per hectare.

No Regional Storm controls are required.

Table 1.1 presents a summary of the erosion and quantity control targets for the proposed SWM facility. Refer to Appendix C for excerpt from Urbantech's FSR.

Table 1.1 Allowable Peak Flow Rates from SWM Pond #6

Storm Events	Allowable Peak Flow Rates from SWM Pond #6 (Based on Contributing Drainage Area: 28.2 ha)	
	Unit Flow Rate ($m^3/s/ha$)	Allowable Flow Rates (m^3/s)
25 mm	0.00031	0.009
25-year	0.006	0.169
100-year	0.035	0.984
Regional	---	---

Thermal Regime and Redside Dace Requirements

It was noted that the proposed SWM Pond #6 will discharge to Etobicoke Creek which is regulated Redside Dace habitat, as defined under the *Endangered Species Act 2007*. The Ontario MNRF document entitled, Guidance for Development Activities in Redside Dace Protected Habitat BMPs for Stormwater Management (2016) notes that discharge temperatures, for SWM facilities connected to Redside Dace streams, should be below 24°C. In addition, stormwater effluent should have dissolved oxygen concentrations of at least seven milligrams per litre, and total suspended sediment levels less than 25 mg/L above background conditions.

The MNRF Guidance document proposes a long list of mitigation measures, such as bottom draw outlets, cooling towers, cooling trenches and floating islands. Due to site high groundwater table, bottom draw outlet is excluded from the mitigation measures.

The Stormwater Management and Planning Design Manual (MECP, 2003) recommends the following for thermal regime mitigation measures relevant to stormwater pond discharge. The Thermal Mitigation Checklist for Stormwater Management Ponds Discharging into Redside Dace Habitat – Version 1.0 (MNRF Aurora District, June 2014) also provides guidance for the design of SWM ponds which discharge into Redside Dace regulated habitat. Measures for consideration in the design of SWM Pond #6 include:

- Treatment of water, by routing the discharge through a subsurface trench filled with clear stone, can be used to reduce temperature. As the water flows through the trench, heat is transferred to the stone.
- The perimeter of the pond at the permanent pool elevation is to include a 3.0 m wide flat shelf, 0.30 m deep, as a wetland planting area. The shelf will include 30 cm of topsoil and planted with native emergent species (cattail and bulrushes) suited for fluctuating water levels;

2 DRAINAGE AND HYDROLOGIC MODELLING

2.1 OVERVIEW

A standard event-oriented modelling approach, the Visual OTTHYMO Model Version 5.0 (VO5), was used to size the outlet structures, and confirm the control performance of the SWM Pond #6.

2.2 RAINFALL DATA

The TRCA 12-hour AES storm with 2-year up to 100-year return periods are used in the Etobicoke Creek Hydrology Update Study (MMM Group Limited, 2013), AMEC's CEIS & MP (2014), and Urbantech's FSR (December 2018). Therefore, the TRCA 12-hour AES storm shall be used in the hydrologic modelling and SWM pond design.

For comparison purpose, the 2-year up to 100-year 24-hour Chicago storm based on Town of Caledon Rainfall Intensity – Duration – Frequency (IDF) equations shall be used in the hydrologic modelling and pond performance evaluation.

Furthermore, the 25-mm rainfall event is used to evaluate the erosion control performance of the SWM wet pond. The Regional Storm, 12-hour Hurricane Hazel, is used in the hydrologic modelling for sizing the emergency spillway.

Table 2.1 presents a comparison of rainfall intensity and total rainfall depth between the TRCA 12-hour AES storm and Town of Caledon 24-hour Chicago storm.

Table 2.1 Rainfall Intensity and Depth of Design Storms

Return Periods (years)	12-hour AES Storm (Bloor, TRCA)		24-hour Chicago Storm (Town of Caledon)	
	Rainfall Intensity (mm/hr)	Rainfall Depth (mm)	Rainfall Intensity (mm/hr)	Rainfall Depth (mm)
2	19.32	42.00	85.72	43.76
5	25.02	54.38	109.68	63.63
10	28.84	62.71	134.16	71.73
25	33.63	73.10	156.47	84.55
50	37.17	80.82	176.19	92.53
100	40.71	88.54	196.54	101.55

2.3 DRAINAGE PLAN

The SWM Pond #6 receives runoff from total 28.2 ha development areas, consisting of 14.78 ha high density residential development (townhouse units), 6.66 ha medium density residential development (semi- or single houses), a 2.85 ha school block, a 1.70 ha community park, and a 2.23 ha SWM pond block. Refer to Appendix C for Ultimate Storm Drainage Plan to Pond #6.

Typical imperviousness of 75%, 60%, 80%, and 10% are assigned to high density residential development, medium density residential development, school block, and community park, respectively. The SWM pond block is assumed with 100% imperviousness, which is deemed conservative. The overall drainage area is represented by a single catchment (600) in the VO5 model, with a lumped imperviousness of 70%.

Catchment 600 has an imperviousness greater than 20% and shall be modelled using the STANDHYD command in VO5 model. A value of 85 for the SCS curve number (CN) shall be used to model the infiltration potential of the native soil which is dominated by silty clay till. Initial abstraction (IA) of 5 mm and 1 mm are assigned to the pervious and impervious surfaces, respectively. The length of impervious area is derived from the VO5 model, which is calculated based on $A=1.5\times L^2$.

The model parameters for the post-development catchments are summarized in Table 2.2. Refer to Appendix A for detailed calculations.

Table 2.2 Catchment Parameters under Proposed Development Conditions

Catchment	Area (ha)	IMP (%)	CN	IA (mm)	Command
600	28.2	70	85	5.0	STANDHYD

2.4 STORM SYSTEM

The subject development will be serviced by a conventional storm sewer system designed in accordance with Town's standards. The storm sewers will be sized using a 10-year return frequency and the current Town's IDF curves. All runoff from the development areas will be conveyed to the proposed SWM Pond #6. The collected runoff will be treated for water quality and quantity control with extended detention for erosion control.

A design for the overland flow routes will be provided throughout the development blocks to safely convey major storm system flows in excess of the minor system up to the Regional event into the SWM Pond #6.

3 SWM POND DESIGN

3.1 OVERVIEW

SWM Pond #6 shall be designed to provide quality (Enhanced Level Protection), erosion (Extended Detention), and quantity control for 2- though 100-year events as per Urbantech's FSR. Thermal mitigation measures shall be incorporated into the pond design to address the impacts on the regulated Redside Dace habitat.

3.2 STORAGE REQUIREMENTS

The required storage volume for quality control is determined following the MECP's Stormwater Management Planning and Design Manual (March 2003). Erosion and quantity control volume is determined as per Urbantech's FSR (December 2018) and hydrologic modelling results.

3.2.1 WATER QUALITY CONTROL

SWM Wet Pond #6 shall provide an Enhanced Level of Protection for runoff from total drainage area of 28.2 ha at an imperviousness of 70%.

Based on the Table 3.2 in the 2003 MECP's Stormwater Management Planning and Design Manual and a lumped imperviousness of 70%, a wet pond will require 225 m^3/ha of storage volume to provide a "Enhanced Level of Protection" or 80% TSS removal, of which 40 m^3/ha will be extended detention storage and remaining 185 m^3/ha will be permanent pool storage. Based on a total drainage area of 28.2 ha, these objectives translate to a volume of 6,347 m^3, of which 5,219 m^3 is the permanent pool volume and 1,128 m^3 is extended detention storage.

Note that the extended detention volume required for the quality control (1,128 m^3) is less than that for erosion control (6,575 m^3) and shall be combined with the latter and controlled with an orifice plate/tube.

3.2.2 EROSION CONTROL

SWM Pond #6 is required to provide an erosion control volume of 325 m^3 per impervious hectare or 6,575 m^3 for 20.2 ha impervious area, which is 70% of total 28.2 ha drainage area.

Note that the extended detention volume for water quality control is smaller than that for the erosion control, and shall be combined with the larger volume to be release at the maximum allowable release rate for erosion control.

The target discharge rate for erosion control shall be 0.00031 m^3/s per hectare or 0.009 m^3/s for total 28.2 ha drainage area, per AMEC's CEIS & MP. The minimum 75 mm orifice plate would result in a drawdown time of approximately 240 hours or 10 days. Therefore, Urbantech's FSR recommended that a target drawdown time of less than 6 days be selected such that there would be sufficient extended detention storage available for the next 25 mm rainfall event.

3.2.3 WATER QUANTITY CONTROL

Hydrologic modelling was carried out to determine the required storage volume for quantity control up to 100-year events. As shown in Table 3.1, the storage volume required for water quantity control is approximately 19,145 m^3 to limit the 100-year peak to allowable levels.

Table 3.1 Quantity Control Storage Requirements for SWM Pond #6

Storm Event	Target Peak Flow Rates (m^3/s)	Required Active Storage (m^3)		
		Urbantech's FSR	WSP's Analysis	
			12-hr AES	24-hr Chicago
25 mm	0.009	6,575		
25-year	0.169	13,191	14,885	17,025
100-year	0.948	15,568	15,100	19,145

3.3 POND GRADING

The layout of SWM Pond #6 is shown in Drawing SWM1. The wet pond is designed to provide the required permanent pool and active storage volumes, and to conform to the grading of the site. A summary of required storage volumes and provided storage for water quality, erosion control and quantity control is provided in Table 4.2.

Table 3.2 Storage Summary for SWM Pond #6

		Required Storage (m^3)	Storage Provided (m^3)
Permanent Pool Storage	Water Quality	**5,219**	**5,447**
Active Storage**	Water Quality*	1,128	**6,609**
	Erosion Control	**6,575**	
	Water Quantity (100-year)	**19,145**	**20,738**
Total***		**24,364**	**26,185**

* *Extended detention storage for water quality and erosion control will be combined.*

** *Extended detention storage is part of the active storage for water quantity control up to 100-year event.*

*** *A 0.50 m freeboard is provided above the design high water level (100 year) to incorporate emergency spillway.*

SWM Pond #6 will provide total 5,447 m^3 permanent pool storage at the elevation 255.40 m. The permanent pool storage is provided with a depth of 1.0 m at the sediment forebay and at the main cell.

An extended detention volume of 6,609 m^3 is provided at the elevation 256.20 m, with a maximum depth of 0.80 m above the permanent pool elevation. Total 20,738 m^3 active storage is available for quantity control up to 100-year event.

A 0.50 m freeboard is provided above the design high water level for 100-year event and an emergency spillway shall be incorporated at the northeast berm of the pond to safety convey the inflow from the 100-year event or regional storm, whichever is larger.

3.4 SEDIMENT FOREBAY

The SWM Pond #6 has a storm inlet to convey the minor system flow to the wet pond. The major system flow shall be conveyed to the pond via overland flow routes.

A sediment forebay is required at the storm inlet to settle out majority of the sediment load within an area that can be conveniently accessed for maintenance. The forebay for the proposed wet pond is sized according to the guidelines given in the *Stormwater Management Planning and Design Manual* (SWMPDM, MECP, 2003). The forebay length is determined based on calculations of the dispersion and settling lengths, as shown in Section 2.3.6 of Appendix A.

3.5 OUTLET STRUCTURE

The outlet structures proposed for SWM Pond #6 consist of the following components:

- **Low Flow Control for Extended Detention**

  A 300Ø mm reverse slope pipe configured with a 110Ø mm orifice plate (invert = 255.40 m) is proposed to achieve the target flow rate of 0.023 m^3/s with an extended detention volume of 6,609 m^3 at 256.20 m.

  Please note that this configuration shall achieve a drawdown time of approximately 140.6 hours or 5.9 days, such that there would be sufficient extended detention storage available for the next 25 mm rainfall event.

- **Flow Control up to 25-year Storm Event**

  A 600 x 1200 mm precast concrete ditch inlet catch basin (DICB) (OPSD 705.040) (lid elevation = 256.20 m) is proposed to convey the flow (up to 25-year event) into the DICB. Then the inflow from the grating of DICB shall be controlled by a 200Ø mm orifice tube (invert = 255.65 m).

- **Flow Control up to 100-year Storm Event**

  A twin 600 x 1200 mm precast concrete ditch inlet catch basin (DICB) (OPSD 705.040) (lid elevation = 257.20 m) configured with a 450Ø mm orifice pipe (invert = 255.65 m), along with the above flow control structure for 25-year storm event, shall control the 100-year flow rate to the allowable level.

- **Outlet Pipe**

  Controlled flow from the low flow control device (110Ø mm orifice plate) shall discharge into Outlet MH202 and be conveyed to the storm outfall to the creek via a 50.0 m long 300Ø mm perforated PVC STM c/w 1.0 m X 1.0 m trench filled with clear stone and wrapped in Terrafix Bentofix Srnwl Synthetic Clay Liner, or approved equivalent.

  Controlled flow from above high flow control devices (200Ø mm orifice tube and 450Ø mm orifice tube) shall discharge into Outlet MH201 and be conveyed to the storm outfall to the creek via a 900Ø mm concrete pipe.

- **Emergency Spillway**

  In case of blockage to the outlet structures, a 20.0 m wide emergency overflow spillway (lid elevation = 257.50 m) is proposed at the northeast embankment to safely convey the peak flow rate from 100-year event, which is greater than the peak flow rate from regional storm.

  The Presto Geoweb® geocell system combined with a turf reinforcement mat (TRM) with topsoil infill and vegetation is proposed as erosion protection measures for the emergency spill channel.

Table 3.3 shows the stage – storage – discharge relationship for the proposed wet pond. The detailed calculations are included in Appendix A.

Table 3.3 Stage – Storage – Discharge Relationships for SWM Pond #6

Description	Elevation (m)	Active Storage (m^3)	Discharge (m^3/s)
Permanent Pool	255.40	0	0.000
	255.60	1,474	0.010
	255.80	3,067	0.016
	256.00	4,784	0.020
Extended Detention	256.20	6,609	0.023
	256.40	8,534	0.116
	256.50	9,547	0.124
	256.60	10,560	0.131
	256.70	11,623	0.138
	256.80	12,686	0.145
	256.90	13,800	0.151
	257.00	14,914	0.157
	257.10	16,079	0.163
25-year Water Level	257.20	17,243	0.169
	257.30	18,408	0.206
	257.40	19,573	0.584
100-year Water Level	257.50	20,738	0.886
	257.60	21,902	2.006
	257.80	24,232	6.569
Top of Pond	258.00	26,562	13.052

3.6 OPERATION PERFORMANCE

The Hydrologic model was simulated for the 25mm, 2-year up to 100-year, and Regional storm to determine the operation performance of the SWM Pond #6 with the proposed outlet structure. The modelling results are summarized in Table 3.4. Detailed hydrologic modelling (VO5) outputs are included in Appendix B.

Table 3.4 Quantity Control Performance of SWM Pond #6

Storm Event	Inflow Rate (m^3/s)	Outflow Rate (m^3/s)	Utilized Storage (m^3)	Water Elevation (m)
Erosion Control Storm Event				
25 mm	1.862	0.020	5,025	256.03
12-hour AES Storm (Bloor, TRCA)				
2-year	1.209	0.094	8,086	256.35
5-year	1.630	0.130	10,459	256.59
10-year	1.933	0.143	12,316	256.77
25-year	2.303	0.156	14,713	256.98
50-year	2.579	0.166	16,524	257.14
100-year	2.874	0.201	18,253	257.29
24-hour Chicago Storm (Town of Caledon)				
2-year	3.985	0.078	7,763	256.32
5-year	5.597	0.137	11,411	256.68
10-year	7.365	0.150	13,575	256.88
25-year	8.919	0.167	16,863	257.17
50-year	10.258	0.295	18,682	257.32
100-year	11.674	0.663	19,880	257.43
12-hour Hurricane Hazel				
Regional	4.098	4.033	22,947	257.69

Table 3.5 presents a comparison of the post-development peak flow rates and the allowable flow rates from the proposed SWM Pond #6. It shows that, with the proposed SWM Pond #6, the post-development peak flow rates from the subject site and external future development areas shall be controlled to allowable levels for 2-year up to 100-year events.

Table 3.5 Post-development Peak Flow Rates vs Target Flow Rates

Storm Events	Target Flow Rates (m^3/s)	Post-Development Peak Flow Rates (m^3/s)	
		12-hr AES Storm	24-hr Chicago Storm
25 mm*	0.009	0.020	
2-Yr	---	0.094	0.078
5-Yr	---	0.130	0.137
10-Yr	---	0.143	0.150
25-Yr	0.169	0.156	0.167
50-Yr	---	0.166	0.295
100-Yr	0.948	0.201	0.663

* *Note that the orifice was sized to achieve a less than 6-days drawdown time with the peak flow rate exceeding the target rate, as per Urbantech's FSR.*

3.7 THERMAL DESIGN PROVISIONS

The MNRF document entitled, Guidance for Development Activities in Redside Dace Protected Habitat BMPs for Stormwater Management (2016) has been followed in the conceptual design of the SWM pond as summarized below:

- The proposed SWM Pond #6 is conventional wet pond with a 1.0 m deep permanent pool at the main cell. Treatment of water by routing the discharge from low flow control device through a subsurface trench filled with clear stone, has been recommended to reduce temperature of the discharge.
- A 3.0 m wide planting shelf is proposed at the top of the permanent pool, which will be planted with native emergent species (cattail and bulrushes) suited for fluctuating water levels.
- As indicated in the CVC thermal mitigation guidelines study, narrow facility with an east-west pond orientation such as SWM Pond #6, can reduce the hours of potential solar radiation and thus thermal impacts.

The above, combined with adhering to planting guidelines for water quality ponds, would allow relatively cool effluent to the receiving watercourse in accordance with the mitigation measures proposed by the MECP (2003) manual. It is anticipated that the proposed thermal design provisions should meet the MNRF (2016) design criteria.

3.8 CONSTRUCTION PHASING AND INTERIM CONDITIONS

Due to the large scale of the proposed development, the CD2 lands shall be developed in two stages. Development stages have been proposed in a manner such that all units within each stage are fully serviced on the basis of road networks, stormwater management facilities, water servicing and sanitary servicing prior to build-out.

The major consideration for the construction phasing is the stormwater management. Phases shall be completed in such a manner that no stage will be developed prior to the construction of the SWM facilities that service the stage. Though the SWM Pond #6 is located north of the CD2 lands and adjacent to the stage 2 development, it should be constructed during stage 1 development.

The SWM Pond #6 is designed to service the CD2 lands under ultimate development conditions. Under the interim development conditions, a portion of the drainage area will be undeveloped and therefore the product of the total drainage area and site imperviousness to the SWM Pond #6 will be lower than the ultimate conditions. No additional analysis is required for SWM Pond #6.

4 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

The following erosion and sediment controls are proposed for implementation during construction to minimize erosion potential and soil migration from the site to adjacent lands and/or receiving waters:

- Install silt fence at the downslope side of disturbed areas and snow fence (if necessary) along the perimeter of the development site, prior to the start of construction.
- Install stone mud mats at all construction entrances.
- Stockpile topsoil at designated locations and at least 15 m away from the top bank of the watercourse. Stockpiles will be contained by silt fences on the downslope side.
- Accumulated silt shall be removed from all sediment control devices as required during construction and disposed of in locations approved by the Town of Caledon and TRCA.
- All exposed soils are to be stabilized and vegetated as soon as possible using seed and mulch application on 100 mm of topsoil, as directed by the engineer.
- All catch basins are to be fitted with sediment control devices as directed by the engineer and in accordance with Town of Caledon's standard requirements.
- Half bulk head to be installed in storm manholes immediately upstream from outfall structures and removed after all building construction and landscaping activity has been completed.
- Additional erosion/sediment controls may be required on site as determined by the engineer.
- No construction activity/machinery shall intrude beyond the silt/snow fence or property limit. All construction vehicles shall enter and leave the site via designated entrances.
- All regraded areas that are not occupied by dwellings, roads, sidewalks, driveways, park, and other services shall be covered by 100 mm topsoil, and sodded/seeded immediately after completion of final grading operations, as directed by the engineer.
- All temporary erosion and sediment controls must be installed prior to the commencement of site grading, must be inspected on a regular basis and after every rainfall event, and must be cleaned and maintained as required to prevent the migration of sediment from the site.
- All sediment and erosion control facility are to remain in place until finalization of construction activity.
- All temporary erosion and sediment controls must be removed after construction and once the site has been stabilized to the Town of Caledon's satisfaction. All areas disturbed by erosion/sediment control devices are to be restored with 100 mm topsoil and sodded/seeded after construction.
- The contractor shall keep public roadways free of debris during construction. Any material tracked from the site shall be promptly removed from roadways at the contractor's expenses.
- All material and workmanship shall conform to the current OPSD and standards endorsed by the Town of Caledon, the TRCA and other regulatory agencies.

- The contractor is responsible to locate and protect all existing utilities and municipal services, and to make arrangement with utility companies prior to construction.
- All excavations shall be in accordance with the Ontario "Occupational Health and Safety Act", and other federal and provincial regulations related to construction projects.

5 CONCLUSION

The detailed design of the proposed SWM Pond #6 on the Caledon Development #2 L.P. (CD2) lands has been completed in order to meet the requirements set out in the 'Mayfield West Phase 2 – Functional Servicing Report', by Urbantech Consulting (December 2018).

The main components and features proposed for the SWM Pond #6 are listed as follow:

Drainage Plan

The SWM Pond #6 provides water quality, erosion and quantity control for runoff from a total drainage area of 28.2 ha with a lumped imperviousness of 70%. The CD2 lands shall be developed in two stages.

Storm Inlet and Sediment Forebay

All runoff from the contributing areas will be conveyed to the proposed SWM Pond #6, with minor system sized to convey runoff up to 10-year event per Town of Caledon standards and overland flow routes throughout the development blocks to safely convey major system flows up to the Regional event into the pond.

Sediment forebay is proposed at the storm inlet to disperse the flow and allow majority of the large particles to settle down where it is convenient to access for maintenance.

Permanent Pool

The SWM Pond #6 has a permanent pool depth of 1.0 m at the sediment forebay and at the main cell. The bottom elevation of the pond is 254.40 m and the permanent pool elevation is 255.40 m. The provided permanent pool storage is 5,447 m^3.

Extended Detention (Water Quality and Erosion Control)

An extended detention volume of 6,609 m^3 is provided at the elevation 256.20 m, with a maximum depth of 0.60 m above the permanent pool elevation of 255.40 m, to store runoff from 25 mm rainfall event for quality and erosion control purpose.

Flood Control Storage (2 ~ 100-year Events)

Total active storage volume of approximately 20,738 m^3 is provided at the elevation 257.50 m, with a maximum depth of 2.1 m above the permanent pool elevation of 255.40 m, to detain runoff and control discharge rates down to the allowable rates set out in the Urbantech's FSR for the 2 to 100-year storm events.

Additional Freeboard

The pond has been designed with an additional freeboard of approximately 0.50 m to incorporate an emergency spillway to safely convey the inflow to downstream creek in case of blockage of flow control devices.

Flow Control Structures

The pond outlet is proposed at the east embankment; thus, the inlet and outlet are at opposite ends of the facility to prevent short circuiting.

A 300mm reversed slope pipe is proposed to draw water from the deep zone of the wet pond. The proposed 110mm orifice plate will drain the extended detention volume at a period approximately 6.0 days.

Ditch inlet catch basins (DICBs) configured with two orifice tubes (200 mm and 450 mm) with inverts of 255.65 m are proposed to control runoff up to 100-year events.

A 20m wide emergency spillway, with appropriate erosion protection measures (Presto Geoweb® Geocell GW-TRM), is proposed to safely convey the pond inflow to downstream creek.

Thermal Mitigation Measures

Thermal mitigation measures such as subsurface trench outlet and planting shelf are incorporated in the pond design to address the impacts on the regulated Redside Dace habitat.

SWM Pond #6 is a narrow facility with an east-west pond orientation which can reduce the hours of potential solar radiation and thus thermal impacts.

Maintenance Access and Others

Maintenance assess to the pond inlet and outlet is provided. A 5:1 slope at either side of the permanent pool level and 4:1 slope at other areas is incorporated in the pond design, as per Town standards and MECP's manual, to ensure public safety.

Respectfully submitted,

WSP Canada Inc.

APPENDIX

A STORMWATER MANAGEMENT CALCULATIONS

1.0 Introduction

The SWM Pond #6 is proposed to service a 28.2 ha development area which is part of Mayfield West Phase 2 (MW2) Secondary Plan Area.

1. The stormwater management (SWM) design criteria were established in the ***Mayfield West Comprehensive Environmental Impact Study and Management Plan (CEIS & MP)*** prepared by AMEC (November 2012).

2. SWM design is guided by ***Mayfield West Phase 2 Functional Servicing Report (FSR)*** prepared by Urbantech Cousulting (December 2019)

1.1 Design Criteria & SWM Strategies

SWM Pond #6 is proposed to provide water quality, erosion, and quantity control for a total drainage area of 28.2 ha with an imperviousness of 70%.
SWM Design Criteria has been outlined in AMEC's CEIS & MP (Nov. 2012)and Urbantech's FSR (Dec. 2018).

1.1.1 Water Quality Controls

SWM Pond #6 must provide water quality control at Enhanced Protection Level.
Storage requirements for permanent pool and extended detention for quality treatment shall follow Table 3.2 in "Stormwater Management Planning and Design Manual" (MOECP, 2003)

1.1.2 Erosion Control

SWM Pond #6 discharges into Etobicoke Creek.
Erosion control criteria are the attenuation of a unitary volume of 325 m^3 per impervious hectare and a unitary release rate of 0.00031 m^3/s per hectare.

Please note that an increased release rate for extended detention was recommended in Urbantech's FSR in order not to result in excessive drawdown time.

1.1.3 Quantity Control

Quantity control for Pond 6 will be based on:

25-year event:

Attenuation of the 25-year peak flow to an unitary release rate of 0.006 $m^3/s/ha$ with a cumulative unitary volume of 650 m^3 per impervious hectare.

100-year event:

Attenuation of the 100-year flow to an unitary release rate of 0.035 $m^3/s/ha$ with a cumulative unitary volume of 700 m^3 per impervious hectare.

Regional event:

Quantity control is not required for Regional Storm.

1.1.4 Thermal Regime and Redside Dace Requirements

The OMNRF document *"Guidance for Development Activities in Redside Dace Protected Habitat BMPs for Stormwater Management (2016)"* notes that:

1. The discharge temperatures, for SWM facilities connected to Redside Dace streams, should be below 24°C.
2. The stormwater effluent should have dissolved oxygen concentrations of at least seven milligrams per litre, and total suspended sediment levels less than 25 mg/L above background conditions.

Mitigation measures such as subsurface trench outlet and riparian planting strategy shall be implemented into the SWM wet pond design.

1) The perimeter of the pond at the permanent pool elevation is to include a 3.0 m wide flat shelf as a wetland planting area planted with native emergent species suited for fluctuating water levels.
2) Routing the discharge through a subsurface trench filled with clear stone will help to reduce temperature.

1.2 SWM Pond #6 Preliminary Design (As per AMEC's CEIS & MP and Urbantech's FSR)

Drainage	Drainage Area to Pond Inlet	26.0	ha
	SWM Pond Block	2.2	ha
	Total Contributing Area	28.2	ha
	Lumped Imperviousness	70	%
Permanent Pool	Required Permanet Pool Volume (185 m^3/ha, Table 3.2 of MOECP Manual)	5,217	m^3
Extended Detention*	Required Extended Deteniton Volume (325 m^3/Imp. ha)	6,575	m^3
	Target Release Rate (0.00031 m^3/s/ha)	0.009	m^3/s
25-year Event	Required Volume	13,191	m^3
	Target Release Rate (0.006 m^3/s/ha)	0.169	m^3/s
100-year Event	Required Volume	15,568	m^3
	Target Release Rate (0.035 m^3/s/ha)	0.984	m^3/s
Regional Storm	Quantity control is not required for regional storm. A minimum 0.30 m freeboard shall be provided to safety convey the inflow from 100-year or regional storm, whichever is greater.		

** Urbantech's FSR recommended that a target drawdown time of less than 6 days to be selected for SWM Pond #6 such that there would be enough extended detention storage available for the next 25 mm rainfall event.*

*** Required storage volume for quantity control shall be re-evaluated using Visual OTTHYMO model.*

2.0 Proposed Development

The proposed development consists of mixed landuse of residential, elementary school, community park, and SWM block.

2.1 Catchment Parameters

The contributing drainage area to SWM Pond #6 is represented with a single catchment (600).
The hydrologic parameters used in Visual OTTHYMO model are summarized in following table.

Sub- Catchment	Are (ha)	IMP (%)	CN	IA (mm)	Command	Land Use
600	28.2	70	85	5.0	StandHyd	Mixed Land Use

2.1.1 Imperviousness

As per Urbantech's FSR.

Pond 6 Drainage Area	Area (ha)	Imperviousness
High Density Residential	14.78	75%
Medium Density Residential	6.66	60%
Community Park	1.70	10%
Elementary School	2.85	80%
SWM Pond Block	2.23	100%
Total Drainage	28.22	70%

2.1.2 SCS CN Numbers

As per Urbantech's FSR and VO model.

CN (II) = 85 *Silty Clay Till, HSG = "D"*
CN (III) = 97

2.1.3 Initial Abstraction (IA)

Initial Abstraction for various land use are as follows.

Land use	IA (mm)	Comments
Urban Lawn	5.0	Typical value for pervious area
Impervious Surface	1.0	Typical value for impervious area

2.2 Hydrologic Model and Design Storm

2.2.1 Hydrologic Model

Visual OTTHYMO model version 5.0 (VO5) is used to simulate the post-development runoff and to size the SWM wet pond.

2.2.2 Design Storm

1) 25 mm Rainfall Event

25 mm 4 hour Chicago storm event for quality and erosion control.

2) 12 Hour AES Storm (Bloor, TRCA)

12 hour AES Storm from TRCA was used in the Etobicoke Creek Hydrology Update Study (MMM Group, 2013) and shall be used in the hydrologic modelling for flood control for consistency.

Storm Event	Peak Intensity (mm/hr)	Rainfall Depth (mm)
2-Yr	19.32	42.00
5-Yr	25.02	54.38
10-Yr	28.84	62.71
25-Yr	33.63	73.10
50-Yr	37.17	80.82
100-Yr	40.71	88.54

3) 24 hour Chicago Storm (Town of Caledon IDF Curve)

24 hour Chicago Storm based on Town of Caledon Rainfall Intensity - Duration - Frequency (IDF) equation shall be used in the hydrologic modelling for comparison purpose.

Storm Event	A	B	C	Peak Intensity (mm/hr)	Rainfall Depth (mm)
2-Yr	1070	7.85	0.8759	85.72	43.76
5-Yr	1593	11.00	0.8789	109.68	63.63
10-Yr	2221	12.00	0.9080	134.16	71.73
25-Yr	3158	15.00	0.9335	156.47	84.55
50-Yr	3886	16.00	0.9495	176.19	92.53
100-Yr	4688	17.00	0.9624	196.54	101.55

4) 12 hour Hazel Hurricane

Regional Storm (12 hour Hazel Hurricane) for design of emergency spillway.

2.3. SWM Pond #6 Design

2.3.1 Required Storage Volume

2.3.1.1 Water Quality Controls Volume

Pond #6 must provide water quality control at Enhanced Protection Level
Refer to Table 3.2 in "Stormwater Management Planning and Design Manual" (MOECP, 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced 80% long-term S.S. removal	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250

Total Drainage Area	28.2	ha			
Imperviousness	70	%			
SWMP Type	Wet Pond				
Enhanced Level Protection:	80	% TSS Removal			
Storage Volume per ha	225	m^3/ha	or	6,347	m^3
Extended Detention Volume	40.0	m^3/ha	or	1,128	m^3
Permanent Pool Storage	185	m^3/ha	or	**5,219**	m^3

2.3.1.2 Erosion and Quantity Control Target

Target release rate and required storage volume for erosion and quantity control are listed in the following table.

Storm Event	Target Flow Rate (m^3/s)	Minimum Design Storage Requirement (m^3)		
		Urbantech's FSR (December 2018)	WSP (August 2019)	
			12 hr AES	24 hr Chicago
25 mm	0.009	6,575		
25-Yr	0.169	13,191	14,885	17,025
100-Yr	0.984	15,568	15,100	19,145

2.3.2 Pond Grading

Pond grading was carried out to provide required storage.
The Stage - Storage Relationships for Pond #6 are as follows.

Description	Elevation (m)	Surface Area (m^2)	Total Volume (m^3)	Active Volume (m^3)
Bottom of Pond	254.40	4,394	0	---
	254.90	5,288	2,390	---
Permanent Pool (PP)	255.40	6,421	**5,447**	0
	255.60	6,857	6,921	1,474
	255.80	7,298	8,514	3,067
	256.00	8,876	10,232	4,784
Extended Detention	256.20	9,375	12,057	6,609
	256.40	9,876	13,982	8,534
	256.60	10,379	16,007	10,560
	256.80	10,885	18,134	12,686
	257.00	11,393	20,361	14,914
	257.20	11,903	22,691	17,243
	257.40	12,416	25,123	19,675
	257.60	12,931	27,657	22,210
	257.80	13,448	30,295	24,848
Top of Pond	258.00	13,968	33,037	27,589

1) Storm Inlets

A storm inlet is proposed to receive runoff from contributing area and sediment forebay is proposed to settle down majority of the sediment particles.

2) Permanent Pool Depth

Permanent pool shall have a 1.0 m depth at the sediment forebay and at the main cell.

3) Active Storage Depth

Quantity control volume for 100-year event is provided within a depth of 2.1 m.
A 0.50 m freeboard is provided above the 100-year water level to incorporate emergency spillway.

4) Side Slope

A side slope of 5:1 is proposed at 3 m either side of the permanent pool level.
A 4:1 slope is proposed at other areas.

5) Maintenance access, etc.

Maintenance accesses are proposed to pond inlet and outlet.

2.3.3 Outlet Structure Design

Outlet Structure for the Pond #6 consists of:

1. Reverse Slope Pipe configured with orifice plate for Erosion Control.
2. DICB configured with orifice tube for Quantity Control up to 25-year event.
3. DICB configured with orifice tube for Quantity Control up to 100-year event.
4. Emergency Spillway.

2.3.3.1 Low Flow Outlet for Erosion Control

A 300 mm reverse slope pipe is proposed to drain water from the deep portion of the pond.
A 110 mm orifice plate is proposed to achieve the target flow rate for the extended detention volume

Orifice Discharge Equation is used to calculate the release rate from the 110 mm orifice plate:

$$Q = CA\sqrt{2gh}$$

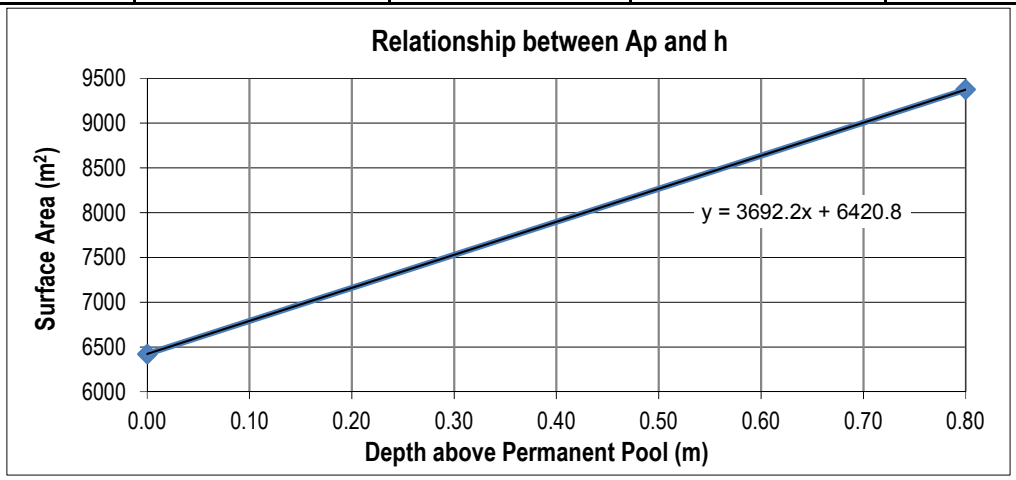
Where,	Q = Orifice Plate Flow Rate (m^3/s)	0.023	m^3/s
	C = Flow Coefficient for Orifice Plate	0.63	
	d = Diameter of orifice (mm)	110	mm
	A = Cross-section Area of Orifice Plate (m^2)	0.0095	m^2
	g = Gravity Acceleration (m/s^2)	9.81	m/s^2
	h = Water Head above Centerline of Orifice Plate (m)	0.745	m
	Invert of Orifice Plate is set at permanent pool level	255.40	m
	Extended Detention	256.20	m

The detention time is approximated by the drawdown time which is estimated using the Falling Head Orifice Equation.

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_0}$$

C_2 =	Slope coefficient from the area-depth linear regression	3692.2	
C_3 =	Intercept from the area-depth linear regression	6420.8	
h =	Maximum water elevation above the orifice (m)	0.80	m
d =	Diameter of orifice plate (mm)	110	mm
A_0 =	Cross-section area of the orifice plate (m^2)	0.0095	m^2
t =	Drawdown time in seconds	506218	s, or
		or 140.6	hrs
		or 5.9	days

Description	Elevation (m)	$D_{to\ PP}$ (m)	Surface Area (m^2)	Active Volume (m^3)
Ending Water Elevation	255.40	0.00	6421	0
starting Water Elevation	256.20	0.80	9375	6609



2.3.3.2 High Flow Outlet for Quantity Control up to 25-year Event

A 600 x 1200 mm precast concrete ditch inlet (OPSD 705.040) with 600 X 1200 mm grate (OPSD 403.010) & a 4:1 slope is proposed to convey the 25-year flow to the DICB.

A 200 mm orifice pipe is proposed to control flow rate up to 25-year event

The invert of the grate is set at elevation:	256.20	m
The invert of 200 mm orifice pipe is set at	255.65	m

The flow rate through the grate can be estimated using either weir flow equation or orifice discharge equation, depending on the water head. Note that a 50% blockage is assumed in the flow capacity calculations.

When water head is low and the grate is not submerged, the flow rate can be estimated using Sharp-Crested Weir Equation

$$Q = 50\%\ CLH^{1.5}$$

Where,	Q = Sharp-Crested Weir Flow Rate (m^3/s)		
	C = Flow Coefficient for Sharp-Crested Weir	1.84	
	L' = Length of the Ditch Inlet Catchbasin (m)	1.20	m
	α = Effective Length Ratio	0.90	
	L = Effective Weir Length (m)	1.08	m
	H = Water Depth (m) = Water surface Elevation - 256.2 m.	(Note: H < = 0.60/4= 0.15 m)	

When water head is high and the grate is submerged, the flow can be estimated using Orifice Discharge Equation

$$Q = 50\%\ CA\sqrt{2gh}$$

Where,	Q = Orifice Plate Flow Rate (m^3/s)	0.858	m^3/s
	C = Flow Coefficient for Orifice Plate	0.63	
	A = Cross-section Area of Orifice Plate (m^2) = Length X Width X 0.9 (Opening Ratio)	0.648	m^2
	g = Gravity Acceleration (m/s^2)	9.81	m/s^2
	h = Water Head above centerline of the grate (m) = Water Surface Elevation - 256.2 - 0.15/2		

Orifice Discharge Equation is used to calculate the release rate from the 200 mm orifice pipe:

$$Q = CA\sqrt{2gh}$$

Where,	Q = Orifice Tube Controlled Flow Rate (m^3/s)	0.134	m^3/s
	C = Flow Coefficient for Orifice Tube	0.80	
	d = Diameter of Orifice Tube (mm)	200	mm
	A = Cross-section Area of Orifice Tube (m^2)	0.031	m^2
	g = Gravity Acceleration (m/s^2)	9.81	m/s^2
	h = Water Head above Centerline of Orifice Tube (m)	1.45	
	Invert of Orifice Tube	255.65	m
	25-Year Water Level	257.20	m

2.3.3.3 High Flow Outlet for Quantity Control up to 100-year Event

Twin 600 x 1200 mm precast concrete ditch inlet (OPSD 705.040) with 1200 X 1200 mm grate (OPSD 403.010) & a 4:1 slope is proposed to convey the 100-year flow to the DICB.

A 450 mm diameter pipe functions as an Orifice Tube to control the peak flow rate up to the 100-year event.

The invert of the grate is set at elevation:	257.20	m
The invert of 450 mm orifice tube is set at	255.65	m

The flow rate through the grate can be estimated using either weir flow equation or orifice discharge equation, depending on the water head. Note that a 50% blockage is assumed in the flow capacity calculations.

When water head is low and the grate is not submerged, the flow rate can be estimated using Sharp-Crested Weir Equation:

$$Q = 50\%\ CLH^{1.5}$$

Where,	Q = Sharp-Crested Weir Flow Rate (m^3/s)		
	C = Flow Coefficient for Sharp-Crested Weir	1.84	
	L' = Length of the Ditch Inlet Catchbasin (m)	1.20	m
	α = Effective Length Ratio	0.90	
	L = Effective Weir Length (m)	1.08	m
	H = Water Depth (m) = Water surface Elevation - 257.2 m.	(Note: H < = 1.20/4= 0.30 m)	

When water head is high and the grate is submerged, the flow can be estimated using Orifice Discharge Equation

$$Q = 50\%\ CA\sqrt{2gh}$$

Where,	Q = Orifice Plate Flow Rate (m^3/s)	0.572	m^3/s
	C = Flow Coefficient for Orifice Plate	0.63	
	A = Cross-section Area of Orifice Plate (m^2)		
	= Length X Width X 0.9 (Opening Ratio)	1.296	m^2
	g = Gravity Acceleration (m/s^2)	9.81	m/s^2
	h = Water Head above centerline of the grate (m) = Water Surface Elevation - 257.2 - 0.30/2		

Outflow from 450 mm Orifice Tube is estimated using Orifice Discharge Equation

$$Q = CA\sqrt{2gh}$$

Where,	Q= Flow Rate from Orifice Tube	0.718	m^3/s
	C = Flow Coefficient for Orifice Tube	0.80	
	d = Diameter of Orifice Tube	450	mm
	A = Cross-section area of the orifice (m^2)	0.159	m^2
	g = Gravity Acceleration (m/s^2)	9.81	m/s^2
	h= WSEL - Orifice Center Elevation (m)	1.62	m
	Invert of Orifice Tube	255.65	m
	100-Year Water Level	257.50	m

2.3.3.4 Emergency Spillway

In case that all orifice tubes be blocked, an emergency spillway shall be proposed to convey the peak inflow rate from regional or 100-year event, whichever is greater.

100-year inflow rate=	11.67	m^3/s
Regional inflow rate=	4.10	m^3/s

Weir Bottom Lid Elevation is set at 257.50 m

Broad-Crested Weir Equation is used to estimate the flow through the emergency spillway.

$$Q = CLH^{3/2}$$

Where,	Q = Broad-Crested Weir Flow Rate (m^3/s)	12.02	m^3/s
	C = Flow Coefficient	1.70	
	L = Weir Length (m)	20.0	m
	H = Water Depth (m) = Top of Pond - 257.5 m	0.50	m

2.3.4 Stage - Storage - Discharge Relationships for SWM Pond #6

Elevation (m)	Flow Control for Extended Detention		Flow Control for Up to 25-Year Event					Flow Control for Up to 100-Year Event					Emergency Spillway		Total Flow (m^3/s)	Active Storage (m^3)
	Orifice Plate #1 C = 0.63 Dia. = 110 Inv. = 255.40		Grating of DICB* C = 0.63 600 x 1200 Lid. = 256.20		Orifice Tube #2 C = 0.80 Dia. = 200 Inv. = 255.65		Orifice Tube #2 Controlled Flow (m^3/s)	Grating of DICB C = 0.63 1200 x 1200 Lid. = 257.20		Orifice Tube #3 C = 0.80 Dia. = 450 Inv. = 255.65		Orifice Tube #3 Controlled Flow (m^3/s)	Broad Crest Weir C = 1.70 L = 20 Lid. = 257.50			
	Depth (m)	Flow (m^3/s)	Depth (m)	Flow (m^3/s)	Depth (m)	Flow (m^3/s)		Depth (m)	Flow (m^3/s)	Depth (m)	Flow (m^3/s)		Depth (m)	Flow (m^3/s)		
255.40	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	**0**
255.60	0.14	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.010**	**1,474**
255.80	0.35	0.016	0.000	0.000	0.050	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.016**	**3,067**
256.00	0.54	0.020	0.000	0.000	0.250	0.056	0.000	0.000	0.000	0.125	0.199	0.000	0.000	0.000	**0.020**	**4,784**
256.20	0.74	0.023	0.000	0.000	0.450	0.075	0.000	0.000	0.000	0.325	0.321	0.000	0.000	0.000	**0.023**	**6,609**
256.40	0.94	0.026	0.125	0.320	0.650	0.090	0.090	0.000	0.000	0.525	0.408	0.000	0.000	0.000	**0.116**	**8,534**
256.50	1.04	0.027	0.225	0.429	0.750	0.096	0.096	0.000	0.000	0.625	0.446	0.000	0.000	0.000	**0.124**	**9,547**
256.60	1.15	0.028	0.325	0.515	0.850	0.103	0.103	0.000	0.000	0.725	0.480	0.000	0.000	0.000	**0.131**	**10,560**
256.70	1.25	0.030	0.425	0.589	0.950	0.109	0.109	0.000	0.000	0.825	0.512	0.000	0.000	0.000	**0.138**	**11,623**
256.80	1.35	0.031	0.525	0.655	1.050	0.114	0.114	0.000	0.000	0.925	0.542	0.000	0.000	0.000	**0.145**	**12,686**
256.90	1.45	0.032	0.625	0.715	1.150	0.119	0.119	0.000	0.000	1.025	0.571	0.000	0.000	0.000	**0.151**	**13,800**
257.00	1.54	0.033	0.725	0.770	1.250	0.124	0.124	0.000	0.000	1.125	0.598	0.000	0.000	0.000	**0.157**	**14,914**
257.10	1.65	0.034	0.825	0.821	1.350	0.129	0.129	0.000	0.000	1.225	0.624	0.000	0.000	0.000	**0.163**	**16,079**
257.20	1.74	0.035	0.925	0.870	1.450	0.134	0.134	0.000	0.000	1.325	0.649	0.000	0.000	0.000	**0.169**	**17,243**
257.30	1.85	0.036	1.025	0.915	1.550	0.139	0.139	0.100	0.031	1.425	0.673	0.031	0.000	0.000	**0.206**	**18,408**
257.40	1.94	0.037	1.125	0.959	1.650	0.143	0.143	0.050	0.404	1.525	0.696	0.404	0.000	0.000	**0.584**	**19,573**
257.50	2.04	0.038	1.225	1.001	1.750	0.147	0.147	0.150	0.700	1.625	0.718	0.700	0.000	0.000	**0.886**	**20,738**
257.60	2.15	0.039	1.325	1.041	1.850	0.151	0.151	0.250	0.904	1.725	0.740	0.740	0.100	1.075	**2.006**	**21,902**
257.80	2.35	0.041	1.525	1.117	2.050	0.159	0.159	0.450	1.213	1.925	0.782	0.782	0.300	5.587	**6.569**	**24,232**
258.00	2.54	0.042	1.725	1.187	2.250	0.167	0.167	0.650	1.458	2.125	0.822	0.822	0.500	12.021	**13.052**	**26,562**

DICB grating functions as weir with lower flow head.

2.3.5 Quantity Control Performance

Visual OTTHYMO model was simulated for 25 mm, 2-year up to 100-year, and Regional Storm. The results are summarized as follows.

2.3.5.1 Quantity Control Performance (12 hour AES Storm)

Storm Event	Q_{in} (m^3/s)	Q_{out} (m^3/s)	V (m^3)	WSE (m)
2-Yr	1.209	0.094	8,086	256.35
5-Yr	1.630	0.130	10,459	256.59
10-Yr	1.933	0.143	12,316	256.77
25-Yr	2.303	0.156	14,713	256.98
50-Yr	2.579	0.166	16,524	257.14
100-Yr	2.874	0.201	18,253	257.29

2.3.5.2 Quantity Control Performance (24 hour Chicago Storm)

Storm Event	Q_{in} (m^3/s)	Q_{out} (m^3/s)	V (m^3)	WSE (m)
2-Yr	3.985	0.078	7,763	256.32
5-Yr	5.597	0.137	11,411	256.68
10-Yr	7.365	0.150	13,575	256.88
25-Yr	8.919	0.167	16,863	257.17
50-Yr	10.258	0.295	18,682	257.32
100-Yr	11.674	0.663	19,880	257.43

2.3.5.3 Quantity Control Performance (25 mm and Regional Storm)

Storm Event	Q_{in} (m^3/s)	Q_{out} (m^3/s)	V (m^3)	WSE (m)
25 mm	1.862	0.020	5,025	256.03
Regional Event	4.098	4.033	22,947	257.69

2.3.5.2 Target Flow Rates vs Controlled Flow Rates

Storm Event	Target Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)	
		12 hr AES	24 hr Chicago
25 mm*	0.009	0.020	
2-Yr		0.094	0.078
5-Yr		0.130	0.137
10-Yr		0.143	0.150
25-Yr	0.169	0.156	0.167
50-Yr		0.166	0.295
100-Yr	0.984	0.201	0.663

** Per Urbantech's FSR, a drawdown time less than 6 days is selected to ensure that there is sufficient extended detention volume available for next 25 mm rainfall event.*

Therefore, the resulting erosion control peak flow shall exceed the target flow from AMEC's CEIS & MP.

2.3.6 Sediment Forebay Configuration

A sediment forebay is one of the deeper areas of the pond which facilitates maintenance and improves pollutant removal by trapping larger particles near the inlet of the pond.
The sediment forebay design guidelines are presented in section 4.6.2 of the <Stormwater Management Practice Planning and Design Manual> (MOE, 2003) on page 4.55 to 4.57.

2.3.6.1 Settling Calculation

$$D_{ist} = \sqrt{\frac{rQ_p}{V_s}}$$ *Equation 4.5 of MOE Manual*

Where,

D_{ist} =	Forebay length (m)	16.3	m
r =	Length -to-Width ratio of forebay	4.0	
Q_p =	Peak flow rate from the pond during 25 mm storm	0.020	m^3/s
V_s =	Setting velocity	0.0003	m/s

2.3.6.2 Dispersion Length

The dispersion length refers to the length of fluid required to slow a jet discharge. It is recommended that the forebay length is such that a fluid jet will disperse to a velocity of ≤ 0.50 m/s at the forebay berm.

$$D_{ist} = \frac{8Q}{dV_f}$$ *Equation 4.6 of MOE Manual*

Where,

D_{ist} =	Dispersion Length	65.6	m
Q =	Inlet flow rate from design storm (10-year) *Refer to Storm Sewer Design Spreadsheet*	4.10	m^3/s
d =	Depth of permanent pool in the forebay	1.00	m
V_f =	Desired velocity in the forebay	0.50	m/s

2.3.6.3 Minimum Forebay Bottom Width

$$W_{idth} = \frac{D_{ist}}{8}$$ *Equation 4.7 of MOE Manual*

Where,

W_{idth} =	Minimum Forebay Deep Zone Bottom Width	8.2	m
D_{ist} =	Larger of Settling Length and Dispersion Length	65.6	m

2.3.6.4 Forebay Configuration

Description	Required	Provided
Depth (m)	1.0	1.00
Settling Length (m)	16.3	70
Dispersion Length (m)	65.6	
Minimum Bottom Width of Forebay Deep Zone	8.2	8.5

2.3.7 Subsurfce Trench Outlet

Treatment of water, by routing the discharge through a subsurface trench filled with clear stone, has been suggested to reduce temperature. As the water flows through the trench, heat is transferred to the stone.

The dimensions of the system depend on the intended range of release rates, and the proximity of the pond to the watercourse. The length of the trench should be maximized to increase the opportunity for heat transfer.

The trench should be wrapped with non-woven filter fabric to prevent the native material from blocking the pore space in the stone/rock.

Subsurface trench and perforated pipe

are proposed to accommodate controlled flow from low flow outlet (110 mm orifice plate).

Lenth of Subsurface Trench	50.0	m
Width of Subsurface Trench	1.0	m
Depth of Subsurface Trench	1.0	m
Diameter and Material of Outlet Pipe	300	mm Perforated PVC Pipe
Length of Outlet Pipe	50.0	m
Slope of Outlet Pipe	0.30%	

High Flow Outlet Pipe

900ø Concrete STM @ 0.30% is proposed to accommodate controlled flow from high flow outlets (200 mm orifice tube and 450 mm orifice tube).

2.3.8 Erosion Protection Emergency Spillway

Emergency spillway is proposed to convey the incoming 100-year (uncontrolled) flow from SWM Pond #6 to d/s channel.

2.3.8.1 Design Flow Calculation

Refer to Table under Section 2.3.5. of this Appendix, or VO Model Output.

Location	Q_{100} (m^3/s)
Emergency Spillway	11.67

2.3.8.2 Flow Velocity _ Manning's Equation

Manning's Equation is used to calculate the flow velocity within the storm sewer

BW (m)	D (m)	Z	A (m^2)	P (m)	R (m)	n	S (%)	Q (m^3/s)	V (m/s)
20.0	0.263	3.0	5.47	21.66	0.25	0.035	3.5	11.67	2.13

2.3.8.3 Erosion Protection Measures

The Presto Geoweb® Geocell System combined with a turf reinforcement mat (TRM) with topsoil infill and vegetation can withstand velocities up to 9.0 m/s and is proposed as the erosion proteciton measures for the emergency spillway for the SWM Pond #6.

Refer to the Performance Testing of the GW-TRM System by Colorado State University.

Prestø®

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GEOWEB® system

high-performance vegetated solutions

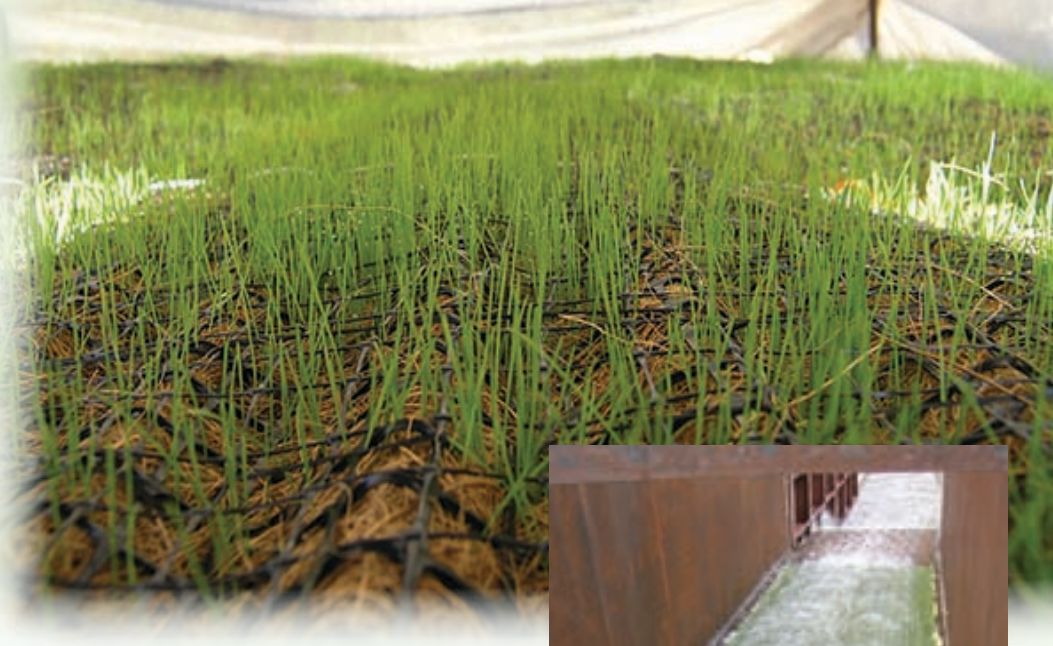
RESEARCH SYNOPSIS

RESEARCH OBJECTIVE

Measure performance of the Geoweb® (GW) material combined with a turf reinforcement mat (TRM) (integrated system) with topsoil infill and vegetation under varying shear stresses and flow rates to quantify both hydraulic forces and corresponding soil loss.

The test consisted of a series of continuous one-hour flows over the GW-TRM system at incrementally increasing discharges. The performance threshold was defined as the point at which 0.5 inch (13 mm) of soil loss occurred.

research scenario



THE RESEARCH FACILITY

Steep-Gradient Overtopping Facility (SGOF) at the Hydraulics Laboratory of the Engineering Research Center (ERCD) at Colorado State University (CSU), Ft. Collins, Colorado

TEST TIMEFRAME

April 2005 – August 2006

TEST MATERIALS

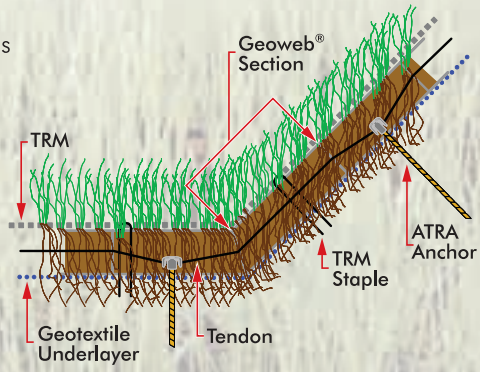
- Presto Geoweb® Cellular Confinement System
- North American Green C350 Turf Reinforcement Mat

scope of test

Hydraulic performance testing was conducted on an integrated system comprised of the GW30V textured/perforated Geoweb system and the North American Green C350 composite turf reinforcement mat. The C350 TRM was chosen for its known performance in the test apparatus. Six tests were conducted under the research program to measure performance of the integrated system, identify stability threshold conditions and to quantify both hydraulic forces and soil loss.

assembling the test components

1. The selected textured/perforated Geoweb section was placed in the test apparatus and topsoil infill added.
2. When the Geoweb cells were completely infilled with topsoil, the soil was lightly tamped.
3. Grass seed and mulch were added to finalize the growing medium.
4. The turf reinforcement mat was secured over the textured/perforated Geoweb section by ground staples at defined intervals in conformance with the manufacturer's recommendations.
5. Vegetation was established over a 14-week period to allow root system integration within the perforated cells of the Geoweb material. Kentucky bluegrass was the chosen vegetation for this series of tests.



test procedures/results

The test apparatus is lifted and positioned in place in the flume with a 2h:1v slope. In an effort to model storm conditions, the soil was saturated prior to the six tests. The integrated system was subjected to flow discharges ranging from 10 ft/sec (3.0 m/sec) to 27 ft/sec (8.2 m/sec). Two sets of water surface elevation data were taken; one at the beginning and one at the end of each hour-long flow to obtain an average depth. Vegetation density counts were also measured prior to and directly after each test at upstream, midstream and downstream locations.

observations

Exposed to the extreme flows, and despite ordinary topsoil infill and typical TRM staple patterns, the system showed no measurable soil loss. It was observed that the vegetation had decreasing stem and blade count during the total testing timeframe, however at a decreasing rate-of-loss for each incremental test.

Chosen vegetation type will influence the stem and blade loss. Typically a hardier grass type or blend would be used for field applications rather than pure Kentucky bluegrass.

At the completion of the test, an extracted soil sample showed vegetative root penetration to a depth of 1.5 inches (38 mm), with larger roots interacting with the cell wall perforations. As future growth occurs, root interaction will increase.

testing summary/conclusions

No system instability was observed for shear stresses up to 15.9 lbf/ft^2 (77.6 kgf/m^2) and for average velocities up to 26.5 ft/sec (8.1 m/sec) with peak velocities over 29 ft/sec (8.8 m/sec). Due to facility constraints that prevented testing higher velocities than those reported, system failure limits were never found. The test results for the integrated system far exceed the limits of separately reported values of the Geoweb cellular confinement system and turf reinforcement mats with topsoil/vegatated soil.

field applicability

The results of this integrated system testing can be applied to highway drainage ditches, spillways, dam and pond overflow systems and other vegetated channels exposed to high shear forces and intermittent, longer-duration velocities. This system replaces rip rap with a less expensive, low maintenance, aesthetically-pleasing green solution.

Stabilized Spillway with Geoweb®/TRM Solution

Stabilized ditch with Geoweb®/TRM solution

Typical Ditch Erosion Problem

EXCLUSIVITY OF RESULTS

The results of the testing are exclusive to the materials utilized in this test. Specifically, no inference shall be drawn from this research review indicating suitability of any cellular confinement system other than the genuine Geoweb® cellular confinement system. Due to the challenging nature of the projects for which this application applies, we strictly warn the reader of the potential for significant infill loss, project failure, and/or loss of property or life if substitutions are made including, but not limited to the Geoweb® cellular confinement product and a properly prepared engineering design analysis.

CERTIFIABLE RESULTS

Results of this testing/research are certifiable and only available through Presto Geosystems.

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LANDLOK® TRMs
BY PROPEX

Supporting a Stable Tomorrow...
Saving You Time, Money, and Resources

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- GEOSYNTHETICS
- CONCRETE REINFORCEMENT
- SOIL & EROSION CONTROL

LANDLOK® Turf Reinforcement Mats (TRMs) are available as a three-dimensional, lofty, woven polypropylene or stitch-bonded geotextile that delivers long-term, value engineered erosion protection. Vegetation is the most effective form of erosion control, capturing up to seven times more sediment than conventional hard armor solutions. That's where LANDLOK® with X3® technology comes in with a complete line of non-degradable rolled erosion control solutions.

APPLICATIONS

For use in erosion control applications such as:

- Channels and steep slopes
- Vegetated waterways
- Applications with minimal non-hydraulic stresses from debris loading and maintenance equipment

FEATURES & BENEFITS

You can expect the following performance features and benefits from LANDLOK® TRMs:

- Offers superior long-term, environmentally-friendly performance compared to rock riprap and concrete paving
- Increases design life over first generation TRMS that are netted, fused, glued or stitch-bonded
- Patented X3® fiber technology offers a unique three-dimensional pattern that creates a thick matrix of voids to trap seed, soil and water in place for quicker and thicker vegetation growth
- Enhances seedling emergence
- Engineered percent open area to provide both short-term and long-term protection
- Demonstrates superior UV resistance

SAVINGS & ADVANTAGES

Designed for superior performance and longer design life as well as reduced installation and life-cycle costs. The LANDLOK® family of TRMs offers 10-25 years of design life, as well as soil protection and environmental improvement to meet regulatory requirements. You can expect up to 50% cost savings over traditional hard armored solutions.

For a complete listing of all LANDLOK® geotextile products available visit propexglobal.com

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Call our technical help hotline at 1-800-214-2737 or visit us online at Propexglobal.com by scanning the QR code with your smart phone.

LANDLOK®
BY PROPEX

Product Data
LANDLOK® 450

LANDLOK® 450 turf reinforcement mat (TRM) ***features X3® technology*** *that* consists of a dense web of crimped, interlocking, multi-lobed polypropylene fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polypropylene thread. The TRM is designed to accelerate seedling emergence, exhibit high resiliency, and possess strength and elongation properties to limit stretching in a saturated condition. Every component of **LANDLOK 450** is stabilized against chemical and ultraviolet degradation which are normally found in a natural soil environment. Furthermore, the TRM contains no biodegradable components.

LANDLOK 450 conforms to the property values listed below[1] and is manufactured at a Propex facility having achieved ISO 9001:2000 certification. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). This product NTPEP approved for AASHTO standards.

PROPERTY	TEST METHOD	MARV[2] ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
PHYSICAL			
Mass/Unit Area	ASTM D-6566	10.0 oz/yd^2	340 g/m^2
Thickness	ASTM D-6525	0.40 in	10.1 mm
Light Penetration (% Passing)	ASTM D-6567	20%	20%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength	ASTM D-6818	400 x 300 lb/ft	5.8 x 4.3 kN/m
Elongation	ASTM D-6818	50% (max)	50% (max)
Resiliency	ASTM D-6524	90%	90%
Flexibility	ASTM D-6575	0.026 in-lb (avg)	30,000 mg-cm (avg)
ENDURANCE			
UV Resistance % Retained 1000 hrs	ASTM D-4355	80%	80%
PERFORMANCE			
Velocity[3] (Vegetated)	Large Scale	18 ft/s	5.5 m/s
Shear Stress[3] (Vegetated)	Large Scale	10 lb/ft^2	479 Pa
Manning's "n"[4] (Unvegetated)	Calculated	0.025	0.025
Seedling Emergence[4]	ECTC Draft Method #4	409%	409%
ROLL SIZES		6.5 ft x 138.5 ft	2.0 m x 42.2 m

NOTES:

1. The property values listed are effective 04/2011 and are subject to change without notice.
2. MARV indicates minimum average roll value calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will exceed the value reported.
3. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
4. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

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DEVELOPMENT BROOKVALLEY - MAYFIELD WEST

CONSULTANT WSP CANADA GROUP LTD.

MAJOR DRAINAGE AREA

	5 Year Parameters	10 Year Parameters	100 Year Parameters
A=	1593.0	2221.0	4688.0
B=	0.879	0.908	0.962
C=	11.000	12.000	17.000

Minimum Initial Time of Concentration = 10.00

TOWN OF CALEDON

STORM DESIGN SHEET

Runoff Coefficients		KCAi	
Apartments	0.75	Conversion Factor	0.002800
ROW Dwellings	0.70	Runoff Coef.	
Duplex Dwellings	0.70	Area (ha)	
Semidetached - Suburban	0.50	Rainfall	= A
Single Family - Downtown	0.40	Intensity	(t+C)B

DESIGNED BY JCV

REVIEWED BY ADR

LOCATION			DRAINAGE AREA				RUNOFF							PIPE SELECTION						
STREET	FROM MH	TO MH	AREA (ha)	RUN OFF COEF.	CA	CUMUL CA	INT. 5YR (i) (mm/hr)	FLOW 5YR (Q) (cms)	INT. 10YR (i) (mm/hr)	FLOW 10YR (Q) (cms)	INLET TIME (min)	SECTION TIME (min)	ACCUM TIME (min)	LENGTH (m)	SLOPE (%)	VELOCITY (m/s)	PIPE DIA. (mm)	CAPACITY (cms)	CAPACITY CHECK	CHANGE IN VELOCITY (m/s)
ROUTE 2 TO SWM POND 6																				
FUT. BEGONIA STREET	***280***	***279***	*0.37*	*0.65*	*0.24*	*0.24*	*109.68*	*0.074*	*134.16*	*0.090*	*10.00*	*0.87*	*10.87*	*72.1*	*1.00*	*1.383*	*300*	*0.10*	*89.5%*	*0.00*
FUT. BEGONIA STREET	***279***	***278***	*0.05*	*0.65*	*0.03*	*0.27*	*105.84*	*0.081*	*129.53*	*0.099*	*10.87*	*0.11*	*10.98*	*10.3*	*1.00*	*1.606*	*375*	*0.18*	*54.1%*	*0.13*
FUT. BEGONIA STREET	***278***	***277***	*0.26*	*0.65*	*0.17*	*0.44*	*105.39*	*0.130*	*128.98*	*0.160*	*10.98*	*0.67*	*11.64*	*51.2*	*0.50*	*1.281*	*450*	*0.21*	*75.9%*	*0.00*
FUT. BEGONIA STREET	***277***	***276***	*0.08*	*0.65*	*0.05*	*0.49*	*102.66*	*---*	*125.68*	*0.174*	*11.64*	*0.18*	*11.83*	*14.2*	*0.50*	*1.282*	*450*	*0.21*	*82.6%*	*-0.01*
FUT. BEGONIA STREET	***283***	***282***	*0.89*	*0.65*	*0.58*	*0.58*	*109.68*	*0.178*	*134.16*	*0.217*	*10.00*	*1.04*	*11.04*	*113.3*	*1.00*	*1.816*	*450*	*0.30*	*72.9%*	*0.35*
FUT. BEGONIA STREET	***282***	***281***	*0.09*	*0.65*	*0.06*	*0.64*	*105.11*	*0.187*	*128.65*	*0.229*	*11.04*	*0.07*	*11.11*	*5.7*	*0.50*	*1.426*	*525*	*0.32*	*72.0%*	*-0.24*
FUT. BEGONIA STREET	***281***	***276***	*0.07*	*0.65*	*0.05*	*0.68*	*104.83*	*0.200*	*128.31*	*0.245*	*11.1*	*0.23*	*11.34*	*19.5*	*0.50*	*1.423*	*525*	*0.32*	*77.1%*	*0.24*
FUT. BEGONIA STREET	***276***	***275***	*0.00*	*0.00*	*0.00*	*1.18*	*101.93*	*0.336*	*124.79*	*0.411*	*11.83*	*0.61*	*12.43*	*46.4*	*0.25*	*1.268*	*750*	*0.58*	*71.1%*	*-0.01*
FUT. PARK BLOCK	***275***	***274***	*0.00*	*0.00*	*0.00*	*1.18*	*99.60*	*0.328*	*121.97*	*0.402*	*12.43*	*0.62*	*13.06*	*47.7*	*0.25*	*1.278*	*750*	*0.58*	*69.0%*	*0.01*
FUT. PARK BLOCK	***274***	***273***	*1.83*	*0.25*	*0.46*	*1.63*	*97.33*	*0.445*	*119.21*	*0.545*	*13.06*	*1.25*	*14.30*	*95.1*	*0.25*	*1.272*	*750*	*0.58*	*94.1%*	*-0.01*
FUT. PARK BLOCK	***273***	***204***	*0.00*	*0.00*	*0.00*	*1.63*	*93.10*	*0.426*	*114.07*	*0.522*	*14.30*	*0.11*	*14.42*	*8.7*	*0.25*	*1.283*	*750*	*0.59*	*89.2%*	*-1.22*
WILTON DOWNEY WAY	**130**	**268**	0.28	0.80	0.22	0.22	109.68	0.069	134.16	0.084	10.00	0.96	10.96	92.1	1.00	1.605	375	0.18	46.0%	0.17
FALABELLA PLACE	**271**	**270**	0.06	0.80	0.05	0.05	109.68	0.015	134.16	0.018	10.00	0.22	10.22	18.0	1.00	1.384	300	0.10	17.9%	-0.11
FALABELLA PLACE	**270**	**269**	0.28	0.80	0.22	0.27	108.69	0.083	132.97	0.101	10.22	1.64	11.86	113.4	0.40	1.150	450	0.19	53.6%	-0.15
FALABELLA PLACE	**269**	**268**	0.06	0.80	0.05	0.32	101.79	0.091	124.63	0.112	11.86	0.20	12.06	15.5	0.50	1.285	450	0.21	52.9%	-0.10
UMBRIA PLACE	**268**	**266**	0.05	0.90	0.05	0.59	101.01	0.167	123.68	0.204	12.06	0.49	12.55	40.8	0.40	1.386	600	0.40	50.4%	-0.23
CAMINO REAL DRIVE	**267**	**266**	0.29	0.65	0.19	0.19	109.68	0.058	134.16	0.071	10.00	0.59	10.59	56.4	1.00	1.604	375	0.18	38.7%	-0.57
CAMINO REAL DRIVE	**266**	**263**	0.39	0.80	0.31	1.09	99.16	0.302	121.44	0.370	12.55	0.79	13.34	71.0	0.40	1.501	675	0.55	66.8%	-0.11
CAMINO REAL DRIVE	**265**	**264**	0.12	0.80	0.10	0.10	109.68	0.029	134.16	0.036	10.00	0.19	10.19	18.7	1.00	1.603	375	0.18	19.7%	-0.04
CAMINO REAL DRIVE	**264**	**263**	0.26	0.80	0.21	0.30	108.79	0.093	133.09	0.113	10.19	0.71	10.91	54.7	0.50	1.280	450	0.21	53.9%	-0.47
VINCENA ROAD	**263**	**259**	0.29	0.65	0.19	1.58	96.33	0.427	118.00	0.523	13.34	0.77	14.11	74.0	0.40	1.611	750	0.73	71.2%	-0.24
IDA TERRACE	**262**	**261**	0.15	0.65	0.10	0.10	109.68	0.030	134.16	0.037	10.00	0.40	10.40	33.3	1.00	1.383	300	0.10	36.3%	0.02
IDA TERRACE	**261**	**260**	0.13	0.65	0.08	0.18	107.87	0.055	131.98	0.067	10.40	0.17	10.57	10.4	0.40	1.009	375	0.12	58.5%	-1.24
IDA TERRACE	**260**	**259**	0.52	0.65	0.34	0.52	107.12	0.156	131.07	0.191	10.57	1.15	11.72	87.3	0.40	1.269	525	0.28	67.3%	-0.78
VINCENA ROAD	**259**	**251**	0.43	0.65	0.28	2.38	93.75	0.625	114.85	0.766	14.11	0.68	14.78	74.0	0.40	1.819	900	1.19	64.1%	-0.24
COULTERVILLE DRIVE	**258**	**257**	0.07	0.65	0.05	0.05	109.68	0.014	134.16	0.017	10.00	0.30	10.30	24.9	1.00	1.383	300	0.10	16.9%	-0.06
COULTERVILLE DRIVE	**257**	**256**	0.44	0.65	0.29	0.33	108.32	0.101	132.52	0.123	10.30	0.81	11.11	52.7	0.35	1.079	450	0.18	69.4%	-0.53
COULTERVILLE DRIVE	**256**	**251**	0.66	0.65	0.43	0.76	104.81	0.223	128.28	0.273	11.11	1.21	12.33	106.1	0.53	1.459	525	0.33	83.8%	-0.67
GATHERWOOD TERRACE	**285**	**255**	0.17	0.65	0.11	0.11	109.68	0.034	134.16	0.042	10.00	0.25	10.25	24.0	1.00	1.603	375	0.18	22.7%	-0.90
GATHERWOOD TERRACE	**255**	**254**	0.25	0.65	0.16	0.27	108.54	0.083	132.79	0.102	10.25	0.70	10.95	42.3	0.40	1.014	375	0.12	87.8%	-0.21

DEVELOPMENT BROOKVALLEY - MAYFIELD WEST

CONSULTANT WSP CANADA GROUP LTD.

MAJOR DRAINAGE AREA

	5 Year Parameters	10 Year Parameters	100 Year Parameters
A=	1593.0	2221.0	4688.0
B=	0.879	0.908	0.962
C=	11.000	12.000	17.000

Minimum Initial Time of Concentration = 10.00

TOWN OF CALEDON

STORM DESIGN SHEET

Runoff Coefficients		KCAi	
Apartments	0.75	Conversion Factor	0.002800
ROW Dwellings	0.70	Runoff Coef.	
Duplex Dwellings	0.70	Area (ha)	
Semidetached - Suburban	0.50	Rainfall	= A
Single Family - Downtown	0.40	Intensity	(t+C)B

DESIGNED BY JCV

REVIEWED BY ADR

LOCATION			DRAINAGE AREA				RUNOFF							PIPE SELECTION						
STREET	FROM MH	TO MH	AREA (ha)	RUN OFF COEF.	CA	CUMUL CA	INT. 5YR (i) (mm/hr)	FLOW 5YR (Q) (cms)	INT. 10YR (i) (mm/hr)	FLOW 10YR (Q) (cms)	INLET TIME (min)	SECTION TIME (min)	ACCUM TIME (min)	LENGTH (m)	SLOPE (%)	VELOCITY (m/s)	PIPE DIA. (mm)	CAPACITY (cms)	CAPACITY CHECK	CHANGE IN VELOCITY (m/s)
GATHERWOOD TERRACE	**254**	**252**	0.33	0.65	0.21	0.49	105.51	0.144	129.13	0.176	10.95	0.94	11.89	64.8	0.40	1.145	450	0.19	93.8%	-0.19
VINCENA ROAD	**252**	**251**	0.32	0.65	0.21	0.70	101.68	0.198	124.49	0.242	11.89	0.97	12.86	74.0	0.40	1.270	525	0.28	85.4%	-0.93
COULTERVILLE DRIVE	**251**	**226**	0.26	0.65	0.17	4.01	91.58	1.027	112.21	1.259	14.78	0.65	15.44	79.0	0.40	2.016	1050	1.80	69.9%	-0.19
FUT. KIANA ROSE STREET	***243***	***242***	*0.34*	*0.65*	*0.22*	*0.22*	*109.68*	*0.068*	*134.16*	*0.083*	*10.00*	*0.58*	*10.58*	*47.7*	*1.00*	*1.382*	*300*	*0.10*	*82.3%*	*0.11*
FUT. KIANA ROSE STREET	***242***	***240***	*0.23*	*0.65*	*0.15*	*0.37*	*107.10*	*0.111*	*131.05*	*0.136*	*10.58*	*0.49*	*11.07*	*33.9*	*0.40*	*1.144*	*450*	*0.19*	*72.4%*	*0.01*
FUT. LOTUS FLOWER ROAD	***240***	***239***	*0.11*	*0.65*	*0.07*	*0.44*	*105.00*	*0.130*	*128.51*	*0.159*	*11.07*	*0.38*	*11.45*	*29.1*	*0.40*	*1.272*	*525*	*0.28*	*55.9%*	*-0.09*
FUT. LOTUS FLOWER ROAD	***239***	***238***	*0.17*	*0.65*	*0.11*	*0.55*	*103.43*	*0.160*	*126.61*	*0.196*	*11.45*	*0.37*	*11.82*	*28.0*	*0.40*	*1.270*	*525*	*0.28*	*69.0%*	*-0.15*
FUT. LOTUS FLOWER ROAD	***238***	***237***	*0.18*	*0.65*	*0.12*	*0.67*	*101.96*	*0.191*	*124.83*	*0.234*	*11.82*	*0.38*	*12.20*	*32.2*	*0.50*	*1.420*	*525*	*0.32*	*73.8%*	*-0.08*
FUT. LOTUS FLOWER ROAD	***237***	***236***	*0.49*	*0.65*	*0.32*	*0.99*	*100.50*	*0.278*	*123.06*	*0.340*	*12.20*	*0.67*	*12.87*	*62.7*	*0.50*	*1.551*	*600*	*0.45*	*75.2%*	*-0.20*
FUT. LOTUS FLOWER ROAD	***236***	***226***	*0.81*	*0.65*	*0.53*	*1.51*	*98.00*	*0.416*	*120.03*	*0.509*	*12.87*	*1.16*	*14.03*	*117.3*	*0.50*	*1.678*	*675*	*0.62*	*82.1%*	*-0.70*
FUT. BEA ROSE STREET	***221***	***222***	*0.16*	*0.65*	*0.10*	*0.10*	*109.68*	*0.032*	*134.16*	*0.039*	*10.00*	*0.57*	*10.57*	*47.1*	*1.00*	*1.382*	*300*	*0.10*	*38.7%*	*0.43*
FUT. BEA ROSE STREET	***222***	***223***	*0.08*	*0.65*	*0.05*	*0.16*	*107.13*	*0.047*	*131.09*	*0.057*	*10.57*	*0.22*	*10.78*	*13.1*	*0.40*	*1.011*	*375*	*0.12*	*49.7%*	*-0.40*
FUT. BEA ROSE STREET	***223***	***224***	*0.43*	*0.65*	*0.28*	*0.44*	*106.20*	*0.129*	*129.96*	*0.158*	*10.78*	*1.04*	*11.82*	*79.1*	*0.40*	*1.271*	*525*	*0.28*	*55.8%*	*-0.29*
LIPPA DRIVE	**235**	**234**	0.67	0.65	0.44	0.44	109.68	0.134	134.16	0.164	10.00	1.04	11.04	99.6	1.00	1.603	375	0.18	89.5%	0.12
LIPPA DRIVE	**234**	**224**	0.23	0.65	0.15	0.59	105.13	0.172	128.67	0.211	11.04	0.31	11.35	26.7	0.50	1.417	525	0.32	66.6%	-0.39
LIPPA DRIVE	**224**	**225**	0.21	0.65	0.14	1.16	101.94	0.330	124.81	0.404	11.82	0.39	12.21	36.5	0.50	1.554	600	0.45	89.2%	-0.08
LIPPA DRIVE	**225**	**226**	0.12	0.65	0.08	1.24	100.43	0.347	122.98	0.425	12.21	0.44	12.65	40.8	0.50	1.553	600	0.45	93.8%	-0.76
LIPPA DRIVE	**226**	**248**	0.62	0.65	0.40	7.16	89.58	1.796	109.78	2.201	15.44	1.14	16.58	150.8	0.40	2.202	1200	2.57	85.6%	-0.46
GALVIN AVENUE	**250**	**249**	0.58	0.65	0.38	0.38	109.68	0.116	134.16	0.142	10.00	1.01	11.01	96.9	1.00	1.604	375	0.18	77.4%	0.13
GALVIN AVENUE	**249**	**253**	0.12	0.65	0.08	0.46	105.25	0.134	128.82	0.164	11.01	0.53	11.53	40.4	0.50	1.281	450	0.21	78.0%	-0.31
VINCENA ROAD	**287**	**253**	0.41	0.65	0.27	0.27	109.68	0.082	134.16	0.100	10.00	0.55	10.55	52.7	1.00	1.605	375	0.18	54.7%	0.08
FUT. SCHOOL BLOCK	**CBMH1**	**253**	2.76	0.45	1.24	1.24	109.68	0.381	134.16	0.467	10.00	0.08	10.08	14.3	2.00	3.104	600	0.91	51.5%	-1.44
GALVIN AVENUE	**253**	**248**	0.18	0.90	0.16	2.13	103.09	0.614	126.20	0.751	11.53	0.69	12.22	79.0	0.50	1.919	825	1.06	70.9%	-1.38
FUT. TREVISO ROAD	**248**	**245**	0.44	0.65	0.29	9.57	86.32	2.313	105.79	2.835	16.58	0.55	17.13	85.9	0.55	2.584	1200	3.02	94.0%	0.03
FUT. TREVISO ROAD	**245**	**207**	0.29	0.65	0.19	9.76	84.82	2.318	103.97	2.841	17.13	0.30	17.44	47.3	0.55	2.584	1200	3.02	94.2%	0.44
FUT. FREDERICA STREET	***230***	***228***	*0.73*	*0.65*	*0.47*	*0.47*	*109.68*	*0.146*	*134.16*	*0.178*	*10.00*	*0.74*	*10.74*	*80.5*	*1.00*	*1.811*	*450*	*0.30*	*59.9%*	*0.01*
FUT. FREDERICA STREET	***228***	***208***	*0.14*	*0.65*	*0.09*	*0.57*	*106.39*	*0.168*	*130.19*	*0.206*	*10.74*	*0.54*	*11.28*	*41.4*	*0.40*	*1.272*	*525*	*0.28*	*72.5%*	*-1.01*
FUT. BEA ROSE STREET	***221***	***220***	*0.29*	*0.65*	*0.19*	*0.19*	*109.68*	*0.058*	*134.16*	*0.071*	*10.00*	*0.80*	*10.80*	*66.7*	*1.00*	*1.382*	*300*	*0.10*	*70.2%*	*0.43*
FUT. SIMONA STREET	***220***	***219***	*0.08*	*0.65*	*0.05*	*0.24*	*106.11*	*0.071*	*129.86*	*0.087*	*10.80*	*0.24*	*11.04*	*14.4*	*0.40*	*1.011*	*375*	*0.12*	*75.9%*	*-0.18*
FUT. SIMONA STREET	***219***	***284***	*0.36*	*0.80*	*0.29*	*0.53*	*105.11*	*0.156*	*128.65*	*0.190*	*11.04*	*1.17*	*12.21*	*89.4*	*0.40*	*1.271*	*525*	*0.28*	*67.1%*	*-0.33*
FUT. LOTUS FLOWER ROAD	***240****	***241***	*0.21*	*0.65*	*0.14*	*0.14*	*109.68*	*0.042*	*134.16*	*0.051*	*10.00*	*0.62*	*10.62*	*44.8*	*0.75*	*1.197*	*300*	*0.09*	*58.7%*	*-1.06*
FUT. LOTUS FLOWER ROAD	***241***	***284***	*0.00*	*0.00*	*0.00*	*0.14*	*106.89*	*0.041*	*130.80*	*0.050*	*10.62*	*0.62*	*11.25*	*36.6*	*0.50*	*0.978*	*300*	*0.07*	*70.1%*	*-0.36*

DEVELOPMENT BROOKVALLEY - MAYFIELD WEST

CONSULTANT WSP CANADA GROUP LTD.

MAJOR DRAINAGE AREA

	5 Year Parameters	10 Year Parameters	100 Year Parameters
A=	1593.0	2221.0	4688.0
B=	0.879	0.908	0.962
C=	11.000	12.000	17.000

Minimum Initial Time of Concentration = 10.00

TOWN OF CALEDON

STORM DESIGN SHEET

Runoff Coefficients		KCAi	
Apartments	0.75	Conversion Factor	0.002800
ROW Dwellings	0.70	Runoff Coef.	
Duplex Dwellings	0.70	Area (ha)	
Semidetached - Suburban	0.50	Rainfall =	A
Single Family - Downtown	0.40	Intensity	(t+C)B

DESIGNED BY JCV

REVIEWED BY ADR

LOCATION			DRAINAGE AREA				RUNOFF							PIPE SELECTION						
STREET	FROM MH	TO MH	AREA (ha)	RUN OFF COEF.	CA	CUMUL CA	INT. 5YR (i) (mm/hr)	FLOW 5YR (Q) (cms)	INT. 10YR (i) (mm/hr)	FLOW 10YR (Q) (cms)	INLET TIME (min)	SECTION TIME (min)	ACCUM TIME (min)	LENGTH (m)	SLOPE (%)	VELOCITY (m/s)	PIPE DIA. (mm)	CAPACITY (cms)	CAPACITY CHECK	CHANGE IN VELOCITY (m/s)
FUT. SIMONA STREET	***284***	***218***	*0.26*	*0.80*	*0.21*	*0.87*	*100.43*	*0.245*	*122.98*	*0.301*	*12.21*	*0.89*	*13.11*	*74.5*	*0.40*	*1.388*	*600*	*0.41*	*74.2%*	*-0.06*
FUT. SIMONA STREET	***218***	***217***	*0.23*	*0.80*	*0.18*	*1.06*	*97.15*	*0.288*	*118.99*	*0.352*	*13.11*	*0.75*	*13.86*	*62.7*	*0.40*	*1.389*	*600*	*0.41*	*86.9%*	*0.00*
FUT. TREVISO ROAD	***217***	***216***	*0.09*	*0.65*	*0.06*	*1.12*	*94.56*	*0.295*	*115.84*	*0.362*	*13.86*	*0.21*	*14.07*	*17.2*	*0.40*	*1.391*	*600*	*0.41*	*89.1%*	*-0.08*
FUT. TREVISO ROAD	***216***	***215***	*0.06*	*0.65*	*0.04*	*1.15*	*93.88*	*0.303*	*115.01*	*0.372*	*14.07*	*0.23*	*14.30*	*20.9*	*0.40*	*1.504*	*675*	*0.56*	*66.9%*	*-0.04*
FUT. TREVISO ROAD	***215***	***214***	*0.42*	*0.65*	*0.27*	*1.43*	*93.12*	*0.372*	*114.09*	*0.456*	*14.30*	*0.77*	*15.07*	*69.6*	*0.40*	*1.501*	*675*	*0.55*	*82.3%*	*-0.20*
FUT. NONNI AVENUE	***233***	***232***	*0.45*	*0.80*	*0.36*	*0.36*	*109.68*	*0.111*	*134.16*	*0.135*	*10.00*	*0.46*	*10.46*	*44.3*	*1.00*	*1.604*	*375*	*0.18*	*74.0%*	*0.48*
FUT. NONNI AVENUE	***232***	***231***	*0.17*	*0.65*	*0.11*	*0.47*	*107.61*	*0.142*	*131.66*	*0.173*	*10.46*	*0.23*	*10.69*	*15.6*	*0.40*	*1.143*	*450*	*0.19*	*92.4%*	*-0.19*
FUT. NONNI AVENUE	***231***	***214***	*0.18*	*0.65*	*0.12*	*0.59*	*106.62*	*0.175*	*130.47*	*0.215*	*10.69*	*0.87*	*11.56*	*66.6*	*0.40*	*1.269*	*525*	*0.28*	*75.7%*	*-0.49*
FUT. TREVISO ROAD	***214***	***213***	*0.28*	*0.65*	*0.18*	*2.20*	*90.69*	*0.558*	*111.13*	*0.684*	*15.07*	*0.58*	*15.65*	*59.6*	*0.40*	*1.715*	*825*	*0.95*	*72.3%*	*0.00*
FUT. TREVISO ROAD	***213***	***212***	*0.11*	*0.65*	*0.07*	*2.27*	*88.95*	*0.565*	*109.01*	*0.692*	*15.65*	*0.16*	*15.82*	*17.0*	*0.40*	*1.717*	*825*	*0.95*	*73.1%*	*-0.03*
FUT. TREVISO ROAD	***212***	***211***	*0.35*	*0.65*	*0.23*	*2.50*	*88.47*	*0.618*	*108.43*	*0.758*	*15.82*	*0.54*	*16.35*	*55.5*	*0.40*	*1.717*	*825*	*0.95*	*80.0%*	*0.00*
FUT. TREVISO ROAD	***211***	***210***	*0.25*	*0.65*	*0.16*	*2.66*	*86.94*	*0.647*	*106.56*	*0.793*	*16.35*	*0.06*	*16.41*	*6.3*	*0.40*	*1.715*	*825*	*0.95*	*83.8%*	*-0.06*
FUT. TREVISO ROAD	***210***	***209***	*0.51*	*0.65*	*0.33*	*2.99*	*86.77*	*0.726*	*106.35*	*0.890*	*16.41*	*0.64*	*17.05*	*69.4*	*0.40*	*1.820*	*900*	*1.20*	*74.5%*	*-0.05*
FUT. TREVISO ROAD	***209***	***208***	*0.93*	*0.65*	*0.60*	*3.59*	*85.04*	*0.856*	*104.23*	*1.049*	*17.05*	*1.10*	*18.15*	*120.4*	*0.40*	*1.818*	*900*	*1.19*	*87.9%*	*-0.29*
FUT. TREVISO ROAD	***208***	***207***	*0.00*	*0.00*	*0.00*	*4.16*	*82.21*	*0.958*	*100.77*	*1.174*	*18.15*	*0.08*	*18.24*	*11.3*	*0.50*	*2.263*	*1050*	*2.02*	*58.0%*	*-0.20*
SWM WALKWAY	**207**	**206**	0.00	0.00	0.00	13.92	82.00	3.196	100.51	3.917	18.24	0.33	18.56	43.1	0.20	**2.202**	**1800x1200**	**4.73**	82.8%	0.00
SWM BLOCK	**206**	**205**	0.00	0.00	0.00	13.92	81.20	3.165	99.54	3.879	18.56	0.90	19.47	119.4	0.20	**2.202**	**1800x1200**	**4.73**	82.0%	0.00
SWM BLOCK	**205**	**204**	0.00	0.00	0.00	13.92	79.08	3.082	96.94	3.778	19.47	0.73	20.20	97.1	0.20	**2.202**	**1800x1200**	**4.73**	79.9%	-0.02
SWM BLOCK	**204**	**HW**	0.00	0.00	0.00	15.55	77.44	3.373	94.93	4.134	20.20	0.12	20.32	15.6	0.20	**2.202**	**1800x1200**	**4.73**	87.4%	2.53

NOTES:
1: Length of pipe used for time of concentration

Designed to accommodate additional flows beyond the 10-yr storm sewer period
Stage 2 (Not Approved. Not to be Constructed)
Tim Manley Avenue Design (By Others)

LICENSED PROFESSIONAL ENGINEER
A.D. RAIMONDO
100173463
MAR 23-2020
PROVINCE OF ONTARIO

APPENDIX

B VISUAL OTTHYMO MODEL OUTPUT

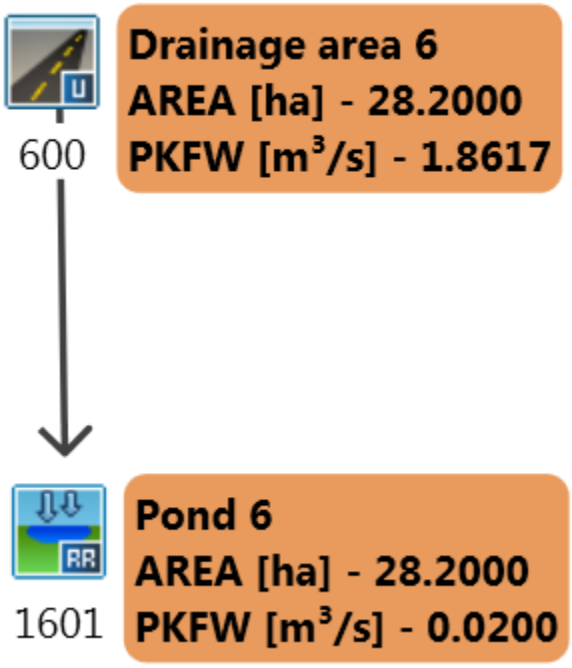

Figure B _ VO Schematic _ Proposed Drainage Plan

APPENDIX B11

SWM POND #6 REQUIRED VOLUME – 12 HOUR ASE STORM (BLOOR, TRCA)

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 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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                  *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
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  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\fac0b3
32-0250-41fe-9774-0c47f84cff7a\scenar

DATE: 08/09/2019                          TIME: 11:47:11

USER:


COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------
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  ************************************************
  ** SIMULATION : Run 01                        **
  ************************************************


-------------------
|    READ STORM   |    Filename: C:\Users\zhouj\AppD
|                 |              ata\Local\Temp\
|                 |              a9f5fe25-df65-4591-a9af-f993e59e433c\eea7fb5c
| Ptotal= 25.00 mm |    Comments: 25mm4HRC
-------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    2.07 |  1.17    5.70 |  2.17    5.19 |  3.17    2.80
                0.33    2.27 |  1.33   10.78 |  2.33    4.47 |  3.33    2.62
                0.50    2.52 |  1.50   50.21 |  2.50    3.95 |  3.50    2.48
                0.67    2.88 |  1.67   13.37 |  2.67    3.56 |  3.67    2.35
                0.83    3.38 |  1.83    8.29 |  2.83    3.25 |  3.83    2.23
                1.00    4.18 |  2.00    6.30 |  3.00    3.01 |  4.00    2.14

--------------------------------------------------------------------------------
```



```
-------------------
| CALIB             |
| STANDHYD (  0600)|   Area    (ha)=  28.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
-------------------

                        IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      19.74         8.46
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     433.59        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083   2.07 | 1.083   5.70 | 2.083   5.19 |  3.08    2.80
                0.167   2.07 | 1.167   5.70 | 2.167   5.19 |  3.17    2.80
                0.250   2.27 | 1.250  10.78 | 2.250   4.47 |  3.25    2.62
                0.333   2.27 | 1.333  10.78 | 2.333   4.47 |  3.33    2.62
                0.417   2.52 | 1.417  50.21 | 2.417   3.95 |  3.42    2.48
                0.500   2.52 | 1.500  50.21 | 2.500   3.95 |  3.50    2.48
                0.583   2.88 | 1.583  13.37 | 2.583   3.56 |  3.58    2.35
                0.667   2.88 | 1.667  13.37 | 2.667   3.56 |  3.67    2.35
                0.750   3.38 | 1.750   8.29 | 2.750   3.25 |  3.75    2.23
                0.833   3.38 | 1.833   8.29 | 2.833   3.25 |  3.83    2.23
                0.917   4.18 | 1.917   6.30 | 2.917   3.01 |  3.92    2.14
                1.000   4.18 | 2.000   6.30 | 3.000   3.01 |  4.00    2.14

     Max.Eff.Inten.(mm/hr)=      50.21         5.99
               over (min)        10.00        30.00
     Storage Coeff.  (min)=       8.11 (ii)  29.88 (ii)
     Unit Hyd. Tpeak (min)=      10.00        30.00
     Unit Hyd. peak  (cms)=       0.13         0.04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       1.84         0.07          1.862 (iii)
     TIME TO PEAK    (hrs)=       1.58         2.08          1.58
     RUNOFF VOLUME    (mm)=      24.00         6.17         18.65
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =       0.96         0.25          0.75

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
---------------------
| RESERVOIR(  1601)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------     (cms)     (ha.m.)    |   (cms)     (ha.m.)
                        0.0000     0.0000    |   0.1690      1.4885
                        0.0090     0.6575    |   0.9840      1.5100

                                    AREA      QPEAK     TPEAK       R.V.
                                    (ha)      (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0600)        28.200      1.862      1.58       18.65
```



```
   OUTFLOW: ID= 1 (  1601)     28.200      0.007      5.00      10.36

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.38
                  TIME SHIFT OF PEAK FLOW         (min)=205.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5172

--------------------------------------------------------------------------------
================================================================================
========================

 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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                  *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\0de58d
7b-7f8d-4375-98d9-eefa693a9965\scenar
  Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\0de58d
7b-7f8d-4375-98d9-eefa693a9965\scenar

DATE: 08/09/2019                          TIME: 11:47:11

USER:


COMMENTS: _____________________________________________________________

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  ************************************************
  ** SIMULATION : Run 11                        **
  ************************************************


-------------------
|    READ STORM   |    Filename: C:\Users\zhouj\AppD
|                 |              ata\Local\Temp\
|                 |              a9f5fe25-df65-4591-a9af-f993e59e433c\66c03f93
| Ptotal= 73.10 mm |    Comments: 25 Year 12 Hour AES (Bloor, TRCA)
-------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    0.00 |  3.50   12.43 |  6.75    5.12 | 10.00    0.73
```



```
                0.50    0.73 |  3.75   12.43 |  7.00    5.12 | 10.25    0.73
                0.75    0.73 |  4.00   12.43 |  7.25    5.12 | 10.50    0.73
                1.00    0.73 |  4.25   12.43 |  7.50    2.92 | 10.75    0.73
                1.25    0.73 |  4.50   33.63 |  7.75    2.92 | 11.00    0.73
                1.50    0.73 |  4.75   33.63 |  8.00    2.92 | 11.25    0.73
                1.75    0.73 |  5.00   33.63 |  8.25    2.92 | 11.50    0.73
                2.00    0.73 |  5.25   33.63 |  8.50    1.46 | 11.75    0.73
                2.25    0.73 |  5.50    9.50 |  8.75    1.46 | 12.00    0.73
                2.50    4.39 |  5.75    9.50 |  9.00    1.46 | 12.25    0.73
                2.75    4.39 |  6.00    9.50 |  9.25    1.46 |
                3.00    4.39 |  6.25    9.50 |  9.50    0.73 |
                3.25    4.39 |  6.50    5.12 |  9.75    0.73 |

--------------------------------------------------------------------------------

-------------------
| CALIB             |
| STANDHYD (  0600)|   Area    (ha)=  28.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
-------------------

                        IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      19.74         8.46
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     433.59        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083   0.00 | 3.167   4.39 | 6.250   9.50 |  9.33    0.73
                0.167   0.00 | 3.250   4.39 | 6.333   5.12 |  9.42    0.73
                0.250   0.00 | 3.333  12.43 | 6.417   5.12 |  9.50    0.73
                0.333   0.73 | 3.417  12.43 | 6.500   5.12 |  9.58    0.73
                0.417   0.73 | 3.500  12.43 | 6.583   5.12 |  9.67    0.73
                0.500   0.73 | 3.583  12.43 | 6.667   5.12 |  9.75    0.73
                0.583   0.73 | 3.667  12.43 | 6.750   5.12 |  9.83    0.73
                0.667   0.73 | 3.750  12.43 | 6.833   5.12 |  9.92    0.73
                0.750   0.73 | 3.833  12.43 | 6.917   5.12 | 10.00    0.73
                0.833   0.73 | 3.917  12.43 | 7.000   5.12 | 10.08    0.73
                0.917   0.73 | 4.000  12.43 | 7.083   5.12 | 10.17    0.73
                1.000   0.73 | 4.083  12.43 | 7.167   5.12 | 10.25    0.73
                1.083   0.73 | 4.167  12.43 | 7.250   5.12 | 10.33    0.73
                1.167   0.73 | 4.250  12.43 | 7.333   2.92 | 10.42    0.73
                1.250   0.73 | 4.333  33.63 | 7.417   2.92 | 10.50    0.73
                1.333   0.73 | 4.417  33.63 | 7.500   2.92 | 10.58    0.73
                1.417   0.73 | 4.500  33.63 | 7.583   2.92 | 10.67    0.73
                1.500   0.73 | 4.583  33.63 | 7.667   2.92 | 10.75    0.73
                1.583   0.73 | 4.667  33.63 | 7.750   2.92 | 10.83    0.73
                1.667   0.73 | 4.750  33.63 | 7.833   2.92 | 10.92    0.73
                1.750   0.73 | 4.833  33.63 | 7.917   2.92 | 11.00    0.73
                1.833   0.73 | 4.917  33.63 | 8.000   2.92 | 11.08    0.73
                1.917   0.73 | 5.000  33.63 | 8.083   2.92 | 11.17    0.73
                2.000   0.73 | 5.083  33.63 | 8.167   2.92 | 11.25    0.73
                2.083   0.73 | 5.167  33.63 | 8.250   2.92 | 11.33    0.73
                2.167   0.73 | 5.250  33.63 | 8.333   1.46 | 11.42    0.73
                2.250   0.73 | 5.333   9.50 | 8.417   1.46 | 11.50    0.73
                2.333   4.39 | 5.417   9.50 | 8.500   1.46 | 11.58    0.73
                2.417   4.39 | 5.500   9.50 | 8.583   1.46 | 11.67    0.73
                2.500   4.39 | 5.583   9.50 | 8.667   1.46 | 11.75    0.73
```

2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
2.833	4.39	5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	6.000	9.50	9.083	1.46	12.17	0.73
3.000	4.39	6.083	9.50	9.167	1.46	12.25	0.73
3.083	4.39	6.167	9.50	9.250	1.46		

Max.Eff.Inten.(mm/hr)=		33.63	24.79	
over (min)		10.00	25.00	
Storage Coeff. (min)=		9.53 (ii)	21.86 (ii)	
Unit Hyd. Tpeak (min)=		10.00	25.00	
Unit Hyd. peak (cms)=		0.12	0.05	
				TOTALS
PEAK FLOW	(cms)=	1.84	0.47	2.303 (iii)
TIME TO PEAK	(hrs)=	5.25	5.33	5.25
RUNOFF VOLUME	(mm)=	72.10	41.07	62.79
TOTAL RAINFALL	(mm)=	73.10	73.10	73.10
RUNOFF COEFFICIENT	=	0.99	0.56	0.86

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)	
IN= 2---> OUT= 1	
DT= 5.0 min	OUTFLOW (cms) / STORAGE (ha.m.)
	0.0000 / 0.0000
	0.0090 / 0.6575
	OUTFLOW (cms) / STORAGE (ha.m.)
	0.1690 / 1.4885
	0.9840 / 1.5100

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	2.303	5.25	62.79
OUTFLOW: ID= 1 (1601)	28.200	0.169	8.42	49.50

PEAK FLOW REDUCTION [Qout/Qin](%)= 7.34
TIME SHIFT OF PEAK FLOW (min)=190.00
MAXIMUM STORAGE USED (ha.m.)= 1.4885

```
       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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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\1475e0dd-f560-46dc-ab2c-a2fd11a7d693\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\1475e0dd-f560-46dc-ab2c-a2fd11a7d693\scenar

DATE: 08/09/2019 TIME: 11:47:11

USER:

COMMENTS: _____

```
  ************************************************
  ** SIMULATION : Run 13                        **
  ************************************************
```

READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\a9f5fe25-df65-4591-a9af-f993e59e433c\32ebeffd
Ptotal= 88.54 mm	Comments: 100 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	15.05	6.75	6.20	10.00	0.89
0.50	0.89	3.75	15.05	7.00	6.20	10.25	0.89
0.75	0.89	4.00	15.05	7.25	6.20	10.50	0.89
1.00	0.89	4.25	15.05	7.50	3.54	10.75	0.89
1.25	0.89	4.50	40.71	7.75	3.54	11.00	0.89
1.50	0.89	4.75	40.71	8.00	3.54	11.25	0.89
1.75	0.89	5.00	40.71	8.25	3.54	11.50	0.89
2.00	0.89	5.25	40.71	8.50	1.77	11.75	0.89
2.25	0.89	5.50	11.51	8.75	1.77	12.00	0.89
2.50	5.31	5.75	11.51	9.00	1.77	12.25	0.89
2.75	5.31	6.00	11.51	9.25	1.77		
3.00	5.31	6.25	11.51	9.50	0.89		
3.25	5.31	6.50	6.20	9.75	0.89		

CALIB	
STANDHYD (0600)	Area (ha)= 28.20
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00

Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Max.Eff.Inten.(mm/hr)=		40.71	32.10	
over (min)		10.00	20.00	
Storage Coeff. (min)=		8.82 (ii)	19.94 (ii)	
Unit Hyd. Tpeak (min)=		10.00	20.00	
Unit Hyd. peak (cms)=		0.12	0.06	
				TOTALS
PEAK FLOW	(cms)=	2.23	0.65	2.874 (iii)
TIME TO PEAK	(hrs)=	5.25	5.33	5.25
RUNOFF VOLUME	(mm)=	87.54	54.37	77.59
TOTAL RAINFALL	(mm)=	88.54	88.54	88.54
RUNOFF COEFFICIENT	=	0.99	0.61	0.88

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)	
IN= 2---> OUT= 1	
DT= 5.0 min	OUTFLOW (cms) / STORAGE (ha.m.)
	0.0000 / 0.0000
	0.0090 / 0.6575
	OUTFLOW (cms) / STORAGE (ha.m.)
	0.1690 / 1.4885
	0.9840 / 1.5100

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	2.874	5.25	77.59
OUTFLOW: ID= 1 (1601)	28.200	0.973	5.92	64.27

PEAK FLOW REDUCTION [Qout/Qin](%)= 33.86
TIME SHIFT OF PEAK FLOW (min)= 40.00
MAXIMUM STORAGE USED (ha.m.)= 1.5098

FINISH

APPENDIX B12

SWM POND #6 REQUIRED VOLUME

– 24 HOUR CHICAGO STORM (CALEDON IDF CURVE)

```
 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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```

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\c7d6299b-dfec-44c3-8790-f501642da9e8\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\c7d6299b-dfec-44c3-8790-f501642da9e8\scenar

DATE: 08/09/2019 TIME: 11:49:27

USER:

COMMENTS: _____

** SIMULATION : Run 01 **

READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\93ee97bb-674d-4606-b026-80876edfc3ad\eea7fb5c
Ptotal= 25.00 mm	Comments: 25mm4HRC

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	2.07	1.17	5.70	2.17	5.19	3.17	2.80
0.33	2.27	1.33	10.78	2.33	4.47	3.33	2.62
0.50	2.52	1.50	50.21	2.50	3.95	3.50	2.48
0.67	2.88	1.67	13.37	2.67	3.56	3.67	2.35
0.83	3.38	1.83	8.29	2.83	3.25	3.83	2.23
1.00	4.18	2.00	6.30	3.00	3.01	4.00	2.14

CALIB STANDHYD (0600) ID= 1 DT= 5.0 min	Area (ha)= 28.20 Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.07	1.083	5.70	2.083	5.19	3.08	2.80
0.167	2.07	1.167	5.70	2.167	5.19	3.17	2.80
0.250	2.27	1.250	10.78	2.250	4.47	3.25	2.62
0.333	2.27	1.333	10.78	2.333	4.47	3.33	2.62
0.417	2.52	1.417	50.21	2.417	3.95	3.42	2.48
0.500	2.52	1.500	50.21	2.500	3.95	3.50	2.48
0.583	2.88	1.583	13.37	2.583	3.56	3.58	2.35
0.667	2.88	1.667	13.37	2.667	3.56	3.67	2.35
0.750	3.38	1.750	8.29	2.750	3.25	3.75	2.23
0.833	3.38	1.833	8.29	2.833	3.25	3.83	2.23
0.917	4.18	1.917	6.30	2.917	3.01	3.92	2.14
1.000	4.18	2.000	6.30	3.000	3.01	4.00	2.14

				TOTALS
Max.Eff.Inten.(mm/hr)=		50.21	5.99	
over (min)		10.00	30.00	
Storage Coeff. (min)=		8.11 (ii)	29.88 (ii)	
Unit Hyd. Tpeak (min)=		10.00	30.00	
Unit Hyd. peak (cms)=		0.13	0.04	
PEAK FLOW	(cms)=	1.84	0.07	1.862 (iii)
TIME TO PEAK	(hrs)=	1.58	2.08	1.58
RUNOFF VOLUME	(mm)=	24.00	6.17	18.65
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.25	0.75

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601) IN= 2---> OUT= 1 DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1690	1.7025
	0.0090	0.6575	0.9840	1.9145

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	1.862	1.58	18.65

OUTFLOW: ID= 1 (1601) 28.200 0.007 5.00 10.36

PEAK FLOW REDUCTION [Qout/Qin](%)= 0.38
TIME SHIFT OF PEAK FLOW (min)=205.00
MAXIMUM STORAGE USED (ha.m.)= 0.5172

```
 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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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\88c089bc-3278-4fd5-a731-1a9dfc702f80\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\88c089bc-3278-4fd5-a731-1a9dfc702f80\scenar

DATE: 08/09/2019 TIME: 11:49:28

USER:

COMMENTS: _____

** SIMULATION : Run 05 **

CHICAGO STORM	IDF curve parameters: A=3158.000 B= 15.000 C= 0.933
Ptotal= 84.55 mm	used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.27	6.17	1.47	12.17	1.22	18.17	0.44
0.33	0.28	6.33	1.67	12.33	1.17	18.33	0.43
0.50	0.29	6.50	1.91	12.50	1.11	18.50	0.42
0.67	0.29	6.67	2.24	12.67	1.07	18.67	0.41
0.83	0.30	6.83	2.68	12.83	1.02	18.83	0.41
1.00	0.31	7.00	3.31	13.00	0.98	19.00	0.40
1.17	0.32	7.17	4.28	13.17	0.94	19.17	0.39
1.33	0.33	7.33	5.90	13.33	0.91	19.33	0.39
1.50	0.34	7.50	9.00	13.50	0.88	19.50	0.38
1.67	0.34	7.67	16.53	13.67	0.85	19.67	0.37
1.83	0.35	7.83	47.76	13.83	0.82	19.83	0.37
2.00	0.37	8.00	156.47	14.00	0.79	20.00	0.36
2.17	0.38	8.17	63.86	14.17	0.77	20.17	0.36
2.33	0.39	8.33	31.72	14.33	0.74	20.33	0.35
2.50	0.40	8.50	19.56	14.50	0.72	20.50	0.35
2.67	0.42	8.67	13.56	14.67	0.70	20.67	0.34
2.83	0.43	8.83	10.11	14.83	0.68	20.83	0.34
3.00	0.45	9.00	7.92	15.00	0.66	21.00	0.33
3.17	0.46	9.17	6.44	15.17	0.64	21.17	0.33
3.33	0.48	9.33	5.38	15.33	0.63	21.33	0.32
3.50	0.50	9.50	4.59	15.50	0.61	21.50	0.32
3.67	0.52	9.67	3.99	15.67	0.60	21.67	0.32
3.83	0.55	9.83	3.51	15.83	0.58	21.83	0.31
4.00	0.57	10.00	3.13	16.00	0.57	22.00	0.31
4.17	0.60	10.17	2.81	16.17	0.56	22.17	0.30
4.33	0.63	10.33	2.55	16.33	0.54	22.33	0.30
4.50	0.67	10.50	2.33	16.50	0.53	22.50	0.30
4.67	0.71	10.67	2.15	16.67	0.52	22.67	0.29
4.83	0.75	10.83	1.99	16.83	0.51	22.83	0.29
5.00	0.80	11.00	1.85	17.00	0.50	23.00	0.29
5.17	0.86	11.17	1.72	17.17	0.49	23.17	0.28
5.33	0.92	11.33	1.62	17.33	0.48	23.33	0.28
5.50	1.00	11.50	1.52	17.50	0.47	23.50	0.28
5.67	1.09	11.67	1.43	17.67	0.46	23.67	0.27
5.83	1.19	11.83	1.36	17.83	0.45	23.83	0.27
6.00	1.32	12.00	1.29	18.00	0.44	24.00	0.27

CALIB STANDHYD (0600) ID= 1 DT= 5.0 min	Area (ha)= 28.20 Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.27	6.083	1.47	12.083	1.22	18.08	0.44
0.167	0.27	6.167	1.47	12.167	1.22	18.17	0.44
0.250	0.28	6.250	1.67	12.250	1.17	18.25	0.43
0.333	0.28	6.333	1.67	12.333	1.17	18.33	0.43

0.417	0.29	6.417	1.91	12.417	1.11	18.42	0.42
0.500	0.29	6.500	1.91	12.500	1.11	18.50	0.42
0.583	0.29	6.583	2.24	12.583	1.07	18.58	0.41
0.667	0.29	6.667	2.24	12.667	1.07	18.67	0.41
0.750	0.30	6.750	2.68	12.750	1.02	18.75	0.41
0.833	0.30	6.833	2.68	12.833	1.02	18.83	0.41
0.917	0.31	6.917	3.31	12.917	0.98	18.92	0.40
1.000	0.31	7.000	3.31	13.000	0.98	19.00	0.40
1.083	0.32	7.083	4.28	13.083	0.94	19.08	0.39
1.167	0.32	7.167	4.28	13.167	0.94	19.17	0.39
1.250	0.33	7.250	5.90	13.250	0.91	19.25	0.39
1.333	0.33	7.333	5.90	13.333	0.91	19.33	0.39
1.417	0.34	7.417	9.00	13.417	0.88	19.42	0.38
1.500	0.34	7.500	9.00	13.500	0.88	19.50	0.38
1.583	0.34	7.583	16.53	13.583	0.85	19.58	0.37
1.667	0.34	7.667	16.53	13.667	0.85	19.67	0.37
1.750	0.35	7.750	47.76	13.750	0.82	19.75	0.37
1.833	0.35	7.833	47.76	13.833	0.82	19.83	0.37
1.917	0.37	7.917	156.47	13.917	0.79	19.92	0.36
2.000	0.37	8.000	156.47	14.000	0.79	20.00	0.36
2.083	0.38	8.083	63.86	14.083	0.77	20.08	0.36
2.167	0.38	8.167	63.86	14.167	0.77	20.17	0.36
2.250	0.39	8.250	31.72	14.250	0.74	20.25	0.35
2.333	0.39	8.333	31.72	14.333	0.74	20.33	0.35
2.417	0.40	8.417	19.56	14.417	0.72	20.42	0.35
2.500	0.40	8.500	19.56	14.500	0.72	20.50	0.35
2.583	0.42	8.583	13.56	14.583	0.70	20.58	0.34
2.667	0.42	8.667	13.56	14.667	0.70	20.67	0.34
2.750	0.43	8.750	10.11	14.750	0.68	20.75	0.34
2.833	0.43	8.833	10.11	14.833	0.68	20.83	0.34
2.917	0.45	8.917	7.92	14.917	0.66	20.92	0.33
3.000	0.45	9.000	7.92	15.000	0.66	21.00	0.33
3.083	0.46	9.083	6.44	15.083	0.64	21.08	0.33
3.167	0.46	9.167	6.44	15.167	0.64	21.17	0.33
3.250	0.48	9.250	5.38	15.250	0.63	21.25	0.32
3.333	0.48	9.333	5.38	15.333	0.63	21.33	0.32
3.417	0.50	9.417	4.59	15.417	0.61	21.42	0.32
3.500	0.50	9.500	4.59	15.500	0.61	21.50	0.32
3.583	0.52	9.583	3.99	15.583	0.60	21.58	0.32
3.667	0.52	9.667	3.99	15.667	0.60	21.67	0.32
3.750	0.55	9.750	3.51	15.750	0.58	21.75	0.31
3.833	0.55	9.833	3.51	15.833	0.58	21.83	0.31
3.917	0.57	9.917	3.13	15.917	0.57	21.92	0.31
4.000	0.57	10.000	3.13	16.000	0.57	22.00	0.31
4.083	0.60	10.083	2.81	16.083	0.56	22.08	0.30
4.167	0.60	10.167	2.81	16.167	0.56	22.17	0.30
4.250	0.63	10.250	2.55	16.250	0.54	22.25	0.30
4.333	0.63	10.333	2.55	16.333	0.54	22.33	0.30
4.417	0.67	10.417	2.33	16.417	0.53	22.42	0.30
4.500	0.67	10.500	2.33	16.500	0.53	22.50	0.30
4.583	0.71	10.583	2.15	16.583	0.52	22.58	0.29
4.667	0.71	10.667	2.15	16.667	0.52	22.67	0.29
4.750	0.75	10.750	1.99	16.750	0.51	22.75	0.29
4.833	0.75	10.833	1.99	16.833	0.51	22.83	0.29
4.917	0.80	10.917	1.85	16.917	0.50	22.92	0.29
5.000	0.80	11.000	1.85	17.000	0.50	23.00	0.29
5.083	0.86	11.083	1.72	17.083	0.49	23.08	0.28
5.167	0.86	11.167	1.72	17.167	0.49	23.17	0.28
5.250	0.92	11.250	1.62	17.250	0.48	23.25	0.28
5.333	0.92	11.333	1.62	17.333	0.48	23.33	0.28
5.417	1.00	11.417	1.52	17.417	0.47	23.42	0.28
5.500	1.00	11.500	1.52	17.500	0.47	23.50	0.28
5.583	1.09	11.583	1.43	17.583	0.46	23.58	0.27

5.667	1.09	11.667	1.43	17.667	0.46	23.67	0.27
5.750	1.19	11.750	1.36	17.750	0.45	23.75	0.27
5.833	1.19	11.833	1.36	17.833	0.45	23.83	0.27
5.917	1.32	11.917	1.29	17.917	0.44	23.92	0.27
6.000	1.32	12.000	1.29	18.000	0.44	24.00	0.27

```
Max.Eff.Inten.(mm/hr)=     156.47         94.32
           over (min)        5.00         10.00
Storage Coeff.  (min)=       5.15 (ii)     9.35 (ii)
Unit Hyd. Tpeak (min)=       5.00         10.00
Unit Hyd. peak  (cms)=       0.21          0.12
                                                     *TOTALS*
PEAK FLOW       (cms)=       7.69          1.51        8.919 (iii)
TIME TO PEAK    (hrs)=       8.00          8.08        8.00
RUNOFF VOLUME    (mm)=      83.54         50.88       73.74
TOTAL RAINFALL   (mm)=      84.55         84.55       84.55
RUNOFF COEFFICIENT   =       0.99          0.60        0.87


  (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
       CN*  =  85.0    Ia = Dep. Storage  (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
      THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1601)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1690     1.7025
                          0.0090     0.6575   |   0.9840     1.9145

                             AREA     QPEAK      TPEAK        R.V.
                             (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0600)  28.200     8.919      8.00        73.74
   OUTFLOW: ID= 1 (  1601)  28.200     0.169     10.58        59.38

              PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.89
              TIME SHIFT OF PEAK FLOW        (min)=155.00
              MAXIMUM  STORAGE   USED       (ha.m.)=  1.7022

-------------------------------------------------------------------------------
===================================================================================
========================


      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
```


***** D E T A I L E D   O U T P U T *****


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  Output  filename:
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72-9cc6-4639-b7f4-eb9a2abc74c3\scenar


DATE: 08/09/2019                          TIME: 11:49:28

USER:


COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** SIMULATION : Run 07                       **
  ************************************************

--------------------
| CHICAGO STORM    |      IDF curve parameters: A=4688.000
| Ptotal=101.55 mm |                            B=  17.000
--------------------                            C=   0.962
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm  = 24.00 hrs
                          Storm time step    = 10.00 min
                          Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.21	6.17	1.46	12.17	1.18	18.17	0.36
0.33	0.22	6.33	1.68	12.33	1.11	18.33	0.35
0.50	0.22	6.50	1.97	12.50	1.06	18.50	0.34
0.67	0.23	6.67	2.35	12.67	1.00	18.67	0.34
0.83	0.24	6.83	2.89	12.83	0.96	18.83	0.33
1.00	0.24	7.00	3.67	13.00	0.91	19.00	0.32
1.17	0.25	7.17	4.88	13.17	0.87	19.17	0.32
1.33	0.26	7.33	6.96	13.33	0.83	19.33	0.31
1.50	0.27	7.50	11.02	13.50	0.80	19.50	0.31
1.67	0.27	7.67	21.03	13.67	0.77	19.67	0.30
1.83	0.28	7.83	62.12	13.83	0.74	19.83	0.30
2.00	0.29	8.00	196.54	14.00	0.71	20.00	0.29
2.17	0.30	8.17	83.09	14.17	0.69	20.17	0.29
2.33	0.31	8.33	41.25	14.33	0.66	20.33	0.28
2.50	0.33	8.50	25.07	14.50	0.64	20.50	0.28
2.67	0.34	8.67	17.06	14.67	0.62	20.67	0.27
2.83	0.35	8.83	12.48	14.83	0.60	20.83	0.27
3.00	0.37	9.00	9.60	15.00	0.58	21.00	0.26
3.17	0.38	9.17	7.66	15.17	0.56	21.17	0.26
3.33	0.40	9.33	6.29	15.33	0.54	21.33	0.26
3.50	0.42	9.50	5.28	15.50	0.53	21.50	0.25
3.67	0.44	9.67	4.51	15.67	0.51	21.67	0.25
3.83	0.47	9.83	3.91	15.83	0.50	21.83	0.25
4.00	0.49	10.00	3.44	16.00	0.49	22.00	0.24

4.17	0.52	10.17	3.05	16.17	0.47	22.17	0.24
4.33	0.55	10.33	2.73	16.33	0.46	22.33	0.24
4.50	0.59	10.50	2.47	16.50	0.45	22.50	0.23
4.67	0.63	10.67	2.24	16.67	0.44	22.67	0.23
4.83	0.67	10.83	2.05	16.83	0.43	22.83	0.23
5.00	0.72	11.00	1.89	17.00	0.42	23.00	0.22
5.17	0.78	11.17	1.75	17.17	0.41	23.17	0.22
5.33	0.85	11.33	1.62	17.33	0.40	23.33	0.22
5.50	0.93	11.50	1.51	17.50	0.39	23.50	0.21
5.67	1.03	11.67	1.41	17.67	0.38	23.67	0.21
5.83	1.14	11.83	1.33	17.83	0.37	23.83	0.21
6.00	1.28	12.00	1.25	18.00	0.37	24.00	0.21

```
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0600)|   Area    (ha)=  28.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     19.74          8.46
     Dep. Storage     (mm)=      1.00          5.00
     Average Slope     (%)=      1.00          2.00
     Length            (m)=    433.59         40.00
     Mannings n          =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.21	6.083	1.46	12.083	1.18	18.08	0.36
0.167	0.21	6.167	1.46	12.167	1.18	18.17	0.36
0.250	0.22	6.250	1.68	12.250	1.11	18.25	0.35
0.333	0.22	6.333	1.68	12.333	1.11	18.33	0.35
0.417	0.22	6.417	1.97	12.417	1.06	18.42	0.34
0.500	0.22	6.500	1.97	12.500	1.06	18.50	0.34
0.583	0.23	6.583	2.35	12.583	1.00	18.58	0.34
0.667	0.23	6.667	2.35	12.667	1.00	18.67	0.34
0.750	0.24	6.750	2.89	12.750	0.96	18.75	0.33
0.833	0.24	6.833	2.89	12.833	0.96	18.83	0.33
0.917	0.24	6.917	3.67	12.917	0.91	18.92	0.32
1.000	0.24	7.000	3.67	13.000	0.91	19.00	0.32
1.083	0.25	7.083	4.88	13.083	0.87	19.08	0.32
1.167	0.25	7.167	4.88	13.167	0.87	19.17	0.32
1.250	0.26	7.250	6.96	13.250	0.83	19.25	0.31
1.333	0.26	7.333	6.96	13.333	0.83	19.33	0.31
1.417	0.27	7.417	11.02	13.417	0.80	19.42	0.31
1.500	0.27	7.500	11.02	13.500	0.80	19.50	0.31
1.583	0.27	7.583	21.03	13.583	0.77	19.58	0.30
1.667	0.27	7.667	21.03	13.667	0.77	19.67	0.30
1.750	0.28	7.750	62.12	13.750	0.74	19.75	0.30
1.833	0.28	7.833	62.13	13.833	0.74	19.83	0.30
1.917	0.29	7.917	196.54	13.917	0.71	19.92	0.29
2.000	0.29	8.000	196.53	14.000	0.71	20.00	0.29
2.083	0.30	8.083	83.09	14.083	0.69	20.08	0.29
2.167	0.30	8.167	83.09	14.167	0.69	20.17	0.29
2.250	0.31	8.250	41.25	14.250	0.66	20.25	0.28
2.333	0.31	8.333	41.24	14.333	0.66	20.33	0.28
2.417	0.33	8.417	25.07	14.417	0.64	20.42	0.28
2.500	0.33	8.500	25.07	14.500	0.64	20.50	0.28

2.583	0.34	8.583	17.06	14.583	0.62	20.58	0.27
2.667	0.34	8.667	17.06	14.667	0.62	20.67	0.27
2.750	0.35	8.750	12.48	14.750	0.60	20.75	0.27
2.833	0.35	8.833	12.48	14.833	0.60	20.83	0.27
2.917	0.37	8.917	9.60	14.917	0.58	20.92	0.26
3.000	0.37	9.000	9.60	15.000	0.58	21.00	0.26
3.083	0.38	9.083	7.66	15.083	0.56	21.08	0.26
3.167	0.38	9.167	7.66	15.167	0.56	21.17	0.26
3.250	0.40	9.250	6.29	15.250	0.54	21.25	0.26
3.333	0.40	9.333	6.29	15.333	0.54	21.33	0.26
3.417	0.42	9.417	5.28	15.417	0.53	21.42	0.25
3.500	0.42	9.500	5.28	15.500	0.53	21.50	0.25
3.583	0.44	9.583	4.51	15.583	0.51	21.58	0.25
3.667	0.44	9.667	4.51	15.667	0.51	21.67	0.25
3.750	0.47	9.750	3.91	15.750	0.50	21.75	0.25
3.833	0.47	9.833	3.91	15.833	0.50	21.83	0.25
3.917	0.49	9.917	3.44	15.917	0.49	21.92	0.24
4.000	0.49	10.000	3.44	16.000	0.49	22.00	0.24
4.083	0.52	10.083	3.05	16.083	0.47	22.08	0.24
4.167	0.52	10.167	3.05	16.167	0.47	22.17	0.24
4.250	0.55	10.250	2.73	16.250	0.46	22.25	0.24
4.333	0.55	10.333	2.73	16.333	0.46	22.33	0.24
4.417	0.59	10.417	2.47	16.417	0.45	22.42	0.23
4.500	0.59	10.500	2.47	16.500	0.45	22.50	0.23
4.583	0.63	10.583	2.24	16.583	0.44	22.58	0.23
4.667	0.63	10.667	2.24	16.667	0.44	22.67	0.23
4.750	0.67	10.750	2.05	16.750	0.43	22.75	0.23
4.833	0.67	10.833	2.05	16.833	0.43	22.83	0.23
4.917	0.72	10.917	1.89	16.917	0.42	22.92	0.22
5.000	0.72	11.000	1.89	17.000	0.42	23.00	0.22
5.083	0.78	11.083	1.75	17.083	0.41	23.08	0.22
5.167	0.78	11.167	1.75	17.167	0.41	23.17	0.22
5.250	0.85	11.250	1.62	17.250	0.40	23.25	0.22
5.333	0.85	11.333	1.62	17.333	0.40	23.33	0.22
5.417	0.93	11.417	1.51	17.417	0.39	23.42	0.21
5.500	0.93	11.500	1.51	17.500	0.39	23.50	0.21
5.583	1.03	11.583	1.41	17.583	0.38	23.58	0.21
5.667	1.03	11.667	1.41	17.667	0.38	23.67	0.21
5.750	1.14	11.750	1.33	17.750	0.37	23.75	0.21
5.833	1.14	11.833	1.33	17.833	0.37	23.83	0.21
5.917	1.28	11.917	1.25	17.917	0.37	23.92	0.21
6.000	1.28	12.000	1.25	18.000	0.37	24.00	0.21

Max.Eff.Inten.(mm/hr)=		196.54	130.58
over (min)		5.00	10.00
Storage Coeff. (min)=		4.70 (ii)	8.54 (ii)
Unit Hyd. Tpeak (min)=		5.00	10.00
Unit Hyd. peak (cms)=		0.22	0.12
			TOTALS
PEAK FLOW	(cms)=	9.87	2.18	11.674 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	100.55	65.94	90.17
TOTAL RAINFALL	(mm)=	101.55	101.55	101.55
RUNOFF COEFFICIENT	=	0.99	0.65	0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2---> OUT= 1				
DT= 5.0 min	0.0000	0.0000	0.1690	1.7025
	0.0090	0.6575	0.9840	1.9145

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	11.674	8.00	90.17
OUTFLOW: ID= 1 (1601)	28.200	0.979	8.92	75.82

PEAK FLOW REDUCTION [Qout/Qin](%)= 8.38
TIME SHIFT OF PEAK FLOW (min)= 55.00
MAXIMUM STORAGE USED (ha.m.)= 1.9145

FINISH

APPENDIX B21

SWM POND #6 DETAIL DESIGN

– 12 HOUR ASE STORM (BLOOR, TRCA)

```
 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
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\a0a63ee6-ea0f-4483-946e-0c5cb2690fd2\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\a0a63ee6-ea0f-4483-946e-0c5cb2690fd2\scenar

DATE: 08/09/2019 TIME: 11:50:18

USER:

COMMENTS: _____

****
** SIMULATION : Run 08 **
****

READ STORM | Filename: C:\Users\zhouj\AppData\Local\Temp\e393f547-c8c3-4618-b160-5e36bbe834d0\b4db7d30
Ptotal= 42.00 mm | Comments: 2 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	7.14	6.75	2.94	10.00	0.42
0.50	0.42	3.75	7.14	7.00	2.94	10.25	0.42
0.75	0.42	4.00	7.14	7.25	2.94	10.50	0.42
1.00	0.42	4.25	7.14	7.50	1.68	10.75	0.42
1.25	0.42	4.50	19.32	7.75	1.68	11.00	0.42
1.50	0.42	4.75	19.32	8.00	1.68	11.25	0.42
1.75	0.42	5.00	19.32	8.25	1.68	11.50	0.42
2.00	0.42	5.25	19.32	8.50	0.84	11.75	0.42

2.25	0.42	5.50	5.46	8.75	0.84	12.00	0.42
2.50	2.52	5.75	5.46	9.00	0.84	12.25	0.42
2.75	2.52	6.00	5.46	9.25	0.84		
3.00	2.52	6.25	5.46	9.50	0.42		
3.25	2.52	6.50	2.94	9.75	0.42		

CALIB | STANDHYD (0600) | ID= 1 DT= 5.0 min | Area (ha)= 28.20 | Total Imp(%)= 70.00 | Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	2.52	6.250	5.46	9.33	0.42
0.167	0.00	3.250	2.52	6.333	2.94	9.42	0.42
0.250	0.00	3.333	7.14	6.417	2.94	9.50	0.42
0.333	0.42	3.417	7.14	6.500	2.94	9.58	0.42
0.417	0.42	3.500	7.14	6.583	2.94	9.67	0.42
0.500	0.42	3.583	7.14	6.667	2.94	9.75	0.42
0.583	0.42	3.667	7.14	6.750	2.94	9.83	0.42
0.667	0.42	3.750	7.14	6.833	2.94	9.92	0.42
0.750	0.42	3.833	7.14	6.917	2.94	10.00	0.42
0.833	0.42	3.917	7.14	7.000	2.94	10.08	0.42
0.917	0.42	4.000	7.14	7.083	2.94	10.17	0.42
1.000	0.42	4.083	7.14	7.167	2.94	10.25	0.42
1.083	0.42	4.167	7.14	7.250	2.94	10.33	0.42
1.167	0.42	4.250	7.14	7.333	1.68	10.42	0.42
1.250	0.42	4.333	19.32	7.417	1.68	10.50	0.42
1.333	0.42	4.417	19.32	7.500	1.68	10.58	0.42
1.417	0.42	4.500	19.32	7.583	1.68	10.67	0.42
1.500	0.42	4.583	19.32	7.667	1.68	10.75	0.42
1.583	0.42	4.667	19.32	7.750	1.68	10.83	0.42
1.667	0.42	4.750	19.32	7.833	1.68	10.92	0.42
1.750	0.42	4.833	19.32	7.917	1.68	11.00	0.42
1.833	0.42	4.917	19.32	8.000	1.68	11.08	0.42
1.917	0.42	5.000	19.32	8.083	1.68	11.17	0.42
2.000	0.42	5.083	19.32	8.167	1.68	11.25	0.42
2.083	0.42	5.167	19.32	8.250	1.68	11.33	0.42
2.167	0.42	5.250	19.32	8.333	0.84	11.42	0.42
2.250	0.42	5.333	5.46	8.417	0.84	11.50	0.42
2.333	2.52	5.417	5.46	8.500	0.84	11.58	0.42
2.417	2.52	5.500	5.46	8.583	0.84	11.67	0.42
2.500	2.52	5.583	5.46	8.667	0.84	11.75	0.42
2.583	2.52	5.667	5.46	8.750	0.84	11.83	0.42
2.667	2.52	5.750	5.46	8.833	0.84	11.92	0.42
2.750	2.52	5.833	5.46	8.917	0.84	12.00	0.42
2.833	2.52	5.917	5.46	9.000	0.84	12.08	0.42
2.917	2.52	6.000	5.46	9.083	0.84	12.17	0.42
3.000	2.52	6.083	5.46	9.167	0.84	12.25	0.42
3.083	2.52	6.167	5.46	9.250	0.84		

Max.Eff.Inten.(mm/hr)=	19.32	10.50	
over (min)	10.00	30.00	
Storage Coeff. (min)=	11.89 (ii)	29.27 (ii)	
Unit Hyd. Tpeak (min)=	10.00	30.00	
Unit Hyd. peak (cms)=	0.10	0.04	
			TOTALS
PEAK FLOW (cms)=	1.05	0.17	1.209 (iii)
TIME TO PEAK (hrs)=	5.25	5.50	5.25
RUNOFF VOLUME (mm)=	41.00	16.73	33.72
TOTAL RAINFALL (mm)=	42.00	42.00	42.00
RUNOFF COEFFICIENT =	0.98	0.40	0.80

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601) | IN= 2---> OUT= 1 | DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	0.2056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	1.209	5.25	33.72
OUTFLOW: ID= 1 (1601)	28.200	0.094	8.50	32.58

PEAK FLOW REDUCTION [Qout/Qin](%)= 7.77
TIME SHIFT OF PEAK FLOW (min)=195.00
MAXIMUM STORAGE USED (ha.m.)= 0.8086


```
 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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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
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Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\d836aa57-4cc2-4c4d-9c51-014e71969f38\scenar

DATE: 08/09/2019 TIME: 11:50:18

USER:

COMMENTS: _____

****
** SIMULATION : Run 09 **
****

READ STORM | Filename: C:\Users\zhouj\AppData\Local\Temp\e393f547-c8c3-4618-b160-5e36bbe834d0\a3936b4f
Ptotal= 54.38 mm | Comments: 5 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	9.25	6.75	3.81	10.00	0.54
0.50	0.54	3.75	9.25	7.00	3.81	10.25	0.54
0.75	0.54	4.00	9.25	7.25	3.81	10.50	0.54
1.00	0.54	4.25	9.25	7.50	2.18	10.75	0.54
1.25	0.54	4.50	25.02	7.75	2.18	11.00	0.54
1.50	0.54	4.75	25.02	8.00	2.18	11.25	0.54
1.75	0.54	5.00	25.02	8.25	2.18	11.50	0.54
2.00	0.54	5.25	25.02	8.50	1.09	11.75	0.54
2.25	0.54	5.50	7.07	8.75	1.09	12.00	0.54
2.50	3.26	5.75	7.07	9.00	1.09	12.25	0.54
2.75	3.26	6.00	7.07	9.25	1.09		
3.00	3.26	6.25	7.07	9.50	0.54		
3.25	3.26	6.50	3.81	9.75	0.54		

CALIB | STANDHYD (0600) | ID= 1 DT= 5.0 min | Area (ha)= 28.20 | Total Imp(%)= 70.00 | Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00

Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	3.26	6.250	7.07	9.33	0.54
0.167	0.00	3.250	3.26	6.333	3.81	9.42	0.54
0.250	0.00	3.333	9.25	6.417	3.81	9.50	0.54
0.333	0.54	3.417	9.25	6.500	3.81	9.58	0.54
0.417	0.54	3.500	9.25	6.583	3.81	9.67	0.54
0.500	0.54	3.583	9.25	6.667	3.81	9.75	0.54
0.583	0.54	3.667	9.25	6.750	3.81	9.83	0.54
0.667	0.54	3.750	9.25	6.833	3.81	9.92	0.54
0.750	0.54	3.833	9.25	6.917	3.81	10.00	0.54
0.833	0.54	3.917	9.25	7.000	3.81	10.08	0.54
0.917	0.54	4.000	9.25	7.083	3.81	10.17	0.54
1.000	0.54	4.083	9.25	7.167	3.81	10.25	0.54
1.083	0.54	4.167	9.25	7.250	3.81	10.33	0.54
1.167	0.54	4.250	9.25	7.333	2.18	10.42	0.54
1.250	0.54	4.333	25.02	7.417	2.18	10.50	0.54
1.333	0.54	4.417	25.02	7.500	2.18	10.58	0.54
1.417	0.54	4.500	25.02	7.583	2.18	10.67	0.54
1.500	0.54	4.583	25.02	7.667	2.18	10.75	0.54
1.583	0.54	4.667	25.02	7.750	2.18	10.83	0.54
1.667	0.54	4.750	25.02	7.833	2.18	10.92	0.54
1.750	0.54	4.833	25.02	7.917	2.18	11.00	0.54
1.833	0.54	4.917	25.02	8.000	2.18	11.08	0.54
1.917	0.54	5.000	25.02	8.083	2.18	11.17	0.54
2.000	0.54	5.083	25.02	8.167	2.18	11.25	0.54
2.083	0.54	5.167	25.02	8.250	2.18	11.33	0.54
2.167	0.54	5.250	25.02	8.333	1.09	11.42	0.54
2.250	0.54	5.333	7.07	8.417	1.09	11.50	0.54
2.333	3.26	5.417	7.07	8.500	1.09	11.58	0.54
2.417	3.26	5.500	7.07	8.583	1.09	11.67	0.54
2.500	3.26	5.583	7.07	8.667	1.09	11.75	0.54
2.583	3.26	5.667	7.07	8.750	1.09	11.83	0.54
2.667	3.26	5.750	7.07	8.833	1.09	11.92	0.54
2.750	3.26	5.833	7.07	8.917	1.09	12.00	0.54
2.833	3.26	5.917	7.07	9.000	1.09	12.08	0.54
2.917	3.26	6.000	7.07	9.083	1.09	12.17	0.54
3.000	3.26	6.083	7.07	9.167	1.09	12.25	0.54
3.083	3.26	6.167	7.07	9.250	1.09		

Max.Eff.Inten.(mm/hr)=		25.02	16.14	
over (min)		10.00	30.00	
Storage Coeff. (min)=		10.72 (ii)	25.36 (ii)	
Unit Hyd. Tpeak (min)=		10.00	30.00	
Unit Hyd. peak (cms)=		0.11	0.04	
				TOTALS
PEAK FLOW	(cms)=	1.37	0.28	1.630 (iii)
TIME TO PEAK	(hrs)=	5.25	5.42	5.25
RUNOFF VOLUME	(mm)=	53.38	25.88	45.13
TOTAL RAINFALL	(mm)=	54.38	54.38	54.38
RUNOFF COEFFICIENT	=	0.98	0.48	0.83

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)				
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1513	1.3800
	0.0101	0.1474	0.1574	1.4914
	0.0156	0.3067	0.1634	1.6079
	0.0196	0.4784	0.1691	1.7243
	0.0229	0.6609	0.2060	1.8408
	0.1155	0.8534	0.5843	1.9573
	0.1235	0.9547	0.8855	2.0738
	0.1310	1.0560	2.0056	2.1902
	0.1381	1.1623	6.5687	2.4232
	0.1448	1.2686	13.0517	2.6562

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)		28.200	1.630	5.25	45.13
OUTFLOW: ID= 1 (1601)		28.200	0.130	8.42	43.84
PEAK FLOW REDUCTION [Qout/Qin](%)= 7.99					
TIME SHIFT OF PEAK FLOW			(min)=190.00		
MAXIMUM STORAGE USED			(ha.m.)= 1.0459		

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

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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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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\5efe3129-d16c-4d83-9ca9-6f32dbfd911d\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\5efe3129-d16c-4d83-9ca9-6f32dbfd911d\scenar

DATE: 08/09/2019 TIME: 11:50:18

USER:

COMMENTS: _____

** SIMULATION : Run 10 **

READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\e393f547-c8c3-4618-b160-5e36bbe834d0\ce92e289
Ptotal= 62.71 mm	Comments: 10 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	10.66	6.75	4.39	10.00	0.63
0.50	0.63	3.75	10.66	7.00	4.39	10.25	0.63
0.75	0.63	4.00	10.66	7.25	4.39	10.50	0.63
1.00	0.63	4.25	10.66	7.50	2.51	10.75	0.63
1.25	0.63	4.50	28.84	7.75	2.51	11.00	0.63
1.50	0.63	4.75	28.84	8.00	2.51	11.25	0.63
1.75	0.63	5.00	28.84	8.25	2.51	11.50	0.63
2.00	0.63	5.25	28.84	8.50	1.25	11.75	0.63
2.25	0.63	5.50	8.15	8.75	1.25	12.00	0.63
2.50	3.76	5.75	8.15	9.00	1.25	12.25	0.63
2.75	3.76	6.00	8.15	9.25	1.25		
3.00	3.76	6.25	8.15	9.50	0.63		
3.25	3.76	6.50	4.39	9.75	0.63		

CALIB			
STANDHYD (0600)	Area (ha)= 28.20		
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00	Dir. Conn.(%)= 70.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)= 19.74	8.46	
Dep. Storage	(mm)= 1.00	5.00	
Average Slope	(%)= 1.00	2.00	
Length	(m)= 433.59	40.00	
Mannings n	= 0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	3.76	6.250	8.15	9.33	0.63
0.167	0.00	3.250	3.76	6.333	4.39	9.42	0.63
0.250	0.00	3.333	10.66	6.417	4.39	9.50	0.63
0.333	0.63	3.417	10.66	6.500	4.39	9.58	0.63
0.417	0.63	3.500	10.66	6.583	4.39	9.67	0.63
0.500	0.63	3.583	10.66	6.667	4.39	9.75	0.63

0.583	0.63	3.667	10.66	6.750	4.39	9.83	0.63
0.667	0.63	3.750	10.66	6.833	4.39	9.92	0.63
0.750	0.63	3.833	10.66	6.917	4.39	10.00	0.63
0.833	0.63	3.917	10.66	7.000	4.39	10.08	0.63
0.917	0.63	4.000	10.66	7.083	4.39	10.17	0.63
1.000	0.63	4.083	10.66	7.167	4.39	10.25	0.63
1.083	0.63	4.167	10.66	7.250	4.39	10.33	0.63
1.167	0.63	4.250	10.66	7.333	2.51	10.42	0.63
1.250	0.63	4.333	28.84	7.417	2.51	10.50	0.63
1.333	0.63	4.417	28.84	7.500	2.51	10.58	0.63
1.417	0.63	4.500	28.84	7.583	2.51	10.67	0.63
1.500	0.63	4.583	28.84	7.667	2.51	10.75	0.63
1.583	0.63	4.667	28.84	7.750	2.51	10.83	0.63
1.667	0.63	4.750	28.84	7.833	2.51	10.92	0.63
1.750	0.63	4.833	28.84	7.917	2.51	11.00	0.63
1.833	0.63	4.917	28.84	8.000	2.51	11.08	0.63
1.917	0.63	5.000	28.84	8.083	2.51	11.17	0.63
2.000	0.63	5.083	28.84	8.167	2.51	11.25	0.63
2.083	0.63	5.167	28.84	8.250	2.51	11.33	0.63
2.167	0.63	5.250	28.84	8.333	1.25	11.42	0.63
2.250	0.63	5.333	8.15	8.417	1.25	11.50	0.63
2.333	3.76	5.417	8.15	8.500	1.25	11.58	0.63
2.417	3.76	5.500	8.15	8.583	1.25	11.67	0.63
2.500	3.76	5.583	8.15	8.667	1.25	11.75	0.63
2.583	3.76	5.667	8.15	8.750	1.25	11.83	0.63
2.667	3.76	5.750	8.15	8.833	1.25	11.92	0.63
2.750	3.76	5.833	8.15	8.917	1.25	12.00	0.63
2.833	3.76	5.917	8.15	9.000	1.25	12.08	0.63
2.917	3.76	6.000	8.15	9.083	1.25	12.17	0.63
3.000	3.76	6.083	8.15	9.167	1.25	12.25	0.63
3.083	3.76	6.167	8.15	9.250	1.25		

Max.Eff.Inten.(mm/hr)=		28.84	19.93	
over (min)		10.00	25.00	
Storage Coeff. (min)=		10.13 (ii)	23.58 (ii)	
Unit Hyd. Tpeak (min)=		10.00	25.00	
Unit Hyd. peak (cms)=		0.11	0.05	
				TOTALS
PEAK FLOW	(cms)=	1.58	0.37	1.933 (iii)
TIME TO PEAK	(hrs)=	5.25	5.33	5.25
RUNOFF VOLUME	(mm)=	61.71	32.48	52.94
TOTAL RAINFALL	(mm)=	62.71	62.71	62.71
RUNOFF COEFFICIENT	=	0.98	0.52	0.84

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)				
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1513	1.3800
	0.0101	0.1474	0.1574	1.4914
	0.0156	0.3067	0.1634	1.6079
	0.0196	0.4784	0.1691	1.7243
	0.0229	0.6609	0.2060	1.8408
	0.1155	0.8534	0.5843	1.9573

	0.1235	0.9547	0.8855	2.0738
	0.1310	1.0560	2.0056	2.1902
	0.1381	1.1623	6.5687	2.4232
	0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	1.933	5.25	52.94
OUTFLOW: ID= 1 (1601)	28.200	0.142	8.50	51.52

PEAK FLOW REDUCTION [Qout/Qin](%)= 7.37
TIME SHIFT OF PEAK FLOW (min)=195.00
MAXIMUM STORAGE USED (ha.m.)= 1.2316

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

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\4f566f79-9531-4984-a58d-95e438ba117a\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\4f566f79-9531-4984-a58d-95e438ba117a\scenar

DATE: 08/09/2019 TIME: 11:50:18

USER:

COMMENTS: _____

** SIMULATION : Run 11 **

READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\e393f547-c8c3-4618-b160-5e36bbe834d0\66c03f93
Ptotal= 73.10 mm	Comments: 25 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	12.43	6.75	5.12	10.00	0.73
0.50	0.73	3.75	12.43	7.00	5.12	10.25	0.73
0.75	0.73	4.00	12.43	7.25	5.12	10.50	0.73
1.00	0.73	4.25	12.43	7.50	2.92	10.75	0.73
1.25	0.73	4.50	33.63	7.75	2.92	11.00	0.73
1.50	0.73	4.75	33.63	8.00	2.92	11.25	0.73
1.75	0.73	5.00	33.63	8.25	2.92	11.50	0.73
2.00	0.73	5.25	33.63	8.50	1.46	11.75	0.73
2.25	0.73	5.50	9.50	8.75	1.46	12.00	0.73
2.50	4.39	5.75	9.50	9.00	1.46	12.25	0.73
2.75	4.39	6.00	9.50	9.25	1.46		
3.00	4.39	6.25	9.50	9.50	0.73		
3.25	4.39	6.50	5.12	9.75	0.73		

CALIB
STANDHYD (0600)
ID= 1 DT= 5.0 min

Area (ha)= 28.20
Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	4.39	6.250	9.50	9.33	0.73
0.167	0.00	3.250	4.39	6.333	5.12	9.42	0.73
0.250	0.00	3.333	12.43	6.417	5.12	9.50	0.73
0.333	0.73	3.417	12.43	6.500	5.12	9.58	0.73
0.417	0.73	3.500	12.43	6.583	5.12	9.67	0.73
0.500	0.73	3.583	12.43	6.667	5.12	9.75	0.73
0.583	0.73	3.667	12.43	6.750	5.12	9.83	0.73
0.667	0.73	3.750	12.43	6.833	5.12	9.92	0.73
0.750	0.73	3.833	12.43	6.917	5.12	10.00	0.73
0.833	0.73	3.917	12.43	7.000	5.12	10.08	0.73
0.917	0.73	4.000	12.43	7.083	5.12	10.17	0.73
1.000	0.73	4.083	12.43	7.167	5.12	10.25	0.73
1.083	0.73	4.167	12.43	7.250	5.12	10.33	0.73
1.167	0.73	4.250	12.43	7.333	2.92	10.42	0.73
1.250	0.73	4.333	33.63	7.417	2.92	10.50	0.73
1.333	0.73	4.417	33.63	7.500	2.92	10.58	0.73
1.417	0.73	4.500	33.63	7.583	2.92	10.67	0.73
1.500	0.73	4.583	33.63	7.667	2.92	10.75	0.73
1.583	0.73	4.667	33.63	7.750	2.92	10.83	0.73
1.667	0.73	4.750	33.63	7.833	2.92	10.92	0.73
1.750	0.73	4.833	33.63	7.917	2.92	11.00	0.73
1.833	0.73	4.917	33.63	8.000	2.92	11.08	0.73

1.917	0.73	5.000	33.63	8.083	2.92	11.17	0.73
2.000	0.73	5.083	33.63	8.167	2.92	11.25	0.73
2.083	0.73	5.167	33.63	8.250	2.92	11.33	0.73
2.167	0.73	5.250	33.63	8.333	1.46	11.42	0.73
2.250	0.73	5.333	9.50	8.417	1.46	11.50	0.73
2.333	4.39	5.417	9.50	8.500	1.46	11.58	0.73
2.417	4.39	5.500	9.50	8.583	1.46	11.67	0.73
2.500	4.39	5.583	9.50	8.667	1.46	11.75	0.73
2.583	4.39	5.667	9.50	8.750	1.46	11.83	0.73
2.667	4.39	5.750	9.50	8.833	1.46	11.92	0.73
2.750	4.39	5.833	9.50	8.917	1.46	12.00	0.73
2.833	4.39	5.917	9.50	9.000	1.46	12.08	0.73
2.917	4.39	6.000	9.50	9.083	1.46	12.17	0.73
3.000	4.39	6.083	9.50	9.167	1.46	12.25	0.73
3.083	4.39	6.167	9.50	9.250	1.46		

Max.Eff.Inten.(mm/hr)=		33.63	24.79
over (min)		10.00	25.00
Storage Coeff. (min)=		9.53 (ii)	21.86 (ii)
Unit Hyd. Tpeak (min)=		10.00	25.00
Unit Hyd. peak (cms)=		0.12	0.05
			TOTALS
PEAK FLOW	(cms)=	1.84	0.47	2.303 (iii)
TIME TO PEAK	(hrs)=	5.25	5.33	5.25
RUNOFF VOLUME	(mm)=	72.10	41.07	62.79
TOTAL RAINFALL	(mm)=	73.10	73.10	73.10
RUNOFF COEFFICIENT	=	0.99	0.56	0.86

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	2.303	5.25	62.79
OUTFLOW: ID= 1 (1601)	28.200	0.156	8.50	61.20

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.79
TIME SHIFT OF PEAK FLOW (min)=195.00
MAXIMUM STORAGE USED (ha.m.)= 1.4713

V V I SSSSS U U A L
V V I SS U U A A L
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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

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\e6ca734f-4265-4d11-a6a5-3a4c0f115123\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\e6ca734f-4265-4d11-a6a5-3a4c0f115123\scenar

DATE: 08/09/2019 TIME: 11:50:18

USER:

COMMENTS: _____

** SIMULATION : Run 12 **

READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\e393f547-c8c3-4618-b160-5e36bbe834d0\5bb86b2b
Ptotal= 80.82 mm	Comments: 50 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	13.74	6.75	5.66	10.00	0.81
0.50	0.81	3.75	13.74	7.00	5.66	10.25	0.81
0.75	0.81	4.00	13.74	7.25	5.66	10.50	0.81
1.00	0.81	4.25	13.74	7.50	3.23	10.75	0.81
1.25	0.81	4.50	37.17	7.75	3.23	11.00	0.81
1.50	0.81	4.75	37.17	8.00	3.23	11.25	0.81
1.75	0.81	5.00	37.17	8.25	3.23	11.50	0.81
2.00	0.81	5.25	37.17	8.50	1.62	11.75	0.81
2.25	0.81	5.50	10.50	8.75	1.62	12.00	0.81

2.50	4.85	5.75	10.50	9.00	1.62	12.25	0.81
2.75	4.85	6.00	10.50	9.25	1.62		
3.00	4.85	6.25	10.50	9.50	0.81		
3.25	4.85	6.50	5.66	9.75	0.81		

CALIB	
STANDHYD (0600)	Area (ha)= 28.20
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	4.85	6.250	10.50	9.33	0.81
0.167	0.00	3.250	4.85	6.333	5.66	9.42	0.81
0.250	0.00	3.333	13.74	6.417	5.66	9.50	0.81
0.333	0.81	3.417	13.74	6.500	5.66	9.58	0.81
0.417	0.81	3.500	13.74	6.583	5.66	9.67	0.81
0.500	0.81	3.583	13.74	6.667	5.66	9.75	0.81
0.583	0.81	3.667	13.74	6.750	5.66	9.83	0.81
0.667	0.81	3.750	13.74	6.833	5.66	9.92	0.81
0.750	0.81	3.833	13.74	6.917	5.66	10.00	0.81
0.833	0.81	3.917	13.74	7.000	5.66	10.08	0.81
0.917	0.81	4.000	13.74	7.083	5.66	10.17	0.81
1.000	0.81	4.083	13.74	7.167	5.66	10.25	0.81
1.083	0.81	4.167	13.74	7.250	5.66	10.33	0.81
1.167	0.81	4.250	13.74	7.333	3.23	10.42	0.81
1.250	0.81	4.333	37.17	7.417	3.23	10.50	0.81
1.333	0.81	4.417	37.17	7.500	3.23	10.58	0.81
1.417	0.81	4.500	37.17	7.583	3.23	10.67	0.81
1.500	0.81	4.583	37.17	7.667	3.23	10.75	0.81
1.583	0.81	4.667	37.17	7.750	3.23	10.83	0.81
1.667	0.81	4.750	37.17	7.833	3.23	10.92	0.81
1.750	0.81	4.833	37.17	7.917	3.23	11.00	0.81
1.833	0.81	4.917	37.17	8.000	3.23	11.08	0.81
1.917	0.81	5.000	37.17	8.083	3.23	11.17	0.81
2.000	0.81	5.083	37.17	8.167	3.23	11.25	0.81
2.083	0.81	5.167	37.17	8.250	3.23	11.33	0.81
2.167	0.81	5.250	37.17	8.333	1.62	11.42	0.81
2.250	0.81	5.333	10.50	8.417	1.62	11.50	0.81
2.333	4.85	5.417	10.50	8.500	1.62	11.58	0.81
2.417	4.85	5.500	10.50	8.583	1.62	11.67	0.81
2.500	4.85	5.583	10.50	8.667	1.62	11.75	0.81
2.583	4.85	5.667	10.50	8.750	1.62	11.83	0.81
2.667	4.85	5.750	10.50	8.833	1.62	11.92	0.81
2.750	4.85	5.833	10.50	8.917	1.62	12.00	0.81
2.833	4.85	5.917	10.50	9.000	1.62	12.08	0.81
2.917	4.85	6.000	10.50	9.083	1.62	12.17	0.81
3.000	4.85	6.083	10.50	9.167	1.62	12.25	0.81
3.083	4.85	6.167	10.50	9.250	1.62		

Max.Eff.Inten.(mm/hr)=	37.17	28.43	
over (min)	10.00	25.00	
Storage Coeff. (min)=	9.15 (ii)	20.82 (ii)	
Unit Hyd. Tpeak (min)=	10.00	25.00	
Unit Hyd. peak (cms)=	0.12	0.05	
			TOTALS
PEAK FLOW (cms)=	2.04	0.55	2.579 (iii)
TIME TO PEAK (hrs)=	5.25	5.33	5.25
RUNOFF VOLUME (mm)=	79.82	47.65	70.17
TOTAL RAINFALL (mm)=	80.82	80.82	80.82
RUNOFF COEFFICIENT =	0.99	0.59	0.87

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)	
IN= 2---> OUT= 1	
DT= 5.0 min	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	2.579	5.25	70.17
OUTFLOW: ID= 1 (1601)	28.200	0.166	8.58	68.45

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.42
TIME SHIFT OF PEAK FLOW (min)=200.00
MAXIMUM STORAGE USED (ha.m.)= 1.6524

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      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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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\062abb94-63ab-4857-b943-0b336c1ca02a\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\062abb94-63ab-4857-b943-0b336c1ca02a\scenar

DATE: 08/09/2019 TIME: 11:50:18

USER:

COMMENTS: _____

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**************************************************
** SIMULATION : Run 13                          **
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READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\e393f547-c8c3-4618-b160-5e36bbe834d0\32ebeffd
Ptotal= 88.54 mm	Comments: 100 Year 12 Hour AES (Bloor, TRCA)

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	15.05	6.75	6.20	10.00	0.89
0.50	0.89	3.75	15.05	7.00	6.20	10.25	0.89
0.75	0.89	4.00	15.05	7.25	6.20	10.50	0.89
1.00	0.89	4.25	15.05	7.50	3.54	10.75	0.89
1.25	0.89	4.50	40.71	7.75	3.54	11.00	0.89
1.50	0.89	4.75	40.71	8.00	3.54	11.25	0.89
1.75	0.89	5.00	40.71	8.25	3.54	11.50	0.89
2.00	0.89	5.25	40.71	8.50	1.77	11.75	0.89
2.25	0.89	5.50	11.51	8.75	1.77	12.00	0.89
2.50	5.31	5.75	11.51	9.00	1.77	12.25	0.89
2.75	5.31	6.00	11.51	9.25	1.77		
3.00	5.31	6.25	11.51	9.50	0.89		
3.25	5.31	6.50	6.20	9.75	0.89		

CALIB	
STANDHYD (0600)	Area (ha)= 28.20
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00

Length (m)=	433.59	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	3.167	5.31	6.250	11.51	9.33	0.89
0.167	0.00	3.250	5.31	6.333	6.20	9.42	0.89
0.250	0.00	3.333	15.05	6.417	6.20	9.50	0.89
0.333	0.89	3.417	15.05	6.500	6.20	9.58	0.89
0.417	0.89	3.500	15.05	6.583	6.20	9.67	0.89
0.500	0.89	3.583	15.05	6.667	6.20	9.75	0.89
0.583	0.89	3.667	15.05	6.750	6.20	9.83	0.89
0.667	0.89	3.750	15.05	6.833	6.20	9.92	0.89
0.750	0.89	3.833	15.05	6.917	6.20	10.00	0.89
0.833	0.89	3.917	15.05	7.000	6.20	10.08	0.89
0.917	0.89	4.000	15.05	7.083	6.20	10.17	0.89
1.000	0.89	4.083	15.05	7.167	6.20	10.25	0.89
1.083	0.89	4.167	15.05	7.250	6.20	10.33	0.89
1.167	0.89	4.250	15.05	7.333	3.54	10.42	0.89
1.250	0.89	4.333	40.71	7.417	3.54	10.50	0.89
1.333	0.89	4.417	40.71	7.500	3.54	10.58	0.89
1.417	0.89	4.500	40.71	7.583	3.54	10.67	0.89
1.500	0.89	4.583	40.71	7.667	3.54	10.75	0.89
1.583	0.89	4.667	40.71	7.750	3.54	10.83	0.89
1.667	0.89	4.750	40.71	7.833	3.54	10.92	0.89
1.750	0.89	4.833	40.71	7.917	3.54	11.00	0.89
1.833	0.89	4.917	40.71	8.000	3.54	11.08	0.89
1.917	0.89	5.000	40.71	8.083	3.54	11.17	0.89
2.000	0.89	5.083	40.71	8.167	3.54	11.25	0.89
2.083	0.89	5.167	40.71	8.250	3.54	11.33	0.89
2.167	0.89	5.250	40.71	8.333	1.77	11.42	0.89
2.250	0.89	5.333	11.51	8.417	1.77	11.50	0.89
2.333	5.31	5.417	11.51	8.500	1.77	11.58	0.89
2.417	5.31	5.500	11.51	8.583	1.77	11.67	0.89
2.500	5.31	5.583	11.51	8.667	1.77	11.75	0.89
2.583	5.31	5.667	11.51	8.750	1.77	11.83	0.89
2.667	5.31	5.750	11.51	8.833	1.77	11.92	0.89
2.750	5.31	5.833	11.51	8.917	1.77	12.00	0.89
2.833	5.31	5.917	11.51	9.000	1.77	12.08	0.89
2.917	5.31	6.000	11.51	9.083	1.77	12.17	0.89
3.000	5.31	6.083	11.51	9.167	1.77	12.25	0.89
3.083	5.31	6.167	11.51	9.250	1.77		

Max.Eff.Inten.(mm/hr)=	40.71	32.10	
over (min)	10.00	20.00	
Storage Coeff. (min)=	8.82 (ii)	19.94 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.12	0.06	
			TOTALS
PEAK FLOW (cms)=	2.23	0.65	2.874 (iii)
TIME TO PEAK (hrs)=	5.25	5.33	5.25
RUNOFF VOLUME (mm)=	87.54	54.37	77.59
TOTAL RAINFALL (mm)=	88.54	88.54	88.54
RUNOFF COEFFICIENT =	0.99	0.61	0.88

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601) IN= 2---> OUT= 1 DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1513	1.3800
	0.0101	0.1474	0.1574	1.4914
	0.0156	0.3067	0.1634	1.6079
	0.0196	0.4784	0.1691	1.7243
	0.0229	0.6609	0.2060	1.8408
	0.1155	0.8534	0.5843	1.9573
	0.1235	0.9547	0.8855	2.0738
	0.1310	1.0560	2.0056	2.1902
	0.1381	1.1623	6.5687	2.4232
	0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	2.874	5.25	77.59
OUTFLOW: ID= 1 (1601)	28.200	0.201	8.42	75.75

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.99
TIME SHIFT OF PEAK FLOW (min)=190.00
MAXIMUM STORAGE USED (ha.m.)= 1.8253

FINISH

APPENDIX B22

SWM POND #6 DETAIL DESIGN

– 24 HOUR CHICAGO STORM (CALEDON IDF CURVE)

```
 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 M  O   O
  OOO     T      T    H   H    Y    M   M   OOO
```

Developed and Distributed by Civica Infrastructure

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\f9e2e2a7-7409-47c1-8ec5-0740ea8af334\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\f9e2e2a7-7409-47c1-8ec5-0740ea8af334\scenar

DATE: 08/09/2019 TIME: 11:51:16

USER:

COMMENTS: _____

** SIMULATION : Run 01 **

READ STORM	Filename: C:\Users\zhouj\AppData\Local\Temp\de396a48-8df1-4a37-a414-2c6593535cb9\eea7fb5c
Ptotal= 25.00 mm	Comments: 25mm4HRC

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	2.07	1.17	5.70	2.17	5.19	3.17	2.80
0.33	2.27	1.33	10.78	2.33	4.47	3.33	2.62
0.50	2.52	1.50	50.21	2.50	3.95	3.50	2.48
0.67	2.88	1.67	13.37	2.67	3.56	3.67	2.35
0.83	3.38	1.83	8.29	2.83	3.25	3.83	2.23
1.00	4.18	2.00	6.30	3.00	3.01	4.00	2.14

CALIB	
STANDHYD (0600)	Area (ha)= 28.20
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.07	1.083	5.70	2.083	5.19	3.08	2.80
0.167	2.07	1.167	5.70	2.167	5.19	3.17	2.80
0.250	2.27	1.250	10.78	2.250	4.47	3.25	2.62
0.333	2.27	1.333	10.78	2.333	4.47	3.33	2.62
0.417	2.52	1.417	50.21	2.417	3.95	3.42	2.48
0.500	2.52	1.500	50.21	2.500	3.95	3.50	2.48
0.583	2.88	1.583	13.37	2.583	3.56	3.58	2.35
0.667	2.88	1.667	13.37	2.667	3.56	3.67	2.35
0.750	3.38	1.750	8.29	2.750	3.25	3.75	2.23
0.833	3.38	1.833	8.29	2.833	3.25	3.83	2.23
0.917	4.18	1.917	6.30	2.917	3.01	3.92	2.14
1.000	4.18	2.000	6.30	3.000	3.01	4.00	2.14

				TOTALS
Max.Eff.Inten.(mm/hr)=		50.21	5.99	
over (min)		10.00	30.00	
Storage Coeff. (min)=		8.11 (ii)	29.88 (ii)	
Unit Hyd. Tpeak (min)=		10.00	30.00	
Unit Hyd. peak (cms)=		0.13	0.04	
PEAK FLOW	(cms)=	1.84	0.07	1.862 (iii)
TIME TO PEAK	(hrs)=	1.58	2.08	1.58
RUNOFF VOLUME	(mm)=	24.00	6.17	18.65
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.25	0.75

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)	
IN= 2---> OUT= 1	
DT= 5.0 min	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573

0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	1.862	1.58	18.65
OUTFLOW: ID= 1 (1601)	28.200	0.020	4.58	18.16

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.08
TIME SHIFT OF PEAK FLOW (min)=180.00
MAXIMUM STORAGE USED (ha.m.)= 0.5025

```
 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 M  O   O
  OOO     T      T    H   H    Y    M   M   OOO
```

Developed and Distributed by Civica Infrastructure

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\6b581627-5f45-4ff9-b48b-337bb38be8b6\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\6b581627-5f45-4ff9-b48b-337bb38be8b6\scenar

DATE: 08/09/2019 TIME: 11:51:16

USER:

COMMENTS: _____

** SIMULATION : Run 02 **

CHICAGO STORM	IDF curve parameters: A=1070.000

Ptotal= 43.76 mm	B= 7.850
	C= 0.876

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.24	6.17	0.96	12.17	0.83	18.17	0.36
0.33	0.24	6.33	1.05	12.33	0.79	18.33	0.35
0.50	0.25	6.50	1.17	12.50	0.77	18.50	0.34
0.67	0.25	6.67	1.33	12.67	0.74	18.67	0.34
0.83	0.26	6.83	1.53	12.83	0.72	18.83	0.33
1.00	0.27	7.00	1.81	13.00	0.69	19.00	0.33
1.17	0.27	7.17	2.22	13.17	0.67	19.17	0.33
1.33	0.28	7.33	2.87	13.33	0.65	19.33	0.32
1.50	0.28	7.50	4.06	13.50	0.63	19.50	0.32
1.67	0.29	7.67	6.86	13.67	0.61	19.67	0.31
1.83	0.30	7.83	19.60	13.83	0.60	19.83	0.31
2.00	0.31	8.00	85.72	14.00	0.58	20.00	0.30
2.17	0.31	8.17	26.59	14.17	0.57	20.17	0.30
2.33	0.32	8.33	12.64	14.33	0.55	20.33	0.30
2.50	0.33	8.50	7.99	14.50	0.54	20.50	0.29
2.67	0.34	8.67	5.76	14.67	0.53	20.67	0.29
2.83	0.35	8.83	4.48	14.83	0.51	20.83	0.29
3.00	0.36	9.00	3.65	15.00	0.50	21.00	0.28
3.17	0.37	9.17	3.08	15.17	0.49	21.17	0.28
3.33	0.39	9.33	2.66	15.33	0.48	21.33	0.28
3.50	0.40	9.50	2.34	15.50	0.47	21.50	0.27
3.67	0.41	9.67	2.10	15.67	0.46	21.67	0.27
3.83	0.43	9.83	1.89	15.83	0.45	21.83	0.27
4.00	0.45	10.00	1.73	16.00	0.44	22.00	0.26
4.17	0.47	10.17	1.59	16.17	0.44	22.17	0.26
4.33	0.49	10.33	1.47	16.33	0.43	22.33	0.26
4.50	0.51	10.50	1.37	16.50	0.42	22.50	0.26
4.67	0.53	10.67	1.29	16.67	0.41	22.67	0.25
4.83	0.56	10.83	1.21	16.83	0.40	22.83	0.25
5.00	0.59	11.00	1.14	17.00	0.40	23.00	0.25
5.17	0.62	11.17	1.08	17.17	0.39	23.17	0.25
5.33	0.66	11.33	1.03	17.33	0.38	23.33	0.24
5.50	0.70	11.50	0.98	17.50	0.38	23.50	0.24
5.67	0.75	11.67	0.94	17.67	0.37	23.67	0.24
5.83	0.81	11.83	0.90	17.83	0.37	23.83	0.24
6.00	0.88	12.00	0.86	18.00	0.36	24.00	0.23

CALIB	
STANDHYD (0600)	Area (ha)= 28.20
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.24	6.083	0.96	12.083	0.83	18.08	0.36
0.167	0.24	6.167	0.96	12.167	0.83	18.17	0.36
0.250	0.24	6.250	1.05	12.250	0.79	18.25	0.35
0.333	0.24	6.333	1.05	12.333	0.79	18.33	0.35
0.417	0.25	6.417	1.17	12.417	0.77	18.42	0.34
0.500	0.25	6.500	1.17	12.500	0.77	18.50	0.34
0.583	0.25	6.583	1.33	12.583	0.74	18.58	0.34
0.667	0.25	6.667	1.33	12.667	0.74	18.67	0.34
0.750	0.26	6.750	1.53	12.750	0.72	18.75	0.33
0.833	0.26	6.833	1.53	12.833	0.72	18.83	0.33
0.917	0.27	6.917	1.81	12.917	0.69	18.92	0.33
1.000	0.27	7.000	1.81	13.000	0.69	19.00	0.33
1.083	0.27	7.083	2.22	13.083	0.67	19.08	0.33
1.167	0.27	7.167	2.22	13.167	0.67	19.17	0.33
1.250	0.28	7.250	2.87	13.250	0.65	19.25	0.32
1.333	0.28	7.333	2.87	13.333	0.65	19.33	0.32
1.417	0.28	7.417	4.06	13.417	0.63	19.42	0.32
1.500	0.28	7.500	4.06	13.500	0.63	19.50	0.32
1.583	0.29	7.583	6.86	13.583	0.61	19.58	0.31
1.667	0.29	7.667	6.87	13.667	0.61	19.67	0.31
1.750	0.30	7.750	19.60	13.750	0.60	19.75	0.31
1.833	0.30	7.833	19.61	13.833	0.60	19.83	0.31
1.917	0.31	7.917	85.72	13.917	0.58	19.92	0.30
2.000	0.31	8.000	85.71	14.000	0.58	20.00	0.30
2.083	0.31	8.083	26.59	14.083	0.57	20.08	0.30
2.167	0.31	8.167	26.59	14.167	0.57	20.17	0.30
2.250	0.32	8.250	12.64	14.250	0.55	20.25	0.30
2.333	0.32	8.333	12.64	14.333	0.55	20.33	0.30
2.417	0.33	8.417	7.99	14.417	0.54	20.42	0.29
2.500	0.33	8.500	7.99	14.500	0.54	20.50	0.29
2.583	0.34	8.583	5.76	14.583	0.53	20.58	0.29
2.667	0.34	8.667	5.76	14.667	0.53	20.67	0.29
2.750	0.35	8.750	4.48	14.750	0.51	20.75	0.29
2.833	0.35	8.833	4.48	14.833	0.51	20.83	0.29
2.917	0.36	8.917	3.65	14.917	0.50	20.92	0.28
3.000	0.36	9.000	3.65	15.000	0.50	21.00	0.28
3.083	0.37	9.083	3.08	15.083	0.49	21.08	0.28
3.167	0.37	9.167	3.08	15.167	0.49	21.17	0.28
3.250	0.39	9.250	2.66	15.250	0.48	21.25	0.28
3.333	0.39	9.333	2.66	15.333	0.48	21.33	0.28
3.417	0.40	9.417	2.34	15.417	0.47	21.42	0.27
3.500	0.40	9.500	2.34	15.500	0.47	21.50	0.27
3.583	0.41	9.583	2.10	15.583	0.46	21.58	0.27
3.667	0.41	9.667	2.10	15.667	0.46	21.67	0.27
3.750	0.43	9.750	1.89	15.750	0.45	21.75	0.27
3.833	0.43	9.833	1.89	15.833	0.45	21.83	0.27
3.917	0.45	9.917	1.73	15.917	0.44	21.92	0.26
4.000	0.45	10.000	1.73	16.000	0.44	22.00	0.26
4.083	0.47	10.083	1.59	16.083	0.44	22.08	0.26
4.167	0.47	10.167	1.59	16.167	0.44	22.17	0.26
4.250	0.49	10.250	1.47	16.250	0.43	22.25	0.26
4.333	0.49	10.333	1.47	16.333	0.43	22.33	0.26
4.417	0.51	10.417	1.37	16.417	0.42	22.42	0.26
4.500	0.51	10.500	1.37	16.500	0.42	22.50	0.26
4.583	0.53	10.583	1.29	16.583	0.41	22.58	0.25
4.667	0.53	10.667	1.29	16.667	0.41	22.67	0.25
4.750	0.56	10.750	1.21	16.750	0.40	22.75	0.25
4.833	0.56	10.833	1.21	16.833	0.40	22.83	0.25
4.917	0.59	10.917	1.14	16.917	0.40	22.92	0.25

5.000	0.59	11.000	1.14	17.000	0.40	23.00	0.25
5.083	0.62	11.083	1.08	17.083	0.39	23.08	0.25
5.167	0.62	11.167	1.08	17.167	0.39	23.17	0.25
5.250	0.66	11.250	1.03	17.250	0.38	23.25	0.24
5.333	0.66	11.333	1.03	17.333	0.38	23.33	0.24
5.417	0.70	11.417	0.98	17.417	0.38	23.42	0.24
5.500	0.70	11.500	0.98	17.500	0.38	23.50	0.24
5.583	0.75	11.583	0.94	17.583	0.37	23.58	0.24
5.667	0.75	11.667	0.94	17.667	0.37	23.67	0.24
5.750	0.81	11.750	0.90	17.750	0.37	23.75	0.24
5.833	0.81	11.833	0.90	17.833	0.37	23.83	0.24
5.917	0.88	11.917	0.86	17.917	0.36	23.92	0.23
6.000	0.88	12.000	0.86	18.000	0.36	24.00	0.23

```
     Max.Eff.Inten.(mm/hr)=      85.72         25.58
                over (min)        5.00         20.00
     Storage Coeff.  (min)=       6.55 (ii)    18.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00         20.00
     Unit Hyd. peak  (cms)=       0.18          0.06
                                                           *TOTALS*
     PEAK FLOW       (cms)=       3.88          0.32         3.985 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.25          8.00
     RUNOFF VOLUME    (mm)=      42.76         17.98         35.33
     TOTAL RAINFALL   (mm)=      43.76         43.76         43.76
     RUNOFF COEFFICIENT   =       0.98          0.41          0.81

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1601)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |
--------------------
```

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	3.985	8.00	35.33
OUTFLOW: ID= 1 (1601)	28.200	0.078	11.25	33.97

```
                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.97
                 TIME SHIFT OF PEAK FLOW         (min)=195.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.7763

--------------------------------------------------------------------------------
=====================================================================================
========================
```



```
 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
```


***** D E T A I L E D   O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\5f93bb51-1e5f-449b-bb7d-83c590d83ced\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\5f93bb51-1e5f-449b-bb7d-83c590d83ced\scenar

DATE: 08/09/2019   TIME: 11:51:17

USER:

COMMENTS: ____

```
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  ***********************************************
  ** SIMULATION : Run 03                       **
  ***********************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1593.000
| Ptotal= 63.63 mm |                           B=  11.000
--------------------                           C=   0.879
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.35	6.17	1.44	12.17	1.23	18.17	0.52
0.33	0.35	6.33	1.59	12.33	1.19	18.33	0.51
0.50	0.36	6.50	1.78	12.50	1.14	18.50	0.50
0.67	0.37	6.67	2.02	12.67	1.10	18.67	0.49
0.83	0.38	6.83	2.35	12.83	1.06	18.83	0.49
1.00	0.38	7.00	2.80	13.00	1.03	19.00	0.48
1.17	0.39	7.17	3.46	13.17	0.99	19.17	0.47
1.33	0.40	7.33	4.52	13.33	0.96	19.33	0.47

1.50	0.41	7.50	6.48	13.50	0.93	19.50	0.46
1.67	0.42	7.67	11.07	13.67	0.91	19.67	0.45
1.83	0.43	7.83	30.47	13.83	0.88	19.83	0.45
2.00	0.44	8.00	109.68	14.00	0.86	20.00	0.44
2.17	0.46	8.17	40.71	14.17	0.83	20.17	0.44
2.33	0.47	8.33	20.28	14.33	0.81	20.33	0.43
2.50	0.48	8.50	12.91	14.50	0.79	20.50	0.43
2.67	0.50	8.67	9.28	14.67	0.77	20.67	0.42
2.83	0.51	8.83	7.17	14.83	0.76	20.83	0.42
3.00	0.53	9.00	5.81	15.00	0.74	21.00	0.41
3.17	0.55	9.17	4.87	15.17	0.72	21.17	0.41
3.33	0.56	9.33	4.19	15.33	0.71	21.33	0.40
3.50	0.58	9.50	3.67	15.50	0.69	21.50	0.40
3.67	0.61	9.67	3.26	15.67	0.68	21.67	0.39
3.83	0.63	9.83	2.93	15.83	0.66	21.83	0.39
4.00	0.65	10.00	2.67	16.00	0.65	22.00	0.38
4.17	0.68	10.17	2.45	16.17	0.64	22.17	0.38
4.33	0.71	10.33	2.26	16.33	0.62	22.33	0.37
4.50	0.75	10.50	2.10	16.50	0.61	22.50	0.37
4.67	0.78	10.67	1.96	16.67	0.60	22.67	0.37
4.83	0.82	10.83	1.84	16.83	0.59	22.83	0.36
5.00	0.87	11.00	1.73	17.00	0.58	23.00	0.36
5.17	0.92	11.17	1.63	17.17	0.57	23.17	0.36
5.33	0.98	11.33	1.55	17.33	0.56	23.33	0.35
5.50	1.04	11.50	1.47	17.50	0.55	23.50	0.35
5.67	1.12	11.67	1.40	17.67	0.54	23.67	0.34
5.83	1.21	11.83	1.34	17.83	0.53	23.83	0.34
6.00	1.31	12.00	1.29	18.00	0.52	24.00	0.34

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0600)|   Area    (ha)=  28.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=      19.74          8.46
     Dep. Storage    (mm)=       1.00          5.00
     Average Slope    (%)=       1.00          2.00
     Length           (m)=     433.59         40.00
     Mannings n          =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.35	6.083	1.44	12.083	1.23	18.08	0.52
0.167	0.35	6.167	1.44	12.167	1.23	18.17	0.52
0.250	0.35	6.250	1.59	12.250	1.19	18.25	0.51
0.333	0.35	6.333	1.59	12.333	1.19	18.33	0.51
0.417	0.36	6.417	1.78	12.417	1.14	18.42	0.50
0.500	0.36	6.500	1.78	12.500	1.14	18.50	0.50
0.583	0.37	6.583	2.02	12.583	1.10	18.58	0.49
0.667	0.37	6.667	2.02	12.667	1.10	18.67	0.49
0.750	0.38	6.750	2.35	12.750	1.06	18.75	0.49
0.833	0.38	6.833	2.35	12.833	1.06	18.83	0.49
0.917	0.38	6.917	2.80	12.917	1.03	18.92	0.48
1.000	0.38	7.000	2.80	13.000	1.03	19.00	0.48
1.083	0.39	7.083	3.46	13.083	0.99	19.08	0.47
1.167	0.39	7.167	3.46	13.167	0.99	19.17	0.47

1.250	0.40	7.250	4.52	13.250	0.96	19.25	0.47
1.333	0.40	7.333	4.52	13.333	0.96	19.33	0.47
1.417	0.41	7.417	6.48	13.417	0.93	19.42	0.46
1.500	0.41	7.500	6.48	13.500	0.93	19.50	0.46
1.583	0.42	7.583	11.07	13.583	0.91	19.58	0.45
1.667	0.42	7.667	11.08	13.667	0.91	19.67	0.45
1.750	0.43	7.750	30.47	13.750	0.88	19.75	0.45
1.833	0.43	7.833	30.48	13.833	0.88	19.83	0.45
1.917	0.44	7.917	109.68	13.917	0.86	19.92	0.44
2.000	0.44	8.000	109.67	14.000	0.86	20.00	0.44
2.083	0.46	8.083	40.71	14.083	0.83	20.08	0.44
2.167	0.46	8.167	40.71	14.167	0.83	20.17	0.44
2.250	0.47	8.250	20.28	14.250	0.81	20.25	0.43
2.333	0.47	8.333	20.28	14.333	0.81	20.33	0.43
2.417	0.48	8.417	12.91	14.417	0.79	20.42	0.43
2.500	0.48	8.500	12.91	14.500	0.79	20.50	0.43
2.583	0.50	8.583	9.28	14.583	0.77	20.58	0.42
2.667	0.50	8.667	9.28	14.667	0.77	20.67	0.42
2.750	0.51	8.750	7.17	14.750	0.76	20.75	0.42
2.833	0.51	8.833	7.17	14.833	0.76	20.83	0.42
2.917	0.53	8.917	5.81	14.917	0.74	20.92	0.41
3.000	0.53	9.000	5.81	15.000	0.74	21.00	0.41
3.083	0.55	9.083	4.87	15.083	0.72	21.08	0.41
3.167	0.55	9.167	4.87	15.167	0.72	21.17	0.41
3.250	0.56	9.250	4.19	15.250	0.71	21.25	0.40
3.333	0.56	9.333	4.19	15.333	0.71	21.33	0.40
3.417	0.58	9.417	3.67	15.417	0.69	21.42	0.40
3.500	0.58	9.500	3.67	15.500	0.69	21.50	0.40
3.583	0.61	9.583	3.26	15.583	0.68	21.58	0.39
3.667	0.61	9.667	3.26	15.667	0.68	21.67	0.39
3.750	0.63	9.750	2.93	15.750	0.66	21.75	0.39
3.833	0.63	9.833	2.93	15.833	0.66	21.83	0.39
3.917	0.65	9.917	2.67	15.917	0.65	21.92	0.38
4.000	0.65	10.000	2.67	16.000	0.65	22.00	0.38
4.083	0.68	10.083	2.45	16.083	0.64	22.08	0.38
4.167	0.68	10.167	2.45	16.167	0.64	22.17	0.38
4.250	0.71	10.250	2.26	16.250	0.62	22.25	0.37
4.333	0.71	10.333	2.26	16.333	0.62	22.33	0.37
4.417	0.75	10.417	2.10	16.417	0.61	22.42	0.37
4.500	0.75	10.500	2.10	16.500	0.61	22.50	0.37
4.583	0.78	10.583	1.96	16.583	0.60	22.58	0.37
4.667	0.78	10.667	1.96	16.667	0.60	22.67	0.37
4.750	0.82	10.750	1.84	16.750	0.59	22.75	0.36
4.833	0.82	10.833	1.84	16.833	0.59	22.83	0.36
4.917	0.87	10.917	1.73	16.917	0.58	22.92	0.36
5.000	0.87	11.000	1.73	17.000	0.58	23.00	0.36
5.083	0.92	11.083	1.63	17.083	0.57	23.08	0.36
5.167	0.92	11.167	1.63	17.167	0.57	23.17	0.36
5.250	0.98	11.250	1.55	17.250	0.56	23.25	0.35
5.333	0.98	11.333	1.55	17.333	0.56	23.33	0.35
5.417	1.04	11.417	1.47	17.417	0.55	23.42	0.35
5.500	1.04	11.500	1.47	17.500	0.55	23.50	0.35
5.583	1.12	11.583	1.40	17.583	0.54	23.58	0.34
5.667	1.12	11.667	1.40	17.667	0.54	23.67	0.34
5.750	1.21	11.750	1.34	17.750	0.53	23.75	0.34
5.833	1.21	11.833	1.34	17.833	0.53	23.83	0.34
5.917	1.31	11.917	1.29	17.917	0.52	23.92	0.34
6.000	1.31	12.000	1.29	18.000	0.52	24.00	0.34

Max.Eff.Inten.(mm/hr)=	109.68	54.81
over (min)	5.00	15.00
Storage Coeff. (min)=	5.94 (ii)	10.78 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00

Unit Hyd. peak (cms)=	0.19	0.09
		TOTALS
PEAK FLOW (cms)=	5.17	0.79	5.597 (iii)
TIME TO PEAK (hrs)=	8.00	8.17	8.00
RUNOFF VOLUME (mm)=	62.63	33.22	53.81
TOTAL RAINFALL (mm)=	63.63	63.63	63.63
RUNOFF COEFFICIENT =	0.98	0.52	0.85

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)| IN= 2---> OUT= 1 | DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1513	1.3800
	0.0101	0.1474	0.1574	1.4914
	0.0156	0.3067	0.1634	1.6079
	0.0196	0.4784	0.1691	1.7243
	0.0229	0.6609	0.2060	1.8408
	0.1155	0.8534	0.5843	1.9573
	0.1235	0.9547	0.8855	2.0738
	0.1310	1.0560	2.0056	2.1902
	0.1381	1.1623	6.5687	2.4232
	0.1448	1.2686	13.0517	2.6562

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)		28.200	5.597	8.00	53.81
OUTFLOW: ID= 1 (1601)		28.200	0.137	10.83	52.23

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.44
TIME SHIFT OF PEAK FLOW (min)=170.00
MAXIMUM STORAGE USED (ha.m.)= 1.1411

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      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 M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
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DATE: 08/09/2019 TIME: 11:51:17

USER:

COMMENTS: _____

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  **********************************************
  ** SIMULATION : Run 04                      **
  **********************************************
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CHICAGO STORM | Ptotal= 71.73 mm	IDF curve parameters: A=2221.000 B= 12.000 C= 0.908

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.30	6.17	1.40	12.17	1.19	18.17	0.47
0.33	0.31	6.33	1.56	12.33	1.14	18.33	0.46
0.50	0.32	6.50	1.77	12.50	1.09	18.50	0.45
0.67	0.32	6.67	2.03	12.67	1.05	18.67	0.44
0.83	0.33	6.83	2.39	12.83	1.01	18.83	0.44
1.00	0.34	7.00	2.89	13.00	0.97	19.00	0.43
1.17	0.35	7.17	3.65	13.17	0.94	19.17	0.42
1.33	0.36	7.33	4.89	13.33	0.91	19.33	0.42
1.50	0.37	7.50	7.23	13.50	0.88	19.50	0.41
1.67	0.38	7.67	12.87	13.67	0.85	19.67	0.41
1.83	0.39	7.83	37.17	13.83	0.82	19.83	0.40
2.00	0.40	8.00	134.16	14.00	0.80	20.00	0.39
2.17	0.41	8.17	50.03	14.17	0.78	20.17	0.39
2.33	0.42	8.33	24.37	14.33	0.76	20.33	0.38
2.50	0.43	8.50	15.14	14.50	0.74	20.50	0.38
2.67	0.45	8.67	10.64	14.67	0.72	20.67	0.37
2.83	0.46	8.83	8.06	14.83	0.70	20.83	0.37
3.00	0.48	9.00	6.42	15.00	0.68	21.00	0.36
3.17	0.49	9.17	5.30	15.17	0.66	21.17	0.36
3.33	0.51	9.33	4.50	15.33	0.65	21.33	0.36
3.50	0.53	9.50	3.89	15.50	0.63	21.50	0.35
3.67	0.55	9.67	3.42	15.67	0.62	21.67	0.35
3.83	0.57	9.83	3.05	15.83	0.61	21.83	0.34
4.00	0.60	10.00	2.75	16.00	0.59	22.00	0.34
4.17	0.63	10.17	2.50	16.17	0.58	22.17	0.33
4.33	0.66	10.33	2.29	16.33	0.57	22.33	0.33

4.50	0.69	10.50	2.11	16.50	0.56	22.50	0.33
4.67	0.72	10.67	1.96	16.67	0.55	22.67	0.32
4.83	0.77	10.83	1.83	16.83	0.54	22.83	0.32
5.00	0.81	11.00	1.71	17.00	0.53	23.00	0.32
5.17	0.86	11.17	1.61	17.17	0.52	23.17	0.31
5.33	0.92	11.33	1.52	17.33	0.51	23.33	0.31
5.50	0.99	11.50	1.44	17.50	0.50	23.50	0.31
5.67	1.07	11.67	1.37	17.67	0.49	23.67	0.30
5.83	1.16	11.83	1.30	17.83	0.48	23.83	0.30
6.00	1.27	12.00	1.24	18.00	0.47	24.00	0.30

CALIB | STANDHYD (0600)| ID= 1 DT= 5.0 min	Area (ha)= 28.20 Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.30	6.083	1.40	12.083	1.19	18.08	0.47
0.167	0.30	6.167	1.40	12.167	1.19	18.17	0.47
0.250	0.31	6.250	1.56	12.250	1.14	18.25	0.46
0.333	0.31	6.333	1.56	12.333	1.14	18.33	0.46
0.417	0.32	6.417	1.77	12.417	1.09	18.42	0.45
0.500	0.32	6.500	1.77	12.500	1.09	18.50	0.45
0.583	0.32	6.583	2.03	12.583	1.05	18.58	0.44
0.667	0.32	6.667	2.03	12.667	1.05	18.67	0.44
0.750	0.33	6.750	2.39	12.750	1.01	18.75	0.44
0.833	0.33	6.833	2.39	12.833	1.01	18.83	0.44
0.917	0.34	6.917	2.89	12.917	0.97	18.92	0.43
1.000	0.34	7.000	2.89	13.000	0.97	19.00	0.43
1.083	0.35	7.083	3.65	13.083	0.94	19.08	0.42
1.167	0.35	7.167	3.65	13.167	0.94	19.17	0.42
1.250	0.36	7.250	4.89	13.250	0.91	19.25	0.42
1.333	0.36	7.333	4.89	13.333	0.91	19.33	0.42
1.417	0.37	7.417	7.23	13.417	0.88	19.42	0.41
1.500	0.37	7.500	7.23	13.500	0.88	19.50	0.41
1.583	0.38	7.583	12.87	13.583	0.85	19.58	0.41
1.667	0.38	7.667	12.87	13.667	0.85	19.67	0.41
1.750	0.39	7.750	37.17	13.750	0.82	19.75	0.40
1.833	0.39	7.833	37.18	13.833	0.82	19.83	0.40
1.917	0.40	7.917	134.16	13.917	0.80	19.92	0.39
2.000	0.40	8.000	134.16	14.000	0.80	20.00	0.39
2.083	0.41	8.083	50.03	14.083	0.78	20.08	0.39
2.167	0.41	8.167	50.03	14.167	0.78	20.17	0.39
2.250	0.42	8.250	24.37	14.250	0.76	20.25	0.38
2.333	0.42	8.333	24.37	14.333	0.76	20.33	0.38
2.417	0.43	8.417	15.14	14.417	0.74	20.42	0.38
2.500	0.43	8.500	15.13	14.500	0.74	20.50	0.38
2.583	0.45	8.583	10.64	14.583	0.72	20.58	0.37
2.667	0.45	8.667	10.64	14.667	0.72	20.67	0.37

2.750	0.46	8.750	8.06	14.750	0.70	20.75	0.37
2.833	0.46	8.833	8.06	14.833	0.70	20.83	0.37
2.917	0.48	8.917	6.42	14.917	0.68	20.92	0.36
3.000	0.48	9.000	6.42	15.000	0.68	21.00	0.36
3.083	0.49	9.083	5.30	15.083	0.66	21.08	0.36
3.167	0.49	9.167	5.30	15.167	0.66	21.17	0.36
3.250	0.51	9.250	4.50	15.250	0.65	21.25	0.36
3.333	0.51	9.333	4.50	15.333	0.65	21.33	0.36
3.417	0.53	9.417	3.89	15.417	0.63	21.42	0.35
3.500	0.53	9.500	3.89	15.500	0.63	21.50	0.35
3.583	0.55	9.583	3.42	15.583	0.62	21.58	0.35
3.667	0.55	9.667	3.42	15.667	0.62	21.67	0.35
3.750	0.57	9.750	3.05	15.750	0.61	21.75	0.34
3.833	0.57	9.833	3.05	15.833	0.61	21.83	0.34
3.917	0.60	9.917	2.75	15.917	0.59	21.92	0.34
4.000	0.60	10.000	2.75	16.000	0.59	22.00	0.34
4.083	0.63	10.083	2.50	16.083	0.58	22.08	0.33
4.167	0.63	10.167	2.50	16.167	0.58	22.17	0.33
4.250	0.66	10.250	2.29	16.250	0.57	22.25	0.33
4.333	0.66	10.333	2.29	16.333	0.57	22.33	0.33
4.417	0.69	10.417	2.11	16.417	0.56	22.42	0.33
4.500	0.69	10.500	2.11	16.500	0.56	22.50	0.33
4.583	0.72	10.583	1.96	16.583	0.55	22.58	0.32
4.667	0.72	10.667	1.96	16.667	0.55	22.67	0.32
4.750	0.77	10.750	1.83	16.750	0.54	22.75	0.32
4.833	0.77	10.833	1.83	16.833	0.54	22.83	0.32
4.917	0.81	10.917	1.71	16.917	0.53	22.92	0.32
5.000	0.81	11.000	1.71	17.000	0.53	23.00	0.32
5.083	0.86	11.083	1.61	17.083	0.52	23.08	0.31
5.167	0.86	11.167	1.61	17.167	0.52	23.17	0.31
5.250	0.92	11.250	1.52	17.250	0.51	23.25	0.31
5.333	0.92	11.333	1.52	17.333	0.51	23.33	0.31
5.417	0.99	11.417	1.44	17.417	0.50	23.42	0.31
5.500	0.99	11.500	1.44	17.500	0.50	23.50	0.31
5.583	1.07	11.583	1.37	17.583	0.49	23.58	0.30
5.667	1.07	11.667	1.37	17.667	0.49	23.67	0.30
5.750	1.16	11.750	1.30	17.750	0.48	23.75	0.30
5.833	1.16	11.833	1.30	17.833	0.48	23.83	0.30
5.917	1.27	11.917	1.24	17.917	0.47	23.92	0.30
6.000	1.27	12.000	1.24	18.000	0.47	24.00	0.30

Max.Eff.Inten.(mm/hr)=	134.16	73.17	
over (min)	5.00	10.00	
Storage Coeff. (min)=	5.48 (ii)	9.95 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.20	0.11	
			TOTALS
PEAK FLOW (cms)=	6.46	1.13	7.365 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	70.73	39.92	61.48
TOTAL RAINFALL (mm)=	71.73	71.73	71.73
RUNOFF COEFFICIENT =	0.99	0.56	0.86

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(1601)|

| IN= 2---> OUT= 1 |
| DT= 5.0 min |

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	7.365	8.00	61.48
OUTFLOW: ID= 1 (1601)	28.200	0.150	10.67	59.78

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.04
TIME SHIFT OF PEAK FLOW (min)=160.00
MAXIMUM STORAGE USED (ha.m.)= 1.3575

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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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***** D E T A I L E D   O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
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DATE: 08/09/2019 TIME: 11:51:17

USER:

COMMENTS: ____

****
** SIMULATION : Run 05 **
****

| CHICAGO STORM |
| Ptotal= 84.55 mm |

IDF curve parameters: A=3158.000
B= 15.000
C= 0.933
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.27	6.17	1.47	12.17	1.22	18.17	0.44
0.33	0.28	6.33	1.67	12.33	1.17	18.33	0.43
0.50	0.29	6.50	1.91	12.50	1.11	18.50	0.42
0.67	0.29	6.67	2.24	12.67	1.07	18.67	0.41
0.83	0.30	6.83	2.68	12.83	1.02	18.83	0.41
1.00	0.31	7.00	3.31	13.00	0.98	19.00	0.40
1.17	0.32	7.17	4.28	13.17	0.94	19.17	0.39
1.33	0.33	7.33	5.90	13.33	0.91	19.33	0.39
1.50	0.34	7.50	9.00	13.50	0.88	19.50	0.38
1.67	0.34	7.67	16.53	13.67	0.85	19.67	0.37
1.83	0.35	7.83	47.76	13.83	0.82	19.83	0.37
2.00	0.37	8.00	156.47	14.00	0.79	20.00	0.36
2.17	0.38	8.17	63.86	14.17	0.77	20.17	0.36
2.33	0.39	8.33	31.72	14.33	0.74	20.33	0.35
2.50	0.40	8.50	19.56	14.50	0.72	20.50	0.35
2.67	0.42	8.67	13.56	14.67	0.70	20.67	0.34
2.83	0.43	8.83	10.11	14.83	0.68	20.83	0.34
3.00	0.45	9.00	7.92	15.00	0.66	21.00	0.33
3.17	0.46	9.17	6.44	15.17	0.64	21.17	0.33
3.33	0.48	9.33	5.38	15.33	0.63	21.33	0.32
3.50	0.50	9.50	4.59	15.50	0.61	21.50	0.32
3.67	0.52	9.67	3.99	15.67	0.60	21.67	0.32
3.83	0.55	9.83	3.51	15.83	0.58	21.83	0.31
4.00	0.57	10.00	3.13	16.00	0.57	22.00	0.31
4.17	0.60	10.17	2.81	16.17	0.56	22.17	0.30
4.33	0.63	10.33	2.55	16.33	0.54	22.33	0.30
4.50	0.67	10.50	2.33	16.50	0.53	22.50	0.30
4.67	0.71	10.67	2.15	16.67	0.52	22.67	0.29
4.83	0.75	10.83	1.99	16.83	0.51	22.83	0.29
5.00	0.80	11.00	1.85	17.00	0.50	23.00	0.29
5.17	0.86	11.17	1.72	17.17	0.49	23.17	0.28
5.33	0.92	11.33	1.62	17.33	0.48	23.33	0.28
5.50	1.00	11.50	1.52	17.50	0.47	23.50	0.28
5.67	1.09	11.67	1.43	17.67	0.46	23.67	0.27
5.83	1.19	11.83	1.36	17.83	0.45	23.83	0.27
6.00	1.32	12.00	1.29	18.00	0.44	24.00	0.27

| CALIB |
| STANDHYD (0600)|
|ID= 1 DT= 5.0 min |

Area (ha)= 28.20
Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.27	6.083	1.47	12.083	1.22	18.08	0.44
0.167	0.27	6.167	1.47	12.167	1.22	18.17	0.44
0.250	0.28	6.250	1.67	12.250	1.17	18.25	0.43
0.333	0.28	6.333	1.67	12.333	1.17	18.33	0.43
0.417	0.29	6.417	1.91	12.417	1.11	18.42	0.42
0.500	0.29	6.500	1.91	12.500	1.11	18.50	0.42
0.583	0.29	6.583	2.24	12.583	1.07	18.58	0.41
0.667	0.29	6.667	2.24	12.667	1.07	18.67	0.41
0.750	0.30	6.750	2.68	12.750	1.02	18.75	0.41
0.833	0.30	6.833	2.68	12.833	1.02	18.83	0.41
0.917	0.31	6.917	3.31	12.917	0.98	18.92	0.40
1.000	0.31	7.000	3.31	13.000	0.98	19.00	0.40
1.083	0.32	7.083	4.28	13.083	0.94	19.08	0.39
1.167	0.32	7.167	4.28	13.167	0.94	19.17	0.39
1.250	0.33	7.250	5.90	13.250	0.91	19.25	0.39
1.333	0.33	7.333	5.90	13.333	0.91	19.33	0.39
1.417	0.34	7.417	9.00	13.417	0.88	19.42	0.38
1.500	0.34	7.500	9.00	13.500	0.88	19.50	0.38
1.583	0.34	7.583	16.53	13.583	0.85	19.58	0.37
1.667	0.34	7.667	16.53	13.667	0.85	19.67	0.37
1.750	0.35	7.750	47.76	13.750	0.82	19.75	0.37
1.833	0.35	7.833	47.76	13.833	0.82	19.83	0.37
1.917	0.37	7.917	156.47	13.917	0.79	19.92	0.36
2.000	0.37	8.000	156.47	14.000	0.79	20.00	0.36
2.083	0.38	8.083	63.86	14.083	0.77	20.08	0.36
2.167	0.38	8.167	63.86	14.167	0.77	20.17	0.36
2.250	0.39	8.250	31.72	14.250	0.74	20.25	0.35
2.333	0.39	8.333	31.72	14.333	0.74	20.33	0.35
2.417	0.40	8.417	19.56	14.417	0.72	20.42	0.35
2.500	0.40	8.500	19.56	14.500	0.72	20.50	0.35
2.583	0.42	8.583	13.56	14.583	0.70	20.58	0.34
2.667	0.42	8.667	13.56	14.667	0.70	20.67	0.34
2.750	0.43	8.750	10.11	14.750	0.68	20.75	0.34
2.833	0.43	8.833	10.11	14.833	0.68	20.83	0.34
2.917	0.45	8.917	7.92	14.917	0.66	20.92	0.33
3.000	0.45	9.000	7.92	15.000	0.66	21.00	0.33
3.083	0.46	9.083	6.44	15.083	0.64	21.08	0.33
3.167	0.46	9.167	6.44	15.167	0.64	21.17	0.33
3.250	0.48	9.250	5.38	15.250	0.63	21.25	0.32
3.333	0.48	9.333	5.38	15.333	0.63	21.33	0.32
3.417	0.50	9.417	4.59	15.417	0.61	21.42	0.32
3.500	0.50	9.500	4.59	15.500	0.61	21.50	0.32
3.583	0.52	9.583	3.99	15.583	0.60	21.58	0.32
3.667	0.52	9.667	3.99	15.667	0.60	21.67	0.32
3.750	0.55	9.750	3.51	15.750	0.58	21.75	0.31
3.833	0.55	9.833	3.51	15.833	0.58	21.83	0.31
3.917	0.57	9.917	3.13	15.917	0.57	21.92	0.31
4.000	0.57	10.000	3.13	16.000	0.57	22.00	0.31
4.083	0.60	10.083	2.81	16.083	0.56	22.08	0.30
4.167	0.60	10.167	2.81	16.167	0.56	22.17	0.30

4.250	0.63	10.250	2.55	16.250	0.54	22.25	0.30
4.333	0.63	10.333	2.55	16.333	0.54	22.33	0.30
4.417	0.67	10.417	2.33	16.417	0.53	22.42	0.30
4.500	0.67	10.500	2.33	16.500	0.53	22.50	0.30
4.583	0.71	10.583	2.15	16.583	0.52	22.58	0.29
4.667	0.71	10.667	2.15	16.667	0.52	22.67	0.29
4.750	0.75	10.750	1.99	16.750	0.51	22.75	0.29
4.833	0.75	10.833	1.99	16.833	0.51	22.83	0.29
4.917	0.80	10.917	1.85	16.917	0.50	22.92	0.29
5.000	0.80	11.000	1.85	17.000	0.50	23.00	0.29
5.083	0.86	11.083	1.72	17.083	0.49	23.08	0.28
5.167	0.86	11.167	1.72	17.167	0.49	23.17	0.28
5.250	0.92	11.250	1.62	17.250	0.48	23.25	0.28
5.333	0.92	11.333	1.62	17.333	0.48	23.33	0.28
5.417	1.00	11.417	1.52	17.417	0.47	23.42	0.28
5.500	1.00	11.500	1.52	17.500	0.47	23.50	0.28
5.583	1.09	11.583	1.43	17.583	0.46	23.58	0.27
5.667	1.09	11.667	1.43	17.667	0.46	23.67	0.27
5.750	1.19	11.750	1.36	17.750	0.45	23.75	0.27
5.833	1.19	11.833	1.36	17.833	0.45	23.83	0.27
5.917	1.32	11.917	1.29	17.917	0.44	23.92	0.27
6.000	1.32	12.000	1.29	18.000	0.44	24.00	0.27

Max.Eff.Inten.(mm/hr)=	156.47	94.32	
over (min)	5.00	10.00	
Storage Coeff. (min)=	5.15 (ii)	9.35 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.21	0.12	
			TOTALS
PEAK FLOW (cms)=	7.69	1.51	8.919 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	83.54	50.88	73.74
TOTAL RAINFALL (mm)=	84.55	84.55	84.55
RUNOFF COEFFICIENT =	0.99	0.60	0.87

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(1601) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	8.919	8.00	73.74
OUTFLOW: ID= 1 (1601)	28.200	0.167	10.67	71.80

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.88
TIME SHIFT OF PEAK FLOW (min)=160.00
MAXIMUM STORAGE USED (ha.m.)= 1.6863

```
 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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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\7ab37e8d-7de2-4b48-8f9a-001574ebd11b\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\7ab37e8d-7de2-4b48-8f9a-001574ebd11b\scenar

DATE: 08/09/2019 TIME: 11:51:17

USER:

COMMENTS: ____________________

** SIMULATION : Run 06 **

| CHICAGO STORM |
| Ptotal= 92.53 mm |

IDF curve parameters: A=3886.000
B= 16.000
C= 0.950
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.24	6.17	1.45	12.17	1.19	18.17	0.39
0.33	0.25	6.33	1.66	12.33	1.13	18.33	0.39
0.50	0.25	6.50	1.92	12.50	1.08	18.50	0.38
0.67	0.26	6.67	2.27	12.67	1.03	18.67	0.37
0.83	0.27	6.83	2.76	12.83	0.98	18.83	0.36
1.00	0.27	7.00	3.46	13.00	0.94	19.00	0.36
1.17	0.28	7.17	4.54	13.17	0.90	19.17	0.35
1.33	0.29	7.33	6.37	13.33	0.86	19.33	0.35
1.50	0.30	7.50	9.92	13.50	0.83	19.50	0.34
1.67	0.31	7.67	18.63	13.67	0.80	19.67	0.33
1.83	0.32	7.83	54.62	13.83	0.77	19.83	0.33
2.00	0.33	8.00	176.19	14.00	0.74	20.00	0.32
2.17	0.34	8.17	73.10	14.17	0.72	20.17	0.32
2.33	0.35	8.33	36.22	14.33	0.70	20.33	0.31
2.50	0.36	8.50	22.14	14.50	0.67	20.50	0.31
2.67	0.37	8.67	15.18	14.67	0.65	20.67	0.30
2.83	0.39	8.83	11.20	14.83	0.63	20.83	0.30
3.00	0.40	9.00	8.68	15.00	0.61	21.00	0.30
3.17	0.42	9.17	6.99	15.17	0.60	21.17	0.29
3.33	0.44	9.33	5.78	15.33	0.58	21.33	0.29
3.50	0.46	9.50	4.89	15.50	0.57	21.50	0.28
3.67	0.48	9.67	4.21	15.67	0.55	21.67	0.28
3.83	0.50	9.83	3.68	15.83	0.54	21.83	0.28
4.00	0.53	10.00	3.25	16.00	0.52	22.00	0.27
4.17	0.56	10.17	2.91	16.17	0.51	22.17	0.27
4.33	0.59	10.33	2.62	16.33	0.50	22.33	0.27
4.50	0.62	10.50	2.38	16.50	0.49	22.50	0.26
4.67	0.66	10.67	2.18	16.67	0.47	22.67	0.26
4.83	0.71	10.83	2.00	16.83	0.46	22.83	0.26
5.00	0.76	11.00	1.85	17.00	0.45	23.00	0.25
5.17	0.81	11.17	1.72	17.17	0.44	23.17	0.25
5.33	0.88	11.33	1.60	17.33	0.43	23.33	0.25
5.50	0.96	11.50	1.50	17.50	0.43	23.50	0.24
5.67	1.05	11.67	1.41	17.67	0.42	23.67	0.24
5.83	1.16	11.83	1.33	17.83	0.41	23.83	0.24
6.00	1.29	12.00	1.26	18.00	0.40	24.00	0.23

| CALIB |
| STANDHYD (0600) | Area (ha)= 28.20
|ID= 1 DT= 5.0 min | Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	19.74	8.46
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	433.59	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.24	6.083	1.45	12.083	1.19	18.08	0.39
0.167	0.24	6.167	1.45	12.167	1.19	18.17	0.39
0.250	0.25	6.250	1.66	12.250	1.13	18.25	0.39
0.333	0.25	6.333	1.66	12.333	1.13	18.33	0.39
0.417	0.25	6.417	1.92	12.417	1.08	18.42	0.38

0.500	0.25	6.500	1.92	12.500	1.08	18.50	0.38
0.583	0.26	6.583	2.27	12.583	1.03	18.58	0.37
0.667	0.26	6.667	2.27	12.667	1.03	18.67	0.37
0.750	0.27	6.750	2.76	12.750	0.98	18.75	0.36
0.833	0.27	6.833	2.76	12.833	0.98	18.83	0.36
0.917	0.27	6.917	3.46	12.917	0.94	18.92	0.36
1.000	0.27	7.000	3.46	13.000	0.94	19.00	0.36
1.083	0.28	7.083	4.54	13.083	0.90	19.08	0.35
1.167	0.28	7.167	4.54	13.167	0.90	19.17	0.35
1.250	0.29	7.250	6.37	13.250	0.86	19.25	0.35
1.333	0.29	7.333	6.37	13.333	0.86	19.33	0.35
1.417	0.30	7.417	9.92	13.417	0.83	19.42	0.34
1.500	0.30	7.500	9.92	13.500	0.83	19.50	0.34
1.583	0.31	7.583	18.63	13.583	0.80	19.58	0.33
1.667	0.31	7.667	18.63	13.667	0.80	19.67	0.33
1.750	0.32	7.750	54.62	13.750	0.77	19.75	0.33
1.833	0.32	7.833	54.63	13.833	0.77	19.83	0.33
1.917	0.33	7.917	176.19	13.917	0.74	19.92	0.32
2.000	0.33	8.000	176.18	14.000	0.74	20.00	0.32
2.083	0.34	8.083	73.10	14.083	0.72	20.08	0.32
2.167	0.34	8.167	73.10	14.167	0.72	20.17	0.32
2.250	0.35	8.250	36.22	14.250	0.70	20.25	0.31
2.333	0.35	8.333	36.22	14.333	0.70	20.33	0.31
2.417	0.36	8.417	22.14	14.417	0.67	20.42	0.31
2.500	0.36	8.500	22.14	14.500	0.67	20.50	0.31
2.583	0.37	8.583	15.18	14.583	0.65	20.58	0.30
2.667	0.37	8.667	15.18	14.667	0.65	20.67	0.30
2.750	0.39	8.750	11.20	14.750	0.63	20.75	0.30
2.833	0.39	8.833	11.20	14.833	0.63	20.83	0.30
2.917	0.40	8.917	8.68	14.917	0.61	20.92	0.30
3.000	0.40	9.000	8.68	15.000	0.61	21.00	0.30
3.083	0.42	9.083	6.99	15.083	0.60	21.08	0.29
3.167	0.42	9.167	6.99	15.167	0.60	21.17	0.29
3.250	0.44	9.250	5.78	15.250	0.58	21.25	0.29
3.333	0.44	9.333	5.78	15.333	0.58	21.33	0.29
3.417	0.46	9.417	4.89	15.417	0.57	21.42	0.28
3.500	0.46	9.500	4.89	15.500	0.57	21.50	0.28
3.583	0.48	9.583	4.21	15.583	0.55	21.58	0.28
3.667	0.48	9.667	4.21	15.667	0.55	21.67	0.28
3.750	0.50	9.750	3.68	15.750	0.54	21.75	0.28
3.833	0.50	9.833	3.68	15.833	0.54	21.83	0.28
3.917	0.53	9.917	3.25	15.917	0.52	21.92	0.27
4.000	0.53	10.000	3.25	16.000	0.52	22.00	0.27
4.083	0.56	10.083	2.91	16.083	0.51	22.08	0.27
4.167	0.56	10.167	2.91	16.167	0.51	22.17	0.27
4.250	0.59	10.250	2.62	16.250	0.50	22.25	0.27
4.333	0.59	10.333	2.62	16.333	0.50	22.33	0.27
4.417	0.62	10.417	2.38	16.417	0.49	22.42	0.26
4.500	0.62	10.500	2.38	16.500	0.49	22.50	0.26
4.583	0.66	10.583	2.18	16.583	0.47	22.58	0.26
4.667	0.66	10.667	2.18	16.667	0.47	22.67	0.26
4.750	0.71	10.750	2.00	16.750	0.46	22.75	0.26
4.833	0.71	10.833	2.00	16.833	0.46	22.83	0.26
4.917	0.76	10.917	1.85	16.917	0.45	22.92	0.25
5.000	0.76	11.000	1.85	17.000	0.45	23.00	0.25
5.083	0.81	11.083	1.72	17.083	0.44	23.08	0.25
5.167	0.81	11.167	1.72	17.167	0.44	23.17	0.25
5.250	0.88	11.250	1.60	17.250	0.43	23.25	0.25
5.333	0.88	11.333	1.60	17.333	0.43	23.33	0.25
5.417	0.96	11.417	1.50	17.417	0.43	23.42	0.24
5.500	0.96	11.500	1.50	17.500	0.43	23.50	0.24
5.583	1.05	11.583	1.41	17.583	0.42	23.58	0.24
5.667	1.05	11.667	1.41	17.667	0.42	23.67	0.24

5.750	1.16	11.750	1.33	17.750	0.41	23.75	0.24
5.833	1.16	11.833	1.33	17.833	0.41	23.83	0.24
5.917	1.29	11.917	1.26	17.917	0.40	23.92	0.23
6.000	1.29	12.000	1.26	18.000	0.40	24.00	0.23

Max.Eff.Inten.(mm/hr)=		176.19	111.68	
over (min)		5.00	10.00	
Storage Coeff. (min)=		4.91 (ii)	8.92 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.22	0.12	
				TOTALS
PEAK FLOW	(cms)=	8.76	1.83	10.258 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	91.53	57.89	81.44
TOTAL RAINFALL	(mm)=	92.53	92.53	92.53
RUNOFF COEFFICIENT	=	0.99	0.63	0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601)				
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1513	1.3800
	0.0101	0.1474	0.1574	1.4914
	0.0156	0.3067	0.1634	1.6079
	0.0196	0.4784	0.1691	1.7243
	0.0229	0.6609	0.2060	1.8408
	0.1155	0.8534	0.5843	1.9573
	0.1235	0.9547	0.8855	2.0738
	0.1310	1.0560	2.0056	2.1902
	0.1381	1.1623	6.5687	2.4232
	0.1448	1.2686	13.0517	2.6562

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)		28.200	10.258	8.00	81.44
OUTFLOW: ID= 1 (1601)		28.200	0.295	9.83	79.40

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.87
TIME SHIFT OF PEAK FLOW (min)=110.00
MAXIMUM STORAGE USED (ha.m.)= 1.8682

```
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
```



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

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\2d4ed978-b7b5-4ab9-b4c6-1eaf81b4d0f0\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\2d4ed978-b7b5-4ab9-b4c6-1eaf81b4d0f0\scenar

DATE: 08/09/2019 TIME: 11:51:17

USER:

COMMENTS: _____

****
** SIMULATION : Run 07 **
****

CHICAGO STORM	IDF curve parameters: A=4688.000
Ptotal=101.55 mm	B= 17.000
	C= 0.962

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.21	6.17	1.46	12.17	1.18	18.17	0.36
0.33	0.22	6.33	1.68	12.33	1.11	18.33	0.35
0.50	0.22	6.50	1.97	12.50	1.06	18.50	0.34
0.67	0.23	6.67	2.35	12.67	1.00	18.67	0.34
0.83	0.24	6.83	2.89	12.83	0.96	18.83	0.33
1.00	0.24	7.00	3.67	13.00	0.91	19.00	0.32
1.17	0.25	7.17	4.88	13.17	0.87	19.17	0.32
1.33	0.26	7.33	6.96	13.33	0.83	19.33	0.31
1.50	0.27	7.50	11.02	13.50	0.80	19.50	0.31
1.67	0.27	7.67	21.03	13.67	0.77	19.67	0.30
1.83	0.28	7.83	62.12	13.83	0.74	19.83	0.30
2.00	0.29	8.00	196.54	14.00	0.71	20.00	0.29
2.17	0.30	8.17	83.09	14.17	0.69	20.17	0.29
2.33	0.31	8.33	41.25	14.33	0.66	20.33	0.28
2.50	0.33	8.50	25.07	14.50	0.64	20.50	0.28
2.67	0.34	8.67	17.06	14.67	0.62	20.67	0.27

2.83	0.35	8.83	12.48	14.83	0.60	20.83	0.27
3.00	0.37	9.00	9.60	15.00	0.58	21.00	0.26
3.17	0.38	9.17	7.66	15.17	0.56	21.17	0.26
3.33	0.40	9.33	6.29	15.33	0.54	21.33	0.26
3.50	0.42	9.50	5.28	15.50	0.53	21.50	0.25
3.67	0.44	9.67	4.51	15.67	0.51	21.67	0.25
3.83	0.47	9.83	3.91	15.83	0.50	21.83	0.25
4.00	0.49	10.00	3.44	16.00	0.49	22.00	0.24
4.17	0.52	10.17	3.05	16.17	0.47	22.17	0.24
4.33	0.55	10.33	2.73	16.33	0.46	22.33	0.24
4.50	0.59	10.50	2.47	16.50	0.45	22.50	0.23
4.67	0.63	10.67	2.24	16.67	0.44	22.67	0.23
4.83	0.67	10.83	2.05	16.83	0.43	22.83	0.23
5.00	0.72	11.00	1.89	17.00	0.42	23.00	0.22
5.17	0.78	11.17	1.75	17.17	0.41	23.17	0.22
5.33	0.85	11.33	1.62	17.33	0.40	23.33	0.22
5.50	0.93	11.50	1.51	17.50	0.39	23.50	0.21
5.67	1.03	11.67	1.41	17.67	0.38	23.67	0.21
5.83	1.14	11.83	1.33	17.83	0.37	23.83	0.21
6.00	1.28	12.00	1.25	18.00	0.37	24.00	0.21

CALIB			
STANDHYD (0600)	Area (ha)= 28.20		
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00	Dir. Conn.(%)= 70.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	19.74	8.46	
Dep. Storage (mm)=	1.00	5.00	
Average Slope (%)=	1.00	2.00	
Length (m)=	433.59	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.21	6.083	1.46	12.083	1.18	18.08	0.36
0.167	0.21	6.167	1.46	12.167	1.18	18.17	0.36
0.250	0.22	6.250	1.68	12.250	1.11	18.25	0.35
0.333	0.22	6.333	1.68	12.333	1.11	18.33	0.35
0.417	0.22	6.417	1.97	12.417	1.06	18.42	0.34
0.500	0.22	6.500	1.97	12.500	1.06	18.50	0.34
0.583	0.23	6.583	2.35	12.583	1.00	18.58	0.34
0.667	0.23	6.667	2.35	12.667	1.00	18.67	0.34
0.750	0.24	6.750	2.89	12.750	0.96	18.75	0.33
0.833	0.24	6.833	2.89	12.833	0.96	18.83	0.33
0.917	0.24	6.917	3.67	12.917	0.91	18.92	0.32
1.000	0.24	7.000	3.67	13.000	0.91	19.00	0.32
1.083	0.25	7.083	4.88	13.083	0.87	19.08	0.32
1.167	0.25	7.167	4.88	13.167	0.87	19.17	0.32
1.250	0.26	7.250	6.96	13.250	0.83	19.25	0.31
1.333	0.26	7.333	6.96	13.333	0.83	19.33	0.31
1.417	0.27	7.417	11.02	13.417	0.80	19.42	0.31
1.500	0.27	7.500	11.02	13.500	0.80	19.50	0.31
1.583	0.27	7.583	21.03	13.583	0.77	19.58	0.30
1.667	0.27	7.667	21.03	13.667	0.77	19.67	0.30
1.750	0.28	7.750	62.12	13.750	0.74	19.75	0.30
1.833	0.28	7.833	62.13	13.833	0.74	19.83	0.30

1.917	0.29	7.917	196.54	13.917	0.71	19.92	0.29
2.000	0.29	8.000	196.53	14.000	0.71	20.00	0.29
2.083	0.30	8.083	83.09	14.083	0.69	20.08	0.29
2.167	0.30	8.167	83.09	14.167	0.69	20.17	0.29
2.250	0.31	8.250	41.25	14.250	0.66	20.25	0.28
2.333	0.31	8.333	41.24	14.333	0.66	20.33	0.28
2.417	0.33	8.417	25.07	14.417	0.64	20.42	0.28
2.500	0.33	8.500	25.07	14.500	0.64	20.50	0.28
2.583	0.34	8.583	17.06	14.583	0.62	20.58	0.27
2.667	0.34	8.667	17.06	14.667	0.62	20.67	0.27
2.750	0.35	8.750	12.48	14.750	0.60	20.75	0.27
2.833	0.35	8.833	12.48	14.833	0.60	20.83	0.27
2.917	0.37	8.917	9.60	14.917	0.58	20.92	0.26
3.000	0.37	9.000	9.60	15.000	0.58	21.00	0.26
3.083	0.38	9.083	7.66	15.083	0.56	21.08	0.26
3.167	0.38	9.167	7.66	15.167	0.56	21.17	0.26
3.250	0.40	9.250	6.29	15.250	0.54	21.25	0.26
3.333	0.40	9.333	6.29	15.333	0.54	21.33	0.26
3.417	0.42	9.417	5.28	15.417	0.53	21.42	0.25
3.500	0.42	9.500	5.28	15.500	0.53	21.50	0.25
3.583	0.44	9.583	4.51	15.583	0.51	21.58	0.25
3.667	0.44	9.667	4.51	15.667	0.51	21.67	0.25
3.750	0.47	9.750	3.91	15.750	0.50	21.75	0.25
3.833	0.47	9.833	3.91	15.833	0.50	21.83	0.25
3.917	0.49	9.917	3.44	15.917	0.49	21.92	0.24
4.000	0.49	10.000	3.44	16.000	0.49	22.00	0.24
4.083	0.52	10.083	3.05	16.083	0.47	22.08	0.24
4.167	0.52	10.167	3.05	16.167	0.47	22.17	0.24
4.250	0.55	10.250	2.73	16.250	0.46	22.25	0.24
4.333	0.55	10.333	2.73	16.333	0.46	22.33	0.24
4.417	0.59	10.417	2.47	16.417	0.45	22.42	0.23
4.500	0.59	10.500	2.47	16.500	0.45	22.50	0.23
4.583	0.63	10.583	2.24	16.583	0.44	22.58	0.23
4.667	0.63	10.667	2.24	16.667	0.44	22.67	0.23
4.750	0.67	10.750	2.05	16.750	0.43	22.75	0.23
4.833	0.67	10.833	2.05	16.833	0.43	22.83	0.23
4.917	0.72	10.917	1.89	16.917	0.42	22.92	0.22
5.000	0.72	11.000	1.89	17.000	0.42	23.00	0.22
5.083	0.78	11.083	1.75	17.083	0.41	23.08	0.22
5.167	0.78	11.167	1.75	17.167	0.41	23.17	0.22
5.250	0.85	11.250	1.62	17.250	0.40	23.25	0.22
5.333	0.85	11.333	1.62	17.333	0.40	23.33	0.22
5.417	0.93	11.417	1.51	17.417	0.39	23.42	0.21
5.500	0.93	11.500	1.51	17.500	0.39	23.50	0.21
5.583	1.03	11.583	1.41	17.583	0.38	23.58	0.21
5.667	1.03	11.667	1.41	17.667	0.38	23.67	0.21
5.750	1.14	11.750	1.33	17.750	0.37	23.75	0.21
5.833	1.14	11.833	1.33	17.833	0.37	23.83	0.21
5.917	1.28	11.917	1.25	17.917	0.37	23.92	0.21
6.000	1.28	12.000	1.25	18.000	0.37	24.00	0.21

Max.Eff.Inten.(mm/hr)=		196.54	130.58	
over (min)		5.00	10.00	
Storage Coeff. (min)=		4.70 (ii)	8.54 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.22	0.12	
				TOTALS
PEAK FLOW	(cms)=	9.87	2.18	11.674 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	100.55	65.94	90.17
TOTAL RAINFALL	(mm)=	101.55	101.55	101.55
RUNOFF COEFFICIENT	=	0.99	0.65	0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(1601) IN= 2---> OUT= 1 DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1513	1.3800
	0.0101	0.1474	0.1574	1.4914
	0.0156	0.3067	0.1634	1.6079
	0.0196	0.4784	0.1691	1.7243
	0.0229	0.6609	0.2060	1.8408
	0.1155	0.8534	0.5843	1.9573
	0.1235	0.9547	0.8855	2.0738
	0.1310	1.0560	2.0056	2.1902
	0.1381	1.1623	6.5687	2.4232
	0.1448	1.2686	13.0517	2.6562

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)		28.200	11.674	8.00	90.17
OUTFLOW: ID= 1 (1601)		28.200	0.663	9.08	88.13

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.68
TIME SHIFT OF PEAK FLOW (min)= 65.00
MAXIMUM STORAGE USED (ha.m.)= 1.9880

FINISH

APPENDIX B23

SWM POND #6 DETAIL DESIGN

– REGIONAL STORM (12 HOUR HAZEL HURRICANE)

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===================================================================================
========================

   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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***** D E T A I L E D   O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat

Output filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\26e6a128-c715-4c01-81a9-5124cdb8734d\scenar
Summary filename:
C:\Users\zhouj\AppData\Local\Civica\VH5\80553807-60af-42aa-82ba-587931b98dfc\26e6a128-c715-4c01-81a9-5124cdb8734d\scenar

DATE: 08/09/2019   TIME: 11:52:16

USER:

COMMENTS: ____

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  ************************************************
  ** SIMULATION : Run 14                        **
  ************************************************

--------------------
|   READ STORM     |    Filename: C:\Users\zhouj\AppD
|                  |              ata\Local\Temp\
|                  |              9dc78f03-e1c1-4581-975f-967c49e8b324\229503a6
| Ptotal=212.00 mm |    Comments: Hazel
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.00	6.00	4.00	13.00	7.00	23.00	10.00	53.00
2.00	4.00	5.00	17.00	8.00	13.00	11.00	38.00
3.00	6.00	6.00	13.00	9.00	13.00	12.00	13.00

```
-------------------------------------------------------------------------------

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| CALIB            |
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```
| STANDHYD (  0600)|   Area    (ha)=  28.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	19.74	8.46
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	433.59	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

				TOTALS
Max.Eff.Inten.(mm/hr)=		53.00	52.87	
over (min)		10.00	20.00	
Storage Coeff.	(min)=	7.94 (ii)	17.05 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	20.00	
Unit Hyd. peak	(cms)=	0.13	0.06	
PEAK FLOW	(cms)=	2.90	1.19	4.098 (iii)
TIME TO PEAK	(hrs)=	10.00	10.00	10.00
RUNOFF VOLUME	(mm)=	211.00	199.43	207.53
TOTAL RAINFALL	(mm)=	212.00	212.00	212.00

RUNOFF COEFFICIENT   =   1.00   0.94   0.98

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 97.0   Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------------------------------------------------------------------

--------------------
| RESERVOIR( 1601)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |
--------------------
```

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1513	1.3800
0.0101	0.1474	0.1574	1.4914
0.0156	0.3067	0.1634	1.6079
0.0196	0.4784	0.1691	1.7243
0.0229	0.6609	0.2060	1.8408
0.1155	0.8534	0.5843	1.9573
0.1235	0.9547	0.8855	2.0738
0.1310	1.0560	2.0056	2.1902
0.1381	1.1623	6.5687	2.4232
0.1448	1.2686	13.0517	2.6562

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0600)	28.200	4.098	10.00	207.53
OUTFLOW: ID= 1 (1601)	28.200	4.033	10.00	205.52

PEAK   FLOW   REDUCTION [Qout/Qin](%)= 98.42
TIME SHIFT OF PEAK FLOW   (min)= 0.00
MAXIMUM STORAGE   USED   (ha.m.)= 2.2947

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 FINISH
===================================================================================
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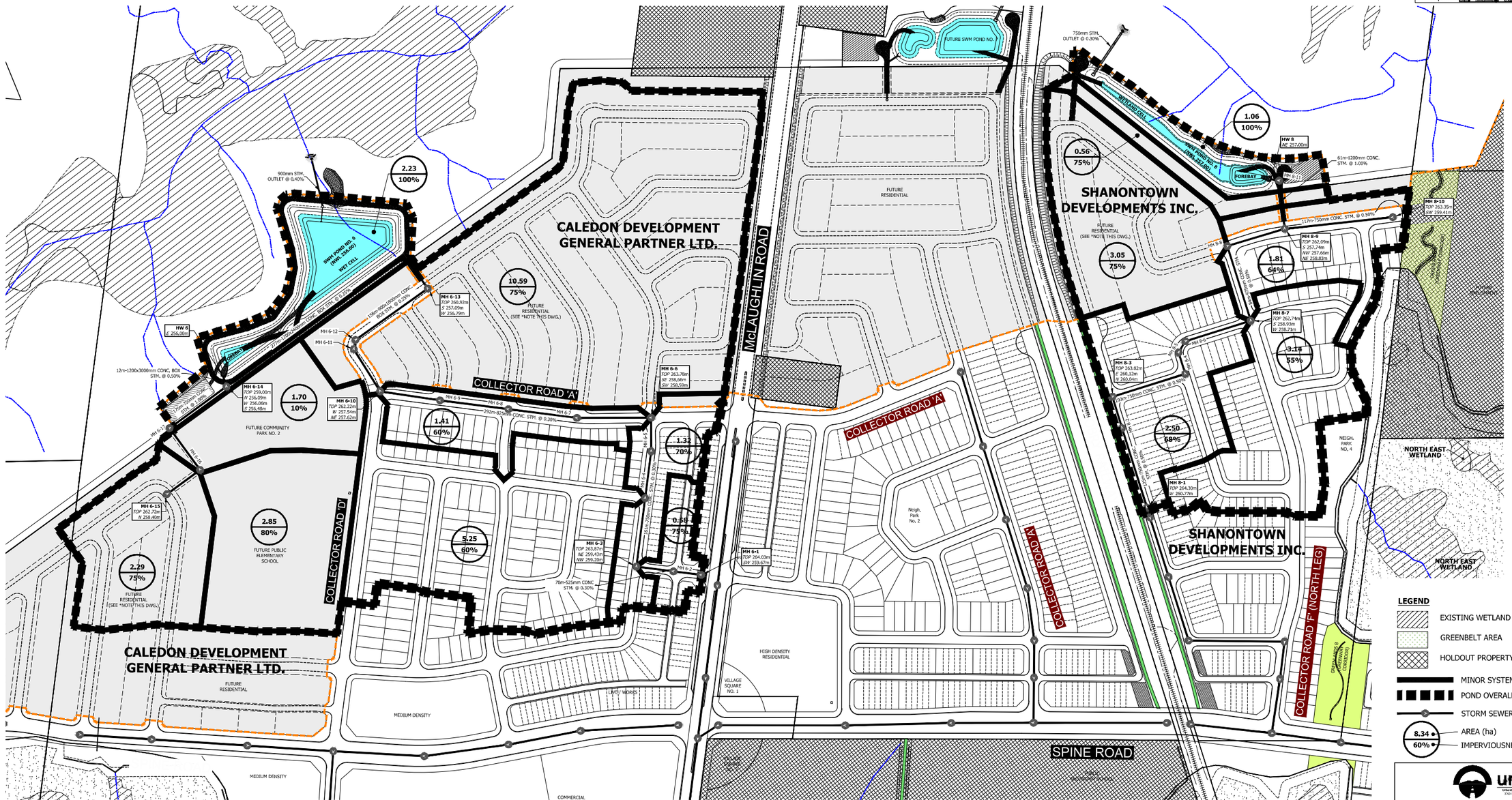
APPENDIX

C BACKGROUND DOCUMENTS



LAND USE	TRCA % IMP. VALUE
COMMERCIAL	95%
APPARTMENTS	80%
ROW DWELINGS / TOWNHOUSES	75%
DUPLEX	75%
SEMI-DETACHED	60%
SINGLE FAMILY	60%
SCHOOLS / INSTITUTIONAL	80%
SWM FACILITY	100%
PARKS	10%

*** NOTE:**
75% IMPERVIOUS VALUE HAS BEEN ASSUMED FOR ALL FUTURE STAGE 2 RESIDENTIAL LANDS.

NOTES:

*** PROPOSED SWM PONDS 6 AND 8 ARE LOCATED OUTSIDE OF THE MW2 STAGE 1 LIMIT AND THEY ARE PART OF THE EXTERNAL STAGE 1 INFRASTRUCTURE.**
*** POND 6 AND 8 FOOTPRINTS WILL RESPECT THE LIMITS OF THE GREENBELT ENCROACHMENT AS APPROVED BY TRCA. REFER TO DRAWINGS 606A AND 608A FOR DETAILS OF PONDS 6 AND 8.**
*** FUTURE STAGE 2 DRAINAGE CONTRIBUTION TO SWM PONDS 6 AND 8 TO BE CONFIRMED FOLLOWING APPROVAL OF THE STAGE 2 PLAN. HOWEVER, CONSERVATIVE ASSUMPTIONS WITH RESPECT TO THE STAGE 2 LAND USE PLAN AND % IMPERVIOUS VALUE RECOMMENDED BY TRCA HAVE BEEN CONSIDERED FOR SIZING OF PONDS 6 AND 8.**

LEGEND

- EXISTING WETLAND
- GREENBELT AREA
- HOLDOUT PROPERTY
- WOODLOT
- STAGE 2 LANDS
- MINOR SYSTEM STORM DRAINAGE BOUNDARY
- POND OVERALL DRAINAGE BOUNDARY
- STORM SEWER ALIGNMENT
- 8.34 / 60% — AREA (ha) / IMPERVIOUSNESS

urbantech
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TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
MW2 STAGE 1 ADDENDUM

ULTIMATE STORM DRAINAGE PLAN (PONDS 6 & 8)

SURVEYED BY:	R.P.E.	DATE:	2015	JOB NO.	15-483
DRAWN BY:	V.P.	CHECKED BY:	D.Z.	DRAWING NO.	502A
DESIGNED BY:	D.Z.	CHECKED BY:	D.Z.	SHEET NO.	
SCALE:	1:2000	DATE:	DECEMBER 2018		

urbantech

SWM DESIGN CALCULATIONS
HYRDO-0: Contributing Drainage Area and Land Use

Project Name: Mayfield West Phase 2
Municipality: Town of Caledon
Project No.: 15-483
Date: 29-Mar-16

Prepared by: L.M.
Checked by: A.F.
Last Revised: 17-Sep-18

Pond 6

Contributing Drainage Area (Ultimate)

Pond 6	Area [ha]	Imperviousness	Design Requirement		
			Conveyance	Quantity	Quality
Minor System Drainage Area (Stage 2)	10.59	75%	•	•	•
Minor System Drainage Area (Stage 2)	2.85	75%	•	•	•
Minor System Drainage Area (Stage 2)	2.29	75%	•	•	•
Minor System Drainage Area (Stage 2)	1.70	10%	•	•	•
Minor System Drainage Area (Stage 1)	1.41	60%	•	•	•
Minor System Drainage Area (Stage 1)	5.25	60%	•	•	•
Minor System Drainage Area (Stage 1)	1.32	75%	•	•	•
Minor System Drainage Area (Stage 1)	0.58	75%	•	•	•
Pond Block	2.23	100%	•	•	•
Total Drainage Area	**28.2**	**70%** (Weighted Average)	**28.2**	**28.2**	**28.2**

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DESIGN CALCULATIONS
SWMF-1: SWM Facility Targets

Project Name: Mayfield West Phase 2
Municipality: Town of Caledon
Project No.: 15-483
Date: 29-Mar-16

Prepared by: D.L.
Checked by: A.F.
Last Revised: 10-Jan-19

SWM Pond 6

Event	Volume	Discharge	Description
PERM POOL	185.0 m^3/ha	-	(Based on 70% imperviousness; see below)
EXT DET	325 m^3/imp ha	0.00031 m^3/s/ha	AMEC SWS (2014)

Wet Pond Water Quality Storage Requirements

(MOE Stormwater Management Planning and Design Manual 2003, Table 3.2)

Impervious Level (%)	Water Quality Volume m^3/ha	Extended Detention Volume m^3/ha	Permanent Pool Volume m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210
Interpolated Permanent Pool and Extended Detention Storage Requirements:			
70%	225.0	40	**185.0**

Drainage Area= 28.2 ha (refer to HYDRO-1 for areas)
Imperviousness= 70% (refer to HYDRO-1 for %IMP calculations)

	Stage [m]	Required Volume [m^3]	Provided Volume [m^3]	Target Discharge [m^3/s]
PERM POOL	256.0	5217	6451	-
EXT DET	257.30	6575	11203	0.009
25YR	257.70	13191	15643	0.169
100YR	257.9	15568	17413	0.984

P:\projects\15-483\Design\SWM\Preliminary Pond Design\[SWMF-1 Pond Storage Calculations (June 2017).xlsx]SUMMARY

urbantech

DESIGN CALCULATIONS
SWMF-2: Drawdown Time

Project Name: Mayfield West Phase 2
Municipality: Town of Caledon
Project No.: 15-483
Date: 10-Jan-19

Prepared by: L.M.
Checked by:

SWM Pond 6

Detention Time Calculations

$t = (0.66C_2h^{1.5}+2C_3h^{0.5})/2.75Ao$ *(MOE Eq'n 4.11)*

t= 1155194	*drawdown time in seconds*
t= 320.9	*drawdown time in hours*
d= 0.065	*diameter of the orifice (m)*
A_0= 0.0033	*cross-sectional area of the orifice (m^2)*
h= 0.667	*maximum water elevation above orifice (m)*
Drainage Area= 28.2	*ha*
$Q_{ext\ det}$= 0.007	*proposed extended detention release rate (m3/s)* [1]
Q_{target}= 0.007	*based on target release rate (0.00025 m3/s/ha) and 28.2ha drainage area*

[1] Although the proposed extended detention release rate exceeds the target flow, it should be noted that the minimum orifice size of 75 mm would lead to a drawdown time of approximately 240 hours or 10 days. As the inter-event rainfall period in the GTA for a 25 mm rain event has a frequency of approximately 6 days, a target of less than 6 days was selected for this pond such that there would be enough extended detention storage available for the next 25 mm rainfall event.

C_2= 5484.817757	*slope coefficient from the area-depth linear regression*
C_3= 5243	*intercept from the area-depth linear regression*

Pond area-depth relationship:

	Elevation	Area	Depth Difference per section	Total Depth above Orifice	Cumulative Volume
N.W.L.	256.30	5243	0.00	0.00	0
	256.60	6280	0.30	0.30	1728
	256.80	7081	0.20	0.50	3065
Ext. Detention	257.30	9290	0.50	0.70	7157

The drawdown time for SWM Pond 6 is 320.9 hours (13.4 days)

Hickenbottom (Perforated Riser Pipe) Calculation

Pipe Diameter	300	(mm)
Hole Diameter	25	(mm)
Number of Holes	100	
Hole Spacing	50	(mm)
Max. # of holes per row	12	
# of rows required	9	
Min. Perf. Pipe Length	**0.73**	(m)

Area Check:

Area of holes	49087	(mm^2)
Equivalent Diameter	**250**	(mm)

Therefore, the perforated riser pipe does not control the extended detention release rate.

Provided Perf. Pipe Length	**1**	(m)

P:\projects\15-483\Design\SWM\Preliminary Pond Design\[SWMF-2 Drawdown Time (June 2017).xlsx]Pond 8

Urbantech Consulting, A Division of Leighton-Zec Ltd.
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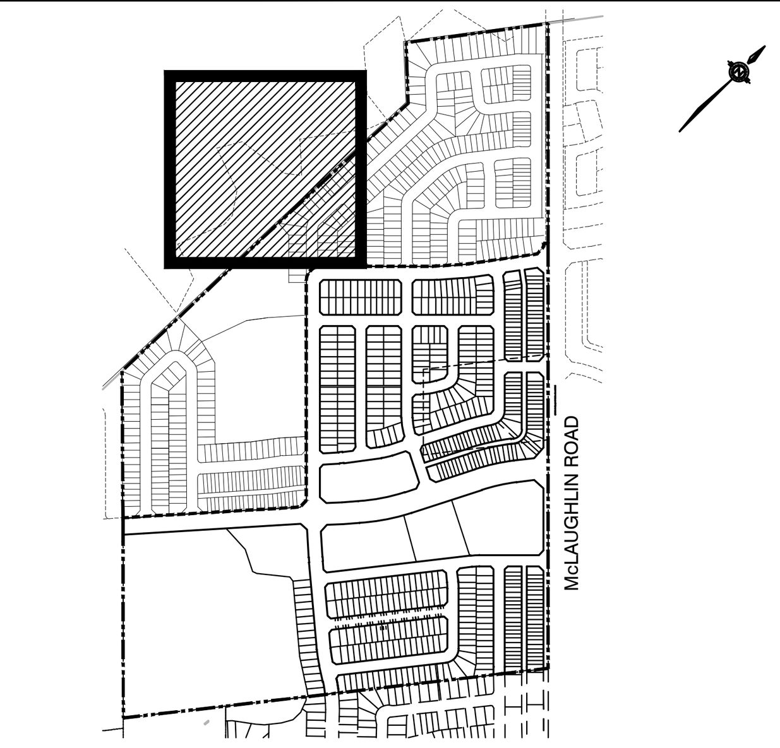
www.urbantech.com

TOWN OF CALEDON
PLANNING
RECEIVED
Dec 18, 2020

REFER TO DWG No. P35 FOR DETAILS OF CROSS SECTION A-A AND SWM2 FOR DETAILS OF CROSS-SECTIONS B-B, C-C AND D-D



KEY PLAN NTS

No.	REVISIONS TO DRAWING	BY	DATE	APPR.
5	3rd ENGINEERING SUBMISSION	A.D.R.	MAR 23/20	
4	2nd ENGINEERING SUBMISSION	A.D.R.	MAR 18/20	
3	ISSUED FOR ADDENDUM 1	A.D.R.	DEC 10/19	
2	ISSUED FOR TENDER	A.D.R.	DEC 2/19	
1	1st ENGINEERING SUBMISSION	A.D.R.	AUG 15/19	

ALL PREVIOUS ISSUES OF THIS DRAWING ARE SUPERSEDED

CLIENT
CALEDON DEVELOPMENT #2 LP

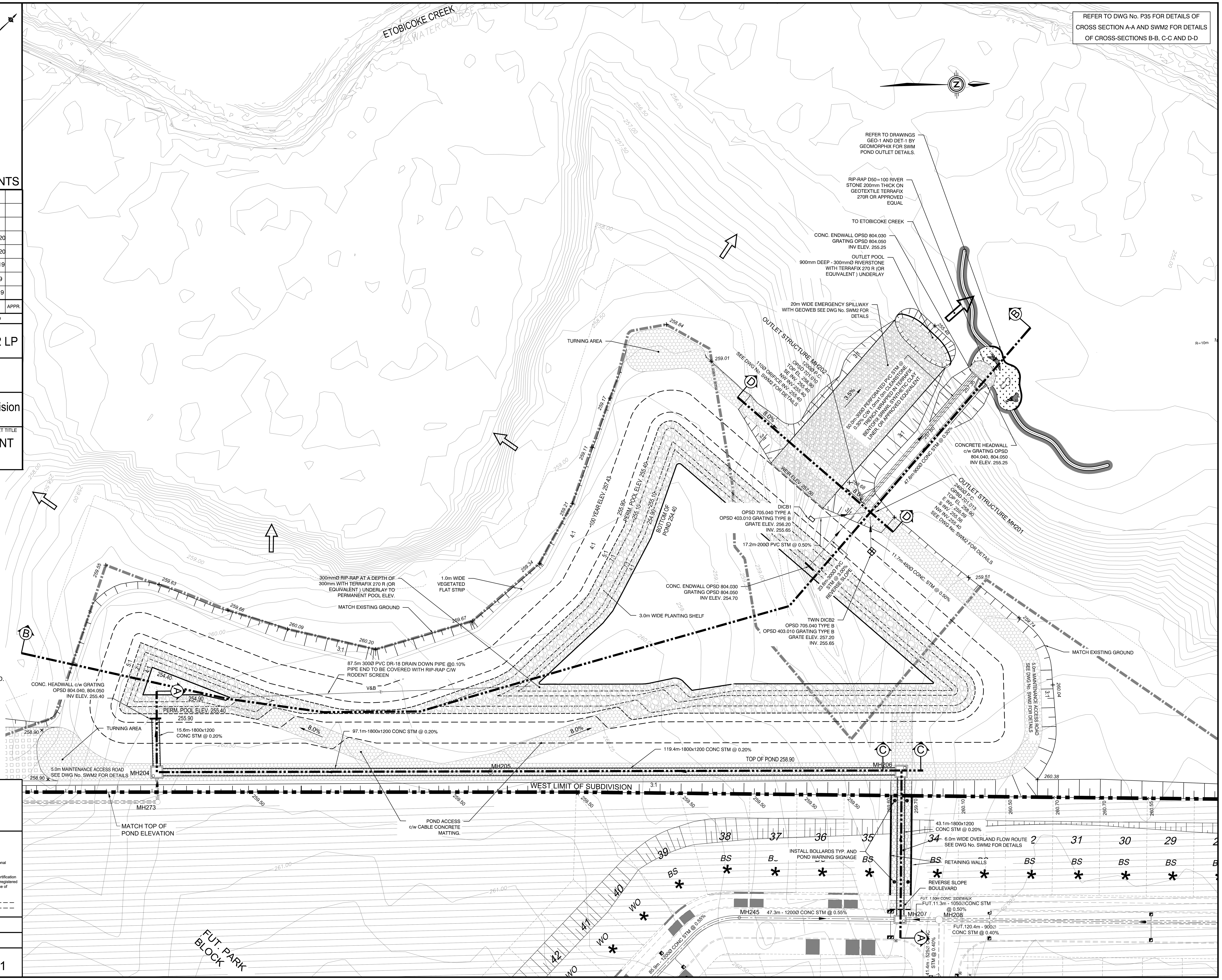
MUNICIPALITY
TOWN OF CALEDON

PROJECT TITLE
Mayfield West Residential Subdivision
Brookvalley - Stage 1B

SHEET TITLE
STORMWATER MANAGEMENT FACILITY PLAN

LEGEND

- EXISTING ELEVATION
- PROPOSED ELEVATION
- FUTURE ELEVATION
- EX. CONTOUR
- OVERLAND FLOW
- DIRECTION OF FLOW
- SANITARY MANHOLE
- STORM MANHOLE
- CB CATCHBASIN
- DCB DOUBLE CATCHBASIN
- V&B VALVE AND BOX
- H&V HYDRANT AND VALVE
- LIMIT OF PHASE / STAGE
- LIMIT OF SUBDIVISION
- MAINTENANCE ACCESS ROAD PER DETAIL ON SWM2
- PROPOSED SLOPING
- FUTURE STAGE 2. NOT APPROVED. NOT TO BE CONSTRUCTED.
- PHASE 1A



ETOBICOKE CREEK
WATERCOURSE
REFER TO DRAWINGS GEO-1 AND DET-1 BY GEOMORPHIX FOR SWM POND OUTLET DETAILS.
RIP-RAP D50=100 RIVER STONE 200mm THICK ON GEOTEXTILE TERRAFIX 270R OR APPROVED EQUAL
TO ETOBICOKE CREEK
CONC. ENDWALL OPSD 804.030 GRATING OPSD 804.050 INV ELEV. 255.25
OUTLET POOL 900mm DEEP - 300mmØ RIVERSTONE WITH TERRAFIX 270 R (OR EQUIVALENT) UNDERLAY
20m WIDE EMERGENCY SPILLWAY WITH GEOWEB SEE DWG No. SWM2 FOR DETAILS
OUTLET STRUCTURE MH202
SEE DWG No. SWM2 FOR DETAILS
TURNING AREA
CONCRETE HEADWALL c/w GRATING OPSD 804.040, 804.050 INV ELEV. 255.25
OUTLET STRUCTURE MH201
SEE DWG No. SWM2 FOR DETAILS
47.6m-900Ø CONC STM @ 0.30%
DICB1 OPSD 705.040 TYPE A OPSD 403.010 GRATING TYPE B GRATE ELEV. 256.20 INV. 255.65
17.2m-200Ø PVC STM @ 0.50%
11.7m-450Ø CONC. STM @ 0.50%
100 YEAR ELEV. 257.43
PERM. POOL ELEV. 255.40
BOTTOM OF POND 254.40
300mmØ RIP-RAP AT A DEPTH OF 300mm WITH TERRAFIX 270 R (OR EQUIVALENT) UNDERLAY TO PERMANENT POOL ELEV.
1.0m WIDE VEGETATED FLAT STRIP
MATCH EXISTING GROUND
CONC. ENDWALL OPSD 804.030 GRATING OPSD 804.050 INV ELEV. 254.70
3.0m WIDE PLANTING SHELF
TWIN DICB2 OPSD 705.040 TYPE B OPSD 403.010 GRATING TYPE B GRATE ELEV. 257.20 INV. 255.65
MATCH EXISTING GROUND
5.0m MAINTENANCE ACCESS ROAD SEE DWG No. SWM2 FOR DETAILS
87.5m 300Ø PVC DR-18 DRAIN DOWN PIPE @0.10% PIPE END TO BE COVERED WITH RIP-RAP C/W RODENT SCREEN
CONC. HEADWALL c/w GRATING OPSD 804.040, 804.050 INV ELEV. 255.40
PERM. POOL ELEV. 255.40
TURNING AREA
15.6m-1800x1200 CONC STM @ 0.20%
97.1m-1800x1200 CONC STM @ 0.20%
119.4m-1800x1200 CONC STM @ 0.20%
TOP OF POND 258.90
5.0m MAINTENANCE ACCESS ROAD SEE DWG No. SWM2 FOR DETAILS
MH204
MH205
MH206
MH273
WEST LIMIT OF SUBDIVISION
MATCH TOP OF POND ELEVATION
POND ACCESS c/w CABLE CONCRETE MATTING.
43.1m-1800x1200 CONC STM @ 0.20%
6.0m WIDE OVERLAND FLOW ROUTE SEE DWG No. SWM2 FOR DETAILS
INSTALL BOLLARDS TYP. AND POND WARNING SIGNAGE
RETAINING WALLS
REVERSE SLOPE BOULEVARD
FUT. 1.5m CONC. SIDEWALK
MH245
47.3m - 1200Ø CONC STM @ 0.55%
MH207
MH208
FUT. PARK BLOCK
R=10m

CONSULTANT
wsp
100 Commerce Valley Dr. West, Thornhill, ON Canada L3T 0A1
t: 905.882.1100 f: 905.882.0055 www.wsp.com

STAMP
LICENSED PROFESSIONAL ENGINEER
A.D. RAIMONDO
100173463
MAR 23-2020
PROVINCE OF ONTARIO

Town of Caledon
APPROVED
AS NOTED

This approval constitutes a general review and does not certify dimensional accuracy.

This approval is subject to further certification of the "as constructed" works by a registered Professional Engineer of the Province of Ontario.

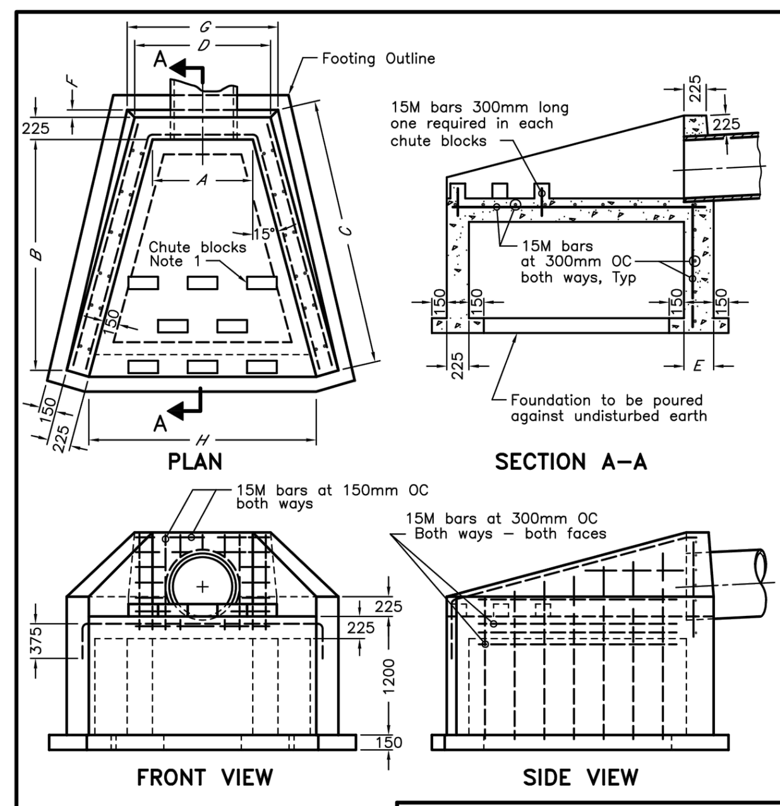
Date :
Approved by :

DESIGNED	DRAWN	CHECKED
S.D. / J.V.	10/12 CAD	A.D.R.

SCALE	DATE
1:500	MARCH 2019

PROJECT NUMBER	DWG. NUMBER
12M-00011	SWM1

T-16005Cb



PIPE DIA	ENDWALL DIMENSIONS							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
600	1050	2400	2725	1400	300	75	1525	2350
675	1125	2400	2725	1475	300	75	1600	2425
750	1200	2400	2725	1550	300	75	1675	2500
825	1275	2400	2725	1625	300	75	1755	2575
900	1350	2400	2725	1700	300	75	1825	2650
975	1425	2400	2725	1775	375	150	1975	2725
1050	1500	3000	3400	1850	375	150	2050	3100
1200	1650	3000	3400	2000	375	150	2200	3250
1350	1800	3000	3400	2150	375	150	2350	3400
1500	1950	3000	3400	2300	375	150	2500	3550
1650	2100	3000	3400	2450	375	150	2650	3700
1800	2250	3000	3400	2600	375	150	2800	3850
2400	3000	3000	3400	3350	375	150	3550	4600

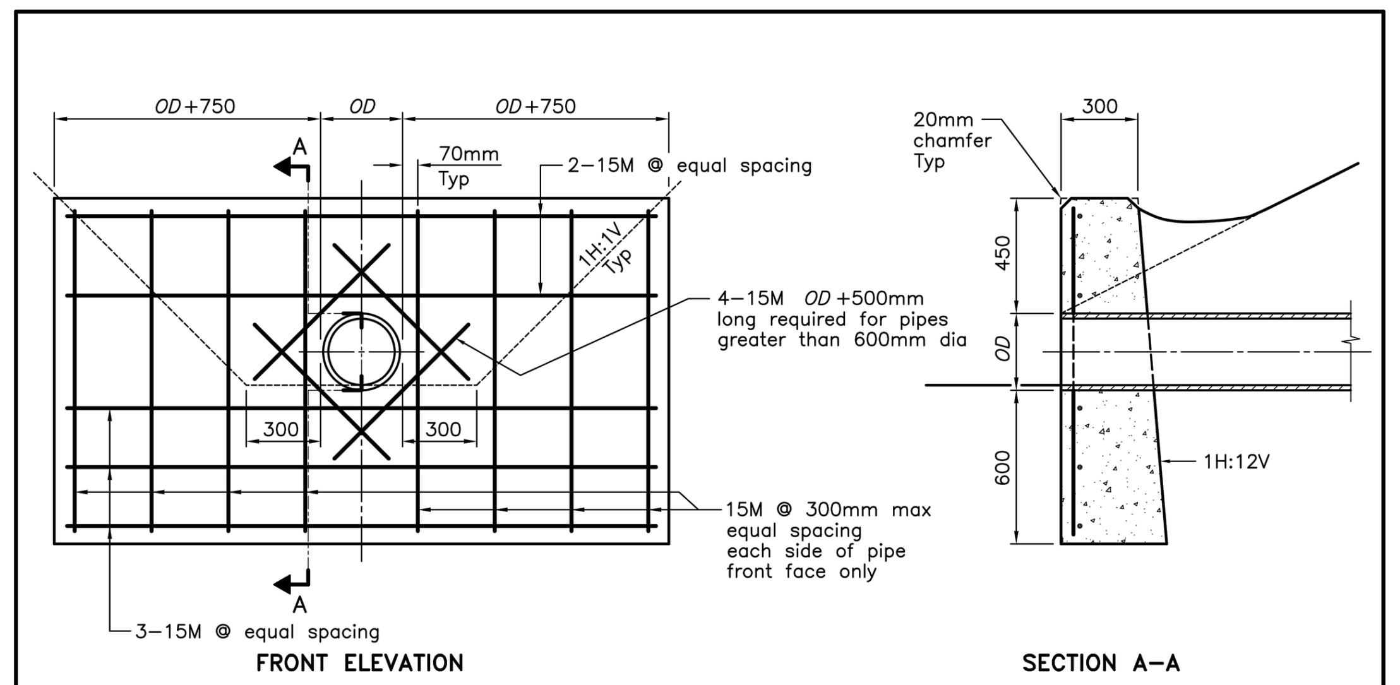
NOTES:
1 Poured concrete chute blocks 300x200x100mm high.

A This OPSD to be read in conjunction with OPSD 3940.150.
B Class of concrete: 30MPa.
C Cover to reinforcing bars: 75mm ±20mm.
D Granular backfill to be placed to 300mm min thickness on all sides.
E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2005 Rev 0

CONCRETE HEADWALL
FOR SEWER OR CULVERT PIPE OUTLET

OPSD 804.040



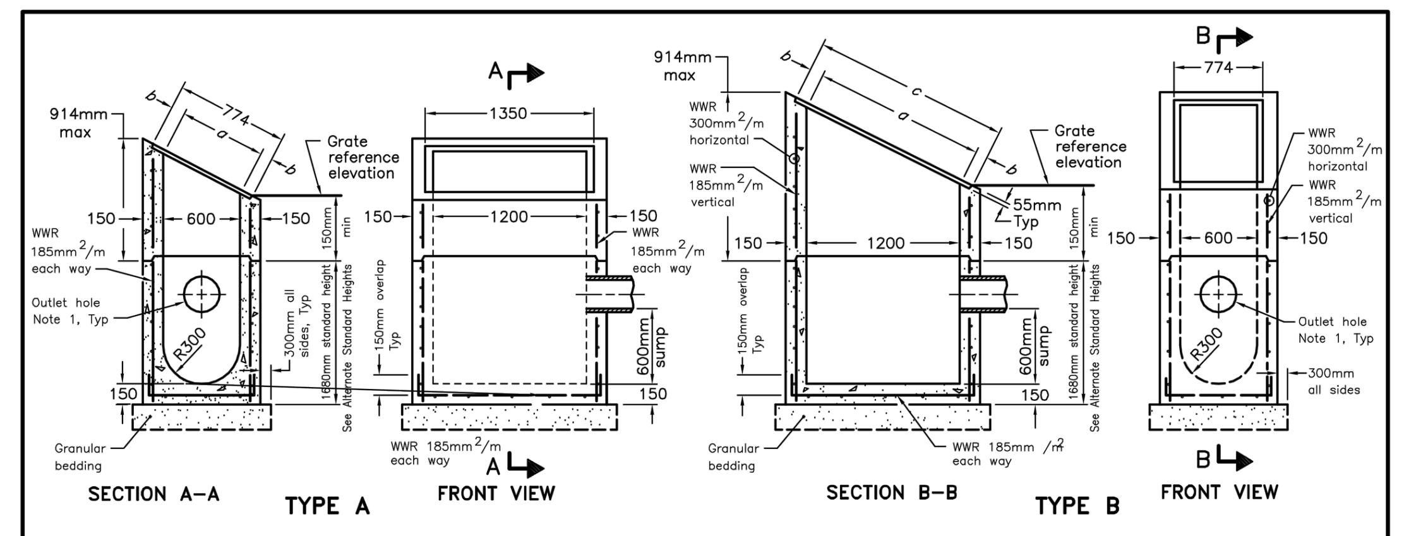
LEGEND:
OD – Outside diameter of pipe

NOTES:
A This OPSD to be read in conjunction with OPSD 3940.150.
B If a steel grate is required, refer to OPSD 804.05.
C Class of concrete: 30MPa.
D Cover to reinforcing bars 75mm ± 20mm.
E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2006 Rev 1

CONCRETE HEADWALL
FOR PIPE LESS THAN 900mm DIAMETER

OPSD 804.030



Opening Dimensions			
Grate Type	Grate Slope	*a*	*b*
B	2H:1V	670	52
	3H:1V	632	71
	4H:1V	618	78
	HOR	600	87

Alternate Standard Heights	
Alternate	Dimension
A	1980
B	1520
C	1380

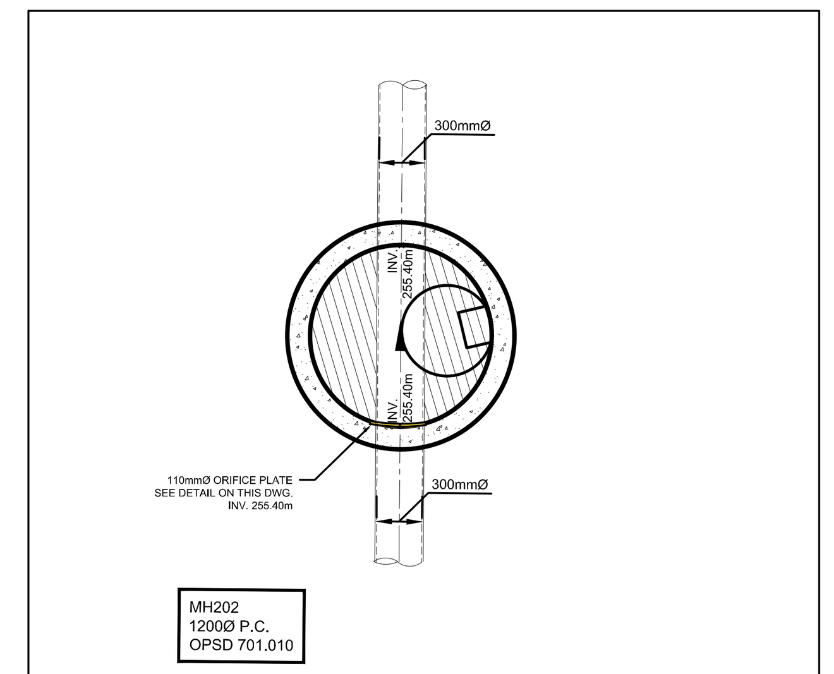
Opening Dimensions				
Grate Type	Grate Slope	*a*	*b*	*c*
C	2H:1V	1341	66	1473
	3H:1V	1265	104	1473
	4H:1V	1237	118	1473
B	6H:1V	1216	65	1346
	HOR	1200	73	1346

NOTES:
1 Outlet hole size 525mm maximum diameter, location as required.
A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope shall be 6H:1V or flatter.
B Center reinforcing in wall and base slab ±25mm.
C Lap riser horizontal wires 300mm. Laps shall be placed at corners.
D Granular backfill shall be placed to a minimum thickness of 300mm all around the ditch inlet.
E Grating shall be according to OPSD 403.010.
F Pipe support shall be according to OPSD 708.020.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2009 Rev 2

PRECAST CONCRETE DITCH INLETS
600 x 1200mm

OPSD 705.040



STM MH202
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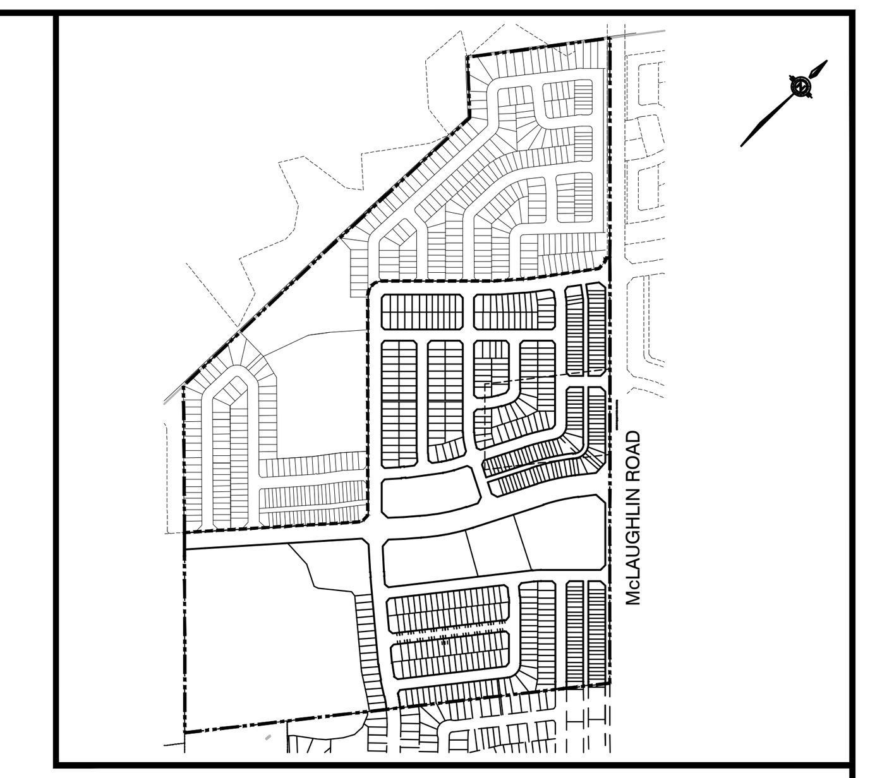
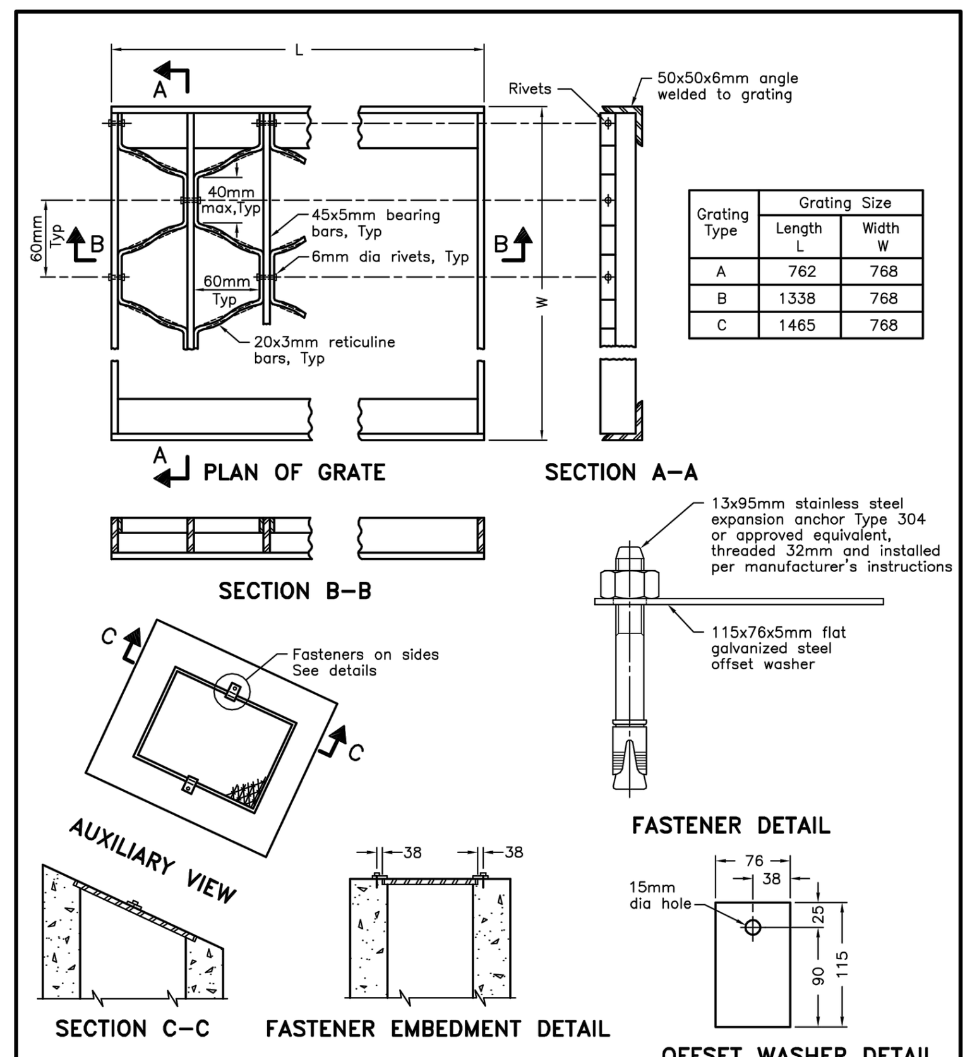


KEY PLAN — NTS

LEGEND

+263.25	EXISTING ELEVATION
+263.50	PROPOSED ELEVATION
+[263.50]	FUTURE ELEVATION
263.0	EX. CONTOUR
	OVERLAND FLOW
	DIRECTION OF FLOW
	SANITARY MANHOLE
	STORM MANHOLE
CB	CATCHBASIN
DCB	DOUBLE CATCHBASIN
V&B	VALVE AND BOX
H&V	HYDRANT AND VALVE
	LIMIT OF PHASE / STAGE
	LIMIT OF SUBDIVISION
	MAINTENANCE ACCESS ROAD PER DETAIL ON SWM2
	PROPOSED SLOPING
	FUTURE STAGE 2. NOT APPROVED. NOT TO BE CONSTRUCTED.
	PHASE 1A



Grating Type	Grating Size	
	Length L	Width W
A	762	768
B	1338	768
C	1465	768

NOTES:
A Fastener shall be inserted to maintain minimum concrete cover requirements.
B All steel components and rivets shall be galvanized.
C All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2013 Rev 2

GALVANIZED STEEL HONEYCOMB GRATING FOR DITCH INLETS

OPSD 403.010

Stormwater Management Pond Warning Sign

STORMWATER MANAGEMENT POND WARNING SIGN

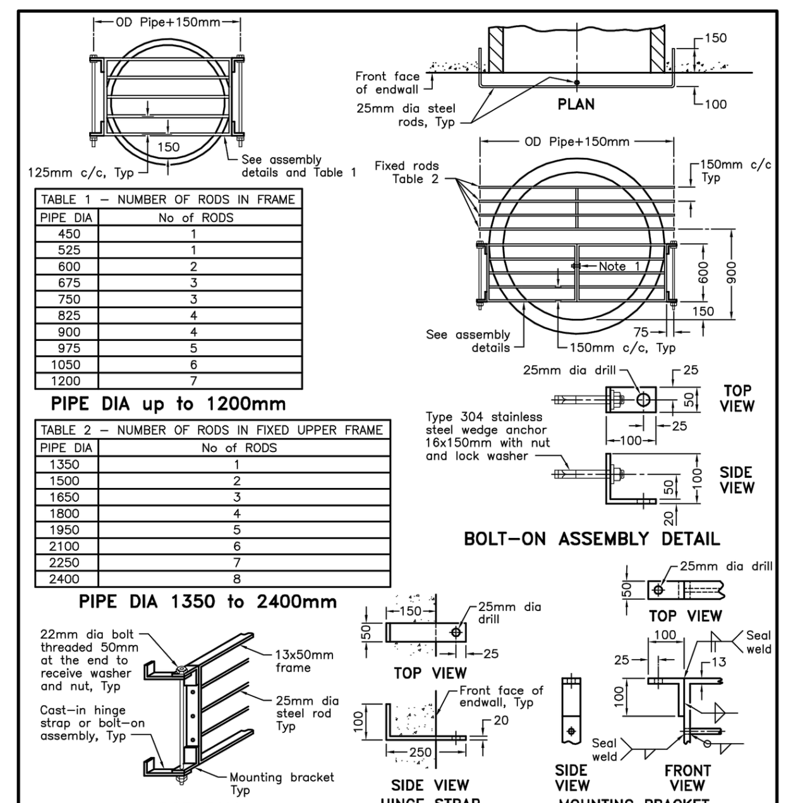


TABLE 1 – NUMBER OF RODS IN FRAME	
PIPE DIA	No of RODS
450	1
525	1
600	2
675	3
750	3
825	4
900	4
975	5
1050	6
1200	7

PIPE DIA up to 1200mm

TABLE 2 – NUMBER OF RODS IN FIXED UPPER FRAME	
PIPE DIA	No of RODS
1350	1
1500	2
1650	3
1800	4
1950	5
2100	6
2250	7
2400	8

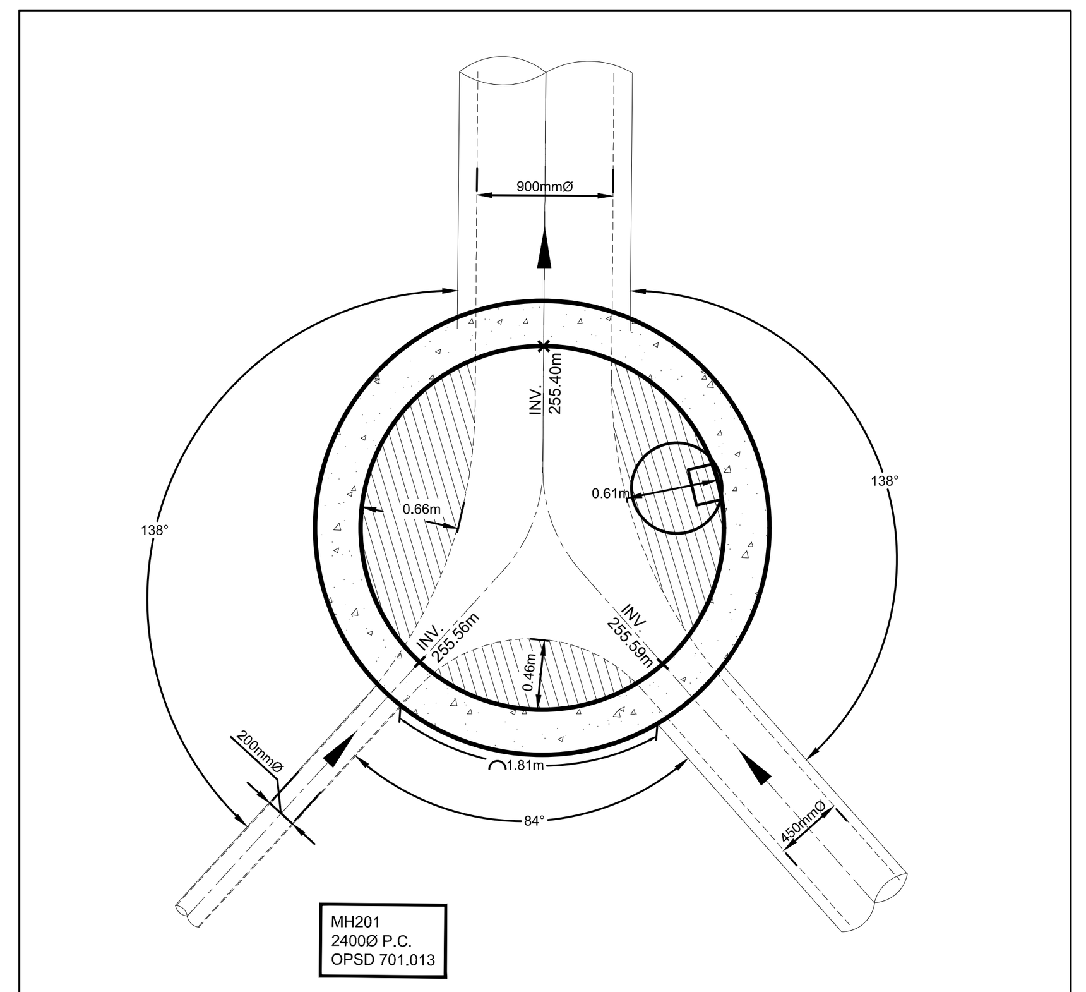
PIPE DIA 1350 to 2400mm

NOTES:
1 Grates shall be secured by either a bolt and nut or a locking device as specified.
A Metal surfaces shall be either painted with 2 coats of self priming abrasion resistant immersion grade epoxy or hot dip galvanized, as specified.
B Frame, hinge strap, mounting bracket, and steel rods shall be medium grade steel.
C All welding shall be according to CSA W59 and W47.1.
D All dimensions are in millimetres unless otherwise shown.

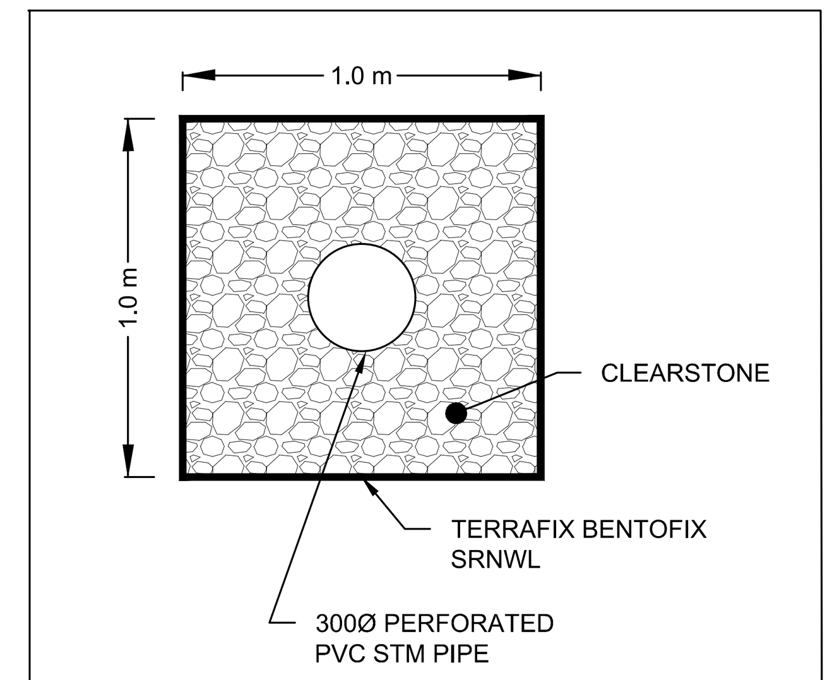
ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2013 Rev 1

GRATING
FOR CONCRETE ENDWALL

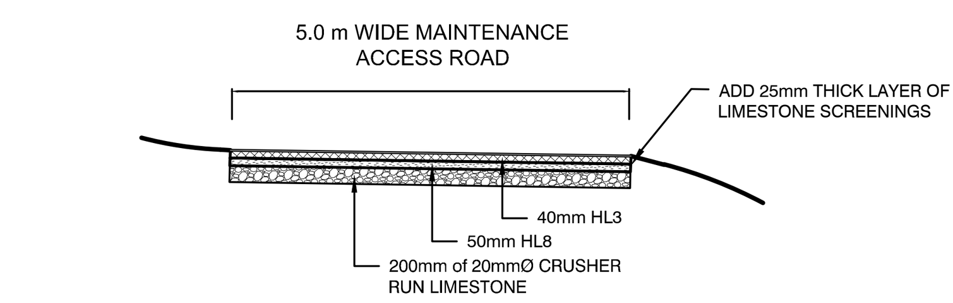
OPSD 804.050



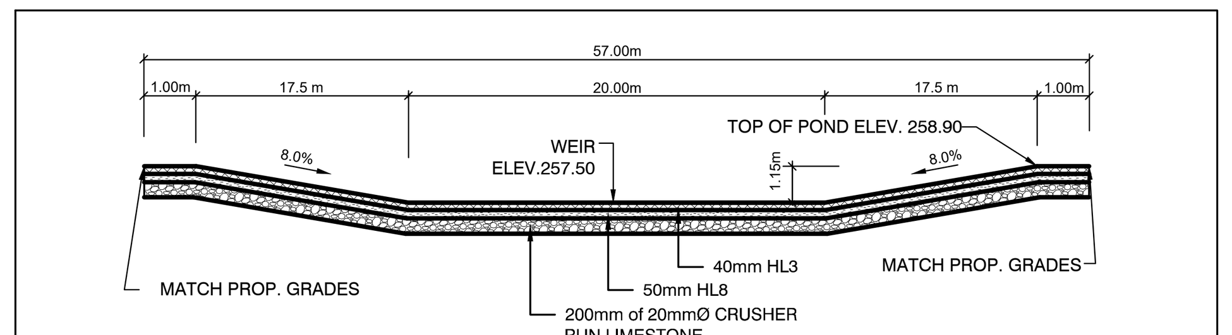
STM MH201
1:50



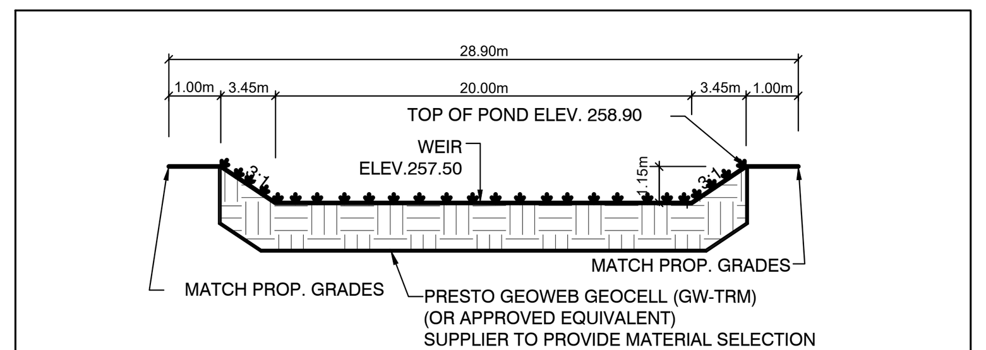
OUTLET PIPE DETAIL
N.T.S.



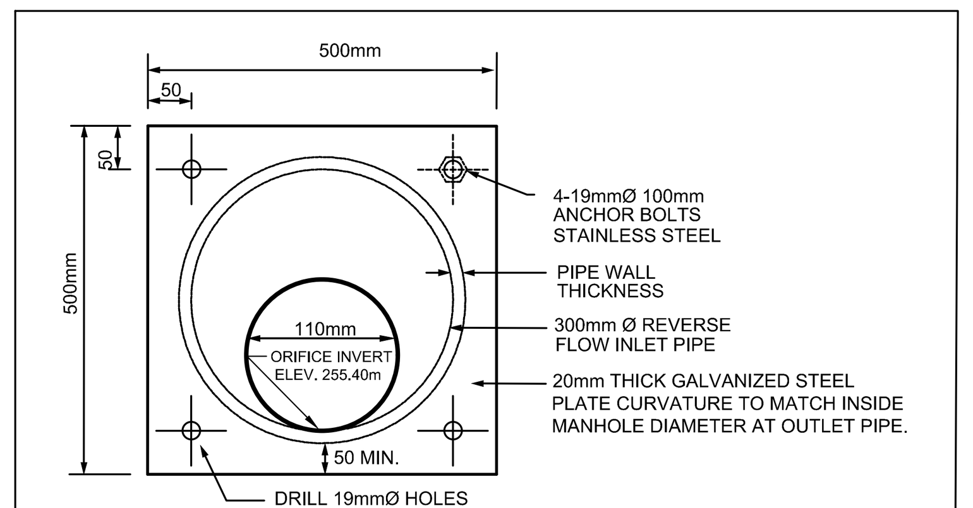
MAINTENANCE ACCESS ROAD
N.T.S.



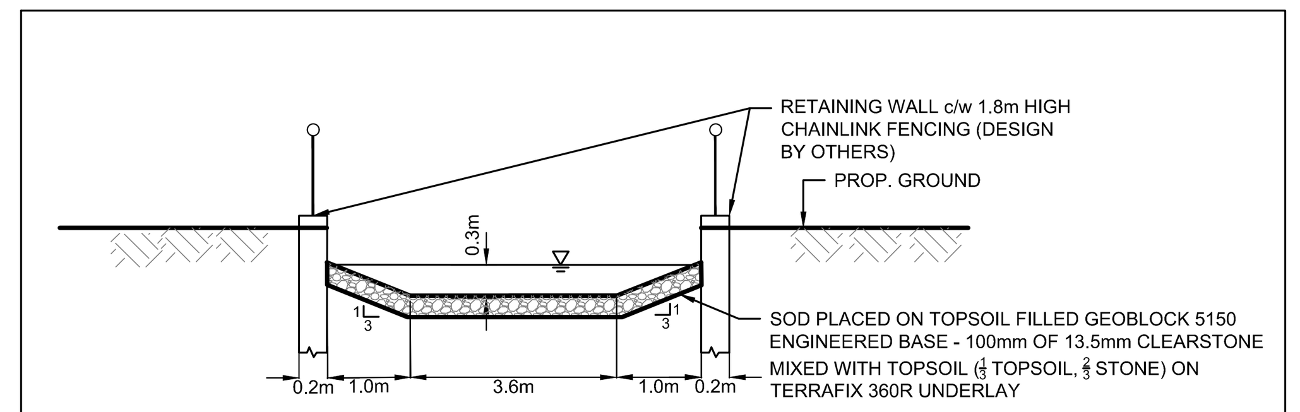
SECTION D-D - POND 1 EMERGENCY OVERFLOW SPILLWAY
N.T.S.



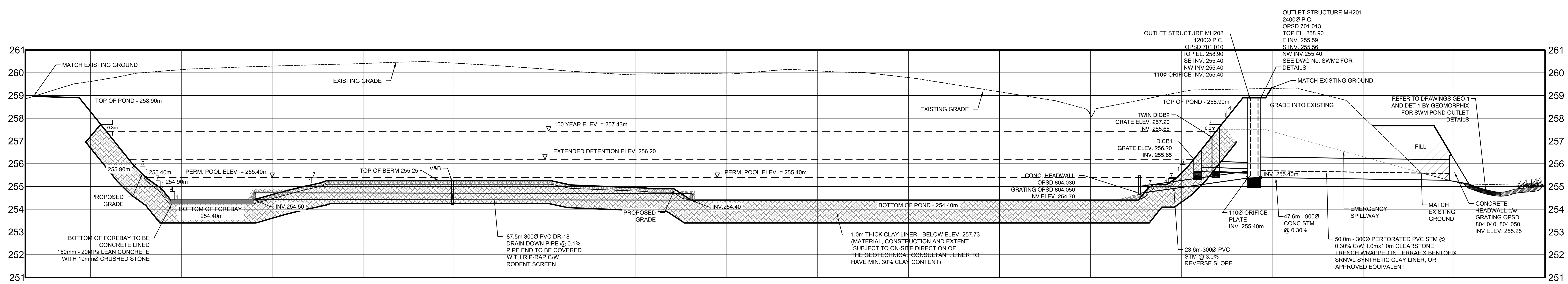
TYPICAL POND 1 EMERGENCY OVERFLOW SPILLWAY SECTION
N.T.S.



ORIFICE PLATE DETAIL
N.T.S.



SECTION C-C - 6.0m WIDE OVERLAND FLOW CHANNEL (SWM POND)
N.T.S.



SECTION B-B
HOR. 1:100
VERT. 1:500

No.	REVISIONS TO DRAWING	BY	DATE	APPR.
5	3rd ENGINEERING SUBMISSION	A.D.R.	MAR 23/20	
4	2nd ENGINEERING SUBMISSION	A.D.R.	MAR 18/20	
3	ISSUED FOR ADDENDUM 1	A.D.R.	DEC 10/19	
2	ISSUED FOR TENDER	A.D.R.	DEC 2/19	
1	1st ENGINEERING SUBMISSION	A.D.R.	AUG 15/19	

ALL PREVIOUS ISSUES OF THIS DRAWING ARE SUPERSEDED

CLIENT
CALEDON DEVELOPMENT #2 LP

MUNICIPALITY
TOWN OF CALEDON

PROJECT TITLE
Mayfield West Residential Subdivision
Brookvalley - Stage 1B

SHEET TITLE
STORMWATER MANAGEMENT DETAILS

CONSULTANT
wsp
100 Commerce Valley Dr. West, Thornhill, ON Canada L3T 0A1
t: 905.882.1100 f: 905.882.0055 www.wsp.com

STAMP
LICENSED PROFESSIONAL ENGINEER
A.D. RAIMONDO
100173463
MAR 23-2020
PROVINCE OF ONTARIO

Town of Caledon
APPROVED
AS NOTED
This approval constitutes a general review and does not certify dimensional accuracy.
This approval is subject to further certification of the "as constructed" works by a registered Professional Engineer of the Province of Ontario.
Date :
Approved by :

DESIGNED	DRAWN	CHECKED
S.D. / J.V.	10/12 CAD	A.D.R.

SCALE	DATE
1:600	MARCH 2019

PROJECT NUMBER	DWG. NUMBER
12M-00011	SWM2

T-16005Cb