Stormwater Management Report
Niagara Village Development

2592693 Ontario Inc.
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Mississauga, ON L4Z 1S2

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Revision	Date	Description
0	February 6, 2020	Internal Submission for Client and Planner
1	March 11, 2020	Final Submission to Client and Planner

R.J. Burnside & Associates Limited

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Disclaimer

1.0 Introduction

1.1 General

R.J. Burnside & Associates Limited (Burnside) has been retained by 2592693 Ontario Inc. to prepare a Stormwater Management (SWM) Report in support of the proposed Niagara Village development. This report will support the application for Official Plan Amendment, Zoning amendment and Draft Plan of Subdivision approval by demonstrating that the subject lands can provide adequate stormwater management measures in accordance with applicable regulatory requirements and criteria. A Functional Servicing Report has been prepared by Burnside, under a separate cover, and should be reviewed in conjunction with this report.

1.2 Site Description and Context

The Niagara Village development is 64.06 ha in size and is located on the existing Thundering Waters Golf Course in the City of Niagara Falls. The site is located south of McLeod Road and generally between Drummond Road and Stanley Avenue. Refer to Figure 1 for the location of the site.

The Niagara Village development is surrounded by existing residential development to the north, the existing industrial sites to the east and generally undeveloped land to the south and west. Currently work is being undertaken to develop the lands surrounding the Niagara Village site to the west and south, known as the Riverfront Community.

KEY MAP OF ONTARIO

BURNSIDE

Client

2592693 ONTARIO INC.

Figure Title

NIAGARA VILLAGE DEVELOPMENT

SITE LOCATION PLAN

Drawn	Checked	Date	Figure No.
KT	DN	19/12/13	**FIG1**
Scale		Project No.	
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1.3 Background

The development concepts contained in this report are an extension of and in accordance with the information contained in the following reports and engineering drawings:

- Functional Servicing Report – Niagara Village, R.J. Burnside & Associates Limited, February 6, 2020
- Environmental Impact Study – Niagara Village Residential Development, R.J. Burnside & Associates Limited, February 6, 2020

This report has been prepared in accordance with, and consideration of the information and recommendations provided in the following documents:

- Engineering Design Guidelines Manual, The City of Niagara Falls, April 2016
- Stormwater Management Guidelines, Niagara Peninsula Conservation Authority, March 17, 2010
- Stormwater Management Planning and Design Manual, Ministry of Environment (MOE), March 2003.
- Preliminary Geotechnical Investigation Report, Proposed Residential Development – Thundering Waters Golf Course, Golder Associates Limited, May 31, 2018.
- Phase Two Environmental Site Assessment – 600 Marineland Parkway, Golder Associates Limited, June 2018.
- Hydrology Technical Memo – Water Balance Assessment, Thundering Waters Golf Course, Golder Associates Ltd., July 6, 2018.
- Baseline Hydrogeological Assessment, Proposed Residential Development, Golder Associates Limited, September 27, 2018.

2.0 Existing Site Characteristics

2.1 Land Uses

The majority of the site is currently occupied by the Thundering Waters Golf Course. A CP rail corridor runs through the middle of the site, essentially splitting it in two. Adjacent to the CP rail corridor is the Conrail Drainage Channel which is a drainage feature that conveys upstream flows ultimately to the Welland River located southwest of the site.

There is a provincially significant wetland located within the development area as well as a woodlot which are proposed to be retained as part of the development plan per the Environmental Impact Study. The existing site conditions are shown in Figure 2.

2.2 Soil Conditions

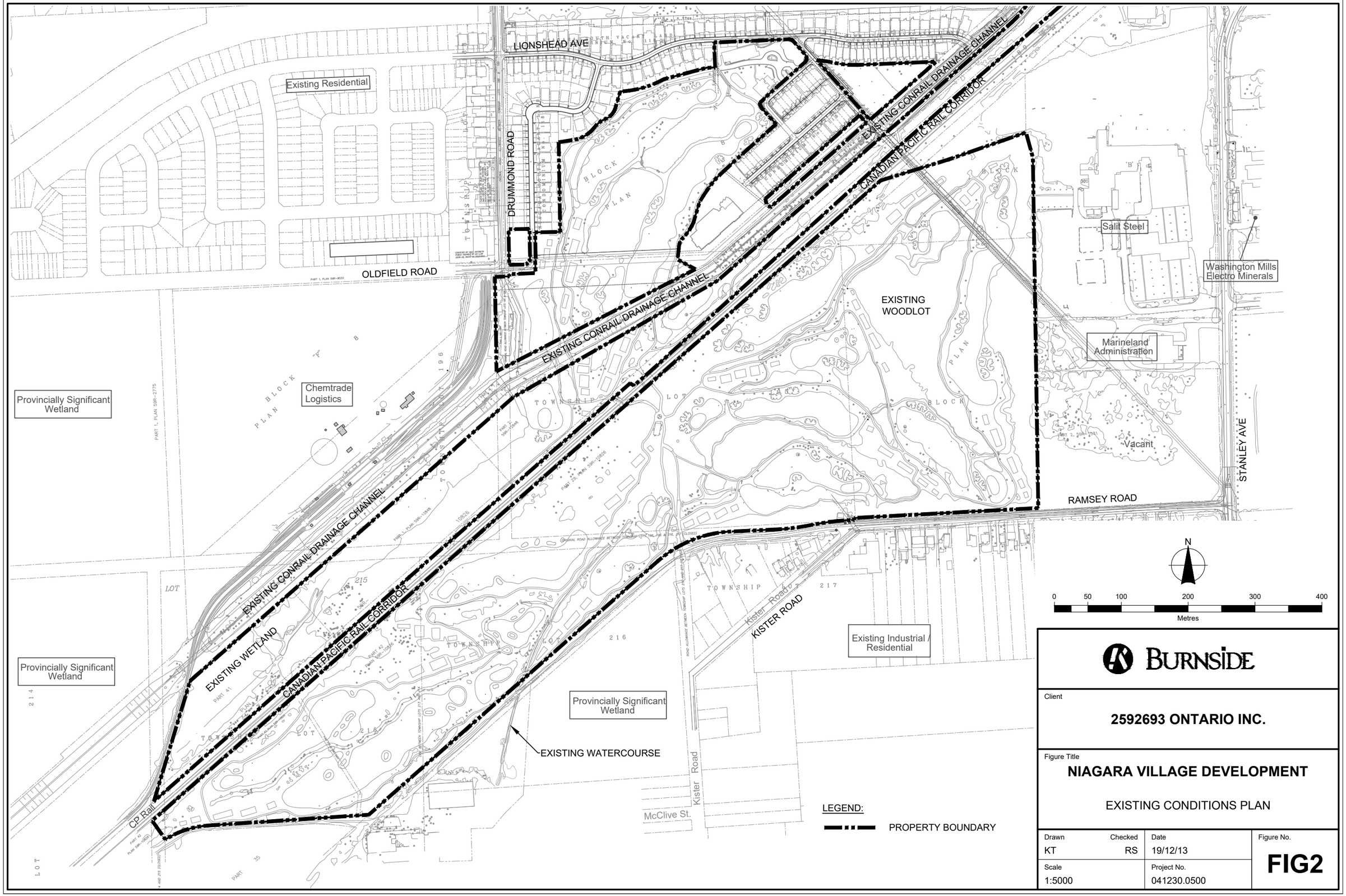
A geotechnical investigation for the study area was completed by Golder Associates Limited. Based upon the findings, the site is covered by a topsoil and/or sand and gravel, overlying silty clay and/or silty sand fill. Bedrock is approximately 29 m below the surface on the east side of the site and 18 m below on the west side.

2.3 Groundwater Conditions

Groundwater conditions were monitored as party of the hydrogeological assessment completed by Golder Associates Limited. It was found that the groundwater depths varied from 2.2 m to 7.5 m below ground level. The deepest water table depths were generally located in the north-east portion of the site. The overall direction of the groundwater flows to the south / south-west.

2.4 Environmental Features

A detailed description of the natural features and functions of the subject property is presented in the Environmental Impact Study by R.J. Burnside and Associates Limited, February 6, 2020.



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2592693 ONTARIO INC.

Figure Title

NIAGARA VILLAGE DEVELOPMENT

EXISTING CONDITIONS PLAN

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KT	RS	19/12/13	**FIG2**
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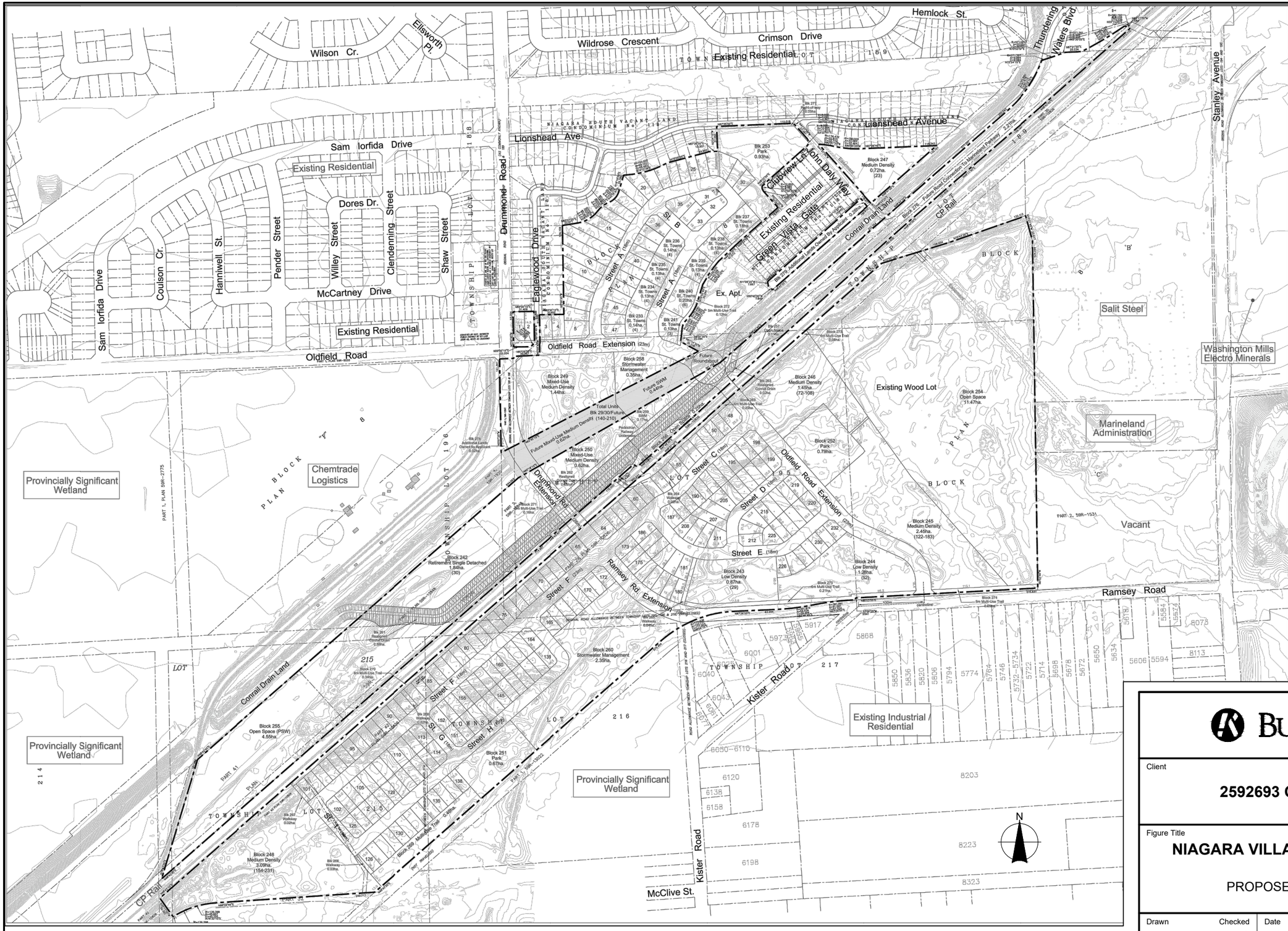
3.0 Proposed Land Use

The proposed Draft Plan of Subdivision was completed by GSP Group Incorporated. Table 1 identifies the land use schedule for the proposed subdivision as shown on the plan dated January 28, 2020. The Niagara Village Draft Plan of Subdivision is depicted on Figure 3.

Table 1: Land Use Schedule

Land Use	Area (ha)	Units
Single Detached Residential	13.66	232
Street Townhouses	1.31	39
Retirement Singles	1.84	30
Low Density Residential	2.15	81
Medium Density Residential	7.71	371-545
Mixed-Use Medium Density Residential	2.06	140-210
Park/Parkette	2.39	
Open Space	16.38	
Stormwater Management	2.87	
Realigned Conrail Drain	1.55	
Walkway	0.13	
Multi-Use Trail	1.52	
Future Road Connection	2.21	
Right-of-Way	0.05	
Additional Lands	0.30	
Roads	7.93	
Total	**64.06**	**893-1137**



DRAFT PLAN OF SUBDIVISION AS PROVIDED BY GSP GROUP, JAN 29/2020

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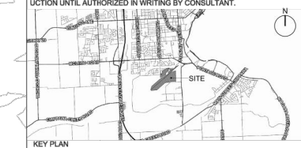

KEY PLAN

REVISION		
NO.	DATE	DESCRIPTION
01	23/05/2019	DRAFT SUBDIVISION PLAN
02	28/05/2019	DRAFT SUBDIVISION PLAN
03	29/05/2019	DRAFT SUBDIVISION PLAN
04	19/08/2019	DRAFT SUBDIVISION PLAN (GSP)
05	05/09/2019	DRAFT SUBDIVISION PLAN (GSP)
06	09/19/2019	DRAFT SUBDIVISION PLAN (GSP)
07	12/12/2019	DRAFT SUBDIVISION PLAN (GSP)
08	28/01/2020	DRAFT SUBDIVISION PLAN (GSP)

LEGEND

- Property Line
- City Owned Land to be Acquired
- Realigned Conrail Drain

LAND USE SCHEDULE

USE	LOTS / BLOCKS	UNITS	AREA (ha.)
Single Detached Residential	1-232	232	13.66
Street Townhouses	233-241	39	1.31
Retirement Singles	242	30	1.84
Low Density Residential	243,244	81	2.15
Medium Density Residential	245-248	371-545	7.71
Mixed-Use Medium Density Residential	249,250	140-210	2.06
Park / Parkette	251-253		2.39
Open Space	254-257		16.38
Stormwater Management	258-260		2.87
Realigned Conrail Drain	261-263		1.55
Walkway	264-268		0.13
Multi-Use Trail	269-275		1.52
Future Road Connection	276		2.21
Right-of-way	277		0.05
Additional Lands	278,279		0.30
Roads			7.93
TOTAL		893-1137	64.06

UNIT BREAKDOWN

Singles	232
Retirement Singles Condo	30
Street Townhouses	39
Low Density Residential (towns, back-to-back towns)	81
Medium Density Residential (towns, back-to-back towns, or low rise apartments)	371-545
Total	753-927

ADDITIONAL INFORMATION
(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and I ARE AS SHOWN ON THE DRAFT PLAN.
h) Municipal water supply
i) Silt clay and minor sand
k) All sanitary and storm sewers as required

OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE CITY OF NIAGARA FALLS.

2592693 ONTARIO INC. — DATE

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

Dasha Page, O.L.S. J.D. BARNES LIMITED — DATE

Client Information:

BURNSIDE

Client

2592693 ONTARIO INC.

Figure Title

NIAGARA VILLAGE DEVELOPMENT

PROPOSED DRAFT PLAN

Drawn	Checked	Date	Figure No.
BF	RS	19/12/13	**FIG3**
Scale		Project No.	
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4.0 Grading and Storm Drainage

Refer to the Functional Servicing Report prepared by R.J. Burnside and Associates Limited dated February 2020 for details on the site grading. An overview of the storm drainage has been provided in this section.

4.1 Existing Storm Drainage

4.1.1 South

The existing southern portion of the site is very flat and on average has a slope less than 1.0%. To ensure proper drainage within the golf course, a series of ponds and flat channels had been placed throughout the site to promote drainage. These ponds and channels flow into one another and provide drainage relief to the golf course.

To calculate runoff volumes and peak drainage flows in the existing condition, the site was divided into three drainage sub-catchments. Catchment boundaries were delineated using topographic base mapping for the site. The catchments are described in the Table 2 and depicted in Figure 4.

Table 2: South – Existing Catchments

Catchment ID	Area (ha)	Time to Peak (hrs)
101	1.55	0.23
102	2.62	0.08
103	25.82	2.06
Total	**29.99**	**-**

Catchment 101 drains to an existing wetland that is located south-west of the site. It should be noted that the wetland is located on the adjacent lands, not within the development site included in this application. Catchment 102 is conveyed towards the CP Rail corridor where the drainage is captured within the swales that run along the CP Rail property line and ultimately is conveyed south-west through the corridor. Drainage within the entirety of Catchment 103 is directed towards the channels and ponds and traverses south towards an existing watercourse that is located on the southern border of the site, approximately 300 m south-west of the Ramsey Road dead end.

It should be noted that the ultimate downstream outlet for each of the catchments is the Welland River which is a vast watercourse located approximately 850 m south of the most southern tip of the site.

There are existing storm sewers located adjacent to the southern portion of this development. A storm sewer runs south along Stanley Avenue and ranges in size from 1050 mm to 1200 mm in the vicinity of the site. This sewer picks up drainage from Stanley Avenue, a small portion of Ramsey Road, some of the neighbouring industrial

sites as well as a trunk sewer that runs south-east on a diagonal through the portion of the lands owned by 2592693 Ontario Inc. A separate storm sewer runs west on Ramsey Road and then traverses along Kister Road. Along Ramsey Road, this sewer varies in size from 600 mm to 825 mm in diameter and picks up drainage from Ramsey Road as well as the existing residential lots located on the south side of Ramsey Road. Neither of these existing sewers are currently used to provide storm service for the existing golf course.

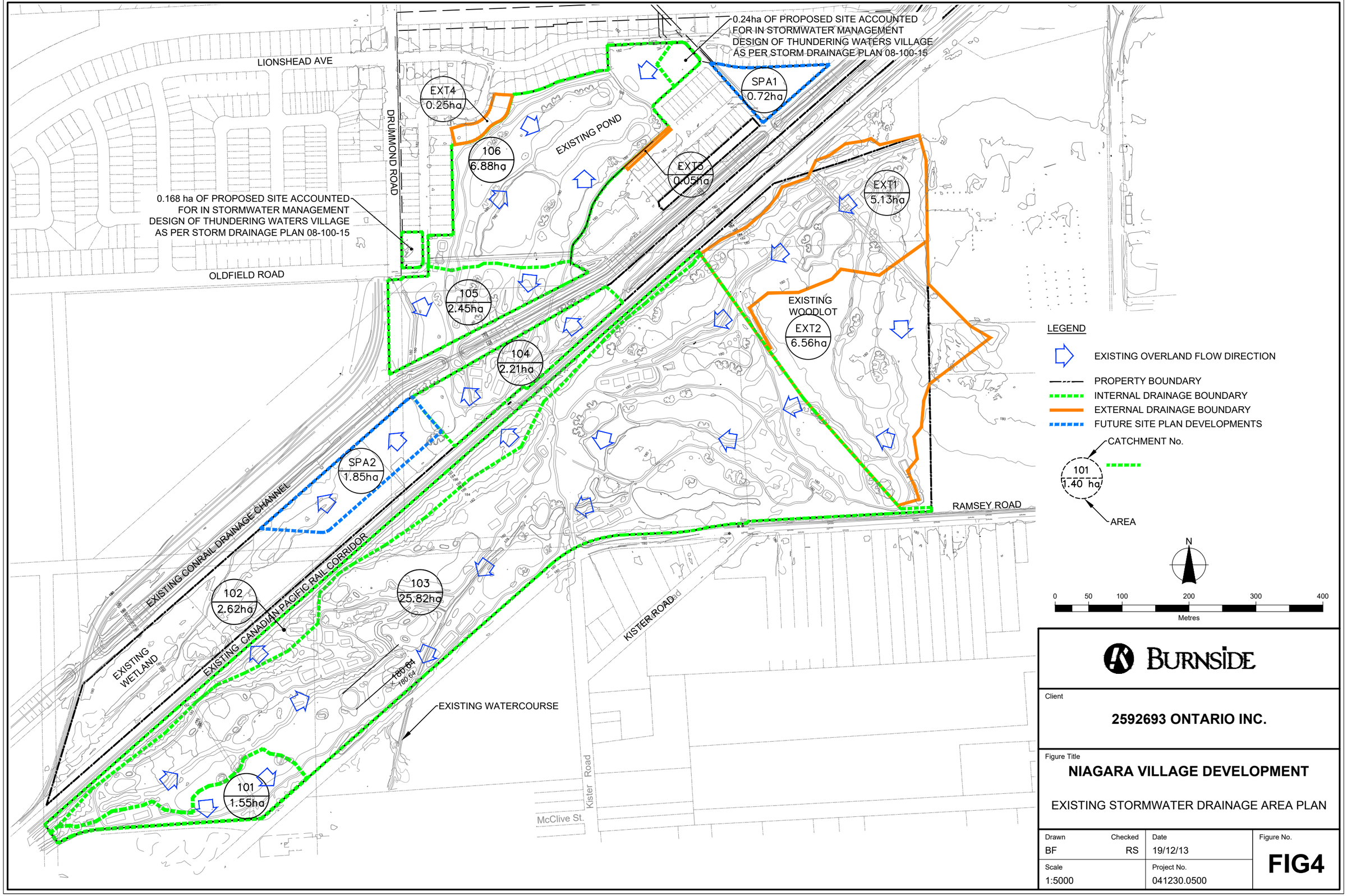

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

EXISTING STORMWATER DRAINAGE AREA PLAN

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4.1.2 North

The existing northern portion of the site is very flat and has undulating topography through golf course bunkers and ponds. Ultimately the site drainage on the northern side of the CP Railway drains to the existing Conrail Drainage Channel.

The Conrail Drainage Channel is a surface drainage channel that is owned by the City of Niagara Falls. The Conrail Drainage Channel has a varying cross section that is generally flat bottomed with 2:1 side slopes with depths ranging from 3.2 m to 5.8 m deep with a bottom width of 0.6 m to 2.6 m. The Conrail Drainage Channel generally follows the CP Rail corridor and flows through the site from east to west. The ultimate downstream outlet for the Conrail Drainage Canal is the Welland River.

To calculate runoff volumes and peak drainage flows in the existing condition, the site was divided into three drainage sub-catchments, ultimately all three areas draining to the Conrail Drainage Channel. Catchment boundaries were delineated using topographic base mapping for the site. The catchments are described in the following table and depicted in Figure 4.

Table 3: North – Existing Catchments

Catchment ID	Area (ha)	Time to Peak (hrs)
104	2.21	0.23
105	2.45	0.33
106	6.88	0.45
SPA1	0.72	N/A – Future Development TBD
SPA2	1.85	N/A – Future Development TBD
Total	**14.11**	-

Catchment 104 generally slopes north away from the railway towards the Conrail Drainage Channel. Catchment 105 generally slopes south towards the Conrail Drainage Channel and Catchment 106 drains in a north-east direction through a series of low spots and ponds to the existing pond located on the existing golf course. This pond has a 600 mm outlet pipe connected to the Conrail Drainage Channel through the existing condo site south of the golf course.

4.2 External Drainage Conveyance

4.2.1 South

There is a large external drainage area that flows through the site on the south side of the CP Rail corridor. The majority of this external drainage comes from lands that are currently the golf course and are owned by the current applicant; however, are not proposed to be developed as part of this application. A small portion of these external

lands are part of the industrial site located to the west. There are two external areas as depicted on Figure 4. The parameters of the external areas are outlined in Table 4.

Table 4: South – External Catchments

Catchment ID	Area (ha)	Time to Peak (hrs)
EXT1	5.13	0.43
EXT2	6.56	0.79
Total	**11.69**	**-**

Similar to existing Catchment 103 described in the section above, both of the external areas drain through a series of ponds and channels and ultimately discharge to the same existing watercourse as Catchment 103.

4.2.2 North

The existing Thundering Waters Village development is located at the north-east corner of the site. The west half of Lionshead Avenue drains to what was an existing pond on the Thundering Waters Golf Course with a 675 mm diameter inlet into the pond. This pond has a 600 mm outlet pipe connected to the Conrail Drainage Channel through an easement on the existing Green Vista condo site abutting the golf course. The portion of the Thundering Waters Village development on Green Vista Gate connects to this existing 600 mm diameter storm sewer that outlets to the Conrail Drainage Channel.

The east half of Lionshead Avenue drains to the Conrail Drainage Channel via a 525 mm storm sewer at the intersection of Thundering Waters Boulevard and Lionshead Avenue. A stormwater drainage area plan obtained from the City (Dwg. 08-100-15) exists for this subdivision that indicates localized areas were previously designed to surface drain to the existing Thundering Waters Golf Course. These areas (shown as EXT3 and EXT4) on Figure 4 have been accounted for in the proposed stormwater management design for the site. A summary of these areas are presented in Table 5. Refer to Appendix D for a copy of the Thundering Waters Village drainage plan mentioned above.

Table 5: North – External Catchments

Catchment ID	Area (ha)	Time to Peak (hrs)
EXT3	0.05	0.05
EXT4	0.25	0.09
Total	**0.30**	**-**

Also shown on the drainage plan for the Thundering Waters Village development mentioned above, there are two areas located on the subject site that have been accounted for in the design of the existing storm system. One area (0.168 ha) that accounts for two proposed single detached lots at the northeast intersection of Oldfield Road and Drummond Road was accounted for in the stormwater design of Thundering Waters Village. The second area (0.24 ha) that is a portion of the proposed park at the northeast corner of the site was also accounted for in the design of Thundering Waters Village. These two areas have been excluded from the stormwater management calculations as it is assumed, they can continue to drain to the existing system as per the approved Thundering Waters Village design. These areas are identified on Figure 4 and the Thundering Waters Village drainage plan (Dwg.08-100-15) provided in Appendix D.

On the west side of the existing site, north of the railway tracks, there is an existing 1650 mm storm outfall located in a 10 m easement southeast of the intersection of Oldfield Road and Drummond Road that drains into the Conrail Drainage Channel. This pipe serves as the outfall from the Oldfield Estates development which is located north-west of the Oldfield Road and Drummond Road intersection. On the east side of this easement is a surface drainage channel that drains Eaglewood Drive from the existing Thundering Waters Village subdivision. These external drainage areas have not been quantified in Table 5 above as they are proposed to bypass the on-site stormwater management design in post-development therefore, they have not been modelled as part of the stormwater management design. This bypass system will be relocated to align with the proposed extension of Drummond Road.

4.3 Proposed Storm Drainage

4.3.1 South

The minor system flow for the south will be conveyed through a series of storm sewers sized to convey the 5-year design storm within local subdivision streets. The minor system discharges into the stormwater management pond via the storm sewer network. The stormwater management pond for the south includes a single forebay with two inlets, one from the west and one from the east, as well as overland flow inlets. Drawing STM1 shows the overall layout for the storm sewer network.

The major system will be collected and conveyed within the Right-of-Ways (ROWs). Storm events that are not captured within the minor system will be conveyed overland to

the proposed stormwater management pond. Calculations have been completed to confirm that the 100-year storm (less the 5-year flow) can be conveyed within the curb lines of the ROWs. Refer to Appendix A for overland flow calculations.

Proposed drainage areas have been delineated as per the grading shown on Drawings GRD1-GRD3. The drainage areas encompass both the major and minor events and are demonstrated on Figure 5 as well as summarized in Table 6.

Table 6: South – Proposed Catchments

Catchment ID	Area (ha)	Total Imperviousness
201	3.09	80.0%
202	9.35	54.0%
203	1.54	80.0%
204	2.46	80.0%
205	1.28	80.0%
206	0.90	80.0%
207	8.98	55.7%
208	0.62	90.0%
UNC1	1.41	24.2%
UNC2	0.36	43.0%
Total	**29.99**	**-**

Similar to existing conditions, under post development there will remain multiple discharge points from the site. The discharge locations have been maintained due to grading constraints as well as to mimic existing drainage patterns. Catchments 202 to 207 are comprised of single family, medium density, ROWs, park blocks and a SWM block and will discharge to the proposed stormwater management pond which outlets to the existing watercourse. Catchments 201 and 202 discharge to the west inlet in the forebay and Catchments 203 to 207 discharge to the east forebay. Catchments 201 and 203 to 206 are medium density blocks. The stormwater management design proposes that the medium density blocks, upon development, be required to control the flow from the site the 5-year post-development flow. The results of the modelling and allowable release rate will be discussed further in sections below. Catchment 208 includes a ROW and multi-use trail and is graded to drain towards existing Ramsey Road.

There are two uncontrolled areas on the south side of the site. Catchment UNC1 is made up of a park block as well as the rear of some single-family lots. This catchment will discharge to the existing wetland located at the south-west corner of the site. Catchment UNC2 includes the rear of a few single-family lots and will outlet to the CP Rail corridor.

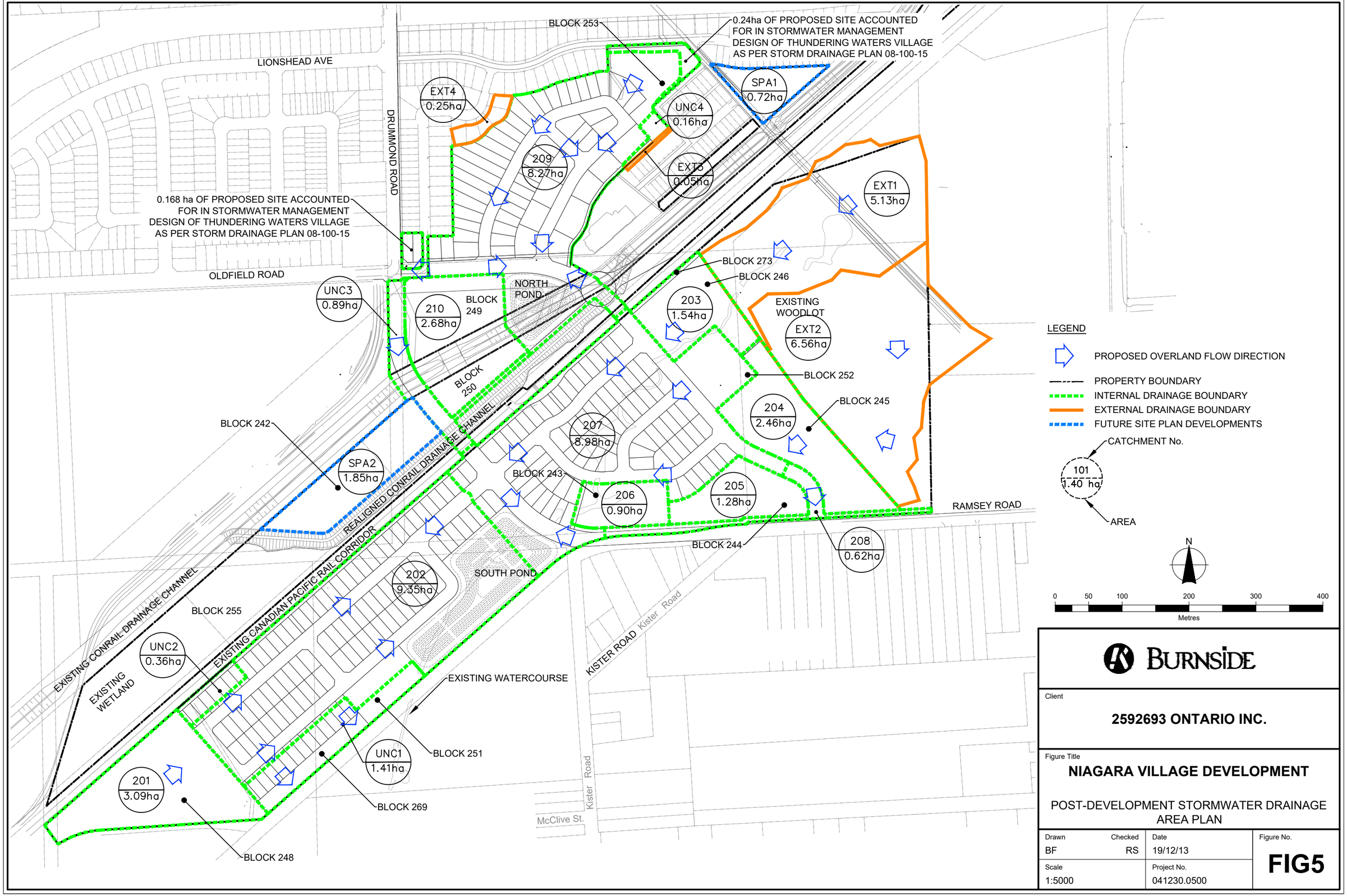

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

POST-DEVELOPMENT STORMWATER DRAINAGE AREA PLAN

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BF	RS	19/12/13	**FIG5**
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4.3.1.1 External System Conveyance

As previously mentioned, under existing conditions there is external drainage from the portion of the golf course that is not proposed to be developed that currently discharges through the site. As shown on Drawing GRD2, the site is proposed to be elevated above existing elevations in this area, causing the external drainage conveyance to be disrupted. The site was elevated in this location to allow for the majority of the site to be conveyed to the stormwater management pond. Further detail regarding grading restrictions is included in the Functional Servicing Report prepared by R.J. Burnside & Associates Limited dated February 2020, which is included under separate cover.

A small portion of the external lands is proposed to be regraded, as shown on Drawing GRD2, to promote proper conveyance of the external lands under post-development conditions. A portion of the existing channels within the external area surrounding the woodlot will be regraded. As discussed in the Environmental Impact Study, included under separate cover, it is proposed that the area surrounding the existing woodlot will be utilized to form a slough forest / swamp.

4.3.2 North

As per City of Niagara Falls standards, the minor system flow will be conveyed through a series of storm sewers sized to convey the 5-year return storm design flow within local subdivision streets. Drawing STM1 shows the overall layout for the storm sewer network. The minor system discharges into the north stormwater management pond via the storm sewer network. The stormwater management pond includes a single forebay, with a pipe and overland flow inlet.

The major system will be collected and conveyed within the ROWs. Storm events that are not captured within the minor system will be conveyed overland to the stormwater management pond. The street just upstream of the north pond is the Oldfield Road extension which is proposed as a 23 m ROW. Calculations have been completed to confirm that the 100-year storm (less the 5-year flow) can be conveyed within the curb lines of the ROWs. Refer to Appendix A for overland flow calculations.

Proposed drainage areas have been delineated as per the grading shown on Drawings GRD1-GRD3. The post-development drainage areas are shown on Figure 5 and identified in Table 7.

Table 7: North – Proposed Catchments

Catchment ID	Area (ha)	Total Imperviousness	Time to Peak (hr)
209	8.27	56.0%	
210	2.68	90.0%	
UNC3	0.89	90.0%	
UNC4	0.16		0.11
SPA1	0.72	N/A – Future Development TBD	
SPA2	1.85	N/A – Future Development TBD	
Total	**14.57**	**-**	**-**

As identified in the table above there are two catchments that drain to the north stormwater management pond (Catchments 209 and 210). Catchment 209 is comprised of single family, townhouse, right-of-way and park areas and drains the minor and major system to the pond. Catchment 210 is a proposed medium density block. The stormwater management design proposes that the multi-use block, upon development, will be required to control the flow from the site the 5-year post-development flow. The results of the modelling and allowable release rate will be discussed further in Section 5.3.2.1.

There are two uncontrolled areas on the north side of the site. Catchment UNC3 is primarily comprised of the Drummond Road Extension and is proposed to drain directly to the Conrail Drainage Channel. Catchment UNC4 is a small landscaped portion of the park that based on grading constraints to tie into the existing Clubview Lane cannot drain back towards Street A. It is proposed that this uncontrolled area be collected in a catchbasin and connected to the proposed storm bypass that is collecting the west half of Lionshead Avenue and directing the flows to the Conrail Drainage Channel.

Within the site area on the north side of the CP Rail tracks there are two areas that are within the property boundary that are isolated from the storm network. These areas are shown as SPA1 and SPA2 on Figure 4. It is proposed that these areas be developed under Site Plan Applications to address all servicing and stormwater management requirements as individual entities. Since they are separated either by existing roads and infrastructure or the re-aligned Conrail Drainage Channel, they are applicable to be developed under Site Plan Applications.

Overall the post-development drainage area is larger than the pre-development drainage area as the existing Conrail Drainage Channel and the proposed re-aligned Drainage Channel have been excluded from the drainage areas and modelling. Since the pre-development area is smaller than the post-development areas, the pre-development flow rates used to calculate the allowable release rates are more conservative than if they had been included.

4.3.2.1 External System Conveyance

As mentioned in Section 4.2.2 above, there is currently external drainage from the Thundering Waters Village subdivision that enters the subject site. The rear lot drainage that has been identified as external areas on the drainage plan has been included in the post-development drainage design (Catchments EXT3 and EXT4).

There is currently a 675 mm pipe that inlets to the existing pond on the Thundering Waters Golf Course, as part of this plan it is proposed that this pipe be diverted in the road and ultimately through an easement to connect into the existing outlet that exists to the Conrail Drainage Channel. This layout is shown on drawing STM1. In post-development, Area EXT4 will be captured and drained to the Conrail Drainage Channel using this bypass.

There is also an outfall located in an easement on the west side of the existing Thundering Waters Golf Course as described in Section 4.1.2 above that is proposed to be enclosed and conveyed via a new headwall to the Conrail Drainage Channel. This pipe will run under the Drummond Road Extension as a separate system and will bypass the stormwater management measures proposed for the site. Refer to drawing STM1 for the proposed layout of this storm sewer.

5.0 Proposed Stormwater Management

5.1 Design Criteria

Through discussion with Niagara Peninsula Conservation Authority (NPCA) and Niagara Region as well as a pre-consultation meeting, stormwater management criteria were developed as part of the Terms of Reference that were prepared for this report. The following outlines the stormwater management criteria for the site:

Quantity

Post development stormwater management quantity controls shall be implemented, as required, in order to attenuate post development peak stormwater flows to the pre-development flows for up to and including the 100-year storm event. Different design storms will be assessed to determine the storm that yields the lowest pre-development peak flow and the highest post-development peak flow.

Erosion

In consultation with Niagara Region, it has been confirmed that erosion control is not required for the north portion of the site as it is not expected that the flows will have any significant impact on the erosion potential of the downstream system. The NPCA has indicated that erosion control of the 25mm 4-hour Chicago design storm over 24-hour period is required for the south portion of the site because the existing watercourse is vulnerable to erosion.

Quality

A minimum of Enhanced level water quality treatment as defined in MOE design guidelines is required for all SWM facilities, equivalent to 80% TSS Removal.

Water Balance

Best efforts will be made to match post development infiltration volumes to the pre-development level to maintain groundwater discharge. Existing peak flows and runoff volumes flowing into and supporting the natural heritage features located both within and adjacent to the site shall be analyzed and quantified. These peak flows and volumes shall be maintained, as a minimum, in the post development condition.

Conveyance

Safely convey external drainage, assuming that sufficient quality, quantity and erosion control has been provided upstream.

5.2 Design Parameters

The following two sections outline the parameters that are specific to the site and the proposed development that are shared by both the north and south portions of the site. It should be noted that flows are quantified for the site using SWMHYMO which is a hydrologic modeling program. Further detail pertaining to the modeling results is provided in the latter sections of this report.

5.2.1 Curve Number

The curve numbers used in the SWMHYMO modelling was determined using Tables 9-1 and 9-5 from the National Engineering Handbook. The Geotechnical Report for the site identifies the soils as generally silty clay and the Ontario soils mapping identifies Welland Clay (soil group C) and Jeddo Clay (soil group D) for the site. The site is comprised of existing golf course and woodlots. Table 8 outlines the curve number associated with the specific land covers and soil types.

Table 8: Curve Numbers

Land Cover	Soil Group	Curve Number
Golf Course	C	74
Golf Course	D	80
Forest	D	77

The golf course is considered to be in good condition with grass cover greater than 75% and the forest is considered to have poor drainage. These factors were used when determining the curve numbers. For each of the catchments listed in the previous sections of this report, a composite curve number was calculated. The following sections as well as Appendix B detail the composite curve number for each catchment.

5.2.2 Percent Impervious

The impervious values for the site were calculated based on the runoff coefficients from Table 7.2.1 in the NPCA Stormwater Management Guidelines. Table 9 outlines the total imperviousness (TIMP) along with the directly connected imperviousness (XIMP) for each land use proposed for the site.

Table 9: Post-Development Impervious Values

Land Use	TIMP	XIMP
Right-of-Ways	90%	70%
Parkland	10%	5%
SWM Block	50%	50%
Townhomes	64%	44%
Low-Density Residential	43%	20%
Medium Density Residential	80%	60%

Mixed-Use Medium Density	90%	70%

For each of the catchments listed in the previous sections of this report, a composite imperviousness was calculated where applicable. The following sections as well as Appendix C and Appendix D detail the composite TIMP and XIMP for each catchment.

5.3 Stormwater Management Design

5.3.1 South

The first stormwater management pond, South Pond, is located on the south side of the site adjacent to the Ramsey Road extension. This pond receives drainage from the areas south of the CP Rail corridor.

5.3.1.1 Design Storm

In order to determine the governing storm event for the south portion of the site, the 100-year storm event was run for the 3-hour Chicago, 12-hour AES and, 24-hour SCS Type II distributions to simulate rainfall data as per the NPCA Guidelines. These storms were run for both the existing and post-development catchments previously described, which are shown on Figures 4 and 5, respectively. The detailed SWMHYMO modeling is included in Appendix C. Table 10 summarizes the resulting flows from all three storm distributions for the catchments that discharge to the existing watercourse. This represents the largest portion of the site as well as the location to which the proposed stormwater management pond will discharge.

Table 10: South - Design Storm Sensitivity Analysis

Storm Distribution	Existing Flow (m^3/s)	Post Development Flow (m^3/s) *	Delta (m^3/s)
3-hour Chicago	0.65	4.19	3.54
12-hour AES	0.58	0.69	0.11
24-hour SCS Type II	1.01	4.76	3.75

*Note: This flow is the uncontrolled post-development flow into the south pond.

As per the NPCA Guidelines the storm that yields that the lowest pre-development peak flow and the highest post-development peak flow is to be utilized the design the stormwater management plan for the site. As shown above, the storm with the highest delta between the existing and post development flows is the 24-hour SCS Type II, therefore this storm will be used to model the south portion of the site.

5.3.1.2 Post Development Flows

A SWMHYMO model has been developed that contains each of the post-development catchments. This SWMHYMO model and the supporting calculations are included in

Appendix C. Table 11 lists the post development flow from each catchment as produced by the SWMHYMO model.

Table 11: South – Post Development Flows

Catchment	Outlet	Post Development Flow (m^3/s)
201	South Pond – to Existing Watercourse	0.444 [1]
202		1.772 [2]
203		0.219 [1]
204		0.345 [1]
205		0.184 [1]
206		0.132 [1]
207		1.660 [2]
208	Ramsey Road	0.176 [2]
UNC1	Existing Wetland	0.212 [2]
UNC2	CP Rail Corridor	0.067 [2]

[1] 5-year post development flow rate

2 100-year uncontrolled post development flow rate

Some of the catchments represent a medium density blocks (refer to Figure 5), which as mentioned previously, will have an allowable release rate equivalent to the 5-year post development flow. These blocks will be approved as part of future Site Plan Applications, during which, the blocks will develop individual stormwater management plans to control to the allowable release rate.

The remainder of the catchments and blocks will be released at the 100-year post-development level and will not undergo a Site Plan Application. The quantity control measures for these catchments are described in the following sections.

5.3.1.3 Allowable Release Rate

A SMWHYMO model was created to determine the existing flow from each of the catchments shown in Figure 4. As previously described, these flows are equivalent to the allowable release rates from the site to the previously described outlets. The SWMHYMO model is included in Appendix C. The allowable flows are outlined in Table 12.

Table 12: South - Allowable Release Rate

Catchment	Outlet	Allowable Flow (m^3/s)	Post Development Uncontrolled Flow (m^3/s)
101	Existing Wetland	0.219	0.212
102	CP Rail Corridor	0.561	0.067
103	Existing Watercourse	1.006	4.756

-	Ramsey Road	0.0	0.176

The only catchments that do not exceed the allowable release rate without having any quantity controls applied are the catchments which outlet to the CP Rail corridor and to the existing wetland. All other outlet locations require a level of quantity control to meet the allowable release rate.

The catchment to Ramsey Road will propose low impact development (LID) options to provide the volume required to achieve the allowable release rate. Design of the proposed LIDs will be completed as part of detailed design.

The catchments that discharge to the existing watercourse will be directed through the south stormwater management pond. This pond will provide the volume required to meet the allowable release rate. Detail of the pond is included in the sections to follow.

5.3.1.4 Quality Control

Stormwater from the catchments that discharge towards the existing wetland and the CP Rail corridor does not require quality control. The stormwater from these catchments is considered clean as it is comprised of a park as well as the rear of single-family residential lots.

Stormwater directed to Ramsey Road is not clean because it is comprised largely of a ROW. This water will need quality control either in the form of an oil-grit separator or through treatment provided by the LIDs. Detail of the quality control will be described during detailed design.

Drainage to the existing watercourse will discharge to the proposed south pond which has been designed as a wet pond to provided Level 1 Enhanced quality control. The pond design is further described in the following section.

5.3.1.5 Stormwater Management Pond Design

Catchments 201 through to 207 will discharge to the proposed stormwater management pond. Table 13 outlines the total area as imperviousness of the land that will discharge to the pond. Detailed calculations for the total imperviousness and drainage area to the pond are included in Appendix C.

Table 13: South – Pond Drainage Area

Drainage Area (ha)	TIMP	XIMP
27.60	63.41%	44.65%

As specified in the NPCA Guidelines, the pond is required to achieve Level 1 Enhanced quality control. This level of quality control will be achieved through a combination of permanent pool volume provided as well as through the forebay provided within the pond. The permanent pool volume required has been designed to be in compliance with Table 3.2 from the MOE Stormwater Management Planning and Design Manual. Table 14 shows the permanent pool volume required to achieve the required quality control level.

Table 14: South - Permanent Pool

Storage Volume (m^3/ha)	Volume Required (m^3)	Volume Provided (m^3)
169.91	4,682	7,020

As shown in Table 14, the permanent pool volume provided in the pond exceeds the required volume. This volume is measured from the bottom of the pond (176.50 m) to the normal water level (NWL) for the pond which is set at 178.00 m. The plan view of the proposed pond is shown on Figure 6.

The other component of quality control in the pond is the forebay. The forebay proposed for this pond has two inlets, one from the east and one from the west. The forebays are sized based on the greater of the settling length or dispersion length required based on the incoming flow. The forebay is sized to have a maximum allowable average flow velocity of 0.15 m/s. Forebay sizing calculations have been completed in accordance with the MOE Stormwater Management Planning and Design Manual. Table 15 outlines the forebay sizing requirements. Detailed calculations are included in Appendix C.

Table 15: South - Forebay Size

Inlet	Calculation Method	Design Flow (m^3/s)	L:W Ratio	Required Dimensions		Provided Dimensions	
				Length (m)	Width (m)	Length (m)	Width (m)
East	Settling Length	0.098	2	25.5	12.8	43.1	20.0
	Dispersion Length	1.545	2	34.1	17.1	43.1	20.0
West	Settling Length	0.098	2	25.5	12.8	43.1	20.0
	Dispersion Length	1.273	2	33.4	16.7	43.1	20.0

The design flow for the settling length is based on the extended detention release rate and the design flow for the dispersion length is based on the 5-year flow from the inletting sewers. Table 15 above demonstrates that the size of the designed forebay exceeds the requirements for both settling length and dispersion length.

The proposed pond has been designed to include erosion control in the form of extended detention. The required extended detention volume has been calculated based on the 4-hour 25 mm Chicago storm event. Results of the SWMHYMO modeling completed for extended detention are included in Table 16 and in Appendix C.

Table 16: South – Extended Detention

Runoff Volume (mm) [1]	Volume Required (m^3)	Volume Provided (m^3)
15.32	4,229	4,319

1 from SWMHYMO

The extended detention volume will pond to a depth of 0.50 m above the NWL. The release rate from the pond will occur over a 24-hour period and will be released via a perforated extended detention riser that is connected to a maintenance hole structure via a reverse sloped pipe. Further detail of this structure as well as orifice sizes will be completed during detailed design. The preliminary schematic of the proposed outlet structure layout is shown on Figures 6 and 7.

To determine the volume required to achieve the quantity control requirements within this pond, a route reservoir was added into SWMHYMO. The route reservoir includes consideration of the extended detention release rate. In order to model the medium density blocks that will be required to provide 5-year post-development flow control, a dualhyd command was added into the SWMHYMO modelling to restrict to the allowable release rate from these blocks. Table 17 outlines the requirements to ensure quantity control is achieved.

Table 17: South – Active Storage

Volume Required (m^3)	Volume Provided (m^3)	Controlled 100-year Release Rate from Pond (m^3/s)	Allowable Release Rate from Pond (m^3/s)
11,650	25,652	0.965	1.006

The volume provided is at the maximum high-water level for the pond, which allows for a 0.3 m freeboard. The pond provides a greater volume than required. The release rate from the pond into the existing watercourse is less than the allowable release rate. A control structure will be designed during detailed design.

Under an emergency condition the pond will overflow into the park block located to the west of the SWM block. The overflow will be controlled via a weir built into the side of the pond which will be designed as a part of detailed design.

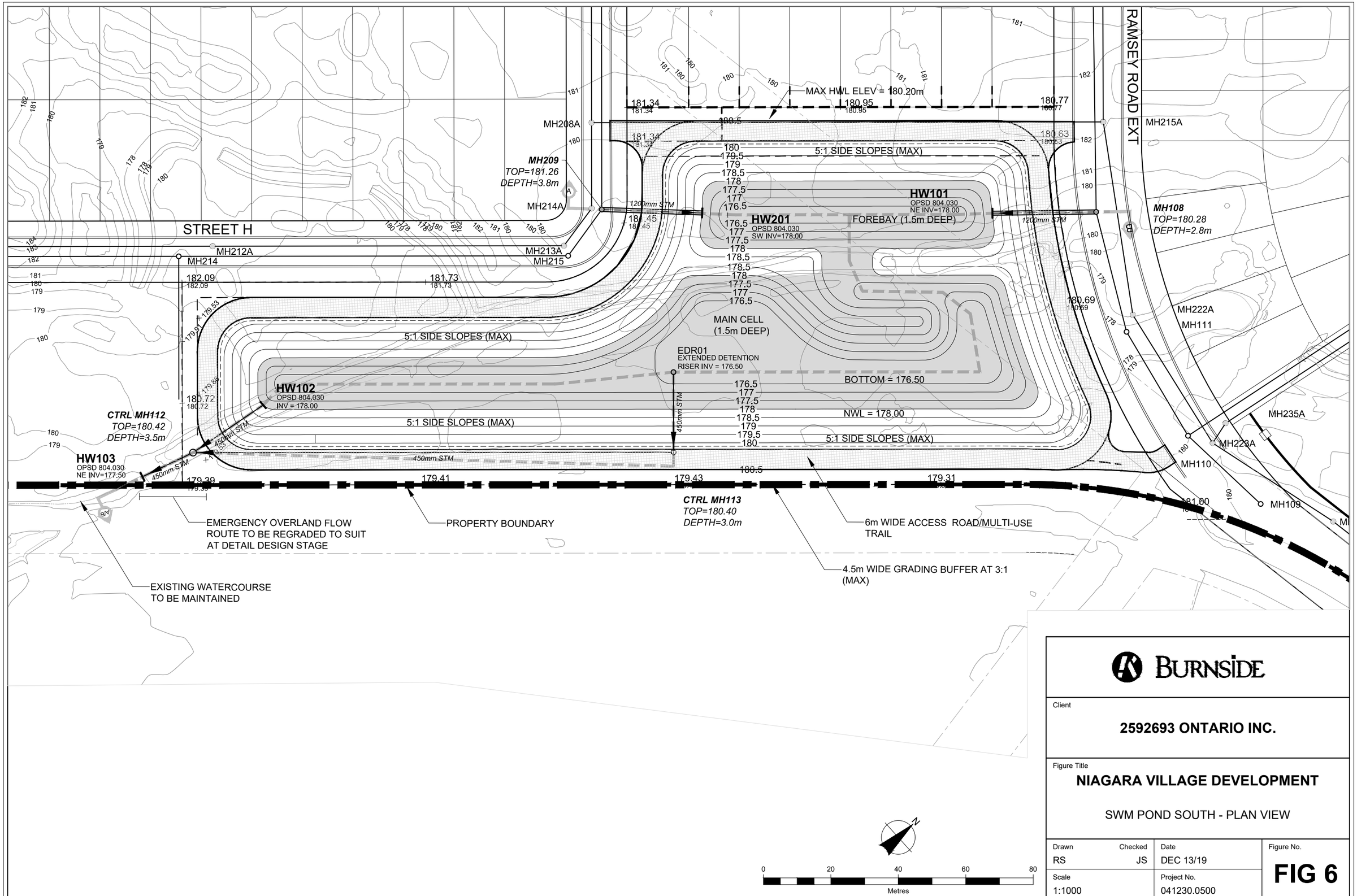

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

SWM POND SOUTH - PLAN VIEW

Drawn	Checked	Date	Figure No.
RS	JS	DEC 13/19	**FIG 6**
Scale		Project No.	
1:1000		041230.0500	

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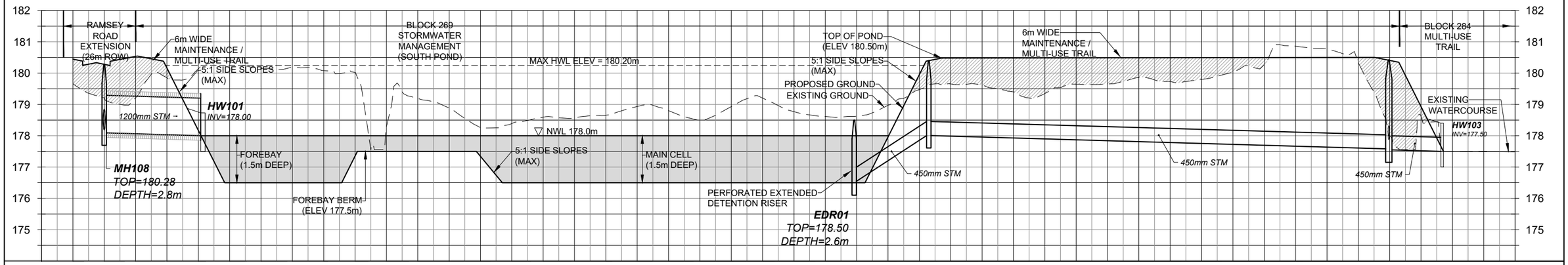
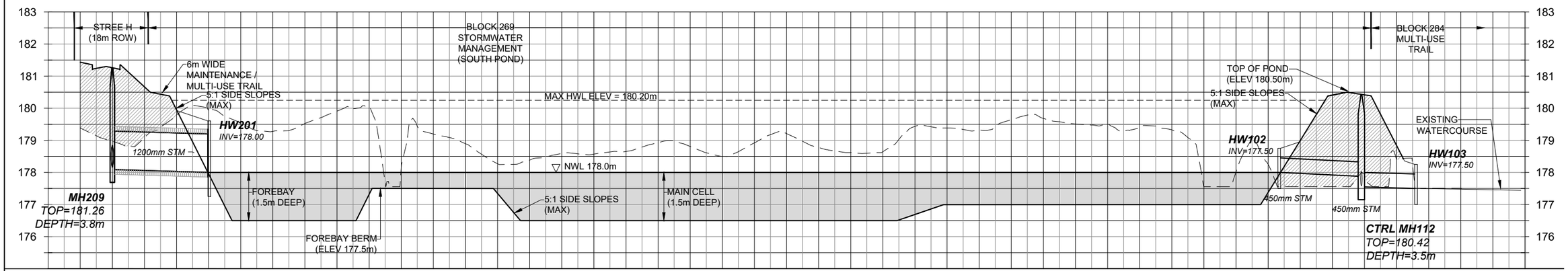


SOUTH SWM POND
SECTION B-B



SOUTH SWM POND
SECTION A-A

0 25 50 75 100
Metres

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

SWM POND SOUTH - SECTIONS

Drawn	Checked	Date	Figure No.
RS	JS	DEC 13/19	**FIG 7**
Scale		Project No.	
H 1:1250 V 1:125		041230.0500	

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5.3.2 North

The second stormwater management pond, North Pond, is located on the north side of the CP Rail tracks adjacent to the Oldfield Road extension. This pond receives drainage from the areas north of the CP Rail tracks.

5.3.2.1 Design Storm

In order to determine the governing storm event for the north portion of the site, the 100-year storm event was run for the 3-hour Chicago, 12-hour AES and, 24-hour SCS Type II distributions to simulate rainfall data as per the NPCA Guidelines. These storms were run for both the existing and post-development catchments previously described, which are shown on Figures 4 and 5, respectively. The detailed SWMHYMO modeling is included in Appendix D. Table 18 summarizes the resulting flows from all three storm distributions for the catchments that discharge to the Conrail Drainage Channel.

Table 18: North - Design Storm Sensitivity Analysis

Storm Distribution	Existing Flow (m^3/s)*	Post Development Flow** (m^3/s)	Delta (m^3/s)
3-hour Chicago	0.614	1.737	**1.123**
12-hour AES	0.243	0.284	0.041
24-hour SCS Type II	0.997	1.99	0.993

*Note: This flow is the sum of the existing flows (Catchment 104, 105, 106, EXT4)
**Note: This flow is the uncontrolled post-development flow into the north pond.

As per the NPCA Guidelines the storm that yields that the lowest pre-development peak flow and the highest post-development peak flow is to be utilized the design the stormwater management plan for the site. Based on the flow differences identified above, the 3-hour Chicago storm provides the largest delta in existing flows to post-development flows, therefore it has been selected as the governing design storm for modelling the north portion of the site.

5.3.2.2 Post Development Flows

A SWMHYMO model has been developed that contains each of the post-development catchments. This SWMHYMO model and the supporting calculations are included in Appendix D. Table 19 lists the post development flow from each catchment as produced by the SWMHYMO model.

Table 19: North – Post Development Flows

Catchment	Outlet	Post Development Flow (m^3/s)
209	North Pond, ultimately Conrail	1.254 [2]
210		0.460 [1]
EXT4		0.028 [2]
UNC3	Direct to Conrail	0.296 [2]
UNC4	Direct to Conrail	0.016 [2]

[1] 5-year post development flow rate
[2] 100-year uncontrolled post development flow rate

As shown in the table above, Catchment 210, which is the medium density block on the north side of the site, is proposed to be controlled to the 5-year post-development flow from the block. This block will be approved as part of a future Site Plan Application, during which the design will require the maximum release rate to the north pond in the 100-year storm event to be controlled to 0.460 m^3/s.

The remainder of the catchments outlined in the table above will be released at the 100-year post development flow rate and will not undergo a Site Plan Application. The quantity control measures for these catchments are described in the following sections.

5.3.2.3 Allowable Release Rates

In order to determine the allowable release rate from the north pond to the Conrail Drainage Channel the uncontrolled flows were subtracted from the pre-development flows for the north portion of the site. Table 20 identifies the results of the SWMHYMO modelling and the allowable release rates from the north pond.

Table 20: North - Allowable Release Rate

Outlet	100-Year Pre-Development Flow (m^3/s)	100-Year Uncontrolled Flow (m^3/s)	100-Year Allowable Flow (m^3/s)
Conrail Drainage Channel	0.614	0.304	0.31

Note: All flows for the north pond design are based on the 3-hr Chicago storm distribution.

5.3.2.4 Quality Control

Stormwater quality treatment is required to achieve a minimum 80% TSS removal rate, or Enhanced protection level, per MOECC guidelines. There are two uncontrolled catchments on the north side of the site, Catchment UNC3 is primarily comprised of the Drummond Road Extension and is proposed to drain directly to the Conrail Drainage Channel. Quality control for Catchment UNC3 will be provided with the use of an oil-grit separator or through treatment train provided by LIDs. Details of the quality control will be provided during detailed design.

Catchment UNC4 is a small landscaped portion of the park. It is proposed that this uncontrolled area be collected in a catchbasin and connected to the proposed storm bypass that is collecting the west half of Lionshead Avenue and directing the flows to the Conrail Drainage Channel. As this area is landscaped and reflects the same conditions as the existing golf course that drains directly to the Conrail Drainage Channel, no quality control is proposed for Catchment UNC4.

The wet pond design outlined in the Section 5.3.2.5 meets the criteria for Enhanced Level 1 TSS removal for areas 209, 210 and EXT4.

5.3.2.5 Stormwater Management Pond Design

The north stormwater management pond is located on Block 267 within the proposed DPOS with an outlet to the re-aligned Conrail Drainage Channel. Details of the proposed outlet will be established as part of the detailed engineering work for the pond. The north pond has been designed with 5:1 side slopes across the entire pond.

Catchments 209, 210 and EXT4 will discharge to the proposed stormwater management pond. Table 21 outlines the total area and imperviousness of the land that will discharge to the pond. Detailed calculations for the total imperviousness and drainage area to the pond are included in Appendix D.

Table 21: North – Pond Drainage Area

Drainage Area (ha)	TIMP	XIMP
11.2	63.21%	45.53%

As specified in the NPCA Guidelines, the pond is required to achieve Level 1 Enhanced quality control. This level of quality control will be achieved through a combination of permanent pool volume provided as well as through the forebay provided within the pond. The permanent pool will have varying depths ranging from 1.5 m within the forebay to 2.5 m within the main cell, as shown on Figure 8. The pond water level of the permanent pool is 178.0 m. In accordance with Table 3.2 of the MOE Guidelines for Level 1 (Enhanced) quality control, the permanent pool storage volume required for the pond is calculated at 169 m^3/ha. Table 22 summarizes the permanent pool design for the proposed north SWM facility.

Table 22: North - Permanent Pool Details

Storage Volume (m^3/ha)	Volume Required (m^3)	Volume Provided (m^3)
169	1,895	3,379

As demonstrated in Table 22, the permanent pool volume provided exceeds the volume required to achieve Level 1 (Enhanced) quality control.

The other component of quality control in the pond is the forebay. The forebay for the north pond proposes one inlet and one forebay. The forebay sizing requirements are based on the greater of the calculated settling length or the dispersion length with a maximum allowable average flow velocity within the forebay of 0.15 m/s. Forebay sizing calculations have been completed in accordance with the MOE Stormwater Management Planning and Design Manual for the dispersion length. Table 23 outlines the forebay sizing requirements. Detailed calculations are included in Appendix D.

Table 23: North - Forebay Size

Calculation Method	Design Flow (m^3/s)	L:W Ratio	Required Dimensions		Provided Dimensions	
			Length (m)	Width (m)	Length (m)	Width (m)
Settling Length	0.157	2	32.4	16.2	40.0	22.0
Dispersion Length	1.143	2	33.0	16.5	40.0	22.0

The design flow for the settling length is based on the peak flow rate from the pond during the quality storm event and the design flow for the dispersion length is based on the 5-year flow from the inletting sewers. The Table 23 demonstrates that the size of the designed forebay exceeds the requirements for the dispersion length.

To determine the volume required to achieve the quantity control requirements within this pond, a route reservoir command was added into SWMHYMO. In order to model the medium density blocks that will be required to provide 5-year post-development flow control a dualhyd command was added into the SWMHYMO modelling to allow a maximum of the 5-year post-development flow from Catchment 210 into the pond. Refer to Appendix D for a copy of the SWMHYMO modelling. Table 24 outlines the requirements to ensure quantity control is achieved.

Table 24: North – Active Storage

Volume Required (m^3)	Volume Provided (m^3)	Controlled 100-year Release Rate from Pond (m^3/s)	Allowable Release Rate from Pond (m^3/s)
3,152	10,227	0.287	0.310

The volume provided is at the maximum high-water level for the pond, which allows for a 0.3 m freeboard. The volume provided in the pond for quantity control exceed the volumes required. The release rate from the pond into the Conrail Drainage Channel is less than the allowable release rate. A control structure will be designed during detailed design.

Under an emergency condition the pond will overflow into the Conrail Drainage Channel located to the south of the SWM block. The overflow will be controlled via a weir built into the side of the pond which will be designed as a part of detailed design.

Figures 8 and 9 show the proposed north pond in plan and section view.

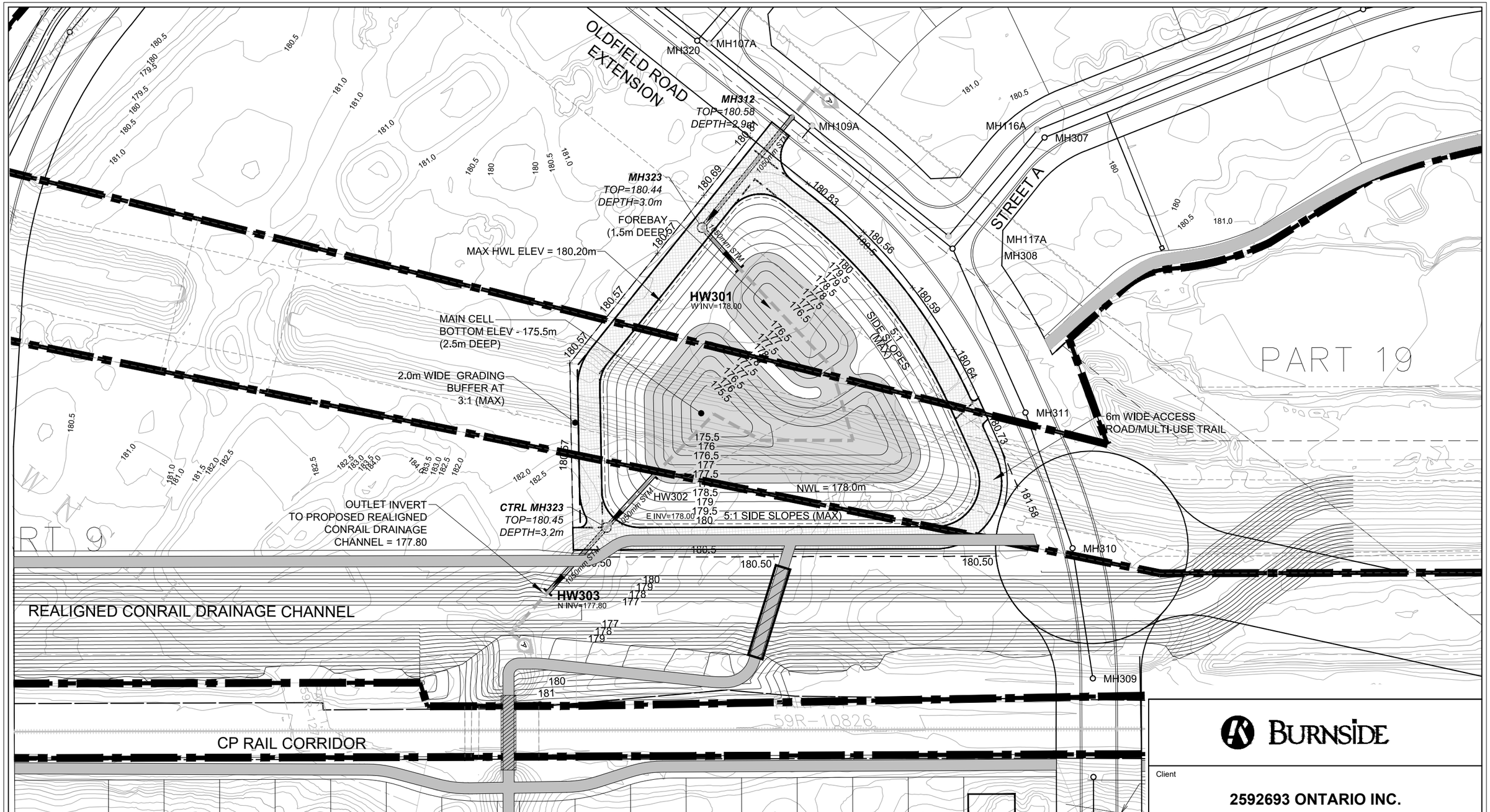

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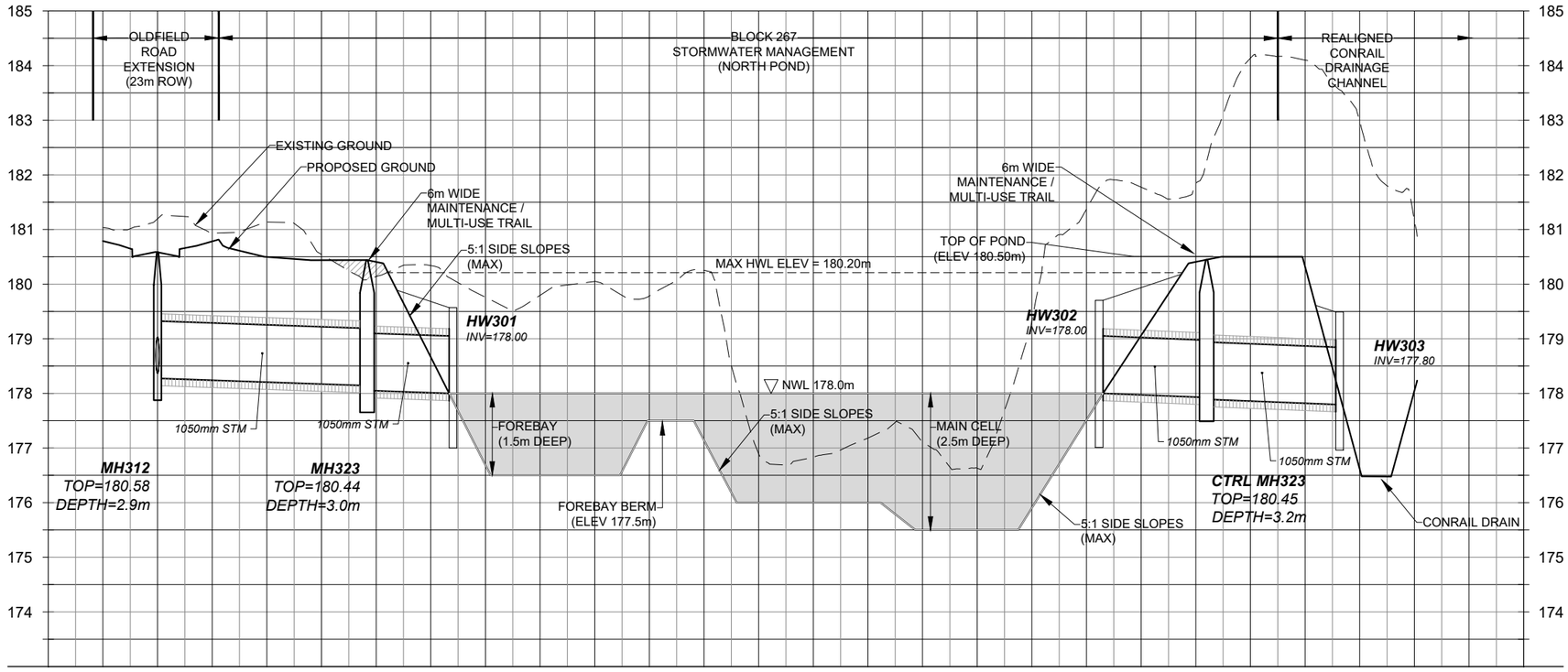
Figure Title

NIAGARA VILLAGE DEVELOPMENT

SWM POND NORTH - PLAN VIEW

Drawn	Checked	Date	Figure No.
RS	LG	DEC 13/19	**FIG 8**
Scale		Project No.	
1:1000		041230.0500	

File: \\MONTY\Shared Work Areas\041230 - Niagara Village\041230.0500 FSR\07_Figures\SWM FIGURES\041230.0500 - SWM NORTH.dwg Date Plotted: February 5, 2020 - 11:34 AM



NORTH SWM POND
SECTION A-A

0 20 40 60 80
Metres

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Figure Title
NIAGARA VILLAGE DEVELOPMENT

SWM POND NORTH - SECTION

Drawn	Checked	Date	Figure No.
RS	LG	DEC 13/19	**FIG 9**
Scale		Project No.	
H 1:1000 V 1:100		041230.0500	

File: \\MONTY\Shared Work Areas\041230 - Niagara Village\041230.0500 FSR\07_Figures\SWM FIGURES\041230.0500 - SWM NORTH.dwg Date Plotted: February 5, 2020 - 11:34 AM

6.0 Water Balance

A preliminary water balance analysis was completed by Golder Associates Limited in the Hydrology Technical Memo dated July 6, 2018. Based on the analysis it was found that "the total estimated average annual runoff from the Site is 293,000 m³ and the estimated annual infiltration is 40,100 m³. Infiltration decreased by 52% from existing conditions to proposed conditions and runoff increased by 147% compared to existing conditions." In order to help mitigate the increased runoff from the proposed development it is recommended that LID measures be implemented to increase infiltration and improve the water balance on the site. Infiltration may be limited based on the predominant soil type encountered on the site of Silty Clay, therefore site specific design information should be used for LID design including, soil type and water table depth. LID measures to be considered at the detailed design stage could include soak-away pits, infiltration trenches, and roof downspout disconnects.

6.1 Existing Woodlot

As previously described, drainage from Catchments EXT1 and EXT2 will be redirected towards the existing woodlot. As shown in Appendix C, the total 100-year flow from these external drainage areas that will be redirected to the woodlot is 0.708 m^3/s. This flow will aid to make up the infiltration deficit that results from the site being developed.

The Environmental Impact Study, included under separate cover, proposes to utilize this flow and form a slough forest / swamp on the east side of the existing woodlot. Further detail of the slough forest / swamp design will be completed as a part of detailed design.

7.0 Conclusions & Recommendations

The preceding report provides an investigation of existing drainage conditions and an assessment of the stormwater management plan for the proposed Niagara Village Development in the City of Niagara Falls.

As outlined in the report above, the stormwater management blocks provided in the Draft Plan of Subdivision are adequate to support the stormwater management measures required to meet the design criteria. We propose that this Stormwater Management Report be accepted for review and approval in order to facilitate the Draft Plan of Subdivision approval for the subject property.

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Appendix A

Overland Flow Calculations

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CALCULATION SHEET

Project:	Prepared by:	J. Scott
Niagara Village	Checked by:	
Overland Flow in ROW (SOUTH)	Project No:	300041230
	Date:	February 5, 2020

Runoff Equation Q = 2.78CIA (l/s)

where, C = runoff coefficient
I = rainfall intensity (mm/hr)
A = area (ha)
2.78= conversion factor

East Forebay	**C**	**West Forebay**	**C**
89800 m^2	0.59	93500 m^2	0.58

(Pond Drainage less Mixed-Use Sites with 5 Year Control)

Captured in Storm Sewers (5-year)

	A	**B**	**C**	**T**	**I**	**Q**
EAST	719.5	6.3	0.77	10.000 min	84.02 mm/hr	1236.70 L/s
WEST	719.5	6.3	0.77	10.000 min	84.02 mm/hr	1265.83 L/s

Major Storm (100-year)

	A	**B**	**C**	**T**	**I**	**Q**
EAST	1264.6	7.7	0.78	10.000 min	133.78 mm/hr	1969.04 L/s
WEST	1264.6	7.7	0.78	10.000 min	133.78 mm/hr	2015.42 L/s

Conveyed in ROW (100-year less 5-year)

EAST **732.34 L/s**
WEST **749.59 L/s**

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Dec 6 2019

Overland to East Forebay (26m ROW)

User-defined

Invert Elev (m)	= 99.7400
Slope (%)	= 0.5000
N-Value	= Composite

Calculations

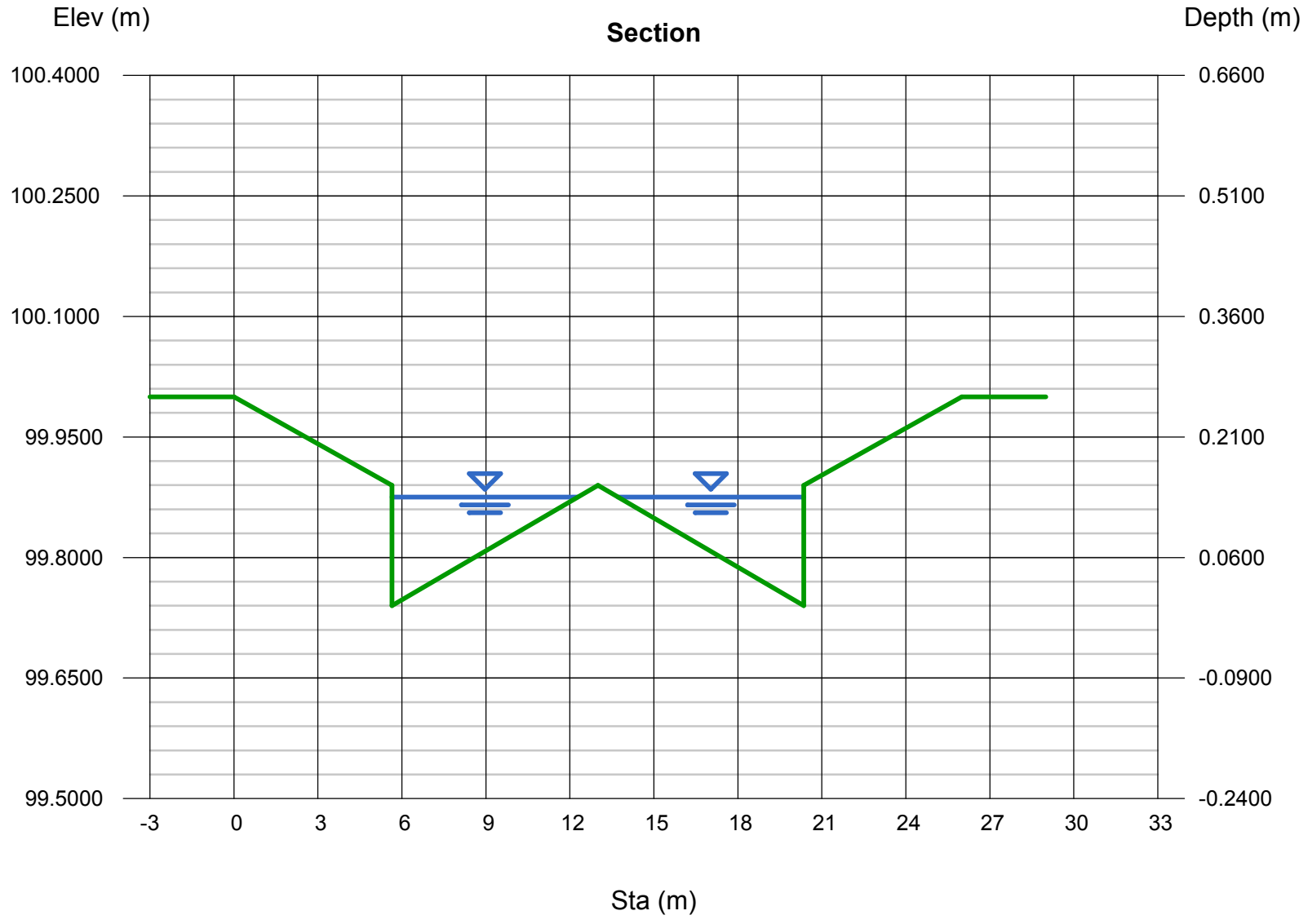
Compute by:	Q vs Depth
No. Increments	= 25

Highlighted

Depth (m)	= 0.1352
Q (cms)	= 0.7989
Area (sqm)	= 0.8957
Velocity (m/s)	= 0.8920
Wetted Perim (m)	= 13.5229
Crit Depth, Yc (m)	= 0.1433
Top Width (m)	= 13.2497
EGL (m)	= 0.1758

(Sta, El, n)-(Sta, El, n)...

(0.0000, 100.0000)-(5.6500, 99.8900, 0.013)-(5.6500, 99.7400, 0.013)-(13.0000, 99.8900, 0.013)-(20.3500, 99.7400, 0.013)-(20.3500, 99.8900, 0.013)-(26.0000, 10



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Dec 6 2019

Overland to West Forebay (18m ROW)

User-defined

Invert Elev (m)	= 99.7600
Slope (%)	= 0.5000
N-Value	= Composite

Calculations

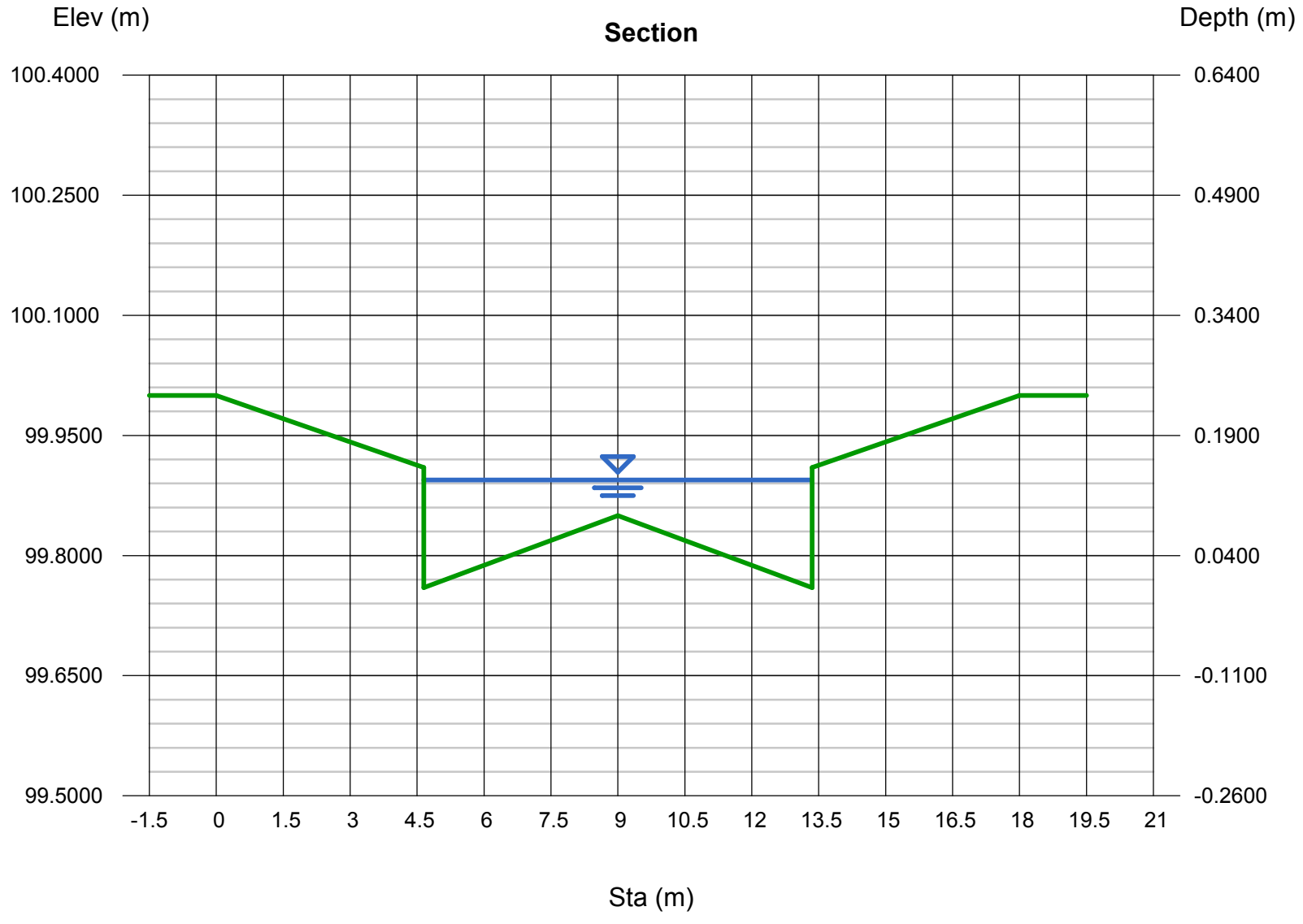
Compute by:	Q vs Depth
No. Increments	= 25

Highlighted

Depth (m)	= 0.1344
Q (cms)	= 0.8303
Area (sqm)	= 0.7778
Velocity (m/s)	= 1.0675
Wetted Perim (m)	= 8.9707
Crit Depth, Yc (m)	= 0.1433
Top Width (m)	= 8.7000
EGL (m)	= 0.1925

(Sta, El, n)-(Sta, El, n)...

(0.0000, 100.0000)-(4.6500, 99.9100, 0.013)-(4.6500, 99.7600, 0.013)-(9.0000, 99.8500, 0.013)-(13.3500, 99.7600, 0.013)-(13.3500, 99.9100, 0.013)-(18.0000, 100



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CALCULATION SHEET

Project:	Prepared by:	L.Garner
Niagara Village	Project No:	300041230
Overland Flow in ROW (NORTH)	Date:	December 9, 2019

Runoff Equation Q = 2.78CIA (l/s)

where,
C = runoff coefficient
I = rainfall intensity (mm/hr)
A = area (ha)
2.78= conversion factor

North Side	**C**	
82661.4 m^2	0.60	(Pond Drainage less Mixed-Use Site with 5 Year Control)

Captured in Storm Sewers (5-year)

	A	**B**	**C**	**T**	**I**	**Q**
NORTH	719.5	6.3	0.77	10.000 min	84.02 mm/hr	1157.68 L/s

Major Storm (100-year)

	A	**B**	**C**	**T**	**I**	**Q**
NORTH	1264.6	7.7	0.78	10.000 min	133.78 mm/hr	1843.23 L/s

Conveyed in ROW (100-year less 5-year)

NORTH **685.55 L/s**

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Dec 9 2019

Overland Flow Capacity - Upstream North Pond

User-defined

Invert Elev (m)	= 1.0000
Slope (%)	= 0.5000
N-Value	= Composite

Calculations

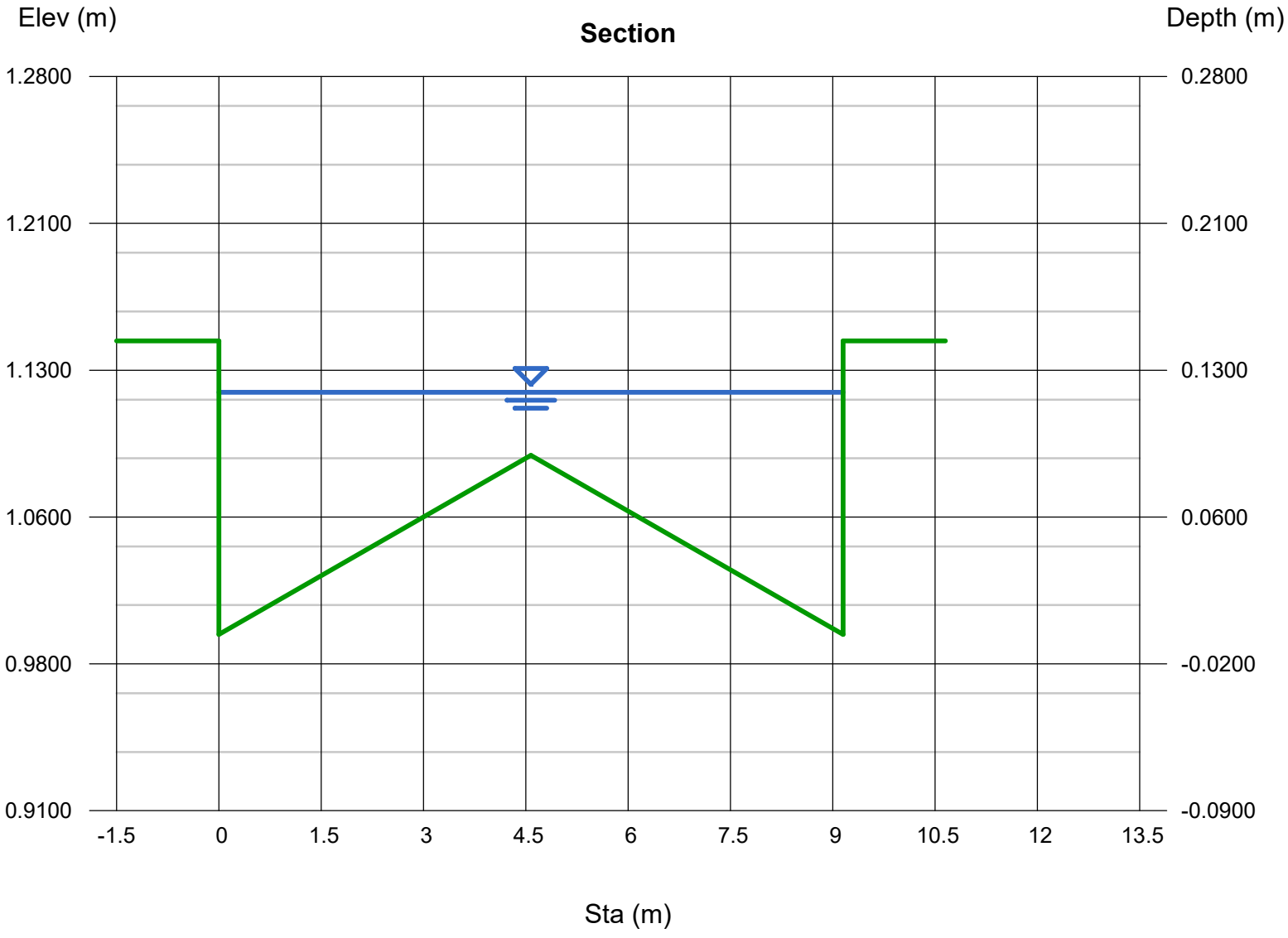
Compute by:	Q vs Depth
No. Increments	= 40

Highlighted

Depth (m)	= 0.1237
Q (cms)	= 0.6973
Area (sqm)	= 0.7137
Velocity (m/s)	= 0.9771
Wetted Perim (m)	= 9.3993
Crit Depth, Yc (m)	= 0.1311
Top Width (m)	= 9.1500
EGL (m)	= 0.1724

(Sta, El, n)-(Sta, El, n)...

(0.0000, 1.1500)-(4.5750, 1.0915, 0.013)-(9.1500, 1.0000, 0.013)-(9.1500, 1.1500, 0.013)



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Appendix B

Modelling Parameters

CHART H2-1 - REPORTS OF THE ONTARIO SOIL SURVEY (6,66)

Soil Maps

	No.		No.
Norfolk	1	Welland	5
Elgin	2	Middlesex	6
Kent	3	Carleton	7
Haldimand	4	Brant	-

Reports

	No.		No.
Carleton (1944 report & map) (See also Map list)	7	Simcoe	29
Parts of Northwest Ontario	8	Soil Assocs. of S.Ont.	30
Durham	9	Parry Sound	31
Prince Edward	10	Wentworth	32
Essex	11	Prescott and Russell	33
Grenville	12	Lincoln	34
Huron	13	Wellington	35
Dundas	14	Lennox & Addington	36
Perth	15	Renfrew	37
Bruce	16	Dufferin	38
Grey	17	Frontenac	39
Peel	18	Lanark	40
York	19	Leeds	41
Stormont	20	Northumberland	42
New Liskeard-Englehart	21	Halton	43
Lambton	22	Waterloo	44
Ontario	23	Peterborough	45
Glengarry	24	Timmins-Noranda-Rouyn	46
Victoria	25	Ottawa Urban Fringe	47
Manitoulin	26	Thunder Bay Area	48
Hastings	27	Sudbury Area	49
Oxford	28	Blind River-Sault Ste Marie	50

CHART H2-6A (Cont'd)

CHART H2-6A - continued

Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.
Darlington	s	B	"	c l	C	Heidelburg	f s l	B
"	l	C	Ferndale	si l	BC	Hendrie	s /g	AB
Dawson	s l	A	"	c l	C	Henwood	s /g	A
"	l	B	Flamboro	s	B	Hespeler	s l	B
Deloro	l	B	"	s l	B	Hillier	c &c l	C
Devlin	si c / c l	C	Floradale	l	B	Hillsburgh	s l	A
			Fonthill	g	A	Himsworth	si l	BC
Dinorwic	c	BC	"	l	B	Hinchinbr.	s l	B
Dobie	c /l	BC	Font	g s l	A	"	l	BC
Doe	s l	B	Forbes	c	D	"	si l	BC
"	si l	BC	Fox	s	A	Honeywood	s l	AB
Donald	l	B	"	s l	AB	"	si l	BC
Donnybrook	s g	A	"	gr l	AB	"	s	A
"	s l	AB	Foxboro	s	A	Howland	s l	B
"	l	B	Franktown	l	B	"	l	BC
Dorion	c /l	C	Freeport	s l	B	Huron	s l	B
Dorking	si c l	BC	Galesburg	s l	A	"	l	BC
Dumfries	s l	A	"	l	AB	"	si l	BC
"	l	AB	Gameland	s /g	AB	"	c l	CorD
Dunmer	s l	A	Gananoque	c	C	"	c	D
"	l	B	Gerow	c l	C	Innisville	s l	B
Dundonald	s l	AB	Gilford	s l	B	Jeddo	l	BC
Dunedin	c	D	"	l	B	"	c l	C
Dymond	s l	AB	Gordon	si c	C	"	c	D
"	l	B	Granby	s	B	Kagawong	si l	BC
Eagle Lake	s /g	AB	"	s l	B	Kars	s /g	A
Eamer	l	BC	Grand	l	B	"	s l	B
Earlton	si l	B	Grenville	s l	A	Kemble	si l	BC
"	c l	C	"	l	BC	"	si c l	C
Eastport	s	A	Grimsby	s l	A	"	si c	C
Edenvale	s	AB	Guelph	s l	A	"	c l	D
"	s l	B	"	l	BC	Kenabeek	s	B
Eganville	l	B	"	si l	BC	"	s l	B
Elderslie	si l	BC	Guerin	s l	AB	Killean	l /s l	AB
"	si c l	C	"	l	B	King	si l	BC
"	c l	C	Gwillimb.	g	AB	"	c l	C
Eldorado	s l	A	Haileybury	si c l	C	Kirkland	s l	A
"	l	B	"	si c	C	Kossuth	s l	B
Elk Pit	s g	A	"	c	CD	L'Achigan	s	AB
Ellwood	c l	C	Haldimand	si l	BC	Lambton	l	BC
Elmbrook	si l	BC	"	si c l	C	"	si l	BC
"	c l	C	"	c	CorD	Lanark	c	C
"	c	C	"	c l	C	Lansdowne	c /si l	C
Elmira	l	B	Hanbury	si c l	C	Leech	si c l	C
Elmsley	s l	B	"	si c	C	"	c l	D
Embro	s l	BC	"	c	D	Leitrim	g	B
"	si l	C	Harkaway	l	B	Leith	si l	BC
Emily	l	B	"	si l	BC	Lily	l /s l	B
Emo	c & p	C	Harriston	l	BC	Lincoln	si c	C
Englehart	s l	B	"	si l	BC	"	c	C
Evanturel	si l	BC	Harrow	s	A	Lindsay	c l	C
"	si c l	C	"	s l	AB	"	c	C
Falardeau	si l	BC	"	l	B	Lisbon	s l	A
"	si c l	C	Havelock	s /g	A	Listowel	l	B/BC
Farmington	s l	A	Hawkesvi.	l	B	"	si l	BC
"	l	B	Haysville	s l	AB	Little Cur.	c	C

CHART H2-6A (Cont'd)

CHART H2-6A - continued

Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.
"	si l	BC	Uplands	s	A			
Snedden	si c l	C	"	s l	A			
Solmesville	c l	C	Upsala	f s	AB			
South Bay	c l	D	Vars	l	B			
"	c	D	Vasey	s l	AB			
Spohn	s /g / c	BC	"	l	B			
Springvale	s l	A	Vergennes	si l	BC			
Stafford	l	B	"	l	BC			
Stockdale	si l/f		"	c	C			
	s	B	Vincent	si l	BC			
St. Clem.	s l	A	"	si c l	C			
"	si c l	C	"	c l	D			
St. Jacobs	l	B	Vineland	s l	AB			
St. Peter	s /g	A	Wabi	s l	A			
St. Rosalie	c	C	"	l	B			
St. Samuel	s	B	Wabigoon	c	C			
"	s l	B	Waterloo	s	A			
St. Thomas	s	A	"	s l	A			
Sullivan	s	A	Watrin	s	B			
"	s l	A	Waupoos	c l	D			
Sutton Bay	s	B	"	c	D			
"	s l	B	Wauseon	s l	B			
Tansley	c	D	Wayside	s	AB			
Tavistock	s l	AB	Welland	c	C			
"	si l	BC	Wellesley	s l	AB			
Tecumseth	s	AB	"	si c l	C			
			Wemyss	s l	AB			
Teeswater	si l	B	Wendigo	s	A			
Temisk'g	r &c	C	"	s l + r	AB			
Tennyson	s l	A	"	s l	AB			
Thames	c l	D	Wendover	c l	D			
Thorah	s	B	"	c	D			
Thornloe	c	C	Westmeath	s	A			
Thwaites	si l	BC	Whitby	l	BC			
Tioga	s	A	White Lake	s /g	A			
"	s l	A	Whitfield	si l	B			
Toledo	si l	BC	Wiarton	l	B			
"	si c l	C	"	si l	BC			
"	c l	C	Wilmot	s l	B			
"	c	C	"	si c l	C			
Trafalgar	c	D	Winona	s l	AB			
Trent	s	AB	Woburn	s l	A			
Tuscola	s l	AB	"	l	B*			
"	si l	BC	Wolford	c l	D			
Tweed	s l	A	Wolsey	si c	C			
"	s l + r	AB	Wooler	si l/f				
"	r	AB		s	AB			
Undiffer'd	s l + r	AB or B(dep. on depth)	Woolwich	l	BC			
			Worthing.	s /g /c	BC			
			Wyevale	s /g	A			

Table 9–5 Runoff curve numbers for urban areas 1/

Cover description cover type and hydrologic condition	Average percent impervious area 2/	-- CN for hydrologic soil group -- A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) 3/					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding rig		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) 4/		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94

Site Soil Groups:
Welland Clay = Soil Group C
Jeddo Clay = Soil Group D

The golf course can be said to be in fair / good condition, refer to composite CN calculation

1/ Average runoff condition, and $I_a = 0.2S$.

2/ The average percent impervious area shown was used to develop the composite CNs. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

3/ CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space type.

4/ Composite CNs for natural desert landscaping should be computed using figures 9–3 or 9–4 based on the impervious area percentage (CN=98) and the pervious area CN. The pervious area CNs are assumed equivalent to desert shrub in poor hydrologic condition.

Table 9–1 Runoff curve numbers for agricultural lands 1/ — Continued

Cover description			CN for hydrologic soil group			
cover type	treatment 2/	hydrologic condition 3/	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing 4/		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		Good	30	58	71	78
Brush-brush-forbs-grass mixture with brush the major element 5/		Poor	48	67	77	83
		Fair	35	56	70	77
		Good	30 6/	48	65	73
Woods-grass combination (orchard or tree farm) 7/		Poor	57	73	82	86
		Fair	43	65	76	82
		Good	32	58	72	79
Woods 8/		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	30	55	70	77
Farmstead–buildings, lanes, driveways, and surrounding lots		---	59	74	82	86
Roads (including right-of-way):						
Dirt		---	72	82	87	89
Gravel		---	76	85	89	91

Welland Clay = Soil Group C

Soils have poor drainage as per Soils Map

1/ Average runoff condition, and I_a=0.2s.

2/ Crop residue cover applies only if residue is on at least 5 percent of the surface throughout the year.

3/ Hydrologic condition is based on combinations of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥20%), and (e) degree of surface toughness.
Poor: Factors impair infiltration and tend to increase runoff.
Good: Factors encourage average and better then average infiltration and tend to decrease runoff.
For conservation tillage poor hydrologic condition, 5 to 20 percent of the surface is covered with residue (less than 750 pounds per acre for row crops or 300 pounds per acre for small grain).
For conservation tillage good hydrologic condition, more than 20 percent of the surface is covered with residue (greater than 750 pounds per acre for row crops or 300 pounds per acre for small grain).

4/ Poor: < 50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

5/ Poor: < 50% ground cover.
Fair: 50 to 75% ground cover.
Good: > 75% ground cover.

6/ If actual curve number is less than 30, use CN = 30 for runoff computation.

7/ CNs shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture.

8/ Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed, but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

BURNSIDE

Project: **Niagara Village**

Task: **CN Number Summary - South**

Date: **4-Feb-20**

Prepared by: **J. Scott**

Project no.:

Soil Name	Jeddo Clay	Welland Clay	Welland Clay	
Land Cover	Golf Course	Golf Course	Forest	
Soil Group	D	C	C	
CN Number	80	74	77	

Catchment	**Total Area**	**Jeddo**	**Welland Golf**	**Welland Forest**	**CN Number**
EXT1	5.13	0.00	4.23	0.90	74.5
EXT2	6.56	0.00	3.73	2.83	75.3
101	1.55	1.55	0.00	0.00	80.0
102	2.62	2.31	0.31	0.00	79.3
103	25.82	12.37	10.91	2.54	77.2
Block 246	1.54	0.00	1.25	0.29	74.6
Block 245	2.46	0.00	2.34	0.12	74.1
Block 244	1.28	0.00	1.18	0.10	74.2
Block 243	0.90	0.47	0.43	0.00	77.1
207	8.98	4.08	4.12	0.78	77.0
Block 248	3.09	3.09	0.00	0.00	80.0
202	9.35	9.35	0.00	0.00	80.0
UNC1	1.41	1.41	0.00	0.00	80.0
UNC2	0.36	0.36	0.00	0.00	80.0
208	0.62	0.00	0.59	0.03	74.1

Project: **Niagara Village**
Project #: 300041230
Designed By: J.Scott
Date: 5-Feb-2020

BURNSIDE

Airport Method for Time to Peak Calculations - SOUTH

Natural Area Watershed Information

WS	Area (ha)	Length (m)	RC	Slope (%)	Time of Concentration (min)	Time to Peak (hrs)
EXTERNAL						
EXT1	5.13	303	0.20	1.650	43.29	0.43
EXT2	6.56	489	0.20	0.550	79.03	0.79
EXISTING						
101	1.55	97.00	0.20	2.00	22.99	0.23
102	2.62	44.00	0.20	13.20	8.31	0.08
103	25.82	798.00	0.20	0.06	206.39	2.06

NOTE: Time to Peak = 0.60Tc

NOTE: Airport method was selected to calculate the watershed time of concentration as per the MOE Drainage Management Manual (for RC less than 0.4) - see below

Airport Formula

For watersheds where the runoff coefficient, C, is less than 0.40, the Airport formula gives a better estimate of t_c. This method was developed for airfields and is expressed as follows:

$$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}} \qquad (8.16)$$

where:

t_c = time of concentration, min
C = runoff coefficient
S_w = watershed slope, %
L = watershed length, m

When a watershed length is made up of widely differing surfaces (e.g. grass and concrete), t_c, can be calculated for each surface, and the individual values summed to give the overall value.

BURNSIDE

Project: **Niagara Village**

Task: **CN Number Summary - North**

Prepared by: **L.Garner**

Date: **29-Nov-19**

Project no.: **300041230.00**

Soil Name	Jeddo Clay	Welland Clay	Welland Clay	
Land Cover	Golf Course	Golf Course	Forest	
Soil Group	D	C	C	
CN Number	80	74	77	

Catchment	Total Area	Jeddo	Welland Golf	Welland Forest	CN Number
104	2.21	0.83	1.38		76
105	2.45		2.45		74
106	6.88		6.13	0.75	74
EXT3	0.05		0.05		74
EXT4	0.25		0.25		74
209	8.27		8.27		74
210	2.71	0.31	2.40		75
UNC3	0.86	0.44	0.42		77
UNC4	0.14		0.14		74

Project: **Niagara Village**
Project #: 300041230
Designed By: L.Garner
Date: 5-Feb-2020

BURNSIDE

Airport Method for Time to Peak Calculations

Natural Area Watershed Information

WS	Area (ha)	Length (m)	RC	Slope (%)	Time of Concentration (min)	Time to Peak (hrs)
EXISTING						
104	2.21	94	0.2	2.03	22.51	0.23
105	2.45	114	0.2	0.85	33.04	0.33
106	6.88	173	0.2	0.63	44.95	0.45
EXTERNAL						
EXT3	0.05	5.45	0.2	2.00	5.45	0.05
EXT4	0.25	19	0.2	2.79	9.12	0.09
PROPOSED						
UNC4	0.16	36	0.2	4.50	10.72	0.11

NOTE: Time to Peak = 0.60Tc

NOTE: Airport method was selected to calculate the watershed time of concentration as per the MOE Drainage Management Manual (for RC less than 0.4) - see below

Airport Formula

For watersheds where the runoff coefficient, C, is less than 0.40, the Airport formula gives a better estimate of t_c. This method was developed for airfields and is expressed as follows:

$$t_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}} \qquad (8.16)$$

where:

t_c = time of concentration, min
C = runoff coefficient
S_w = watershed slope, %
L = watershed length, m

When a watershed length is made up of widely differing surfaces (e.g. grass and concrete), t_c, can be calculated for each surface, and the individual values summed to give the overall value.

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Appendix C

Stormwater Management Calculations – South

Project: Niagara Village - SOUTH
File: 300041230
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

BURNSIDE

IMPERVIOUS CALCULATIONS - TO EAST FOREBAY

Pond Drainage Area = **151630** **m2** **or** **15.16** **ha**

Right of Ways (m2)

28919	ROW

Total Area= 2.89 ha

		Area
TIMP	90%	2.60 ha
XIMP	70%	2.02 ha

Parkland Areas (m2)

7800	Block 283

Total Area= 0.78 ha

		Area
TIMP	10%	0.08 ha
XIMP	5%	0.04 ha

SWM Block (m2)

4938	East Portion

Total Area = 0.49 ha

		Area
TIMP	50%	0.25 ha
XIMP	50%	0.25 ha

Townhouses (m2)

Total Area = 0.00 ha

		Area
TIMP	64%	0.32 ha
XIMP	44%	0.22 ha

Low-Density Residential Areas (m2)

48173	

Total Area 4.82 ha

		Area
TIMP	43%	2.07 ha
XIMP	20%	0.96 ha

Medium-Density (m2)

9000	Block 243
12800	Block 244
24600	Block 245
15400	Block 246

Total Area 6.18 ha

		Area
TIMP	80%	6.85 ha
XIMP	60%	5.13 ha

IMPERVIOUSNESS			
TOTAL Modelled Area=	**15.16 ha**	**TOTAL Pervious Area=**	**5.22 ha**
OVERALL TIMP	**0.656**		
OVERALL XIMP	**0.460**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

BURNSIDE

IMPERVIOUS CALCULATIONS - TO WEST FOREBAY

Pond Drainage Area = **124400** **m2** **or** **12.44** **ha**

Right of Ways (m2)

22348	ROW

Total Area= 2.23 ha

		Area
TIMP	90%	2.01 ha
XIMP	70%	1.56 ha

Parkland Areas (m2)

3441	

Total Area= 0.34 ha

		Area
TIMP	10%	0.03 ha
XIMP	5%	0.02 ha

SWM Block (m2)

18504	West Portion

Total Area = 1.85 ha

		Area
TIMP	50%	0.93 ha
XIMP	50%	0.93 ha

Townhouses (m2)

Total Area = 0.00 ha

		Area
TIMP	64%	1.18 ha
XIMP	44%	0.81 ha

Low-Density Residential Areas (m2)

49207	

Total Area 4.92 ha

		Area
TIMP	43%	2.12 ha
XIMP	20%	0.98 ha

Medium Density (m2)

30900	Block 248

Total Area 3.09 ha

		Area
TIMP	80%	3.94 ha
XIMP	60%	2.95 ha

IMPERVIOUSNESS			
TOTAL Modelled Area=	**12.44 ha**	**TOTAL Pervious Area=**	**4.88 ha**
OVERALL TIMP	**0.608**		
OVERALL XIMP	**0.430**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

BURNSIDE

IMPERVIOUS CALCULATIONS - TO RAMSEY

Pond Drainage Area = **6214** **m2** **or** **0.62** **ha**

Right of Ways (m2)

6214	

Total Area= 0.62 ha

		Area
TIMP	90%	0.56 ha
XIMP	70%	0.43 ha

Parkland Areas (m2)

Total Area= 0 ha

		Area
TIMP	10%	0.00 ha
XIMP	5%	0.00 ha

IMPERVIOUSNESS

TOTAL Modelled Area=	**0.62 ha**	**TOTAL Pervious Area=**	**0.06 ha**
OVERALL TIMP	**0.900**		
OVERALL XIMP	**0.700**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

BURNSIDE

IMPERVIOUS CALCULATIONS - UNCONTROLLED TO RAILWAY

Drainage Area = **3595** **m2** **or** **0.36** **ha**

Low-Density Residential Areas (m2)

3595	

Medium-Density (m2)

Total Area		0.36 ha		Total Area		0.00 ha	
			Area				Area
TIMP	43%		0.15 ha	TIMP	80%		0.29 ha
XIMP	20%		0.07 ha	XIMP	60%		0.22 ha

IMPERVIOUSNESS (UNCONTROLLED TO RAILWAY)			
TOTAL Modelled Area=	**0.36 ha**	**TOTAL Pervious Area=**	**0.20 ha**
OVERALL TIMP	**0.430**		
OVERALL XIMP	**0.200**		

IMPERVIOUS CALCULATIONS - UNCONTROLLED TO WETLAND

Drainage Area = **14100** **m2** **or** **1.41** **ha**

Parkland Areas (m2)

8036	

Low-Density Residential Areas (m2)

6064	

Total Area=		0.8036 ha		Total Area		0.61 ha	
			Area				Area
TIMP	10%		0.08 ha	TIMP	43%		0.15 ha
XIMP	5%		0.04 ha	XIMP	20%		0.07 ha

IMPERVIOUSNESS (UNCONTROLLED TO WETLAND)			
TOTAL Modelled Area=	**1.41 ha**	**TOTAL Pervious Area=**	**1.07 ha**
OVERALL TIMP	**0.242**		
OVERALL XIMP	**0.115**		

Project: Niagara Village - SOUTH
File: 300041230.0000
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

Wet Pond Permament Pool Requirement - Total Pond

MOE Table 3.2 Water Quality Storage Requirements Based on Receiving Waters.

IMPERVIOUSNESS	63.41	%
Protection Level (1, 2, or 3)	1	

NOTE - 40 cu.m/ha has been removed from MOE table values for Ex. Detention Portion

Enhanced (Level 1) Protection

x	**y**	**Known (x)**	**Calc (y)**	
Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Total Permanent Pool Required (cu.m)
35	100	63.41	169.61	4681.84
55	150			
70	185			
85	210			
95.0	**236**	**Extrapolated**		
99.0	**240**	**Extrapolated**		

Normal (Level 2) Protection

x	**y**	**Known (x)**	**Calc (y)**	
Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Total Permanent Pool Required (cu.m)
35	50	63.41	81.21	2241.57
55	70			
70	90			
85	110			
95.0	**121**	**Extrapolated**		
99.0	**127**	**Extrapolated**		

Basic (Level 3) Protection

x	**y**	**Known (x)**	**Calc (y)**	
Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Total Permanent Pool Required (cu.m)
35	20	63.41	40.60	1120.79
55	35			
70	45			
85	55			
99.0	**61**	**Extrapolated**		

EXTENDED DETENTION CALCULATIONS

Project: Niagara Village - SOUTH
File: 300041230.00
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

Extended Detention Storage Required - SCS Method

Q = (P-IA)^2/P-(IA-S)
S = -254+25400/CN
T IMP = **63.41** %

Pervious Area			**Impervious Area**		
P =	25	mm	P =	25	mm
IA =	2.5	mm	IA =	2.5	mm
CN =	75		CN =	98	
S =	84.7		S =	5.2	
Q =	4.7	mm	Q =	18.3	mm

	per	**imp**	**total**	
SCS Runoff Volume	4.7	18.3		mm
Drainage Area	10.10	17.50	**27.60**	ha
Storage Volume	477	3201	3678	cu.m

Extended Detention Component of Pond: **3678 cu.m**

HYMO OUTPUT **15.32 mm**
4229 cu.m

EXTENDED DETENTION REQUIRED **4229 cu.m**

SEDIMENT FOREBAY SIZING

Project: Niagara Village - SOUTH
File: 300041230
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

EAST FOREBAY
Forebay Length: Two calculations (per MOE SWMP Manual, 2003)

1) Settling Calculations **Dist = SQRT(r * Qp / Vs)**
(Equation 4.5, MOE 2003)

where:
- Dist = Forebay length (m)
- r = Length to width ratio of forebay
- Qp = Peak flowrate from the pond during quality design storm (cms)
- Vs = Settling velocity (m/s)

given:
- r = 2
- Qp = 0.09789 cms *see below
- Vs = 0.0003 m/s

therefore:
- Dist = 25.5 metres
- Width= 12.8 metres

Peak quality flowrate (Qp) from pond based on release rate and volume of extended detention multiplied by a factor of 2.0 for peaking

- Extended Detention Vol 4229 cu.m (extended det. volume)
- Release Rate 24 hrs (typically 24 or 48)
- Qp 0.09789 cms

2) Dispersion Length **Dist = (8 * Q) / (d * Vf)**
(Equation 4.6,MOE 2003)

where:
- Dist = Forebay length (m)
- Q = inlet flowrate (cms)
- d = depth of permanent pool in forebay (m)
- Vf = desired forebay velocity (m/s)

given:
- Q = 1.545 cms *see below
- d = 1.5 m
- Vf = 0.5 m/s

therefore:
- Dist = 16.5 metres
- Width= 8.2 metres
- Min Bottom Width= 2.1 metres *MOE equation 4.6
- Pond Side Slopes: 5
- Calc. Top Width= 17.06 metres
- Calc. Top Length= 34.12 meters

Peak inflow rate calculated based on SMWHYMO output for 5 year storm (based of IDF parameters)

Minimum Forebay Dimension:

- Length= 34.1 meters
- Width= 17.1 meters

Actual Forebay Design:

- Length= 43.1 meters
- Width= 20.0 meters

Check Average velocity in forebay <= 0.15 m/s
Pond Side Slopes: 5 H : 1 V
Q = V x A Q = 1.545 A = 19 sq.metres

therefore: V = 0.0824 m/s
Design: **OK**

SEDIMENT FOREBAY SIZING

Project: Niagara Village - SOUTH
File: 300041230
Designed by: J.Scott
Checked by:
Date: 4-Feb-20

WEST FOREBAY
Forebay Length: Two calculations (per MOE SWMP Manual, 2003)

1) Settling Calculations **Dist = SQRT(r * Qp / Vs)**
(Equation 4.5, MOE 2003)

where:
Dist = Forebay length (m)
r = Length to width ratio of forebay
Qp = Peak flowrate from the pond during quality design storm (cms)
Vs = Settling velocity (m/s)

given:
r = 2
Qp = 0.09789 cms *see below
Vs = 0.0003 m/s

therefore:
Dist = 25.5 metres
Width= 12.8 metres

Peak quality flowrate (Qp) from pond based on release rate and volume of extended detention multiplied by a factor of 2.0 for peaking

Extended Detention Vol 4229 cu.m (extended det. volume)
Release Rate 24 hrs (typically 24 or 48)
Qp 0.09789 cms

2) Dispersion Length **Dist = (8 * Q) / (d * Vf)**
(Equation 4.6,MOE 2003)

where:
Dist = Forebay length (m)
Q = inlet flowrate (cms)
d = depth of permanent pool in forebay (m)
Vf = desired forebay velocity (m/s)

given:
Q = 1.273 cms *see below
d = 1.5 m
Vf = 0.5 m/s

therefore:
Dist = 13.6 metres
Width= 6.8 metres
Min Bottom Width= 1.7 metres *MOE equation 4.6
Pond Side Slopes: 5
Calc. Top Width= 16.697 metres
Calc. Top Length= 33.395 meters

Peak inflow rate calculated based on SMWHYMO output for 5 year storm (based of IDF parameters)

Minimum Forebay Dimension:

Length= 33.4 meters
Width= 16.7 meters

Actual Forebay Design:

Length= 43.1 meters
Width= 20.0 meters

Check Average velocity in forebay <= 0.15 m/s
Pond Side Slopes: 5 H : 1 V
Q = V x A Q = 1.273 A = 19 sq.metres

therefore: V = 0.0679 m/s
Design: **OK**

Project: Niagara Village - SOUTH
File: 300041230.0000
Designed by: J.Scott
Checked by:
Date: 2/4/2020

BURNSIDE

SWM Pond Storage Calculations

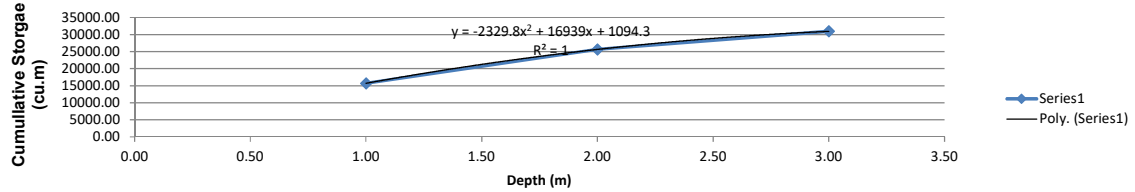
INPUT AREA

Base of Pond:	176.50	
N.W.L.:	178.00	masl
Increment for Volume:	0.2	m
Required Permanent Pool Volume:	4682	m^3
Permanent Pool Volume Provided:	7020	m^3

Red numbers indicate user input areas.

PERMANENT POOL ELEVATION / STORAGE INFORMATION

Description	Elevation (m)	Stage (m)	Elev Above PP (m)	Outlet Pool (m2)	Central Cell	Forebay (m2)	Total Area (m2)	Avg. Area (m2)	Incremental Storage (m3)	Cumulative Storage (m3)	Cumulative Storage in Outlet Pool	Cumulative Storage in Forebay	Cumulative Storage above Permanent Pool (m3)
	176.50	-1.50		1536		349	1885.00				0.00	0.00	
	177.00	-1.00		2913		738	3651.00	2768.00	1384.00	1384.00	1112.25	271.75	
NWL	178.00	0.00	0.00	5866		1755	7621.00	5636.00	5636.00	7020.00	5501.75	1518.25	0.00
ED	178.50	0.50	0.50	9653			9653.00	8637.00	4318.50	11338.50	8942.75	2395.75	4318.50
	179.50	1.50	1.50	13116			13116.00	11384.50	11384.50	22723.00	#DIV/0!	#DIV/0!	15703.00
	180.20	2.20	2.20	15310			15310.00	14213.00	9949.10	32672.10	#DIV/0!	#DIV/0!	25652.10
freeboard	180.50	2.50	2.50	19953			19953.00	17631.50	5289.45	37961.55	#DIV/0!	#DIV/0!	30941.55



	C1	C2	b
The following cells contain the slope and X-intercept of the pond Stage-Storage Curve above. **Storage formula is y=C1* x^2 + C2 * x + b.**	#VALUE!	#VALUE!	#VALUE!

AES EXISTING

```
2     Metric units
*#************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#************************************************************************
*# Existing Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#
*#  TIMP / XIMP and TP as per RJB prelim investigation
*#************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*% 100-year 12-hr AES
MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
                    CURVE_FILENAME=["AES-12HR.mst"]
*%-----------------|-------------------------------------------------------|
*#************************************************************************
* EXT1 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point A
DESIGN NASHYD       ID=[1], NHYD=[EXT1], DT=[1]min, AREA=[5.13](ha),
                    DWF=[0](cms), CN/C=[74.5], TP=[0.43]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* EXT2 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point B
DESIGN NASHYD       ID=[2], NHYD=[EXT2], DT=[1]min, AREA=[6.56](ha),
                    DWF=[0](cms), CN/C=[75.3], TP=[0.79]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* 103 - lands owned by applicant that are to be developed
* Discharges to existing watercourse
DESIGN NASHYD       ID=[3], NHYD=[103], DT=[1]min, AREA=[25.82](ha),
                    DWF=[0](cms), CN/C=[74.0], TP=[2.06]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Total to existing watercourse
* Allowable release rate from post development pond
ADD HYD             IDsum=[9], NHYD=[Total1], IDs to add=[1,2,3]
*%-----------------|-------------------------------------------------------|
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
DESIGN NASHYD       ID=[1], NHYD=[101], DT=[1]min, AREA=[1.55](ha),
```

```
                  DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
                  RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%----------------|-------------------------------------------------------------|
* 102 - lands owned by applicant that are to be developed
* Discharges to railway
DESIGN NASHYD     ID=[1], NHYD=[102], DT=[1]min, AREA=[2.62](ha),
                  DWF=[0](cms), CN/C=[79.3], TP=[0.08]hrs,
                  RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%----------------|-------------------------------------------------------------|
*%----------------|-------------------------------------------------------------|
FINISH
```

AES EXISITNG

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
                                                        9   9  9   9   # 3877524
        StormWater Management HYdrologic Model           999    999    =========

*******************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*******************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*******************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*******************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*******************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
*         DATE: 2019-12-09     TIME: 16:54:00     RUN COUNTER: 002354         *
*******************************************************************************
* Input   filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\AES\100.DAT          *
* Output  filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\AES\100.out          *
* Summary filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\AES\100.sum          *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************

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

```
001:0001--------------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Existing Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#
*#  TIMP / XIMP and TP as per RJB prelim investigation
*#*************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\THUNDE~1\191209~2\Existing\AES\

--------------------  Rainfall dir.: C:\SWMHYMO\THUNDE~1\191209~2\Existing\AES\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------------
-
*#*************************************************************************
--------------------
| MASS STORM       |    Filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\AE
| Ptotal= 88.06 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
--------------------
                       Duration of storm        =   12.00 hrs
                       Mass curve time step     =   60.00 min
                       Selected storm time step =    5.00 min
                       Volume of derived storm  =   88.06 mm

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   4.403 |   3.08   9.687 |   6.08   7.925 |   9.08   5.284
               .17   4.403 |   3.17   9.687 |   6.17   7.925 |   9.17   5.284
               .25   4.403 |   3.25   9.687 |   6.25   7.925 |   9.25   5.284
               .33   4.403 |   3.33   9.687 |   6.33   7.925 |   9.33   5.284
               .42   4.403 |   3.42   9.687 |   6.42   7.925 |   9.42   5.284
               .50   4.403 |   3.50   9.687 |   6.50   7.925 |   9.50   5.284
               .58   4.403 |   3.58   9.687 |   6.58   7.925 |   9.58   5.284
               .67   4.403 |   3.67   9.687 |   6.67   7.925 |   9.67   5.284
               .75   4.403 |   3.75   9.687 |   6.75   7.925 |   9.75   5.284
               .83   4.403 |   3.83   9.687 |   6.83   7.925 |   9.83   5.284
```

.92	4.403	3.92	9.687	6.92	7.925	9.92	5.284
1.00	4.403	4.00	9.687	7.00	7.925	10.00	5.284
1.08	8.806	4.08	13.209	7.08	7.925	10.08	1.761
1.17	8.806	4.17	13.209	7.17	7.925	10.17	1.761
1.25	8.806	4.25	13.209	7.25	7.925	10.25	1.761
1.33	8.806	4.33	13.209	7.33	7.925	10.33	1.761
1.42	8.806	4.42	13.209	7.42	7.925	10.42	1.761
1.50	8.806	4.50	13.209	7.50	7.925	10.50	1.761
1.58	8.806	4.58	13.209	7.58	7.925	10.58	1.761
1.67	8.806	4.67	13.209	7.67	7.925	10.67	1.761
1.75	8.806	4.75	13.209	7.75	7.925	10.75	1.761
1.83	8.806	4.83	13.209	7.83	7.925	10.83	1.761
1.92	8.806	4.92	13.209	7.92	7.925	10.92	1.761
2.00	8.806	5.00	13.209	8.00	7.925	11.00	1.761
2.08	10.567	5.08	12.328	8.08	5.284	11.08	.881
2.17	10.567	5.17	12.328	8.17	5.284	11.17	.881
2.25	10.567	5.25	12.328	8.25	5.284	11.25	.881
2.33	10.567	5.33	12.328	8.33	5.284	11.33	.881
2.42	10.567	5.42	12.328	8.42	5.284	11.42	.881
2.50	10.567	5.50	12.328	8.50	5.284	11.50	.881
2.58	10.567	5.58	12.328	8.58	5.284	11.58	.881
2.67	10.567	5.67	12.328	8.67	5.284	11.67	.881
2.75	10.567	5.75	12.328	8.75	5.284	11.75	.881
2.83	10.567	5.83	12.328	8.83	5.284	11.83	.881
2.92	10.567	5.92	12.328	8.92	5.284	11.92	.881
3.00	10.567	6.00	12.328	9.00	5.284	12.00	.881

-
001:0003---
-
```
*#*********************************************************************
* EXT1 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point A
----------------------
| DESIGN NASHYD      |   Area    (ha)=    5.13   Curve Number   (CN)=74.50
| 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .456

     PEAK FLOW       (cms)=     .106 (i)
     TIME TO PEAK    (hrs)=    6.083
     RUNOFF VOLUME    (mm)=   43.185
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .490

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
* EXT2 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point B
----------------------
| DESIGN NASHYD      |   Area    (ha)=    6.56   Curve Number   (CN)=75.30
| 02:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .317

     PEAK FLOW       (cms)=     .130 (i)
     TIME TO PEAK    (hrs)=    6.283
     RUNOFF VOLUME    (mm)=   44.106
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .501

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
* 103 - lands owned by applicant that are to be developed
* Discharges to existing watercourse
----------------------
| DESIGN NASHYD      |   Area    (ha)=   25.82   Curve Number   (CN)=74.00
| 03:000103 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=   2.060

     Unit Hyd Qpeak  (cms)=     .479

     PEAK FLOW       (cms)=     .397 (i)
     TIME TO PEAK    (hrs)=    8.433
     RUNOFF VOLUME    (mm)=   42.619
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .484

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
* Total to existing watercourse
* Allowable release rate from post development pond
-----------------------
```

ADD HYD (1)	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
ID1	01: 1	5.13	.106	6.08	43.19	.000
+ID2	02: 2	6.56	.130	6.28	44.11	.000
+ID3	03: 103	25.82	.397	8.43	42.62	.000
SUM	09: 1	37.51	.576	8.10	42.96	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0007

---

* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland

DESIGN NASHYD	Area (ha)= 1.55	Curve Number (CN)=80.00
01:000101 DT= 1.00	Ia (mm)= 1.500	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= .230	

Unit Hyd Qpeak (cms)= .257

PEAK FLOW (cms)= .037 (i)
TIME TO PEAK (hrs)= 6.017
RUNOFF VOLUME (mm)= 49.931
TOTAL RAINFALL (mm)= 88.060
RUNOFF COEFFICIENT = .567

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008

---

* 102 - lands owned by applicant that are to be developed
* Discharges to railway

DESIGN NASHYD	Area (ha)= 2.62	Curve Number (CN)=79.30
01:000102 DT= 1.00	Ia (mm)= 1.500	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= .080	

Unit Hyd Qpeak (cms)= 1.251

PEAK FLOW (cms)= .063 (i)
TIME TO PEAK (hrs)= 6.000

```
     RUNOFF VOLUME    (mm)=   49.015
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .557

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0009--------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2019-12-09     at 16:54:00
================================================================================
=
```

AES POST DEVELOPMENT

```
2     Metric units
*#************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#************************************************************************
*# 5-years flows to each forebay (to size forebays)
*#
*# Post Development 5-yr control flows from the Site Plan Blocks
*#
*# CN as per Ontario Soils Map for Welland County
*#************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [   ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*% 5-year 12-hr AES
MASS STORM          PTOTAL=[54.56](mm), CSDT=[5](min),
                    CURVE_FILENAME=["AES-12HR.MST"]
*%-----------------|-------------------------------------------------------|
*#************************************************************************
* BLOCKS TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
```

```
                  XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                  SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%----------------|------------------------------------------------------------|
* BLOCKS TO WEST FOREBAY
*%----------------|------------------------------------------------------------|
* Catchment 201 - Block 248 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                  XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                  SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%----------------|------------------------------------------------------------|
*%----------------|------------------------------------------------------------|
FINISH
```

AES POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 3877524
        StormWater Management HYdrologic Model           999    999    =========

*******************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*******************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*******************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*******************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*******************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
*         DATE: 2020-02-04     TIME: 17:18:09     RUN COUNTER: 000055         *
*******************************************************************************
* Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\5Q.DAT           *
* Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\5Q.out           *
* Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\5Q.sum           *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************

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-
```

```
001:0001--------------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# 5-years flows to each forebay (to size forebays)
*#
*# Post Development 5-yr control flows from the Site Plan Blocks
*#
*# CN as per Ontario Soils Map for Welland County
*#*************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------------
-
*#*************************************************************************
--------------------
| MASS STORM       |    Filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AE
| Ptotal= 54.56 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
--------------------
                       Duration of storm        =   12.00 hrs
                       Mass curve time step     =   60.00 min
                       Selected storm time step =    5.00 min
                       Volume of derived storm  =   54.56 mm

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   2.728 |   3.08   6.002 |   6.08   4.910 |   9.08   3.274
               .17   2.728 |   3.17   6.002 |   6.17   4.910 |   9.17   3.274
               .25   2.728 |   3.25   6.002 |   6.25   4.910 |   9.25   3.274
               .33   2.728 |   3.33   6.002 |   6.33   4.910 |   9.33   3.274
               .42   2.728 |   3.42   6.002 |   6.42   4.910 |   9.42   3.274
               .50   2.728 |   3.50   6.002 |   6.50   4.910 |   9.50   3.274
               .58   2.728 |   3.58   6.002 |   6.58   4.910 |   9.58   3.274
               .67   2.728 |   3.67   6.002 |   6.67   4.910 |   9.67   3.274
               .75   2.728 |   3.75   6.002 |   6.75   4.910 |   9.75   3.274
               .83   2.728 |   3.83   6.002 |   6.83   4.910 |   9.83   3.274
```

```
               .92   2.728 |   3.92   6.002 |   6.92   4.910 |   9.92   3.274
              1.00   2.728 |   4.00   6.002 |   7.00   4.910 |  10.00   3.274
              1.08   5.456 |   4.08   8.184 |   7.08   4.910 |  10.08   1.091
              1.17   5.456 |   4.17   8.184 |   7.17   4.910 |  10.17   1.091
              1.25   5.456 |   4.25   8.184 |   7.25   4.910 |  10.25   1.091
              1.33   5.456 |   4.33   8.184 |   7.33   4.910 |  10.33   1.091
              1.42   5.456 |   4.42   8.184 |   7.42   4.910 |  10.42   1.091
              1.50   5.456 |   4.50   8.184 |   7.50   4.910 |  10.50   1.091
              1.58   5.456 |   4.58   8.184 |   7.58   4.910 |  10.58   1.091
              1.67   5.456 |   4.67   8.184 |   7.67   4.910 |  10.67   1.091
              1.75   5.456 |   4.75   8.184 |   7.75   4.910 |  10.75   1.091
              1.83   5.456 |   4.83   8.184 |   7.83   4.910 |  10.83   1.091
              1.92   5.456 |   4.92   8.184 |   7.92   4.910 |  10.92   1.091
              2.00   5.456 |   5.00   8.184 |   8.00   4.910 |  11.00   1.091
              2.08   6.547 |   5.08   7.638 |   8.08   3.274 |  11.08    .546
              2.17   6.547 |   5.17   7.638 |   8.17   3.274 |  11.17    .546
              2.25   6.547 |   5.25   7.638 |   8.25   3.274 |  11.25    .546
              2.33   6.547 |   5.33   7.638 |   8.33   3.274 |  11.33    .546
              2.42   6.547 |   5.42   7.638 |   8.42   3.274 |  11.42    .546
              2.50   6.547 |   5.50   7.638 |   8.50   3.274 |  11.50    .546
              2.58   6.547 |   5.58   7.638 |   8.58   3.274 |  11.58    .546
              2.67   6.547 |   5.67   7.638 |   8.67   3.274 |  11.67    .546
              2.75   6.547 |   5.75   7.638 |   8.75   3.274 |  11.75    .546
              2.83   6.547 |   5.83   7.638 |   8.83   3.274 |  11.83    .546
              2.92   6.547 |   5.92   7.638 |   8.92   3.274 |  11.92    .546
              3.00   6.547 |   6.00   7.638 |   9.00   3.274 |  12.00    .546

--------------------------------------------------------------------------------
-
001:0003----------------------------------------------------------------------
-
*#*****************************************************************************
001:0005----------------------------------------------------------------------
-
* BLOCKS TO EAST FOREBAY
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=       8.18        10.43
```

```
           over (min)        9.00        35.00
     Storage Coeff.  (min)=       8.63 (ii)   35.05 (ii)
     Unit Hyd. Tpeak (min)=       9.00        35.00
     Unit Hyd. peak  (cms)=        .13          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .01          .028 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.13         5.050
     RUNOFF VOLUME    (mm)=      53.75        29.83        44.190
     TOTAL RAINFALL   (mm)=      54.56        54.56        54.560
     RUNOFF COEFFICIENT   =        .99          .55          .810

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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.

--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.46
| 01:000204 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.97          .49
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     128.06        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=       8.18        10.31
               over (min)        10.00        36.00
     Storage Coeff.  (min)=       9.93 (ii)   36.47 (ii)
     Unit Hyd. Tpeak (min)=      10.00        36.00
     Unit Hyd. peak  (cms)=        .11          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .01          .045 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.15         5.067
     RUNOFF VOLUME    (mm)=      53.76        29.48        44.050
     TOTAL RAINFALL   (mm)=      54.56        54.56        54.560
     RUNOFF COEFFICIENT   =        .99          .54          .807

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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.

--------------------------------------------------------------------------------
-
001:0007--------------------------------------------------------------------------
-
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.28
| 01:000205 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.02          .26
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      92.38        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=       8.18        10.34
               over (min)         8.00        35.00
     Storage Coeff.  (min)=       8.16 (ii)   34.67 (ii)
     Unit Hyd. Tpeak (min)=       8.00        35.00
     Unit Hyd. peak  (cms)=        .14          .03
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .02          .01          .023 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.13         5.033
     RUNOFF VOLUME    (mm)=      53.75        29.55        44.078
     TOTAL RAINFALL   (mm)=      54.56        54.56        54.560
     RUNOFF COEFFICIENT   =        .99          .54          .808

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.2    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.

--------------------------------------------------------------------------------
-
001:0008--------------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72           .18
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=        .50           .50
     Length            (m)=      77.46         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=       8.18         11.01
               over (min)         7.00         33.00
     Storage Coeff.  (min)=       7.34 (ii)    33.20 (ii)
     Unit Hyd. Tpeak (min)=       7.00         33.00
     Unit Hyd. peak  (cms)=        .16           .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01           .01          .017 (iii)
     TIME TO PEAK    (hrs)=       5.00          6.10         5.033
     RUNOFF VOLUME    (mm)=      53.76         31.63         44.910
     TOTAL RAINFALL   (mm)=      54.56         54.56         54.560
     RUNOFF COEFFICIENT   =        .99           .58           .823

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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.

--------------------------------------------------------------------------------
-
001:0009--------------------------------------------------------------------------
-
* BLOCKS TO WEST FOREBAY
* Catchment 201 - Block 248 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47           .62
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=        .50           .50
     Length            (m)=     143.53         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=       8.18         11.66
               over (min)        11.00         36.00
     Storage Coeff.  (min)=      10.63 (ii)    35.91 (ii)
     Unit Hyd. Tpeak (min)=      11.00         36.00
     Unit Hyd. peak  (cms)=        .11           .03
                                                      *TOTALS*
```

```
     PEAK FLOW       (cms)=        .04          .02           .059 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.12          5.083
     RUNOFF VOLUME    (mm)=      53.75        33.83         45.793
     TOTAL RAINFALL   (mm)=      54.56        54.56         54.560
     RUNOFF COEFFICIENT   =        .99          .62           .839

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0010--------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-04     at 17:18:09
================================================================================
=
```

AES POST DEVELOPMENT

```
2     Metric units
*#************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#************************************************************************
*# Post Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*% 100-year 12-hr AES
MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
                    CURVE_FILENAME=["AES-12HR.MST"]
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*%-----------------|-------------------------------------------------------|
* TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.028](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.045](cms), NINLET=[1],
                    MAJID=[4], MajNHYD=["site"],
                    MINID=[5], MinNHYD=["pond"],
```

```
                    TMJSTO=[   ](cu-m)
*%-----------------|---------------------------------------------------------|
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.023](cms), NINLET=[1],
                    MAJID=[6], MajNHYD=["site"],
                    MINID=[7], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|---------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.017](cms), NINLET=[1],
                    MAJID=[8], MajNHYD=["site"],
                    MINID=[9], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|---------------------------------------------------------|
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[8.98](ha),
                    XIMP=[0.364], TIMP=[0.557], DWF=[0](cms), LOSS=[2],CN=[77],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* Total to east side of forebay
ADD HYD             IDsum=[8], NHYD=["EastForebay1"], IDs to add=[3,5,7,9,1]
*%-----------------|---------------------------------------------------------|
* TO WEST FOREBAY
*%-----------------|---------------------------------------------------------|
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
```

```
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.059](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------------|
* Catchment 202 - lands that will be developed
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[9.35](ha),
                    XIMP=[0.372], TIMP=[0.540], DWF=[0](cms), LOSS=[2],CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* Total to pond (east and west forebays)
ADD HYD             IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

AES POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

*******************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*******************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*******************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*******************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*******************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
*         DATE: 2020-02-05     TIME: 10:08:40     RUN COUNTER: 000067         *
*******************************************************************************
* Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\100.DAT          *
* Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\100.out          *
* Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\100.sum          *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************

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

```
001:0001--------------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Post Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#*************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AES\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------------
-
*#*************************************************************************
--------------------
| MASS STORM       |    Filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\AE
| Ptotal= 88.06 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
--------------------
                       Duration of storm        =   12.00 hrs
                       Mass curve time step     =   60.00 min
                       Selected storm time step =    5.00 min
                       Volume of derived storm  =   88.06 mm

             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .08   4.403 |   3.08   9.687 |   6.08   7.925 |   9.08   5.284
              .17   4.403 |   3.17   9.687 |   6.17   7.925 |   9.17   5.284
              .25   4.403 |   3.25   9.687 |   6.25   7.925 |   9.25   5.284
              .33   4.403 |   3.33   9.687 |   6.33   7.925 |   9.33   5.284
              .42   4.403 |   3.42   9.687 |   6.42   7.925 |   9.42   5.284
              .50   4.403 |   3.50   9.687 |   6.50   7.925 |   9.50   5.284
              .58   4.403 |   3.58   9.687 |   6.58   7.925 |   9.58   5.284
              .67   4.403 |   3.67   9.687 |   6.67   7.925 |   9.67   5.284
              .75   4.403 |   3.75   9.687 |   6.75   7.925 |   9.75   5.284
              .83   4.403 |   3.83   9.687 |   6.83   7.925 |   9.83   5.284
              .92   4.403 |   3.92   9.687 |   6.92   7.925 |   9.92   5.284
             1.00   4.403 |   4.00   9.687 |   7.00   7.925 |  10.00   5.284
```

1.08	8.806	4.08	13.209	7.08	7.925	10.08	1.761
1.17	8.806	4.17	13.209	7.17	7.925	10.17	1.761
1.25	8.806	4.25	13.209	7.25	7.925	10.25	1.761
1.33	8.806	4.33	13.209	7.33	7.925	10.33	1.761
1.42	8.806	4.42	13.209	7.42	7.925	10.42	1.761
1.50	8.806	4.50	13.209	7.50	7.925	10.50	1.761
1.58	8.806	4.58	13.209	7.58	7.925	10.58	1.761
1.67	8.806	4.67	13.209	7.67	7.925	10.67	1.761
1.75	8.806	4.75	13.209	7.75	7.925	10.75	1.761
1.83	8.806	4.83	13.209	7.83	7.925	10.83	1.761
1.92	8.806	4.92	13.209	7.92	7.925	10.92	1.761
2.00	8.806	5.00	13.209	8.00	7.925	11.00	1.761
2.08	10.567	5.08	12.328	8.08	5.284	11.08	.881
2.17	10.567	5.17	12.328	8.17	5.284	11.17	.881
2.25	10.567	5.25	12.328	8.25	5.284	11.25	.881
2.33	10.567	5.33	12.328	8.33	5.284	11.33	.881
2.42	10.567	5.42	12.328	8.42	5.284	11.42	.881
2.50	10.567	5.50	12.328	8.50	5.284	11.50	.881
2.58	10.567	5.58	12.328	8.58	5.284	11.58	.881
2.67	10.567	5.67	12.328	8.67	5.284	11.67	.881
2.75	10.567	5.75	12.328	8.75	5.284	11.75	.881
2.83	10.567	5.83	12.328	8.83	5.284	11.83	.881
2.92	10.567	5.92	12.328	8.92	5.284	11.92	.881
3.00	10.567	6.00	12.328	9.00	5.284	12.00	.881

-
001:0003---
-
```
*#*************************************************************************
* TO EAST FOREBAY
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n             =      .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        19.91
               over (min)        7.00        28.00
     Storage Coeff.  (min)=       7.12 (ii)   27.52 (ii)
     Unit Hyd. Tpeak (min)=       7.00        28.00
     Unit Hyd. peak  (cms)=        .16          .04
```

```
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .03          .02           .049 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.05          5.017
     RUNOFF VOLUME    (mm)=      87.25        58.38         75.712
     TOTAL RAINFALL   (mm)=      88.06        88.06         88.060
     RUNOFF COEFFICIENT   =        .99          .66           .860

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .028  (cms)
| TotalHyd 01:000203 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .028  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK      R.V.      DWF
                                  (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000203       1.54      .049     5.017    75.712     .000
     ================================================================================
     MAJOR SYST   02:site          .29      .021     5.017    75.712     .000
     MINOR SYST   03:pond         1.25      .028     2.117    75.712     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.46
| 01:000204 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.97          .49
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     128.06        40.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        19.76
               over (min)         8.00        29.00
     Storage Coeff.  (min)=       8.20 (ii)   28.66 (ii)
     Unit Hyd. Tpeak (min)=       8.00        29.00
     Unit Hyd. peak  (cms)=        .14          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .05          .03          .078 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.05         5.033
     RUNOFF VOLUME    (mm)=      87.25        57.86        75.509
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .66          .857

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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.

--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .045  (cms)
| TotalHyd 01:000204 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .045  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000204       2.46      .078     5.033   75.509     .000
     ================================================================
     MAJOR SYST   04:site          .45      .033     5.033   75.509     .000
     MINOR SYST   05:pond         2.01      .045     2.150   75.509     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0007--------------------------------------------------------------------------
-
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.28
```

```
| 01:000205 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.02          .26
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      92.38        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        19.81
               over (min)         7.00        27.00
     Storage Coeff.  (min)=       6.74 (ii)   27.18 (ii)
     Unit Hyd. Tpeak (min)=       7.00        27.00
     Unit Hyd. peak  (cms)=        .17          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .01          .041 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.03         5.017
     RUNOFF VOLUME    (mm)=      87.25        57.97        75.549
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .66          .858

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.2    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.

--------------------------------------------------------------------------------
-
001:0008--------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .023  (cms)
| TotalHyd 01:000205 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .023  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000205       1.28      .041     5.017   75.549     .000
     ==========================================================================
     MAJOR SYST   06:site          .25      .018     5.017   75.549     .000
     MINOR SYST   07:pond         1.03      .023     2.100   75.549     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
```

```
001:0009-------------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72          .18
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      77.46        40.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        20.65
               over (min)         6.00        26.00
     Storage Coeff.  (min)=       6.06 (ii)   26.17 (ii)
     Unit Hyd. Tpeak (min)=       6.00        26.00
     Unit Hyd. peak  (cms)=        .19          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .01          .029 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.03         5.017
     RUNOFF VOLUME    (mm)=      87.25        60.96        76.744
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .69          .871

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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.

-------------------------------------------------------------------------------
-
001:0010-------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .017  (cms)
| TotalHyd 01:000206 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .017  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK      R.V.       DWF
                                  (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000206        .90      .029     5.017    76.744     .000
     ==========================================================================
```

```
     MAJOR SYST   08:site          .16      .012     5.017   76.744     .000
     MINOR SYST   09:pond          .74      .017     2.117   76.743     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
-
001:0011-----------------------------------------------------------------------
-
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    8.98
| 01:000207 DT= 1.00 |   Total Imp(%)=   55.70   Dir. Conn.(%)=   36.40
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.00         3.98
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     244.68        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        13.39
               over (min)        12.00        36.00
     Storage Coeff.  (min)=      12.09 (ii)   36.00 (ii)
     Unit Hyd. Tpeak (min)=      12.00        36.00
     Unit Hyd. peak  (cms)=        .09          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .12          .14          .252 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.12         6.000
     RUNOFF VOLUME    (mm)=      87.25        54.12        66.193
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .61          .752

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.0    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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-
001:0012-----------------------------------------------------------------------
-
* Total to east side of forebay
------------------------
| ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 03:pond           1.25     .028    2.12  75.71    .000
```

```
                    +ID2 05:pond           2.01     .045    2.15  75.51    .000

                    +ID3 07:pond           1.03     .023    2.10  75.55    .000

                    +ID4 09:pond            .74     .017    2.12  76.74    .000

                    +ID5 01:       207     8.98     .252    6.00  66.19    .000

                     ============================================================
                     SUM 08:EastForeba    14.01     .365    6.00  69.62    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0013----------------------------------------------------------------------
-
* TO WEST FOREBAY
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47          .62
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     143.53        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        21.61
               over (min)        9.00        29.00
     Storage Coeff.  (min)=       8.78 (ii)   28.52 (ii)
     Unit Hyd. Tpeak (min)=       9.00        29.00
     Unit Hyd. peak  (cms)=        .13          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .07          .04          .102 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.03         5.050
     RUNOFF VOLUME    (mm)=      87.25        64.01        77.967
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .73          .885

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

-
001:0014---
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file

| COMPUTE DUALHYD | Average inlet capacities [CINLET] = .059 (cms)
| TotalHyd 01:000201 | Number of inlets in system [NINLET] = 1
--- Total minor system capacity = .059 (cms)
Total major system storage [TMJSTO] = 0.(cu.m.)

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	01:000201	3.09	.102	5.050	77.967	.000
MAJOR SYST	02:site	.56	.043	5.050	77.967	.000
MINOR SYST	03:pond	2.53	.059	2.167	77.967	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-
001:0015---
-
* Catchment 202 - lands that will be developed
* Discharges to west forebay

| DESIGN STANDHYD | Area (ha)= 9.35
| 01:000202 DT= 1.00 | Total Imp(%)= 54.00 Dir. Conn.(%)= 37.20

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	5.05	4.30	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	.50	.50	
Length	(m)=	249.67	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)	=	13.21	13.24	
over (min)		12.00	36.00	
Storage Coeff.	(min)=	12.24 (ii)	36.26 (ii)	
Unit Hyd. Tpeak	(min)=	12.00	36.00	
Unit Hyd. peak	(cms)=	.09	.03	
				TOTALS
PEAK FLOW	(cms)=	.13	.15	.270 (iii)
TIME TO PEAK	(hrs)=	5.00	6.10	6.000
RUNOFF VOLUME	(mm)=	87.25	56.64	68.041
TOTAL RAINFALL	(mm)=	88.06	88.06	88.060

```
     RUNOFF COEFFICIENT   =        .99          .64           .773

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0016--------------------------------------------------------------------------
-
* Total to pond (east and west forebays)
------------------------
| ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 08:EastForeba    14.01     .365    6.00  69.62    .000

                     +ID2 03:pond           2.53     .059    2.17  77.97    .000

                     +ID3 01:       202     9.35     .270    6.00  68.04    .000

                      ============================================================
                      SUM 09:toPond        25.89     .694    6.00  69.87    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0017--------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-05     at 10:08:41
================================================================================
=
```

CHICAGO EXISTING

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Existing Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#
*#  TIMP / XIMP and TP as per RJB prelim investigation
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*% 100-year 3-hr Chicago
CHICAGO STORM       IUNITS=[2],  TD=[3](hrs), TPRAT=[0.333],  CSDT=[5](min),
                    ICASEcs=[1],
                     A=[1264.57],  B=[7.72], and C=[0.7814],
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
* EXT1 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point A
DESIGN NASHYD       ID=[1], NHYD=[EXT1], DT=[1]min, AREA=[5.13](ha),
                    DWF=[0](cms), CN/C=[74.5], TP=[0.43]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* EXT2 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point B
DESIGN NASHYD       ID=[2], NHYD=[EXT2], DT=[1]min, AREA=[6.56](ha),
                    DWF=[0](cms), CN/C=[75.3], TP=[0.79]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* 103 - lands owned by applicant that are to be developed
* Discharges to existing watercourse
DESIGN NASHYD       ID=[3], NHYD=[103], DT=[1]min, AREA=[25.82](ha),
                    DWF=[0](cms), CN/C=[74.0], TP=[2.06]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Total to existing watercourse
* Allowable release rate from post development pond
ADD HYD             IDsum=[9], NHYD=[Total1], IDs to add=[1,2,3]
*%-----------------|-------------------------------------------------------|
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
```

```
DESIGN NASHYD       ID=[1], NHYD=[101], DT=[1]min, AREA=[1.55](ha),
                    DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* 102 - lands owned by applicant that are to be developed
* Discharges to railway
DESIGN NASHYD       ID=[1], NHYD=[102], DT=[1]min, AREA=[2.62](ha),
                    DWF=[0](cms), CN/C=[79.3], TP=[0.08]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

CHICAGO EXISTING

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858            *********
 *********                  E-Mail: swmhymo@jfsa.Com                    *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: R.J. Burnside & Associates Ltd                +++++++++
 +++++++++                Brampton              SERIAL#:3877524        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 ***********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2019-12-09     TIME: 16:56:20     RUN COUNTER: 002355          *
 ********************************************************************************
 * Input   filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\Chicago\100.DAT      *
 * Output  filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\Chicago\100.out      *
 * Summary filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\Chicago\100.sum      *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

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

```
001:0001-------------------------------------------------------------------------
-
*#######################################################################
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#######################################################################
*# Existing Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#
*#  TIMP / XIMP and TP as per RJB prelim investigation
*#######################################################################
--------------------
| START            |  Project  dir.: C:\SWMHYMO\THUNDE~1\191209~2\Existing\Chicago\

--------------------  Rainfall dir.: C:\SWMHYMO\THUNDE~1\191209~2\Existing\Chicago\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
-
001:0002-------------------------------------------------------------------------
-
*#######################################################################
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1264.570
| Ptotal= 63.46 mm |                          B=   7.720
--------------------                          C=    .781
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   5.800 |    .83  31.177 |   1.58  16.063 |   2.33   7.533
               .17   6.318 |    .92  67.936 |   1.67  14.182 |   2.42   7.138
               .25   6.952 |   1.00 173.339 |   1.75  12.713 |   2.50   6.785
               .33   7.747 |   1.08  85.572 |   1.83  11.535 |   2.58   6.469
               .42   8.773 |   1.17  50.381 |   1.92  10.569 |   2.67   6.184
               .50  10.152 |   1.25  35.310 |   2.00   9.762 |   2.75   5.925
               .58  12.108 |   1.33  27.116 |   2.08   9.078 |   2.83   5.690
               .67  15.103 |   1.42  22.018 |   2.17   8.491 |   2.92   5.474
               .75  20.262 |   1.50  18.558 |   2.25   7.980 |   3.00   5.275
```

```
--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
*#**************************************************************************
* EXT1 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point A
----------------------
| DESIGN NASHYD      |   Area    (ha)=    5.13   Curve Number   (CN)=74.50
| 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .456

     PEAK FLOW       (cms)=     .267 (i)
     TIME TO PEAK    (hrs)=    1.567
     RUNOFF VOLUME    (mm)=   25.780
     TOTAL RAINFALL   (mm)=   63.456
     RUNOFF COEFFICIENT   =     .406

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
* EXT2 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point B
----------------------
| DESIGN NASHYD      |   Area    (ha)=    6.56   Curve Number   (CN)=75.30
| 02:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .317

     PEAK FLOW       (cms)=     .234 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   26.423
     TOTAL RAINFALL   (mm)=   63.456
     RUNOFF COEFFICIENT   =     .416

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
```

```
* 103 - lands owned by applicant that are to be developed
* Discharges to existing watercourse
----------------------
| DESIGN NASHYD      |   Area    (ha)=   25.82   Curve Number   (CN)=74.00
| 03:000103 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=   2.060

     Unit Hyd Qpeak  (cms)=     .479

     PEAK FLOW       (cms)=     .443 (i)
     TIME TO PEAK    (hrs)=    3.583
     RUNOFF VOLUME    (mm)=   25.387
     TOTAL RAINFALL   (mm)=   63.456
     RUNOFF COEFFICIENT   =     .400

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
-
001:0006---------------------------------------------------------------------
-
* Total to existing watercourse
* Allowable release rate from post development pond
------------------------
| ADD HYD (         1) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:         1     5.13     .267    1.57  25.78    .000

                     +ID2 02:         2     6.56     .234    2.05  26.42    .000

                     +ID3 03:       103    25.82     .443    3.58  25.39    .000

                      ============================================================
                      SUM 09:         1    37.51     .651    2.37  25.62    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
-
001:0007---------------------------------------------------------------------
-
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
----------------------
| DESIGN NASHYD      |   Area    (ha)=    1.55   Curve Number   (CN)=80.00
| 01:000101 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .257
```

```
     PEAK FLOW       (cms)=     .142 (i)
     TIME TO PEAK    (hrs)=    1.283
     RUNOFF VOLUME    (mm)=   30.597
     TOTAL RAINFALL   (mm)=   63.456
     RUNOFF COEFFICIENT   =     .482

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
-
001:0008---------------------------------------------------------------------
-
* 102 - lands owned by applicant that are to be developed
* Discharges to railway
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.62   Curve Number   (CN)=79.30
| 01:000102 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=    1.251

     PEAK FLOW       (cms)=     .386 (i)
     TIME TO PEAK    (hrs)=    1.083
     RUNOFF VOLUME    (mm)=   29.928
     TOTAL RAINFALL   (mm)=   63.456
     RUNOFF COEFFICIENT   =     .472

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
-
001:0009---------------------------------------------------------------------
-
      FINISH
------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2019-12-09     at 16:56:20
===============================================================================
=
```

CHICAGO POST DEVELOPMENT

```
2     Metric units
*#************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#************************************************************************
*# 5-years flows to each forebay (to size forebays)
*#
*# Post Development 5-yr control flows from the Site Plan Blocks
*#
*# CN as per Ontario Soils Map for Welland County
*#************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*% 5-year 3-hr Chicago
CHICAGO STORM       IUNITS=[2],  TD=[3](hrs), TPRAT=[0.333],  CSDT=[5](min),
                    ICASEcs=[1],
                     A=[719.5],  B=[6.34], and C=[0.7687],
*%-----------------|-------------------------------------------------------|
*#************************************************************************
* BLOCKS TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
```

```
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* BLOCKS TO WEST FOREBAY
*%-----------------|-------------------------------------------------------------|
* Catchment 201 - Block 248 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

CHICAGO POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

*******************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*******************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*******************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*******************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*******************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
*         DATE: 2020-02-04     TIME: 17:21:54     RUN COUNTER: 000057         *
*******************************************************************************
* Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\5Q.DAT      *
* Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\5Q.out      *
* Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\5Q.sum      *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************

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

```
001:0001----------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#**************************************************************************
*# 5-years flows to each forebay (to size forebays)
*#
*# Post Development 5-yr control flows from the Site Plan Blocks
*#
*# CN as per Ontario Soils Map for Welland County
*#**************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
-
001:0002----------------------------------------------------------------------------
-
*#**************************************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 719.500
| Ptotal= 38.81 mm |                          B=   6.340
--------------------                          C=    .769
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   3.630 |    .83  18.423 |   1.58   9.665 |   2.33   4.668
               .17   3.942 |    .92  40.510 |   1.67   8.572 |   2.42   4.432
               .25   4.322 |   1.00 111.263 |   1.75   7.717 |   2.50   4.222
               .33   4.795 |   1.08  51.356 |   1.83   7.028 |   2.58   4.032
               .42   5.404 |   1.17  29.714 |   1.92   6.462 |   2.67   3.861
               .50   6.217 |   1.25  20.826 |   2.00   5.987 |   2.75   3.706
               .58   7.363 |   1.33  16.062 |   2.08   5.584 |   2.83   3.563
               .67   9.107 |   1.42  13.112 |   2.17   5.237 |   2.92   3.433
               .75  12.096 |   1.50  11.110 |   2.25   4.934 |   3.00   3.313
```

```
--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
*#*************************************************************************
001:0005--------------------------------------------------------------------------
-
* BLOCKS TO EAST FOREBAY
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     111.26        58.54
               over (min)         3.00        16.00
     Storage Coeff.  (min)=       3.04 (ii)   16.29 (ii)
     Unit Hyd. Tpeak (min)=       3.00        16.00
     Unit Hyd. peak  (cms)=        .37          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .23          .03          .242 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.28         1.017
     RUNOFF VOLUME    (mm)=      38.01        17.81        29.929
     TOTAL RAINFALL   (mm)=      38.81        38.81        38.806
     RUNOFF COEFFICIENT   =        .98          .46          .771

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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.

--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.46
```

```
| 01:000204 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.97          .49
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     128.06        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     111.26        55.70
               over (min)        3.00        17.00
     Storage Coeff.  (min)=       3.50 (ii)   17.02 (ii)
     Unit Hyd. Tpeak (min)=       3.00        17.00
     Unit Hyd. peak  (cms)=        .34          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .36          .05          .371 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.32         1.017
     RUNOFF VOLUME    (mm)=      38.01        17.57        29.830
     TOTAL RAINFALL   (mm)=      38.81        38.81        38.806
     RUNOFF COEFFICIENT   =        .98          .45          .769

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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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-
001:0007---------------------------------------------------------------------
-
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.28
| 01:000205 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.02          .26
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      92.38        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     111.26        57.81
               over (min)        3.00        16.00
     Storage Coeff.  (min)=       2.87 (ii)   16.19 (ii)
     Unit Hyd. Tpeak (min)=       3.00        16.00
     Unit Hyd. peak  (cms)=        .39          .07
```

```
                                                                  *TOTALS*
     PEAK FLOW       (cms)=        .20          .02           .204 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.28          1.017
     RUNOFF VOLUME    (mm)=      38.01        17.62         29.850
     TOTAL RAINFALL   (mm)=      38.81        38.81         38.806
     RUNOFF COEFFICIENT   =        .98          .45           .769

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.2    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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-
001:0008--------------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72          .18
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      77.46        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=     111.26        65.76
               over (min)        3.00        15.00
     Storage Coeff.  (min)=       2.59 (ii)   15.24 (ii)
     Unit Hyd. Tpeak (min)=       3.00        15.00
     Unit Hyd. peak  (cms)=        .41          .07
                                                                  *TOTALS*
     PEAK FLOW       (cms)=        .14          .02           .148 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.27          1.017
     RUNOFF VOLUME    (mm)=      38.01        19.11         30.448
     TOTAL RAINFALL   (mm)=      38.81        38.81         38.806
     RUNOFF COEFFICIENT   =        .98          .49           .785

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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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-
001:0009-------------------------------------------------------------------------
-
* BLOCKS TO WEST FOREBAY
* Catchment 201 - Block 248 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47          .62
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     143.53        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=     111.26        69.54
               over (min)        4.00        16.00
     Storage Coeff.  (min)=       3.74 (ii)   16.11 (ii)
     Unit Hyd. Tpeak (min)=       4.00        16.00
     Unit Hyd. peak  (cms)=        .29          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .43          .07          .456 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.28         1.033
     RUNOFF VOLUME    (mm)=      38.01        20.75        31.102
     TOTAL RAINFALL   (mm)=      38.81        38.81        38.806
     RUNOFF COEFFICIENT   =        .98          .53          .801

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

-------------------------------------------------------------------------------
-
001:0010-------------------------------------------------------------------------
-
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-04     at 17:21:54
===============================================================================
=
```

CHICAGO POST DEVELOPMENT

```
2     Metric units
*#************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#************************************************************************
*# Post Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*% 100-year 3-hr Chicago
CHICAGO STORM       IUNITS=[2],  TD=[3](hrs), TPRAT=[0.333],  CSDT=[5](min),
                    ICASEcs=[1],
                     A=[1264.57],  B=[7.72], and C=[0.7814],
*%-----------------|-------------------------------------------------------|
*#************************************************************************
*%-----------------|-------------------------------------------------------|
* TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.242](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.371](cms), NINLET=[1],
                    MAJID=[4], MajNHYD=["site"],
```

```
                    MINID=[5], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------------|
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.204](cms), NINLET=[1],
                    MAJID=[6], MajNHYD=["site"],
                    MINID=[7], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.148](cms), NINLET=[1],
                    MAJID=[8], MajNHYD=["site"],
                    MINID=[9], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------------|
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[8.98](ha),
                    XIMP=[0.364], TIMP=[0.557], DWF=[0](cms), LOSS=[2],CN=[77],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* Total to east side of forebay
ADD HYD             IDsum=[8], NHYD=["EastForebay1"], IDs to add=[3,5,7,9,1]
*%-----------------|-------------------------------------------------------------|
* TO WEST FOREBAY
*%-----------------|-------------------------------------------------------------|
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
```

```
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.456](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------------|
* Catchment 202 - lands that will be developed
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[9.35](ha),
                    XIMP=[0.372], TIMP=[0.540], DWF=[0](cms), LOSS=[2],CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* Total to pond (east and west forebays)
ADD HYD             IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

CHICAGO POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
                                                        9   9  9   9   # 3877524
        StormWater Management HYdrologic Model           999    999    =========

********************************************************************************
***************************** SWMHYMO Ver/4.05  ********************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
********************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
********************************************************************************

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
********************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
********************************************************************************
*         DATE: 2020-02-05     TIME: 10:09:27     RUN COUNTER: 000068          *
********************************************************************************
* Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\100.DAT      *
* Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\100.out      *
* Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\100.sum      *
* User comments:                                                               *
* 1:_____________________________________________________________________________*
* 2:_____________________________________________________________________________*
* 3:_____________________________________________________________________________*
********************************************************************************

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-
```

```
001:0001--------------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Post Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#*************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\Chicago\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------------
-
*#*************************************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1264.570
| Ptotal= 63.46 mm |                          B=   7.720
--------------------                          C=    .781
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .33

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   5.800 |    .83  31.177 |   1.58  16.063 |   2.33   7.533
               .17   6.318 |    .92  67.936 |   1.67  14.182 |   2.42   7.138
               .25   6.952 |   1.00 173.339 |   1.75  12.713 |   2.50   6.785
               .33   7.747 |   1.08  85.572 |   1.83  11.535 |   2.58   6.469
               .42   8.773 |   1.17  50.381 |   1.92  10.569 |   2.67   6.184
               .50  10.152 |   1.25  35.310 |   2.00   9.762 |   2.75   5.925
               .58  12.108 |   1.33  27.116 |   2.08   9.078 |   2.83   5.690
               .67  15.103 |   1.42  22.018 |   2.17   8.491 |   2.92   5.474
               .75  20.262 |   1.50  18.558 |   2.25   7.980 |   3.00   5.275

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

```
-
001:0003-------------------------------------------------------------------------
-
*#########################################################################
* TO EAST FOREBAY
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34       141.69
               over (min)        3.00        12.00
     Storage Coeff.  (min)=       2.54 (ii)   11.85 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .42          .10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .38          .08          .413 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.20         1.017
     RUNOFF VOLUME    (mm)=      62.66        37.11        52.439
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.456
     RUNOFF COEFFICIENT   =        .99          .58          .826

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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.

-------------------------------------------------------------------------------
-
001:0004-------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .242  (cms)
| TotalHyd 01:000203 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .242  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
```

		(ha)	(cms)	(hrs)	(mm)	(cms)
TOTAL HYD.	01:000203	1.54	.413	1.017	52.439	.000
MAJOR SYST	02:site	.12	.171	1.017	52.439	.000
MINOR SYST	03:pond	1.42	.242	.950	52.439	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0005

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* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay

DESIGN STANDHYD	Area (ha)= 2.46
01:000204 DT= 1.00	Total Imp(%)= 80.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	1.97	.49	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	.50	.50	
Length	(m)=	128.06	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)	=	173.34	139.94	
over (min)		3.00	12.00	
Storage Coeff.	(min)=	2.93 (ii)	12.28 (ii)	
Unit Hyd. Tpeak	(min)=	3.00	12.00	
Unit Hyd. peak	(cms)=	.38	.09	
				TOTALS
PEAK FLOW	(cms)=	.59	.12	.640 (iii)
TIME TO PEAK	(hrs)=	1.02	1.20	1.017
RUNOFF VOLUME	(mm)=	62.66	36.71	52.279
TOTAL RAINFALL	(mm)=	63.46	63.46	63.456
RUNOFF COEFFICIENT	=	.99	.58	.824

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.1 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.

001:0006

---

* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file

```
---------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .371  (cms)
| TotalHyd 01:000204 |   Number of inlets in system [NINLET] =       1
---------------------   Total minor system capacity         =    .371  (cms)
                        Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK      R.V.      DWF
                                  (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000204       2.46      .640     1.017   52.279     .000
     ==========================================================================
     MAJOR SYST   04:site          .21      .269     1.017   52.279     .000
     MINOR SYST   05:pond         2.25      .371      .950   52.279     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0007--------------------------------------------------------------------------
-
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
---------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.28
| 01:000205 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
---------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.02          .26
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      92.38        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34       140.29
               over (min)        2.00        12.00
     Storage Coeff.  (min)=       2.41 (ii)   11.75 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .49          .10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .33          .06          .353 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.20         1.000
     RUNOFF VOLUME    (mm)=      62.66        36.79        52.311
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.456
     RUNOFF COEFFICIENT   =        .99          .58          .824

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.2    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.
```

```
--------------------------------------------------------------------------------
-
001:0008--------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .204  (cms)
| TotalHyd 01:000205 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .204  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                 ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                 (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.  01:000205       1.28      .353     1.000   52.311     .000
     ========================================================================
     MAJOR SYST  06:site          .10      .149     1.000   52.311     .000
     MINOR SYST  07:pond         1.18      .204      .950   52.311     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0009--------------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72          .18
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      77.46        40.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     173.34       157.48
               over (min)         2.00        11.00
     Storage Coeff.  (min)=       2.17 (ii)   11.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00        11.00
     Unit Hyd. peak  (cms)=        .53          .10
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .24          .05          .257 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.18         1.000
     RUNOFF VOLUME    (mm)=      62.66        39.15        53.255
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.456
```

```
     RUNOFF COEFFICIENT   =        .99          .62          .839

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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.

--------------------------------------------------------------------------------
-
001:0010--------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .148  (cms)
| TotalHyd 01:000206 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .148  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                 ID: NHYD        AREA     QPEAK     TPEAK      R.V.      DWF
                                 (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000206        .90      .257     1.000   53.255     .000
     ========================================================================
     MAJOR SYST   08:site          .07      .109     1.000   53.255     .000
     MINOR SYST   09:pond          .83      .148      .950   53.255     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0011--------------------------------------------------------------------------
-
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    8.98
| 01:000207 DT= 1.00 |   Total Imp(%)=   55.70   Dir. Conn.(%)=   36.40
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.00         3.98
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     244.68        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34        80.06
               over (min)        4.00        16.00
     Storage Coeff.  (min)=       4.32 (ii)   16.01 (ii)
```

```
     Unit Hyd. Tpeak (min)=       4.00        16.00
     Unit Hyd. peak  (cms)=        .27          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.16          .54          1.337 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.28          1.050
     RUNOFF VOLUME    (mm)=      62.66        33.79         44.300
     TOTAL RAINFALL   (mm)=      63.46        63.46         63.456
     RUNOFF COEFFICIENT   =        .99          .53           .698

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.0    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.

--------------------------------------------------------------------------------
-
001:0012--------------------------------------------------------------------------
-
* Total to east side of forebay
------------------------
| ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 03:pond          1.42     .242     .95  52.44    .000

                     +ID2 05:pond          2.25     .371     .95  52.28    .000

                     +ID3 07:pond          1.18     .204     .95  52.31    .000

                     +ID4 09:pond           .83     .148     .95  53.25    .000

                     +ID5 01:       207    8.98    1.337    1.05  44.30    .000

                      ============================================================
                      SUM 08:EastForeba    14.65    2.302    1.05  47.46    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0013--------------------------------------------------------------------------
-
* TO WEST FOREBAY
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
```

```
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47          .62
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     143.53        40.00
     Mannings n             =      .013         .250

     Max.eff.Inten.(mm/hr)=     173.34       161.63
               over (min)         3.00        12.00
     Storage Coeff.  (min)=       3.14 (ii)   11.96 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .36          .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .73          .18          .806 (iii)
     TIME TO PEAK    (hrs)=       1.02         1.18         1.017
     RUNOFF VOLUME    (mm)=      62.66        41.63        54.245
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.456
     RUNOFF COEFFICIENT   =        .99          .66          .855

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0014---------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .456  (cms)
| TotalHyd 01:000201 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .456  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK      R.V.      DWF
                                  (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000201       3.09      .806     1.017    54.245     .000
     ================================================================================
     MAJOR SYST   02:site          .30      .350     1.017    54.245     .000
     MINOR SYST   03:pond         2.79      .456      .950    54.245     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0015---------------------------------------------------------------------------
```

```
-
* Catchment 202 - lands that will be developed
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    9.35
| 01:000202 DT= 1.00 |   Total Imp(%)=   54.00   Dir. Conn.(%)=   37.20
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.05         4.30
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     249.67        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34        81.09
               over (min)         4.00        16.00
     Storage Coeff.  (min)=       4.37 (ii)   16.00 (ii)
     Unit Hyd. Tpeak (min)=       4.00        16.00
     Unit Hyd. peak  (cms)=        .27          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.22          .60          1.429 (iii)
     TIME TO PEAK    (hrs)=       1.03         1.28          1.050
     RUNOFF VOLUME    (mm)=      62.65        35.71         45.738
     TOTAL RAINFALL   (mm)=      63.46        63.46         63.456
     RUNOFF COEFFICIENT   =        .99          .56           .721

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

-------------------------------------------------------------------------------
-
001:0016----------------------------------------------------------------------
-
* Total to pond (east and west forebays)
------------------------
| ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 08:EastForeba    14.65    2.302    1.05  47.46    .000

                     +ID2 03:pond           2.79     .456     .95  54.24    .000

                     +ID3 01:       202     9.35    1.429    1.05  45.74    .000

                      ============================================================
                      SUM 09:toPond        26.79    4.187    1.05  47.57    .000
```

```
   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0017---------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-05     at 10:09:27
================================================================================
=
```

SCS EXISTING

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Existing Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#
*#  TIMP / XIMP and TP as per RJB prelim investigation
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*% 100-year 24-hr SCS
READ STORM          STORM_FILENAME=["100Y24.STM"]
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
* EXT1 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point A
DESIGN NASHYD       ID=[1], NHYD=[EXT1], DT=[1]min, AREA=[5.13](ha),
                    DWF=[0](cms), CN/C=[74.5], TP=[0.43]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* EXT2 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point B
DESIGN NASHYD       ID=[2], NHYD=[EXT2], DT=[1]min, AREA=[6.56](ha),
                    DWF=[0](cms), CN/C=[75.3], TP=[0.79]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* 103 - lands owned by applicant that are to be developed
* Discharges to existing watercourse
DESIGN NASHYD       ID=[3], NHYD=[103], DT=[1]min, AREA=[25.82](ha),
                    DWF=[0](cms), CN/C=[74.0], TP=[2.06]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Total to existing watercourse
* Allowable release rate from post development pond
ADD HYD             IDsum=[9], NHYD=[Total1], IDs to add=[1,2,3]
*%-----------------|-------------------------------------------------------|
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
DESIGN NASHYD       ID=[1], NHYD=[101], DT=[1]min, AREA=[1.55](ha),
                    DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
```

```
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* 102 - lands owned by applicant that are to be developed
* Discharges to railway
DESIGN NASHYD       ID=[1], NHYD=[102], DT=[1]min, AREA=[2.62](ha),
                    DWF=[0](cms), CN/C=[79.3], TP=[0.08]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

SCS EXISTING

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 3877524
        StormWater Management HYdrologic Model           999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858            *********
 *********                  E-Mail: swmhymo@jfsa.Com                    *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: R.J. Burnside & Associates Ltd                +++++++++
 +++++++++                Brampton              SERIAL#:3877524        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 ***********************   D E T A I L E D   O U T P U T   ***********************
 ********************************************************************************
 *         DATE: 2019-12-09     TIME: 14:32:10     RUN COUNTER: 002349          *
 ********************************************************************************
 * Input   filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\100.DAT               *
 * Output  filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\100.out               *
 * Summary filename: C:\SWMHYMO\THUNDE~1\191209~2\Existing\100.sum               *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

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

```
001:0001------------------------------------------------------------------------
-
*#####################################################################
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#####################################################################
*# Existing Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#
*#  TIMP / XIMP and TP as per RJB prelim investigation
*#####################################################################
--------------------
| START            |  Project  dir.: C:\SWMHYMO\THUNDE~1\191209~2\Existing\

--------------------  Rainfall dir.: C:\SWMHYMO\THUNDE~1\191209~2\Existing\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
------------------------------------------------------------------------------
-
001:0002------------------------------------------------------------------------
-
*#####################################################################
--------------------
| READ STORM       |    Filename: 100yr/24hr
| Ptotal= 102.88 mm|    Comments: 100yr/24hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	6.50	2.060	12.75	14.820	19.00	1.850
.50	1.130	6.75	2.060	13.00	7.610	19.25	1.850
.75	1.130	7.00	2.060	13.25	7.610	19.50	1.850
1.00	1.130	7.25	2.060	13.50	1.440	19.75	1.850
1.25	1.130	7.50	2.060	13.75	1.440	20.00	1.850
1.50	1.130	7.75	2.060	14.00	8.440	20.25	1.850
1.75	1.130	8.00	2.060	14.25	8.440	20.50	1.230
2.00	1.130	8.25	2.060	14.50	3.090	20.75	1.230
2.25	1.130	8.50	2.780	14.75	3.090	21.00	1.230
2.50	1.340	8.75	2.780	15.00	3.090	21.25	1.230
2.75	1.340	9.00	2.780	15.25	3.090	21.50	1.230
3.00	1.340	9.25	2.780	15.50	3.090	21.75	1.230
3.25	1.340	9.50	3.290	15.75	3.090	22.00	1.230
3.50	1.340	9.75	3.290	16.00	3.090	22.25	1.230
3.75	1.340	10.00	3.700	16.25	3.090	22.50	1.230

4.00	1.340	10.25	3.700	16.50	1.850	22.75	1.230
4.25	1.340	10.50	4.730	16.75	1.850	23.00	1.230
4.50	1.650	10.75	4.730	17.00	1.850	23.25	1.230
4.75	1.650	11.00	6.380	17.25	1.850	23.50	1.230
5.00	1.650	11.25	6.380	17.50	1.850	23.75	1.230
5.25	1.650	11.50	9.880	17.75	1.850	24.00	1.230
5.50	1.650	11.75	9.880	18.00	1.850	24.25	1.230
5.75	1.650	12.00	42.800	18.25	1.850		
6.00	1.650	12.25	113.590	18.50	1.850		
6.25	1.650	12.50	14.820	18.75	1.850		

001:0003---
*#**********
* EXT1 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point A

| DESIGN NASHYD | Area (ha)= 5.13 Curve Number (CN)=74.50
| 01:000001 DT= 1.00 | Ia (mm)= 1.500 # of Linear Res.(N)= 3.00
--- U.H. Tp(hrs)= .430

Unit Hyd Qpeak (cms)= .456

PEAK FLOW (cms)= .412 (i)
TIME TO PEAK (hrs)= 12.567
RUNOFF VOLUME (mm)= 54.579
TOTAL RAINFALL (mm)= 102.883
RUNOFF COEFFICIENT = .530

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004---
* EXT2 - external lands (lands are owned by applicant by will not be developed
* as part of this application)
* Total flow to Point B

| DESIGN NASHYD | Area (ha)= 6.56 Curve Number (CN)=75.30
| 02:000002 DT= 1.00 | Ia (mm)= 1.500 # of Linear Res.(N)= 3.00
--- U.H. Tp(hrs)= .790

Unit Hyd Qpeak (cms)= .317

PEAK FLOW (cms)= .349 (i)
TIME TO PEAK (hrs)= 12.983

```
     RUNOFF VOLUME    (mm)=   55.649
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .541

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0005---------------------------------------------------------------------------
-
* 103 - lands owned by applicant that are to be developed
* Discharges to existing watercourse
----------------------
| DESIGN NASHYD      |   Area    (ha)=   25.82   Curve Number   (CN)=74.00
| 03:000103 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=   2.060

     Unit Hyd Qpeak  (cms)=     .479

     PEAK FLOW       (cms)=     .636 (i)
     TIME TO PEAK    (hrs)=   14.450
     RUNOFF VOLUME    (mm)=   53.920
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .524

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0006---------------------------------------------------------------------------
-
* Total to existing watercourse
* Allowable release rate from post development pond
------------------------
| ADD HYD (         1) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:         1     5.13     .412   12.57  54.58    .000

                     +ID2 02:         2     6.56     .349   12.98  55.65    .000

                     +ID3 03:       103    25.82     .636   14.45  53.92    .000

                      ============================================================
                      SUM 09:         1    37.51    1.006   12.95  54.31    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

```
001:0007-------------------------------------------------------------------------
-
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
----------------------
| DESIGN NASHYD      |   Area    (ha)=    1.55   Curve Number   (CN)=80.00
| 01:000101 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .257

     PEAK FLOW       (cms)=     .219 (i)
     TIME TO PEAK    (hrs)=   12.367
     RUNOFF VOLUME    (mm)=   62.338
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .606

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0008-------------------------------------------------------------------------
-
* 102 - lands owned by applicant that are to be developed
* Discharges to railway
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.62   Curve Number   (CN)=79.30
| 01:000102 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=    1.251

     PEAK FLOW       (cms)=     .561 (i)
     TIME TO PEAK    (hrs)=   12.250
     RUNOFF VOLUME    (mm)=   61.296
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .596

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0009-------------------------------------------------------------------------
-
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
```

```
     -------------------------
   Simulation ended on 2019-12-09     at 14:32:10
================================================================================
=
```

SCS POST DEVELOPMENT

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-04-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# 5-years flows to each forebay (to size forebays)
*#
*# Post Development 5-yr control flows from the Site Plan Blocks
*#
*# CN as per Ontario Soils Map for Welland County
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*% 5-year 24-hr SCS
READ STORM          STORM_FILENAME=["5Y24.STM"]
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*Flow to East Forebay (to size forebay)
DESIGN STANDHYD     ID=[1], NHYD=[EAST1], DT=[1]min, AREA=[15.16](ha),
                    XIMP=[0.460], TIMP=[0.656], DWF=[0](cms), LOSS=[2], CN=[76.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
*Flow to West Forebay (to size forebay)
DESIGN STANDHYD     ID=[1], NHYD=[WEST1], DT=[1]min, AREA=[12.44](ha),
                    XIMP=[0.430], TIMP=[0.608], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* BLOCKS TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
```

```
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* BLOCKS TO WEST FOREBAY
*%-----------------|-------------------------------------------------------------|
* Catchment 201 - Block 248 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

SCS POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

*******************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*******************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*******************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*******************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*******************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
*         DATE: 2020-02-05     TIME: 10:04:57     RUN COUNTER: 000065         *
*******************************************************************************
* Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\5Q.DAT           *
* Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\5Q.out           *
* Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\5Q.sum           *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************

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

```
001:0001-------------------------------------------------------------------------
-
*#######################################################################
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-04-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#######################################################################
*# 5-years flows to each forebay (to size forebays)
*#
*# Post Development 5-yr control flows from the Site Plan Blocks
*#
*# CN as per Ontario Soils Map for Welland County
*#######################################################################
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
-
001:0002-------------------------------------------------------------------------
-
*#######################################################################
--------------------
| READ STORM       |    Filename: 5yr/24hr
| Ptotal=  64.31 mm|    Comments: 5yr/24hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	6.50	1.290	12.75	9.250	19.00	1.160
.50	.710	6.75	1.290	13.00	4.760	19.25	1.160
.75	.710	7.00	1.290	13.25	4.760	19.50	1.160
1.00	.710	7.25	1.290	13.50	.900	19.75	1.160
1.25	.710	7.50	1.290	13.75	.900	20.00	1.160
1.50	.710	7.75	1.290	14.00	5.270	20.25	1.160
1.75	.710	8.00	1.290	14.25	5.270	20.50	.770
2.00	.710	8.25	1.290	14.50	1.930	20.75	.770
2.25	.710	8.50	1.740	14.75	1.930	21.00	.770
2.50	.840	8.75	1.740	15.00	1.930	21.25	.770
2.75	.840	9.00	1.740	15.25	1.930	21.50	.770
3.00	.840	9.25	1.740	15.50	1.930	21.75	.770
3.25	.840	9.50	2.060	15.75	1.930	22.00	.770
3.50	.840	9.75	2.060	16.00	1.930	22.25	.770
3.75	.840	10.00	2.310	16.25	1.930	22.50	.770

4.00	.840	10.25	2.310	16.50	1.160	22.75	.770
4.25	.840	10.50	2.960	16.75	1.160	23.00	.770
4.50	1.030	10.75	2.960	17.00	1.160	23.25	.770
4.75	1.030	11.00	3.980	17.25	1.160	23.50	.770
5.00	1.030	11.25	3.980	17.50	1.160	23.75	.770
5.25	1.030	11.50	6.170	17.75	1.160	24.00	.770
5.50	1.030	11.75	6.170	18.00	1.160	24.25	.770
5.75	1.030	12.00	26.730	18.25	1.160		
6.00	1.030	12.25	70.940	18.50	1.160		
6.25	1.030	12.50	9.250	18.75	1.160		

001:0003

---

*#**********

*Flow to East Forebay (to size forebay)

DESIGN STANDHYD	Area (ha)= 15.16
01:000001 DT= 1.00	Total Imp(%)= 65.60 Dir. Conn.(%)= 46.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	9.94	5.22	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	.50	.50	
Length	(m)=	317.91	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)=		70.94	56.08	
over (min)		7.00	21.00	
Storage Coeff.	(min)=	7.22 (ii)	20.70 (ii)	
Unit Hyd. Tpeak	(min)=	7.00	21.00	
Unit Hyd. peak	(cms)=	.16	.05	
				TOTALS
PEAK FLOW	(cms)=	1.19	.51	1.545 (iii)
TIME TO PEAK	(hrs)=	12.27	12.48	12.283
RUNOFF VOLUME	(mm)=	63.50	35.14	48.197
TOTAL RAINFALL	(mm)=	64.31	64.31	64.308
RUNOFF COEFFICIENT	=	.99	.55	.749

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 76.1 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.

001:0004

```
*Flow to West Forebay (to size forebay)
----------------------
| DESIGN STANDHYD    |   Area    (ha)=   12.44
| 01:000001 DT= 1.00 |   Total Imp(%)=   60.80   Dir. Conn.(%)=   43.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.56         4.88
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     287.98        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=      70.94        57.26
               over (min)        7.00        20.00
     Storage Coeff.  (min)=       6.81 (ii)   20.18 (ii)
     Unit Hyd. Tpeak (min)=       7.00        20.00
     Unit Hyd. peak  (cms)=        .16          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .93          .48         1.273 (iii)
     TIME TO PEAK    (hrs)=      12.27        12.47        12.283
     RUNOFF VOLUME    (mm)=      63.50        37.42        48.648
     TOTAL RAINFALL   (mm)=      64.31        64.31        64.308
     RUNOFF COEFFICIENT   =        .99          .58          .756

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0005-------------------------------------------------------------------------
-
* BLOCKS TO EAST FOREBAY
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=      70.94        95.64
```

```
           over (min)        4.00        15.00
     Storage Coeff.  (min)=       3.64 (ii)   14.53 (ii)
     Unit Hyd. Tpeak (min)=       4.00        15.00
     Unit Hyd. peak  (cms)=        .30          .08
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .18          .05          .219 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.38        12.250
     RUNOFF VOLUME    (mm)=      63.50        37.82        53.235
     TOTAL RAINFALL   (mm)=      64.31        64.31        64.308
     RUNOFF COEFFICIENT   =        .99          .59          .828

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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.

--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.46
| 01:000204 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.97          .49
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     128.06        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      70.94        94.60
               over (min)        4.00        15.00
     Storage Coeff.  (min)=       4.19 (ii)   15.12 (ii)
     Unit Hyd. Tpeak (min)=       4.00        15.00
     Unit Hyd. peak  (cms)=        .27          .08
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .28          .08          .345 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.38        12.250
     RUNOFF VOLUME    (mm)=      63.50        37.41        53.074
     TOTAL RAINFALL   (mm)=      64.31        64.31        64.308
     RUNOFF COEFFICIENT   =        .99          .58          .825

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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.

-------------------------------------------------------------------------------
-
001:0007----------------------------------------------------------------------
-
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.28
| 01:000205 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.02          .26
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      92.38        40.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=      70.94        95.61
               over (min)        3.00        14.00
     Storage Coeff.  (min)=       3.44 (ii)   14.33 (ii)
     Unit Hyd. Tpeak (min)=       3.00        14.00
     Unit Hyd. peak  (cms)=        .34          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .15          .04          .184 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.37        12.250
     RUNOFF VOLUME    (mm)=      63.51        37.49        53.106
     TOTAL RAINFALL   (mm)=      64.31        64.31        64.308
     RUNOFF COEFFICIENT   =        .99          .58          .826

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.2    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.

-------------------------------------------------------------------------------
-
001:0008----------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72           .18
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=        .50           .50
     Length            (m)=      77.46         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=      70.94        101.66
               over (min)         3.00         14.00
     Storage Coeff.  (min)=       3.10 (ii)    13.72 (ii)
     Unit Hyd. Tpeak (min)=       3.00         14.00
     Unit Hyd. peak  (cms)=        .37           .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .11           .03          .132 (iii)
     TIME TO PEAK    (hrs)=      12.25         12.37        12.250
     RUNOFF VOLUME    (mm)=      63.50         39.88        54.059
     TOTAL RAINFALL   (mm)=      64.31         64.31        64.308
     RUNOFF COEFFICIENT   =        .99           .62          .841

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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.

--------------------------------------------------------------------------------
-
001:0009--------------------------------------------------------------------------
-
* BLOCKS TO WEST FOREBAY
* Catchment 201 - Block 248 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47           .62
     Dep. Storage     (mm)=        .80          1.50
     Average Slope     (%)=        .50           .50
     Length            (m)=     143.53         40.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=      70.94        107.14
               over (min)         4.00         15.00
     Storage Coeff.  (min)=       4.48 (ii)    14.89 (ii)
     Unit Hyd. Tpeak (min)=       4.00         15.00
     Unit Hyd. peak  (cms)=        .26           .08
                                                      *TOTALS*
```

```
     PEAK FLOW       (cms)=        .35          .11           .444 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.38         12.250
     RUNOFF VOLUME    (mm)=      63.50        42.37         55.059
     TOTAL RAINFALL   (mm)=      64.31        64.31         64.308
     RUNOFF COEFFICIENT   =        .99          .66           .856

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0010--------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-05     at 10:04:57
================================================================================
=
```

SCS POST DEVELOPMENT

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Post Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*% 100-year 24-hr SCS
READ STORM          STORM_FILENAME=["100Y24.STM"]
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*%-----------------|-------------------------------------------------------|
* TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.219](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.345](cms), NINLET=[1],
                    MAJID=[4], MajNHYD=["site"],
                    MINID=[5], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
```

```
*%-----------------|---------------------------------------------------------|
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.184](cms), NINLET=[1],
                    MAJID=[6], MajNHYD=["site"],
                    MINID=[7], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|---------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.132](cms), NINLET=[1],
                    MAJID=[8], MajNHYD=["site"],
                    MINID=[9], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|---------------------------------------------------------|
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[8.98](ha),
                    XIMP=[0.364], TIMP=[0.557], DWF=[0](cms), LOSS=[2],CN=[77],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* Total to east side of forebay
ADD HYD             IDsum=[8], NHYD=["EastForebay1"], IDs to add=[3,5,7,9,1]
*%-----------------|---------------------------------------------------------|
* TO WEST FOREBAY
*%-----------------|---------------------------------------------------------|
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
```

```
COMPUTE DUALHYD     IDin=[1], CINLET=[0.444](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------------|
* Catchment 202 - lands that will be developed
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[9.35](ha),
                    XIMP=[0.372], TIMP=[0.540], DWF=[0](cms), LOSS=[2],CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* Total to pond (east and west forebays)
ADD HYD             IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
*%-----------------|-------------------------------------------------------------|
* Includes Extended Detention  (ED outflow accounts for 25mm flow from
* external areas that discharge through the pond)
ROUTE RESERVOIR     IDout=[8],   NHYD=["Pond"],  IDin=[9],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                   [   0.0 ,  0.0 ]
                                   [   0.098, 0.4229  ]
                                   [   1.006, 1.2 ]
                                   [   -1  ,  -1  ]  (max twenty pts)
                          IDovf=[], NHYDovf=[overflow]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
* AREAS THAT WILL DISCHARGE UNCONTROLLED
*%-----------------|-------------------------------------------------------------|
* UNC1 - lands that will be developed
* Discharge to wetland (rear of single lots & park)
DESIGN STANDHYD     ID=[1], NHYD=[UNC1], DT=[1]min, AREA=[1.41](ha),
                    XIMP=[0.115], TIMP=[0.242], DWF=[0](cms), LOSS=[2],CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
* UNC2 - lands that will be developed
* Discharge to railway (rear of single lots)
DESIGN STANDHYD     ID=[2], NHYD=[UNC2], DT=[1]min, AREA=[0.36](ha),
                    XIMP=[0.20], TIMP=[0.43], DWF=[0](cms), LOSS=[2],CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
* AREA TO RAMSEY
*%-----------------|-------------------------------------------------------------|
* Catchment 208 - lands that will be developed
* Includes ROW and multi-use trail
* This area is to be controlled using LIDs
DESIGN STANDHYD     ID=[1], NHYD=[208], DT=[1]min, AREA=[0.62](ha),
                    XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2],CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
```

```
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
* AREA TO EXISTING WOODLOT
*%-----------------|---------------------------------------------------------|
* EXT1
* (lands that are owned by applicant but will not be developed)
DESIGN NASHYD       ID=[1], NHYD=[EXT1], DT=[1]min, AREA=[5.13](ha),
                    DWF=[0](cms), CN/C=[74.5], TP=[0.43]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* EXT2
* (lands that are owned by applicant but will not be developed)
DESIGN NASHYD       ID=[2], NHYD=[EXT2], DT=[1]min, AREA=[6.56](ha),
                    DWF=[0](cms), CN/C=[75.3], TP=[0.79]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* Total to existing woodlot (for water balance)
ADD HYD             IDsum=[3], NHYD=["WOOD"], IDs to add=[1,2]
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
FINISH
```

SCS POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858            *********
 *********                  E-Mail: swmhymo@jfsa.Com                    *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: R.J. Burnside & Associates Ltd                +++++++++
 +++++++++                Brampton              SERIAL#:3877524        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 ***********************   D E T A I L E D   O U T P U T   ***********************
 ********************************************************************************
 *         DATE: 2020-02-05     TIME: 10:47:10     RUN COUNTER: 000070          *
 ********************************************************************************
 * Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\100.DAT          *
 * Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\100.out          *
 * Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\100.sum          *
 * User comments:                                                              *
 * 1:_____________________________________________________________________     *
 * 2:_____________________________________________________________________     *
 * 3:_____________________________________________________________________     *
 ********************************************************************************

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-
```

```
001:0001-------------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*****************************************************************************
*# Post Development Model for the Site
*#
*#  CN as per Ontario Soils Map for Welland County
*#*****************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
-
001:0002-------------------------------------------------------------------------------
-
*#*****************************************************************************
--------------------
| READ STORM       |    Filename: 100yr/24hr
| Ptotal= 102.88 mm|    Comments: 100yr/24hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	6.50	2.060	12.75	14.820	19.00	1.850
.50	1.130	6.75	2.060	13.00	7.610	19.25	1.850
.75	1.130	7.00	2.060	13.25	7.610	19.50	1.850
1.00	1.130	7.25	2.060	13.50	1.440	19.75	1.850
1.25	1.130	7.50	2.060	13.75	1.440	20.00	1.850
1.50	1.130	7.75	2.060	14.00	8.440	20.25	1.850
1.75	1.130	8.00	2.060	14.25	8.440	20.50	1.230
2.00	1.130	8.25	2.060	14.50	3.090	20.75	1.230
2.25	1.130	8.50	2.780	14.75	3.090	21.00	1.230
2.50	1.340	8.75	2.780	15.00	3.090	21.25	1.230
2.75	1.340	9.00	2.780	15.25	3.090	21.50	1.230
3.00	1.340	9.25	2.780	15.50	3.090	21.75	1.230
3.25	1.340	9.50	3.290	15.75	3.090	22.00	1.230
3.50	1.340	9.75	3.290	16.00	3.090	22.25	1.230
3.75	1.340	10.00	3.700	16.25	3.090	22.50	1.230
4.00	1.340	10.25	3.700	16.50	1.850	22.75	1.230
4.25	1.340	10.50	4.730	16.75	1.850	23.00	1.230

```
              4.50   1.650 |  10.75   4.730 |  17.00   1.850 |  23.25   1.230
              4.75   1.650 |  11.00   6.380 |  17.25   1.850 |  23.50   1.230
              5.00   1.650 |  11.25   6.380 |  17.50   1.850 |  23.75   1.230
              5.25   1.650 |  11.50   9.880 |  17.75   1.850 |  24.00   1.230
              5.50   1.650 |  11.75   9.880 |  18.00   1.850 |  24.25   1.230
              5.75   1.650 |  12.00  42.800 |  18.25   1.850 |
              6.00   1.650 |  12.25 113.590 |  18.50   1.850 |
              6.25   1.650 |  12.50  14.820 |  18.75   1.850 |

--------------------------------------------------------------------------------
-
001:0003------------------------------------------------------------------------
-
*#******************************************************************************
* TO EAST FOREBAY
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       184.50
                over (min)        3.00        11.00
     Storage Coeff.  (min)=       3.01 (ii)   11.39 (ii)
     Unit Hyd. Tpeak (min)=       3.00        11.00
     Unit Hyd. peak  (cms)=        .37          .10
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .29          .11            .391 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.32          12.250
     RUNOFF VOLUME    (mm)=     102.08        71.74          89.951
     TOTAL RAINFALL   (mm)=     102.88       102.88         102.883
     RUNOFF COEFFICIENT   =        .99          .70            .874

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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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001:0004------------------------------------------------------------------------
```

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-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .219  (cms)
| TotalHyd 01:000203 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .219  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000203       1.54      .391    12.250   89.951     .000
     ========================================================================
     MAJOR SYST   02:site          .12      .172    12.250   89.951     .000
     MINOR SYST   03:pond         1.42      .219    12.050   89.951     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0005----------------------------------------------------------------------
-
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.46
| 01:000204 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.97          .49
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     128.06        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       182.29
               over (min)         3.00        12.00
     Storage Coeff.  (min)=       3.47 (ii)   11.88 (ii)
     Unit Hyd. Tpeak (min)=       3.00        12.00
     Unit Hyd. peak  (cms)=        .34          .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .46          .17          .612 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.33        12.250
     RUNOFF VOLUME    (mm)=     102.08        71.17        89.726
     TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
     RUNOFF COEFFICIENT   =        .99          .69          .872

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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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-
001:0006--------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .345  (cms)
| TotalHyd 01:000204 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .345  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000204       2.46      .612    12.250   89.726     .000
     ==========================================================================
     MAJOR SYST   04:site          .19      .267    12.250   89.726     .000
     MINOR SYST   05:pond         2.27      .345    12.050   89.726     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
001:0007--------------------------------------------------------------------------
-
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.28
| 01:000205 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.02          .26
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      92.38        40.00
     Mannings n             =      .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       183.48
               over (min)         3.00        11.00
     Storage Coeff.  (min)=       2.85 (ii)   11.24 (ii)
     Unit Hyd. Tpeak (min)=       3.00        11.00
     Unit Hyd. peak  (cms)=        .39          .10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .24          .09          .325 (iii)
```

```
     TIME TO PEAK    (hrs)=      12.25        12.32         12.250
     RUNOFF VOLUME    (mm)=     102.07        71.29         89.771
     TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
     RUNOFF COEFFICIENT   =        .99          .69           .873

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.2    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.

--------------------------------------------------------------------------------
-
001:0008--------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .184  (cms)
| TotalHyd 01:000205 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .184  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK      R.V.      DWF
                                  (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000205       1.28      .325    12.250    89.771     .000
     ================================================================================
     MAJOR SYST   06:site          .10      .141    12.250    89.771     .000
     MINOR SYST   07:pond         1.18      .184    12.050    89.771     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
001:0009--------------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72          .18
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      77.46        40.00
     Mannings n           =       .013         .250
```

```
     Max.eff.Inten.(mm/hr)=     113.59       190.76
                over (min)        3.00        11.00
     Storage Coeff.  (min)=       2.56 (ii)   10.83 (ii)
     Unit Hyd. Tpeak (min)=       3.00        11.00
     Unit Hyd. peak  (cms)=        .41          .10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .17          .07          .233 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.32        12.250
     RUNOFF VOLUME    (mm)=     102.08        74.57        91.084
     TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
     RUNOFF COEFFICIENT   =        .99          .72          .885

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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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-
001:0010--------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .132  (cms)
| TotalHyd 01:000206 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .132  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000206        .90      .233    12.250   91.084     .000
     ==========================================================================
     MAJOR SYST   08:site          .07      .101    12.250   91.084     .000
     MINOR SYST   09:pond          .83      .132    12.050   91.084     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0011--------------------------------------------------------------------------
-
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    8.98
| 01:000207 DT= 1.00 |   Total Imp(%)=   55.70   Dir. Conn.(%)=   36.40
----------------------
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	5.00	3.98	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	.50	.50	
Length	(m)=	244.68	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)	=	113.59	121.67	
over (min)		5.00	15.00	
Storage Coeff. (min)	=	5.11 (ii)	15.00 (ii)	
Unit Hyd. Tpeak (min)	=	5.00	15.00	
Unit Hyd. peak (cms)	=	.22	.08	
				TOTALS
PEAK FLOW	(cms)=	.97	.83	1.660 (iii)
TIME TO PEAK	(hrs)=	12.25	12.38	12.267
RUNOFF VOLUME	(mm)=	102.08	67.02	79.800
TOTAL RAINFALL	(mm)=	102.88	102.88	102.883
RUNOFF COEFFICIENT	=	.99	.65	.776

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 77.0 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.

001:0012

---

* Total to east side of forebay

ADD HYD (EastForeba)	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
ID1	03:pond	1.42	.219	12.05	89.95	.000
+ID2	05:pond	2.27	.345	12.05	89.73	.000
+ID3	07:pond	1.18	.184	12.05	89.77	.000
+ID4	09:pond	.83	.132	12.05	91.08	.000
+ID5	01: 207	8.98	1.660	12.27	79.80	.000
SUM	08:EastForeba	14.67	2.540	12.27	83.75	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-
001:0013-------------------------------------------------------------------------
-
* TO WEST FOREBAY
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47          .62
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     143.53        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       197.01
               over (min)        4.00        12.00
     Storage Coeff.  (min)=       3.71 (ii)   11.87 (ii)
     Unit Hyd. Tpeak (min)=       4.00        12.00
     Unit Hyd. peak  (cms)=        .30          .10
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .57          .23          .784 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.33        12.250
     RUNOFF VOLUME    (mm)=     102.07        77.88        92.415
     TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
     RUNOFF COEFFICIENT   =        .99          .76          .898

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

-------------------------------------------------------------------------------
-
001:0014-------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .444  (cms)
| TotalHyd 01:000201 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .444  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
```

```
     TOTAL HYD.   01:000201       3.09      .784    12.250   92.415     .000
     ==========================================================================
     MAJOR SYST   02:site          .24      .340    12.250   92.415     .000
     MINOR SYST   03:pond         2.85      .444    12.067   92.415     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0015---------------------------------------------------------------------
-
* Catchment 202 - lands that will be developed
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    9.35
| 01:000202 DT= 1.00 |   Total Imp(%)=   54.00   Dir. Conn.(%)=   37.20
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.05         4.30
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     249.67        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       120.44
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       5.18 (ii)   15.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .22          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.04          .89         1.772 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.38        12.267
     RUNOFF VOLUME    (mm)=     102.07        69.84        81.848
     TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
     RUNOFF COEFFICIENT   =        .99          .68          .796

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

-------------------------------------------------------------------------------
-
001:0016---------------------------------------------------------------------
-
* Total to pond (east and west forebays)
------------------------
| ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
```

```
                    ID1 08:EastForeba    14.67    2.540   12.27  83.75    .000

                   +ID2 03:pond           2.85     .444   12.07  92.41    .000

                   +ID3 01:       202     9.35    1.772   12.27  81.85    .000

                    ============================================================
                    SUM 09:toPond        26.87    4.756   12.27  84.01    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0017--------------------------------------------------------------------------
-
* Includes Extended Detention  (ED outflow accounts for 25mm flow from
* external areas that discharge through the pond)
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>09:(toPond)   |
| OUT<08:(Pond  )   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.006  .1200E+01
                           .098  .4229E+00   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >09: (toPond)      26.87     4.756    12.267     84.008
     OUTFLOW<08: (Pond  )      26.87      .965    12.950     84.006

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   20.285
                   TIME SHIFT OF PEAK FLOW         (min)=    41.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1165E+01

--------------------------------------------------------------------------------
-
001:0018--------------------------------------------------------------------------
-
* AREAS THAT WILL DISCHARGE UNCONTROLLED
* UNC1 - lands that will be developed
* Discharge to wetland (rear of single lots & park)
---------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.41
| 01:000001 DT= 1.00 |   Total Imp(%)=   24.20   Dir. Conn.(%)=   11.50
---------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .34         1.07
     Dep. Storage     (mm)=        .80         1.50
```

```
     Average Slope     (%)=        .50          .50
     Length            (m)=      96.95        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     113.59        98.52
               over (min)         3.00        14.00
     Storage Coeff.  (min)=       2.93 (ii)   13.70 (ii)
     Unit Hyd. Tpeak (min)=       3.00        14.00
     Unit Hyd. peak  (cms)=        .38          .08
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .05          .19          .212 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.37         12.283
     RUNOFF VOLUME    (mm)=     102.08        66.16         70.302
     TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
     RUNOFF COEFFICIENT   =        .99          .64          .683

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0019--------------------------------------------------------------------------
-
* UNC2 - lands that will be developed
* Discharge to railway (rear of single lots)
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .36
| 02:000002 DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   20.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .15          .21
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      48.99        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       127.05
               over (min)         2.00        12.00
     Storage Coeff.  (min)=       1.95 (ii)   11.67 (ii)
     Unit Hyd. Tpeak (min)=       2.00        12.00
     Unit Hyd. peak  (cms)=        .57          .10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .02          .05          .067 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.33         12.250
     RUNOFF VOLUME    (mm)=     102.08        70.48         76.809
     TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
     RUNOFF COEFFICIENT   =        .99          .69          .747
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

------------------------------------------------------------------------------
-
001:0020---------------------------------------------------------------------
-
* AREA TO RAMSEY
* Catchment 208 - lands that will be developed
* Includes ROW and multi-use trail
* This area is to be controlled using LIDs
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .62
| 01:000208 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .56          .06
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      64.29        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     113.59       302.57
               over (min)         2.00         9.00
     Storage Coeff.  (min)=       2.29 (ii)    9.16 (ii)
     Unit Hyd. Tpeak (min)=       2.00         9.00
     Unit Hyd. peak  (cms)=        .51          .12
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .14          .04          .176 (iii)
     TIME TO PEAK    (hrs)=      12.25        12.30        12.250
     RUNOFF VOLUME    (mm)=     102.07        79.42        95.285
     TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
     RUNOFF COEFFICIENT   =        .99          .77          .926

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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.

------------------------------------------------------------------------------
-
001:0021---------------------------------------------------------------------
-
* AREA TO EXISTING WOODLOT
* EXT1
```

```
* (lands that are owned by applicant but will not be developed)
----------------------
| DESIGN NASHYD      |   Area    (ha)=    5.13   Curve Number   (CN)=74.50
| 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .456

     PEAK FLOW       (cms)=     .412 (i)
     TIME TO PEAK    (hrs)=   12.567
     RUNOFF VOLUME    (mm)=   54.579
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .530

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0022--------------------------------------------------------------------------
-
* EXT2
* (lands that are owned by applicant but will not be developed)
----------------------
| DESIGN NASHYD      |   Area    (ha)=    6.56   Curve Number   (CN)=75.30
| 02:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .317

     PEAK FLOW       (cms)=     .349 (i)
     TIME TO PEAK    (hrs)=   12.983
     RUNOFF VOLUME    (mm)=   55.649
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .541

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0023--------------------------------------------------------------------------
-
* Total to existing woodlot (for water balance)
------------------------
| ADD HYD (WOOD      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:         1     5.13     .412   12.57  54.58    .000

                    +ID2 02:         2     6.56     .349   12.98  55.65    .000

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

```
                    SUM 03:WOOD          11.69     .708   12.70  55.18    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0024--------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-05     at 10:47:10
================================================================================
=
```

SCS POST DEVELOPMENT

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*************************************************************************
*# Model used to determine required Extended Detention volume
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*% 25mm 4-hr Chicago
MASS STORM          PTOTAL=[25](mm), CSDT=[10](min),
                    CURVE_FILENAME=["4hr-chi.mst"]
*%-----------------|-------------------------------------------------------|
*#*************************************************************************
*%-----------------|-------------------------------------------------------|
* TO EAST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[203], DT=[1]min, AREA=[1.54](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.6],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.219](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[2.46](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.345](cms), NINLET=[1],
                    MAJID=[4], MajNHYD=["site"],
                    MINID=[5], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
```

```
* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[205], DT=[1]min, AREA=[1.28](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74.2],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.184](cms), NINLET=[1],
                    MAJID=[6], MajNHYD=["site"],
                    MINID=[7], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.90](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[77.1],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.132](cms), NINLET=[1],
                    MAJID=[8], MajNHYD=["site"],
                    MINID=[9], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|-------------------------------------------------------|
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[8.98](ha),
                    XIMP=[0.364], TIMP=[0.557], DWF=[0](cms), LOSS=[2],CN=[77],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
* Total to east side of forebay
ADD HYD             IDsum=[8], NHYD=["EastForebay1"], IDs to add=[3,5,7,9,1]
*%-----------------|-------------------------------------------------------|
* TO WEST FOREBAY
*%-----------------|-------------------------------------------------------|
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[3.09](ha),
                    XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|-------------------------------------------------------|
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
COMPUTE DUALHYD     IDin=[1], CINLET=[0.444](cms), NINLET=[1],
```

```
                    MAJID=[2], MajNHYD=["site"],
                    MINID=[3], MinNHYD=["pond"],
                    TMJSTO=[   ](cu-m)
*%-----------------|---------------------------------------------------------|
* Catchment 202 - lands that will be developed
* Discharges to west forebay
DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[9.35](ha),
                    XIMP=[0.372], TIMP=[0.540], DWF=[0](cms), LOSS=[2],CN=[80],
                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----------------|---------------------------------------------------------|
* Total to pond (east and west forebays)
ADD HYD             IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
FINISH
```

SCS POST DEVELOPMENT

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

*******************************************************************************
***************************** SWMHYMO Ver/4.05  *****************************
*********  A single event and continuous hydrologic simulation model  *********
*********     based on the principles of HYMO and its successors      *********
*********                  OTTHYMO-83 and OTTHYMO-89.                 *********
*******************************************************************************
********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
*********                  Ottawa,  Ontario: (613) 836-3884           *********
*********                  Gatineau, Quebec: (819) 243-6858           *********
*********                  E-Mail: swmhymo@jfsa.Com                   *********
*******************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++ Licensed user: R.J. Burnside & Associates Ltd               +++++++++
+++++++++                Brampton              SERIAL#:3877524        +++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*******************************************************************************
*********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
*********           Maximum value for ID numbers  :     10           *********
*********           Max. number of rainfall points: 105408           *********
*********           Max. number of flow points    : 105408           *********
*******************************************************************************


**********************   D E T A I L E D   O U T P U T   **********************
*******************************************************************************
*         DATE: 2020-02-05     TIME: 10:44:53     RUN COUNTER: 000069         *
*******************************************************************************
* Input   filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\25mm.DAT         *
* Output  filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\25mm.out         *
* Summary filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\25mm.sum         *
* User comments:                                                              *
* 1:_____________________________________________________________________     *
* 2:_____________________________________________________________________     *
* 3:_____________________________________________________________________     *
*******************************************************************************

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

```
001:0001-------------------------------------------------------------------------
-
*#######################################################################
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2020
*#  Modeller    : [J.Scott]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#######################################################################
*# Model used to determine required Extended Detention volume
*#######################################################################
--------------------
| START            |  Project  dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\

--------------------  Rainfall dir.: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SCS\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
-
001:0002-------------------------------------------------------------------------
-
*#######################################################################
--------------------
| MASS STORM       |    Filename: C:\SWMHYMO\NIAGAR~1\200204~1\Post-Dev\SC
| Ptotal= 25.00 mm |    Comments: 4 Hour, Chicago Distribution with 10 min
--------------------
                       Duration of storm        =    4.17 hrs
                       Mass curve time step     =   10.00 min
                       Selected storm time step =   10.00 min
                       Volume of derived storm  =   25.00 mm

             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   1.500 |   1.33  36.300 |   2.50   2.850 |   3.67   1.500
              .33   2.100 |   1.50  23.550 |   2.67   2.400 |   3.83   1.050
              .50   2.250 |   1.67   9.900 |   2.83   2.250 |   4.00    .600
              .67   2.550 |   1.83   6.300 |   3.00   2.100 |   4.17    .300
              .83   4.050 |   2.00   4.800 |   3.17   1.800 |
             1.00   7.500 |   2.17   3.900 |   3.33   1.650 |
             1.17  24.000 |   2.33   3.150 |   3.50   1.650 |

-------------------------------------------------------------------------------
-
001:0003-------------------------------------------------------------------------
-
*#######################################################################
* TO EAST FOREBAY
```

```
* Catchment 203 - Block 246 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.54
| 01:000203 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .31
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     101.32        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.30        19.90
               over (min)        5.00        25.00
     Storage Coeff.  (min)=       4.75 (ii)   25.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .23          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .09          .01          .089 (iii)
     TIME TO PEAK    (hrs)=       1.35         1.80         1.350
     RUNOFF VOLUME    (mm)=      24.20         8.71        18.005
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
     RUNOFF COEFFICIENT   =        .97          .35          .720

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.6    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.

-------------------------------------------------------------------------------
-
001:0004----------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .219  (cms)
| TotalHyd 01:000203 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .219  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000203       1.54      .089     1.350   18.005     .000
     ==========================================================================
     MAJOR SYST   02:site          .00      .000      .000     .000     .000
     MINOR SYST   03:pond         1.54      .089     1.350   18.005     .000
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------------------------------------------------------------------
-
001:0005-------------------------------------------------------------------------
-
* Catchment 204 - Block 245 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.46
| 01:000204 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.97          .49
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     128.06        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.30        19.15
               over (min)         5.00        26.00
     Storage Coeff.  (min)=       5.47 (ii)   26.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00        26.00
     Unit Hyd. peak  (cms)=        .21          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .13          .02          .139 (iii)
     TIME TO PEAK    (hrs)=       1.35         1.82         1.367
     RUNOFF VOLUME    (mm)=      24.20         8.57        17.947
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
     RUNOFF COEFFICIENT   =        .97          .34          .718

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.1    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.

--------------------------------------------------------------------------------
-
001:0006-------------------------------------------------------------------------
-
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .345  (cms)
| TotalHyd 01:000204 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .345  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)
```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	01:000204	2.46	.139	1.367	17.947	.000
MAJOR SYST	04:site	.00	.000	.000	.000	.000
MINOR SYST	05:pond	2.46	.139	1.367	17.947	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0007

---

* Catchment 205 - Block 244 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay

DESIGN STANDHYD	Area (ha)= 1.28
01:000205 DT= 1.00	Total Imp(%)= 80.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	1.02	.26	
Dep. Storage	(mm)=	.80	1.50	
Average Slope	(%)=	.50	.50	
Length	(m)=	92.38	40.00	
Mannings n	=	.013	.250	
Max.eff.Inten.(mm/hr)=		36.30	19.61	
over (min)		4.00	25.00	
Storage Coeff.	(min)=	4.50 (ii)	25.02 (ii)	
Unit Hyd. Tpeak	(min)=	4.00	25.00	
Unit Hyd. peak	(cms)=	.26	.05	
				TOTALS
PEAK FLOW	(cms)=	.07	.01	.075 (iii)
TIME TO PEAK	(hrs)=	1.33	1.80	1.350
RUNOFF VOLUME	(mm)=	24.20	8.60	17.959
TOTAL RAINFALL	(mm)=	25.00	25.00	25.000
RUNOFF COEFFICIENT	=	.97	.34	.718

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.2 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.

001:0008

```
* Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .184  (cms)
| TotalHyd 01:000205 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .184  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                 ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                 (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.  01:000205       1.28      .075     1.350   17.959     .000
     ========================================================================
     MAJOR SYST  06:site          .00      .000      .000     .000     .000
     MINOR SYST  07:pond         1.28      .075     1.350   17.959     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0009---------------------------------------------------------------------
-
* Catchment 206 - Block 243 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .90
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .72          .18
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      77.46        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.30        22.83
               over (min)         4.00        23.00
     Storage Coeff.  (min)=       4.05 (ii)   23.36 (ii)
     Unit Hyd. Tpeak (min)=       4.00        23.00
     Unit Hyd. peak  (cms)=        .28          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .05          .01          .054 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.77         1.350
     RUNOFF VOLUME    (mm)=      24.20         9.49        18.316
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
     RUNOFF COEFFICIENT   =        .97          .38          .733

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.1    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.

-------------------------------------------------------------------------------
-
001:0010-------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .132  (cms)
| TotalHyd 01:000206 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .132  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:000206        .90      .054     1.350   18.316     .000
     ==========================================================================
     MAJOR SYST   08:site          .00      .000      .000     .000     .000
     MINOR SYST   09:pond          .90      .054     1.350   18.316     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0011-------------------------------------------------------------------------
-
* Catchment 207 - lands that will be developed
* These lands will not be treated as a site plan
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    8.98
| 01:000207 DT= 1.00 |   Total Imp(%)=   55.70   Dir. Conn.(%)=   36.40
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.00         3.98
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     244.68        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.30        10.52
               over (min)         8.00        34.00
     Storage Coeff.  (min)=       8.07 (ii)   34.41 (ii)
     Unit Hyd. Tpeak (min)=       8.00        34.00
     Unit Hyd. peak  (cms)=        .14          .03
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .27          .07          .288 (iii)
     TIME TO PEAK    (hrs)=       1.40         1.98         1.417
```

```
     RUNOFF VOLUME    (mm)=      24.20         7.47         13.561
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.000
     RUNOFF COEFFICIENT   =        .97          .30           .542

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.0    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.

--------------------------------------------------------------------------------
-
001:0012--------------------------------------------------------------------------
-
* Total to east side of forebay
------------------------
| ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 03:pond          1.54     .089    1.35  18.01    .000

                     +ID2 05:pond          2.46     .139    1.37  17.95    .000

                     +ID3 07:pond          1.28     .075    1.35  17.96    .000

                     +ID4 09:pond           .90     .054    1.35  18.32    .000

                     +ID5 01:       207    8.98     .288    1.42  13.56    .000

                      ============================================================
                      SUM 08:EastForeba    15.16     .633    1.37  15.38    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0013--------------------------------------------------------------------------
-
* TO WEST FOREBAY
* Catchment 201 - Block 254 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    3.09
| 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.47          .62
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
```

```
     Length            (m)=     143.53        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      36.30        24.45
               over (min)         6.00        25.00
     Storage Coeff.  (min)=       5.86 (ii)   24.65 (ii)
     Unit Hyd. Tpeak (min)=       6.00        25.00
     Unit Hyd. peak  (cms)=        .19          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .17          .03          .174 (iii)
     TIME TO PEAK    (hrs)=       1.37         1.80         1.367
     RUNOFF VOLUME    (mm)=      24.20        10.50        18.720
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
     RUNOFF COEFFICIENT   =        .97          .42          .749

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    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.

--------------------------------------------------------------------------------
-
001:0014--------------------------------------------------------------------------
-
*  Release rate controlled to 5-year post-dev flow
* 5-year flow obtained from separate SWMHYMO file
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .444  (cms)
| TotalHyd 01:000201 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .444  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK      R.V.      DWF
                                  (ha)     (cms)     (hrs)      (mm)    (cms)
     TOTAL HYD.   01:000201       3.09      .174     1.367    18.720     .000
     ================================================================================
     MAJOR SYST   02:site          .00      .000      .000      .000     .000
     MINOR SYST   03:pond         3.09      .174     1.367    18.720     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0015--------------------------------------------------------------------------
-
* Catchment 202 - lands that will be developed
* Discharges to west forebay
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    9.35
```

| 01:000202 DT= 1.00 | Total Imp(%)= 54.00 Dir. Conn.(%)= 37.20

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	5.05	4.30	
Dep. Storage (mm)=	.80	1.50	
Average Slope (%)=	.50	.50	
Length (m)=	249.67	40.00	
Mannings n =	.013	.250	
Max.eff.Inten.(mm/hr)=	36.30	10.92	
over (min)	8.00	34.00	
Storage Coeff. (min)=	8.17 (ii)	34.11 (ii)	
Unit Hyd. Tpeak (min)=	8.00	34.00	
Unit Hyd. peak (cms)=	.14	.03	
			TOTALS
PEAK FLOW (cms)=	.29	.08	.307 (iii)
TIME TO PEAK (hrs)=	1.40	1.97	1.417
RUNOFF VOLUME (mm)=	24.20	8.11	14.097
TOTAL RAINFALL (mm)=	25.00	25.00	25.000
RUNOFF COEFFICIENT =	.97	.32	.564

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 80.0 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.

001:0016

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* Total to pond (east and west forebays)

ADD HYD (toPond)	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
ID1	08:EastForeba	15.16	.633	1.37	15.38	.000
+ID2	03:pond	3.09	.174	1.37	18.72	.000
+ID3	01: 202	9.35	.307	1.42	14.10	.000
SUM	09:toPond	27.60	1.108	1.38	15.32	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0017

```
-
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-02-05     at 10:44:53
===============================================================================
=
```

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

Stormwater Management Calculations - North

Project: Niagara Village - NORTH
File: 300041230
Designed by: L.Garner
Date: 31-Jan-20

BURNSIDE

IMPERVIOUS CALCULATIONS

Catchment 209 Drainage Area = **82661.423** **m2** **or** **8.27** **ha**

Right of Ways (m2)

19951	

Total Area= 2.00 ha

		Area
TIMP	90%	1.80 ha
XIMP	70%	1.40 ha

Parkland Areas (m2)

6460	Block 262

Total Area= 0.645999 ha

		Area
TIMP	10%	0.06 ha
XIMP	5%	0.03 ha

SWM Block (m2)

10109	

Total Area = 1.01 ha

		Area
TIMP	50%	0.51 ha
XIMP	50%	0.51 ha

Mixed Use Medium Density (m2)

Total Area = 0.00 ha

		Area
TIMP	90%	0.91 ha
XIMP	70%	0.71 ha

Low-Density Residential Areas (m2)

3566	Single Detached
21740	
6982	

Total Area 3.23 ha

		Area
TIMP	43%	1.39 ha
XIMP	20%	0.65 ha

Townhouses (m2)

5365	Townhouses
8490	

Total Area 1.39 ha

		Area
TIMP	64%	0.77 ha
XIMP	44%	0.53 ha

IMPERVIOUSNESS			
TOTAL Modelled Area=	**8.27 ha**	**TOTAL Pervious Area=**	**3.63 ha**
OVERALL TIMP	**0.561**		
OVERALL XIMP	**0.390**		

Project: Niagara Village - NORTH
File: 300041230.0000
Designed by: L.Garner
Date: 31-Jan-20

BURNSIDE

Wet Pond Permament Pool Requirement

MOE Table 3.2 Water Quality Storage Requirements Based on Receiving Waters.

TOTAL DRAINAGE AREA TO POND	11.20	ha
IMPERVIOUSNESS	63.21	%
Protection Level (1, 2, or 3)	1	

NOTE - 40 cu.m/ha has been removed from MOE table values for Ex. Detention Portion

Enhanced (Level 1) Protection

x	y	Known (x)	Calc (y)	
Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Total Permanent Pool Required (cu.m)
35	100	63.21	169.16	1894.63
55	150			
70	185			
85	210			
95.0	**236**	**Extrapolated**		
99.0	**240**	**Extrapolated**		

Normal (Level 2) Protection

x	y	Known (x)	Calc (y)	
Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Total Permanent Pool Required (cu.m)
35	50	63.21	80.95	0.00
55	70			
70	90			
85	110			
95.0	**121**	**Extrapolated**		
99.0	**127**	**Extrapolated**		

Basic (Level 3) Protection

x	y	Known (x)	Calc (y)	
Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Imperviousness (%)	Permanent Pool StorageVolume (cu.m./ha)	Total Permanent Pool Required (cu.m)
35	20	63.21	40.48	0.00
55	35			
70	45			
85	55			
99.0	**61**	**Extrapolated**		

SEDIMENT FOREBAY SIZING

Project: Niagara Village - NORTH
File: 300041230
Designed by: L.Garner
Date: 31-Jan-20

Forebay Length: Two calculations (per MOE SWMP Manual, 2003)

1) Settling Calculations **Dist = SQRT(r * Qp / Vs)**
(Equation 4.5, MOE 2003)

where:
Dist = Forebay length (m)
r = Length to width ratio of forebay
Qp = Peak flowrate from the pond during quality design storm (cms)
Vs = Settling velocity (m/s)

given:
r = 2
Qp = 0.157 cms *see below
Vs = 0.0003 m/s

therefore:
Dist = 32.4 metres
Width= 16.2 metres

*Peak quality flowrate (Qp) from pond based on 2-year pre-development flow (maximum allowable flow) for a conservative estimate since extended detention is not required for the north pond

2) Dispersion Length **Dist = (8 * Q) / (d * Vf)**
(Equation 4.6,MOE 2003)

where:
Dist = Forebay length (m)
Q = inlet flowrate (cms)
d = depth of permanent pool in forebay (m)
Vf = desired forebay velocity (m/s)

given:
Q = 1.143 cms *see below
d = 1.5 m
Vf = 0.5 m/s
Forebay S

therefore:
Dist = 12.2 metres
Width= 6.1 metres
Min Bottom Width= 1.5 metres *MOE equation 4.6
Pond Side Slopes: 5
Calc. Top Width= 16.524 metres
Calc. Top Length= 33.048 meters

Peak inflow rate calculated based on SMWHYMO output for 5 year storm (based of IDF parameters)

Minimum Forebay Dimension:

Length= 33.0 meters
Width= 16.5 meters

Actual Forebay Design:

Length= 40.0 meters
Width= 22.0 meters

Check Average velocity in forebay <= 0.15 m/s
Pond Side Slopes: 5 H : 1 V
Q = V x A Q = 1.143 A = 22 sq.metres

therefore: V = 0.0526 m/s
Design: **OK**

Project: Niagara Village - NORTH
File: 300041230.0000
Designed by: L.Garner
Date: 1/31/2020

BURNSIDE

North SWM Pond Storage Calculations

INPUT AREA

Base of Pond:	175.50	
N.W.L.:	178.00	masl
Increment for Volume:	0.2	m
Required Permanent Pool Volume:	1895	m^3
Permanent Pool Volume Provided:	3379	m^3

PERMANENT POOL ELEVATION / STORAGE INFORMATION

Description	**Elevation** (m)	**Stage** (m)	**Elev Above PP** (m)	**Cumulative Storage** (m3)	**Cumulative Storage above Permanent Pool** (m3)
	175.50	-2.50			
	176.50	-1.50		444.24	
NWL	**178.00**	0.00	0.00	3378.50	0.00
	178.50	0.50	0.50	5121.63	1743.13
	179.50	1.50	1.50	9600.23	6221.73
Freeboard	**180.20**	2.20	2.20	13605.15	10226.65
Top of Pond	**180.50**	2.50	2.50	15663.91	12285.41

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00004> *#  Date         : 11-29-2019
00005> *#  Modeller     : [L.Garner]
00006> *#  Company      : R. J. Burnside & Associates Ltd.
00007> *#  License #    :  3877524
00008> *#*************************************************************************
00009> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00010> *%                    [  ] <--storm filename, one per line for NSTORM time
00011> *%------------------|---------------------------------------------------------|
00012> *%------------------|---------------------------------------------------------|
00013> *%------------------|---------------------------------------------------------|
00014> *#
00015> *#  Model created to confirm the existing flow from the Niagara Village Site nor
00016> *#  the CN rail lands
00017> *#
00018> *#
00019> *#  CN as per Ontario Soils Map for Welland County
00020> *#  TIMP / XIMP and TP as per RJB investigation
00021> *#
00022> *%------------------|---------------------------------------------------------|
00023> *%------------------|---------------------------------------------------------|
00024> *#  100yr - 3 hr Chicago
00025> CHICAGO STORM       IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00026>                     ICASEcs=[1],
00027>                      A=[1264.57],  B=[7.72], and C=[0.7814],
00028> *%------------------|---------------------------------------------------------|
00029> * Catchment 105 - North of Conrail - Pre-Development
00030> *%------------------|---------------------------------------------------------|
00031> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00032>                     DWF=[0](cms), CN/C=[74], TP=[0.33]hrs,
00033>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00034> *%------------------|---------------------------------------------------------|
00035> * Catchment 106 - North of Conrail - Pre-Development
00036> *%------------------|---------------------------------------------------------|
00037> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00038>                     DWF=[0](cms), CN/C=[74], TP=[0.45]hrs,
00039>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00040> *%------------------|---------------------------------------------------------|
00041> * Catchment 104 - South of Conrail - Pre-Development
00042> *%------------------|---------------------------------------------------------|
00043> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.21](ha),
00044>                     DWF=[0](cms), CN/C=[76], TP=[0.23]hrs,
00045>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00046> *%------------------|---------------------------------------------------------|
00047> * Catchment EXT4 - Rear Lots - North Side of Site
00048> *%------------------|---------------------------------------------------------|
00049> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00050>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00051>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00052> *%------------------|---------------------------------------------------------|
00053> ADD HYD             IDsum=[5], NHYD=["TOTPRE"], IDs to add=[1,2,3,4]
00054> *%------------------|---------------------------------------------------------|
00055> *%------------------|---------------------------------------------------------|
00056> *#  100yr - 12 hr AES (NPCA)
00057> MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
00058>                     CURVE_FILENAME=["AES-12HR.mst"]
00059> *%------------------|---------------------------------------------------------|
00060> * Catchment 105 - North of Conrail - Pre-Development
00061> *%------------------|---------------------------------------------------------|
00062> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00063>                     DWF=[0](cms), CN/C=[74], TP=[0.33]hrs,
00064>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00065> *%------------------|---------------------------------------------------------|
00066> * Catchment 106 - North of Conrail - Pre-Development
00067> *%------------------|---------------------------------------------------------|
00068> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00069>                     DWF=[0](cms), CN/C=[74], TP=[0.45]hrs,
00070>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00071> *%------------------|---------------------------------------------------------|
00072> * Catchment 104 - South of Conrail - Pre-Development
00073> *%------------------|---------------------------------------------------------|
00074> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.21](ha),
00075>                     DWF=[0](cms), CN/C=[76], TP=[0.23]hrs,
00076>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00077> *%------------------|---------------------------------------------------------|
00078> * Catchment EXT4 - Rear Lots - North Side of Site
00079> *%------------------|---------------------------------------------------------|
00080> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00081>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00082>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00083> *%------------------|---------------------------------------------------------|
00084> ADD HYD             IDsum=[5], NHYD=["TOTPRE"], IDs to add=[1,2,3,4]
00085> *%------------------|---------------------------------------------------------|
00086> *%------------------|---------------------------------------------------------|
00087> *#  100yr - 24 hr SCS (NPCA)
00088> READ STORM          STORM_FILENAME=["100Y24.STM"]
00089> *%------------------|---------------------------------------------------------|
00090> * Catchment 105 - North of Conrail - Pre-Development
00091> *%------------------|---------------------------------------------------------|
00092> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00093>                     DWF=[0](cms), CN/C=[74], TP=[0.33]hrs,
00094>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00095> *%------------------|---------------------------------------------------------|
00096> * Catchment 106 - North of Conrail - Pre-Development
00097> *%------------------|---------------------------------------------------------|
00098> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00099>                     DWF=[0](cms), CN/C=[74], TP=[0.45]hrs,
00100>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00101> *%------------------|---------------------------------------------------------|
00102> * Catchment 104 - South of Conrail - Pre-Development
00103> *%------------------|---------------------------------------------------------|
00104> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.21](ha),
00105>                     DWF=[0](cms), CN/C=[76], TP=[0.23]hrs,
00106>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00107> *%------------------|---------------------------------------------------------|
00108> * Catchment EXT4 - Rear Lots - North Side of Site
00109> *%------------------|---------------------------------------------------------|
00110> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00111>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00112>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00113> *%------------------|---------------------------------------------------------|
00114> ADD HYD             IDsum=[5], NHYD=["TOTPRE"], IDs to add=[1,2,3,4]
00115> *%------------------|---------------------------------------------------------|
00116> *#  2yr - 3 hr Chicago
00117> CHICAGO STORM       IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00118>                     ICASEcs=[1],
00119>                      A=[521.97],  B=[5.28], and C=[0.7588],
00120> *%------------------|---------------------------------------------------------|
00121> * Catchment 105 - North of Conrail - Pre-Development
00122> *%------------------|---------------------------------------------------------|
00123> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00124>                     DWF=[0](cms), CN/C=[74], TP=[0.33]hrs,
00125>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00126> *%------------------|---------------------------------------------------------|
00127> * Catchment 106 - North of Conrail - Pre-Development
00128> *%------------------|---------------------------------------------------------|
00129> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00130>                     DWF=[0](cms), CN/C=[74], TP=[0.45]hrs,
00131>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00132> *%------------------|---------------------------------------------------------|
00133> * Catchment 104 - South of Conrail - Pre-Development
00134> *%------------------|---------------------------------------------------------|
00135> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.21](ha),
00136>                     DWF=[0](cms), CN/C=[76], TP=[0.23]hrs,
00137>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00138> *%------------------|---------------------------------------------------------|
00139> * Catchment EXT4 - Rear Lots - North Side of Site
00140> *%------------------|---------------------------------------------------------|
00141> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00142>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00143>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00144> *%------------------|---------------------------------------------------------|
00145> ADD HYD             IDsum=[5], NHYD=["TOTPRE"], IDs to add=[1,2,3,4]
00146> *%------------------|---------------------------------------------------------|
00147> *%------------------|---------------------------------------------------------|
00148> FINISH
00149>
00150>
00151>
00152>
00153>
```

OUTPUT FILE: North Side, Pre- Development, 100-Year Storm

(C:\...Pre1.out)

```
================================================================================
                                                                                
   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS  W W W  M   M  H   H    Y    M   M   OOO            9      9   =========
                                                          9   9  9   9   # 3877524
        StormWater Management HYdrologic Model            999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                    OTTHYMO-83 and OTTHYMO-89.                *********
 ********************************************************************************
 ******** Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                    Ottawa,  Ontario: (613) 836-3884         *********
 *********                    Gatineau, Quebec: (819) 243-6858         *********
 *********                    E-Mail: swmhymo@jfsa.Com                 *********
 ********************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: R.J. Burnside & Associates Ltd                +++++++++
 +++++++++                Brampton              SERIAL#:3877524        +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2019-12-13     TIME: 10:46:03     RUN COUNTER: 002319         *
 ********************************************************************************
 * Input   filename: C:\SWMHYM~1\Niagara\Pre1.dat                               *
 * Output  filename: C:\SWMHYM~1\Niagara\Pre1.out                               *
 * Summary filename: C:\SWMHYM~1\Niagara\Pre1.sum                               *
 * User comments:                                                               *
 * 1:_____________________________________________________________________      *
 * 2:_____________________________________________________________________      *
 * 3:_____________________________________________________________________      *
 ********************************************************************************


--------------------------------------------------------------------------------
001:0001--------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [300041230]
*#  Date        : 11-29-2019
*#  Modeller    : [L.Garner]
*#  Company     : R. J. Burnside & Associates Ltd.
*#  License #   :  3877524
*#*****************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYM~1\Niagara\
-------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
001:0002--------------------------------------------------------------------------
*#
*#  Model created to confirm the existing flow from the Niagara Village Site nor
*#  the CN rail lands
*#
*#
*#  CN as per Ontario Soils Map for Welland County
*#  TIMP / XIMP and TP as per RJB investigation
*#
*#  100yr - 3 hr Chicago
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1264.570
| Ptotal= 63.46 mm |                          B=   7.720
--------------------                          C=    .781
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm  =  3.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =   .30

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   5.780 |    .83  65.130 |   1.58  14.790 |   2.33   7.441
               .17   6.357 |    .92 173.339 |   1.67  13.260 |   2.42   7.073
               .25   7.080 |   1.00  86.681 |   1.75  12.031 |   2.50   6.743
               .33   8.014 |   1.08  51.858 |   1.83  11.023 |   2.58   6.445
               .42   9.270 |   1.17  36.584 |   1.92  10.181 |   2.67   6.175
               .50  11.054 |   1.25  28.183 |   2.00   9.467 |   2.75   5.929
               .58  13.793 |   1.33  22.923 |   2.08   8.854 |   2.83   5.703
               .67  18.543 |   1.42  19.339 |   2.17   8.321 |   2.92   5.496
               .75  28.749 |   1.50  16.748 |   2.25   7.854 |   3.00   5.305

--------------------------------------------------------------------------------
001:0003--------------------------------------------------------------------------
* Catchment 105 - North of Conrail - Pre-Development
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=74.00
| 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=     .284

     PEAK FLOW       (cms)=     .143 (i)
     TIME TO PEAK    (hrs)=    1.367
     RUNOFF VOLUME    (mm)=   25.390
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .400

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004--------------------------------------------------------------------------
* Catchment 106 - North of Conrail - Pre-Development
----------------------
| DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=74.00
| 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .450

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .332 (i)
     TIME TO PEAK    (hrs)=    1.533
     RUNOFF VOLUME    (mm)=   25.390
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .400

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005--------------------------------------------------------------------------
* Catchment 104 - South of Conrail - Pre-Development
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.21   Curve Number   (CN)=76.00
| 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .367

     PEAK FLOW       (cms)=     .170 (i)
     TIME TO PEAK    (hrs)=    1.217
     RUNOFF VOLUME    (mm)=   27.003
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006--------------------------------------------------------------------------
* Catchment EXT4 - Rear Lots - North Side of Site
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
| 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .106

     PEAK FLOW       (cms)=     .028 (i)
     TIME TO PEAK    (hrs)=    1.017
     RUNOFF VOLUME    (mm)=   25.389
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .400

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007--------------------------
| ADD HYD (TOTPRE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                     (ha)     (cms)   (hrs)   (mm)    (cms)
                       ID1 01:105           2.45     .143    1.37  25.39    .000
                      +ID2 02:106           6.88     .332    1.53  25.39    .000
                      +ID3 03:104           2.21     .170    1.22  27.00    .000
                      +ID4 04:EXT4           .25     .028    1.02  25.39    .000
                       ==========================================================
                       SUM 05:TOTPRE        11.79     .614    1.38  25.69    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0008--------------------------------------------------------------------------
*#  100yr - 12 hr AES (NPCA)
--------------------
| MASS STORM       |    Filename: C:\SWMHYM~1\Niagara\AES-12HR.mst
| Ptotal= 88.06 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
--------------------

                          Duration of storm       =  12.00 hrs
                          Mass curve time step    =  60.00 min
                          Selected storm time step =   5.00 min
                          Volume of derived storm  =  88.06 mm

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   4.403 |    3.08   9.687 |   6.08   7.925 |   9.08   5.284
               .17   4.403 |    3.17   9.687 |   6.17   7.925 |   9.17   5.284
               .25   4.403 |    3.25   9.687 |   6.25   7.925 |   9.25   5.284
               .33   4.403 |    3.33   9.687 |   6.33   7.925 |   9.33   5.284
               .42   4.403 |    3.42   9.687 |   6.42   7.925 |   9.42   5.284
               .50   4.403 |    3.50   9.687 |   6.50   7.925 |   9.50   5.284
               .58   4.403 |    3.58   9.687 |   6.58   7.925 |   9.58   5.284
               .67   4.403 |    3.67   9.687 |   6.67   7.925 |   9.67   5.284
               .75   4.403 |    3.75   9.687 |   6.75   7.925 |   9.75   5.284
               .83   4.403 |    3.83   9.687 |   6.83   7.925 |   9.83   5.284
               .92   4.403 |    3.92   9.687 |   6.92   7.925 |   9.92   5.284
              1.00   4.403 |    4.00   9.687 |   7.00   7.925 |  10.00   5.284
              1.08   8.806 |    4.08  13.209 |   7.08   7.925 |  10.08   1.761
              1.17   8.806 |    4.17  13.209 |   7.17   7.925 |  10.17   1.761
              1.25   8.806 |    4.25  13.209 |   7.25   7.925 |  10.25   1.761
              1.33   8.806 |    4.33  13.209 |   7.33   7.925 |  10.33   1.761
              1.42   8.806 |    4.42  13.209 |   7.42   7.925 |  10.42   1.761
              1.50   8.806 |    4.50  13.209 |   7.50   7.925 |  10.50   1.761
              1.58   8.806 |    4.58  13.209 |   7.58   7.925 |  10.58   1.761
              1.67   8.806 |    4.67  13.209 |   7.67   7.925 |  10.67   1.761
              1.75   8.806 |    4.75  13.209 |   7.75   7.925 |  10.75   1.761
              1.83   8.806 |    4.83  13.209 |   7.83   7.925 |  10.83   1.761
              1.92   8.806 |    4.92  13.209 |   7.92   7.925 |  10.92   1.761
              2.00   8.806 |    5.00  13.209 |   8.00   7.925 |  11.00   1.761
              2.08  10.567 |    5.08  12.328 |   8.08   5.284 |  11.08    .881
              2.17  10.567 |    5.17  12.328 |   8.17   5.284 |  11.17    .881
              2.25  10.567 |    5.25  12.328 |   8.25   5.284 |  11.25    .881
              2.33  10.567 |    5.33  12.328 |   8.33   5.284 |  11.33    .881
              2.42  10.567 |    5.42  12.328 |   8.42   5.284 |  11.42    .881
              2.50  10.567 |    5.50  12.328 |   8.50   5.284 |  11.50    .881
              2.58  10.567 |    5.58  12.328 |   8.58   5.284 |  11.58    .881
              2.67  10.567 |    5.67  12.328 |   8.67   5.284 |  11.67    .881
              2.75  10.567 |    5.75  12.328 |   8.75   5.284 |  11.75    .881
              2.83  10.567 |    5.83  12.328 |   8.83   5.284 |  11.83    .881
              2.92  10.567 |    5.92  12.328 |   8.92   5.284 |  11.92    .881
              3.00  10.567 |    6.00  12.328 |   9.00   5.284 |  12.00    .881

--------------------------------------------------------------------------------
001:0009--------------------------------------------------------------------------
* Catchment 105 - North of Conrail - Pre-Development
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=74.00
| 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=     .284

     PEAK FLOW       (cms)=     .050 (i)
     TIME TO PEAK    (hrs)=    6.050
     RUNOFF VOLUME    (mm)=   42.619
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .484

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010--------------------------------------------------------------------------
* Catchment 106 - North of Conrail - Pre-Development
----------------------
| DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=74.00
| 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .450

     Unit Hyd Qpeak  (cms)=     .584

     PEAK FLOW       (cms)=     .140 (i)
     TIME TO PEAK    (hrs)=    6.083
     RUNOFF VOLUME    (mm)=   42.619
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .484

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
00271> ------------------------------------------------------------------------------
00272> 001:0011------------------------------------------------------------------------
00273> * Catchment 104 - South of Conrail - Pre-Development
00274> ----------------------
00275> | DESIGN NASHYD      |   Area    (ha)=    2.21   Curve Number   (CN)=76.00
00276> | 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00277> ----------------------   U.H. Tp(hrs)=    .230
00278>
00279>      Unit Hyd Qpeak  (cms)=     .367
00280>
00281>      PEAK FLOW       (cms)=     .048 (i)
00282>      TIME TO PEAK    (hrs)=    6.017
00283>      RUNOFF VOLUME    (mm)=   44.928
00284>      TOTAL RAINFALL   (mm)=   88.060
00285>      RUNOFF COEFFICIENT   =     .510
00286>
00287>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00288>
00289> ------------------------------------------------------------------------------
00290> 001:0012------------------------------------------------------------------------
00291> * Catchment EXT4 - Rear Lots - North Side of Site
00292> ----------------------
00293> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00294> | 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00295> ----------------------   U.H. Tp(hrs)=    .090
00296>
00297>      Unit Hyd Qpeak  (cms)=     .106
00298>
00299>      PEAK FLOW       (cms)=     .005 (i)
00300>      TIME TO PEAK    (hrs)=    6.000
00301>      RUNOFF VOLUME    (mm)=   42.619
00302>      TOTAL RAINFALL   (mm)=   88.060
00303>      RUNOFF COEFFICIENT   =     .484
00304>
00305>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00306>
00307> ------------------------------------------------------------------------------
00308> 001:0013------------------------------------------------------------------------
00309> ------------------------
00310> | ADD HYD (TOTPRE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00311> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00312>                       ID1 01:105           2.45     .050    6.05  42.62    .000
00313>                      +ID2 02:106           6.88     .140    6.08  42.62    .000
00314>                      +ID3 03:104           2.21     .048    6.02  44.93    .000
00315>                      +ID4 04:EXT4           .25     .005    6.00  42.62    .000
00316>                       ========================================================
00317>                       SUM 05:TOTPRE        11.79     .243    6.03  43.05    .000
00318>
00319>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00320>
00321> ------------------------------------------------------------------------------
00322> 001:0014------------------------------------------------------------------------
00323> *#  100yr - 24 hr SCS (NPCA)
00324> --------------------
00325> | READ STORM       |    Filename: 100yr/24hr
00326> | Ptotal= 102.88 mm|    Comments: 100yr/24hr
00327> --------------------
00328>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00329>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00330>               .25    .000 |   6.50   2.060 |  12.75  14.820 |  19.00   1.850
00331>               .50   1.130 |   6.75   2.060 |  13.00   7.610 |  19.25   1.850
00332>               .75   1.130 |   7.00   2.060 |  13.25   7.610 |  19.50   1.850
00333>              1.00   1.130 |   7.25   2.060 |  13.50   1.440 |  19.75   1.850
00334>              1.25   1.130 |   7.50   2.060 |  13.75   1.440 |  20.00   1.850
00335>              1.50   1.130 |   7.75   2.060 |  14.00   8.440 |  20.25   1.850
00336>              1.75   1.130 |   8.00   2.060 |  14.25   8.440 |  20.50   1.230
00337>              2.00   1.130 |   8.25   2.060 |  14.50   3.090 |  20.75   1.230
00338>              2.25   1.130 |   8.50   2.780 |  14.75   3.090 |  21.00   1.230
00339>              2.50   1.340 |   8.75   2.780 |  15.00   3.090 |  21.25   1.230
00340>              2.75   1.340 |   9.00   2.780 |  15.25   3.090 |  21.50   1.230
00341>              3.00   1.340 |   9.25   2.780 |  15.50   3.090 |  21.75   1.230
00342>              3.25   1.340 |   9.50   3.290 |  15.75   3.090 |  22.00   1.230
00343>              3.50   1.340 |   9.75   3.290 |  16.00   3.090 |  22.25   1.230
00344>              3.75   1.340 |  10.00   3.700 |  16.25   3.090 |  22.50   1.230
00345>              4.00   1.340 |  10.25   3.700 |  16.50   1.850 |  22.75   1.230
00346>              4.25   1.340 |  10.50   4.730 |  16.75   1.850 |  23.00   1.230
00347>              4.50   1.650 |  10.75   4.730 |  17.00   1.850 |  23.25   1.230
00348>              4.75   1.650 |  11.00   6.380 |  17.25   1.850 |  23.50   1.230
00349>              5.00   1.650 |  11.25   6.380 |  17.50   1.850 |  23.75   1.230
00350>              5.25   1.650 |  11.50   9.880 |  17.75   1.850 |  24.00   1.230
00351>              5.50   1.650 |  11.75   9.880 |  18.00   1.850 |  24.25   1.230
00352>              5.75   1.650 |  12.00  42.800 |  18.25   1.850 |
00353>              6.00   1.650 |  12.25 113.590 |  18.50   1.850 |
00354>              6.25   1.650 |  12.50  14.820 |  18.75   1.850 |
00355>
00356> ------------------------------------------------------------------------------
00357> 001:0015------------------------------------------------------------------------
00358> * Catchment 105 - North of Conrail - Pre-Development
00359> ----------------------
00360> | DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=74.00
00361> | 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00362> ----------------------   U.H. Tp(hrs)=    .330
00363>
00364>      Unit Hyd Qpeak  (cms)=     .284
00365>
00366>      PEAK FLOW       (cms)=     .234 (i)
00367>      TIME TO PEAK    (hrs)=   12.467
00368>      RUNOFF VOLUME    (mm)=   53.919
00369>      TOTAL RAINFALL   (mm)=  102.883
00370>      RUNOFF COEFFICIENT   =     .524
00371>
00372>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00373>
00374> ------------------------------------------------------------------------------
00375> 001:0016------------------------------------------------------------------------
00376> * Catchment 106 - North of Conrail - Pre-Development
00377> ----------------------
00378> | DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=74.00
00379> | 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00380> ----------------------   U.H. Tp(hrs)=    .450
00381>
00382>      Unit Hyd Qpeak  (cms)=     .584
00383>
00384>      PEAK FLOW       (cms)=     .528 (i)
00385>      TIME TO PEAK    (hrs)=   12.600
00386>      RUNOFF VOLUME    (mm)=   53.920
00387>      TOTAL RAINFALL   (mm)=  102.883
00388>      RUNOFF COEFFICIENT   =     .524
00389>
00390>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00391>
00392> ------------------------------------------------------------------------------
00393> 001:0017------------------------------------------------------------------------
00394> * Catchment 104 - South of Conrail - Pre-Development
00395> ----------------------
00396> | DESIGN NASHYD      |   Area    (ha)=    2.21   Curve Number   (CN)=76.00
00397> | 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00398> ----------------------   U.H. Tp(hrs)=    .230
00399>
00400>      Unit Hyd Qpeak  (cms)=     .367
00401>
00402>      PEAK FLOW       (cms)=     .281 (i)
00403>      TIME TO PEAK    (hrs)=   12.367
00404>      RUNOFF VOLUME    (mm)=   56.601
00405>      TOTAL RAINFALL   (mm)=  102.883
00406>      RUNOFF COEFFICIENT   =     .550
00407>
00408>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00409>
00410> ------------------------------------------------------------------------------
00411> 001:0018------------------------------------------------------------------------
00412> * Catchment EXT4 - Rear Lots - North Side of Site
00413> ----------------------
00414> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00415> | 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00416> ----------------------   U.H. Tp(hrs)=    .090
00417>
00418>      Unit Hyd Qpeak  (cms)=     .106
00419>
00420>      PEAK FLOW       (cms)=     .046 (i)
00421>      TIME TO PEAK    (hrs)=   12.267
00422>      RUNOFF VOLUME    (mm)=   53.919
00423>      TOTAL RAINFALL   (mm)=  102.883
00424>      RUNOFF COEFFICIENT   =     .524
00425>
00426>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00427>
00428> ------------------------------------------------------------------------------
00429> 001:0019------------------------------------------------------------------------
00430> ------------------------
00431> | ADD HYD (TOTPRE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00432> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00433>                       ID1 01:105           2.45     .234   12.47  53.92    .000
00434>                      +ID2 02:106           6.88     .528   12.60  53.92    .000
00435>                      +ID3 03:104           2.21     .281   12.37  56.60    .000
00436>                      +ID4 04:EXT4           .25     .046   12.27  53.92    .000
00437>                       ========================================================
00438>                       SUM 05:TOTPRE        11.79     .997   12.47  54.42    .000
00439>
00440>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00441>
00442> ------------------------------------------------------------------------------
00443> 001:0020------------------------------------------------------------------------
00444> *#  2yr - 3 hr Chicago
00445> --------------------
00446> | CHICAGO STORM    |    IDF curve parameters: A= 521.970
00447> | Ptotal= 29.78 mm |                          B=   5.280
00448> --------------------                          C=    .759
00449>                           used in:   INTENSITY =  A / (t + B)^C
00450>
00451>                           Duration of storm  =  3.00 hrs
00452>                           Storm time step    =  5.00 min
00453>                           Time to peak ratio =   .30
00454>
00455>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00456>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00457>               .08   2.827 |    .83  29.012 |   1.58   6.779 |   2.33   3.579
00458>               .17   3.090 |    .92  89.073 |   1.67   6.123 |   2.42   3.414
00459>               .25   3.417 |   1.00  39.118 |   1.75   5.594 |   2.50   3.265
00460>               .33   3.835 |   1.08  22.704 |   1.83   5.157 |   2.58   3.130
00461>               .42   4.390 |   1.17  16.029 |   1.92   4.790 |   2.67   3.007
00462>               .50   5.170 |   1.25  12.450 |   2.00   4.477 |   2.75   2.895
00463>               .58   6.352 |   1.33  10.226 |   2.08   4.207 |   2.83   2.792
00464>               .67   8.373 |   1.42   8.711 |   2.17   3.971 |   2.92   2.697
00465>               .75  12.693 |   1.50   7.613 |   2.25   3.764 |   3.00   2.609
00466>
00467> ------------------------------------------------------------------------------
00468> 001:0021------------------------------------------------------------------------
00469> * Catchment 105 - North of Conrail - Pre-Development
00470> ----------------------
00471> | DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=74.00
00472> | 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00473> ----------------------   U.H. Tp(hrs)=    .330
00474>
00475>      Unit Hyd Qpeak  (cms)=     .284
00476>
00477>      PEAK FLOW       (cms)=     .036 (i)
00478>      TIME TO PEAK    (hrs)=    1.383
00479>      RUNOFF VOLUME    (mm)=    6.804
00480>      TOTAL RAINFALL   (mm)=   29.778
00481>      RUNOFF COEFFICIENT   =     .228
00482>
00483>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00484>
00485> ------------------------------------------------------------------------------
00486> 001:0022------------------------------------------------------------------------
00487> * Catchment 106 - North of Conrail - Pre-Development
00488> ----------------------
00489> | DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=74.00
00490> | 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00491> ----------------------   U.H. Tp(hrs)=    .450
00492>
00493>      Unit Hyd Qpeak  (cms)=     .584
00494>
00495>      PEAK FLOW       (cms)=     .085 (i)
00496>      TIME TO PEAK    (hrs)=    1.550
00497>      RUNOFF VOLUME    (mm)=    6.804
00498>      TOTAL RAINFALL   (mm)=   29.778
00499>      RUNOFF COEFFICIENT   =     .228
00500>
00501>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00502>
00503> ------------------------------------------------------------------------------
00504> 001:0023------------------------------------------------------------------------
00505> * Catchment 104 - South of Conrail - Pre-Development
00506> ----------------------
00507> | DESIGN NASHYD      |   Area    (ha)=    2.21   Curve Number   (CN)=76.00
00508> | 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00509> ----------------------   U.H. Tp(hrs)=    .230
00510>
00511>      Unit Hyd Qpeak  (cms)=     .367
00512>
00513>      PEAK FLOW       (cms)=     .044 (i)
00514>      TIME TO PEAK    (hrs)=    1.233
00515>      RUNOFF VOLUME    (mm)=    7.371
00516>      TOTAL RAINFALL   (mm)=   29.778
00517>      RUNOFF COEFFICIENT   =     .248
00518>
00519>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00520>
00521> ------------------------------------------------------------------------------
00522> 001:0024------------------------------------------------------------------------
00523> * Catchment EXT4 - Rear Lots - North Side of Site
00524> ----------------------
00525> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00526> | 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00527> ----------------------   U.H. Tp(hrs)=    .090
00528>
00529>      Unit Hyd Qpeak  (cms)=     .106
00530>
00531>      PEAK FLOW       (cms)=     .007 (i)
00532>      TIME TO PEAK    (hrs)=    1.017
00533>      RUNOFF VOLUME    (mm)=    6.804
00534>      TOTAL RAINFALL   (mm)=   29.778
00535>      RUNOFF COEFFICIENT   =     .228
00536>
00537>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00538>
00539> ------------------------------------------------------------------------------
00540> 001:0025------------------------------------------------------------------------
```

```
00541> ------------------------
00542> | ADD HYD (TOTPRE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00543> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00544>                        ID1 01:105          2.45     .036    1.38   6.80    .000
00545>                       +ID2 02:106          6.88     .085    1.55   6.80    .000
00546>                       +ID3 03:104          2.21     .044    1.23   7.37    .000
00547>                       +ID4 04:EXT4          .25     .007    1.02   6.80    .000
00548>                        ============================================================
00549>                        SUM 05:TOTPRE       11.79     .157    1.40   6.91    .000
00550>
00551>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00552>
00553> ------------------------------------------------------------------------------
00554> 001:0026--------------------------------------------------------------------------
00555>       FINISH
00556> ------------------------------------------------------------------------------
00557> ******************************************************************************
00558>      WARNINGS / ERRORS / NOTES
00559>      -------------------------
00560>    Simulation ended on 2019-12-13     at 10:46:03
00561> ==============================================================================
00562>
00563>
```

INPUT FILE: North Side, Post- Development, 100-Year Storm

(C:\...Post1.dat)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00004> *#  Date        : 01-31-2020
00005> *#  Modeller    : [L.Garner]
00006> *#  Company     : R. J. Burnside & Associates Ltd.
00007> *#  License #   :  3877524
00008> *#*************************************************************************
00009> START              TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00010> *%                   [  ] <--storm filename, one per line for NSTORM time
00011> *%-----------------|---------------------------------------------------------|
00012> *%-----------------|---------------------------------------------------------|
00013> *%-----------------|---------------------------------------------------------|
00014> *#
00015> *#  Model created to confirm pond volumes required for the north pond based on
00016> *#  meeting pre-development release rates
00017> *#
00018> *#
00019> *#  CN as per Ontario Soils Map for Welland County
00020> *#  TIMP / XIMP and TP as per RJB investigation
00021> *#
00022> *%-----------------|---------------------------------------------------------|
00023> *%-----------------|---------------------------------------------------------|
00024> *#  100yr - 3 hr Chicago
00025> CHICAGO STORM      IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00026>                     ICASEcs=[1],
00027>                      A=[1264.57],  B=[7.72], and C=[0.7814],
00028> *%-----------------|---------------------------------------------------------|
00029> * Catchment 209 - North Side Post-Development Controlled
00030> *%-----------------|---------------------------------------------------------|
00031> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.27](ha),
00032>                     XIMP=[0.39], TIMP=[0.56], DWF=[0](cms), LOSS=[2], CN=[74],
00033>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00034> *%-----------------|---------------------------------------------------------|
00035> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00036> *%-----------------|---------------------------------------------------------|
00037> DESIGN STANDHYD     ID=[2], NHYD=["210"], DT=[1]min, AREA=[2.68](ha),
00038>                     XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[75],
00039>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00040> *%-----------------|---------------------------------------------------------|
00041> * Catchment 205 - DUALHYD Max 5 Year Flow to Pond
00042> *%-----------------|---------------------------------------------------------|
00043> COMPUTE DUALHYD     IDin=[2], CINLET=[0.460](cms), NINLET=[1],
00044>                     MAJID=[3], MajNHYD=["OnSiteControl"],
00045>                     MINID=[4], MinNHYD=["ToPond"],
00046>                     TMJSTO=[   ](cu-m)
00047> *%-----------------|---------------------------------------------------------|
00048> * Catchment EXT4 - Rear Lots - North Side of Site
00049> *%-----------------|---------------------------------------------------------|
00050> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00051>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00052>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00053> *%-----------------|---------------------------------------------------------|
00054> * Catchment UNC3 - ROW Post-Development Uncontrolled
00055> *%-----------------|---------------------------------------------------------|
00056> DESIGN STANDHYD     ID=[5], NHYD=["UNC3"], DT=[1]min, AREA=[0.89](ha),
00057>                     XIMP=[0.7], TIMP=[0.9], DWF=[0](cms), LOSS=[2], CN=[77],
00058>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00059> *%-----------------|---------------------------------------------------------|
00060> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00061> *%-----------------|---------------------------------------------------------|
00062> DESIGN NASHYD       ID=[6], NHYD=["UNC4"], DT=[1]min, AREA=[0.16](ha),
00063>                     DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00064>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00065> *%-----------------|---------------------------------------------------------|
00066> * Total Uncontrolled Flow
00067> *%-----------------|---------------------------------------------------------|
00068> ADD HYD             IDsum=[7], NHYD=["TotUnc"], IDs to add=[5,6]
00069> *%-----------------|---------------------------------------------------------|
00070> * Total Flow to Pond
00071> *%-----------------|---------------------------------------------------------|
00072> ADD HYD             IDsum=[8], NHYD=["TotPond"], IDs to add=[4,1,2]
00073> *%-----------------|---------------------------------------------------------|
00074> ROUTE RESERVOIR     IDout=[9],   NHYD=["NorthPond"],  IDin=[8],
00075>                     RDT=[1](min),
00076>                          TABLE of ( OUTFLOW-STORAGE ) values
00077>                                    (cms) - (ha-m)
00078>                                  [   0.0  ,  0.0 ]
00079>                                  [   0.30,  0.33 ]
00080>                                  [   -1   ,  -1  ]  (max twenty pts)
00081>                          IDovf=[   ], NHYDovf=[   ]
00082> *%-----------------|---------------------------------------------------------|
00083> *#  100yr - 12 hr AES (NPCA)
00084> MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
00085>                     CURVE_FILENAME=["AES-12HR.mst"]
00086> *%-----------------|---------------------------------------------------------|
00087> * Catchment 209 - North Side Post-Development Controlled
00088> *%-----------------|---------------------------------------------------------|
00089> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.27](ha),
00090>                     XIMP=[0.39], TIMP=[0.56], DWF=[0](cms), LOSS=[2], CN=[74],
00091>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00092> *%-----------------|---------------------------------------------------------|
00093> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00094> *%-----------------|---------------------------------------------------------|
00095> DESIGN STANDHYD     ID=[2], NHYD=["210"], DT=[1]min, AREA=[2.68](ha),
00096>                     XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[75],
00097>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00098> *%-----------------|---------------------------------------------------------|
00099> * Catchment 205 - DUALHYD Max 5 Year Flow to Pond
00100> *%-----------------|---------------------------------------------------------|
00101> COMPUTE DUALHYD     IDin=[2], CINLET=[0.054](cms), NINLET=[1],
00102>                     MAJID=[3], MajNHYD=["OnSiteControl"],
00103>                     MINID=[4], MinNHYD=["ToPond"],
00104>                     TMJSTO=[   ](cu-m)
00105> *%-----------------|---------------------------------------------------------|
00106> * Catchment EXT4 - Rear Lots - North Side of Site
00107> *%-----------------|---------------------------------------------------------|
00108> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00109>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00110>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00111> *%-----------------|---------------------------------------------------------|
00112> * Catchment UNC3 - ROW Post-Development Uncontrolled
00113> *%-----------------|---------------------------------------------------------|
00114> DESIGN STANDHYD     ID=[5], NHYD=["UNC3"], DT=[1]min, AREA=[0.89](ha),
00115>                     XIMP=[0.7], TIMP=[0.9], DWF=[0](cms), LOSS=[2], CN=[77],
00116>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00117> *%-----------------|---------------------------------------------------------|
00118> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00119> *%-----------------|---------------------------------------------------------|
00120> DESIGN NASHYD       ID=[6], NHYD=["UNC4"], DT=[1]min, AREA=[0.16](ha),
00121>                     DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00122>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00123> *%-----------------|---------------------------------------------------------|
00124> * Total Uncontrolled Flow
00125> *%-----------------|---------------------------------------------------------|
00126> ADD HYD             IDsum=[7], NHYD=["TotUnc"], IDs to add=[5,6]
00127> *%-----------------|---------------------------------------------------------|
00128> * Total Flow to Pond
00129> *%-----------------|---------------------------------------------------------|
00130> ADD HYD             IDsum=[8], NHYD=["TotPond"], IDs to add=[4,1,2]
00131> *%-----------------|---------------------------------------------------------|
00132> *#  100yr - 24 hr SCS (NPCA)
00133> READ STORM          STORM_FILENAME=["100Y24.STM"]
00134> *%-----------------|---------------------------------------------------------|
00135> * Catchment 209 - North Side Post-Development Controlled
00136> *%-----------------|---------------------------------------------------------|
00137> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.27](ha),
00138>                     XIMP=[0.39], TIMP=[0.56], DWF=[0](cms), LOSS=[2], CN=[74],
00139>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00140> *%-----------------|---------------------------------------------------------|
00141> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00142> *%-----------------|---------------------------------------------------------|
00143> DESIGN STANDHYD     ID=[2], NHYD=["210"], DT=[1]min, AREA=[2.68](ha),
00144>                     XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[75],
00145>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00146> *%-----------------|---------------------------------------------------------|
00147> * Catchment 205 - DUALHYD Max 5 Year Flow to Pond
00148> *%-----------------|---------------------------------------------------------|
00149> COMPUTE DUALHYD     IDin=[2], CINLET=[0.430](cms), NINLET=[1],
00150>                     MAJID=[3], MajNHYD=["OnSiteControl"],
00151>                     MINID=[4], MinNHYD=["ToPond"],
00152>                     TMJSTO=[   ](cu-m)
00153> *%-----------------|---------------------------------------------------------|
00154> * Catchment EXT4 - Rear Lots - North Side of Site
00155> *%-----------------|---------------------------------------------------------|
00156> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00157>                     DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00158>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00159> *%-----------------|---------------------------------------------------------|
00160> * Catchment UNC3 - ROW Post-Development Uncontrolled
00161> *%-----------------|---------------------------------------------------------|
00162> DESIGN STANDHYD     ID=[5], NHYD=["UNC3"], DT=[1]min, AREA=[0.89](ha),
00163>                     XIMP=[0.7], TIMP=[0.9], DWF=[0](cms), LOSS=[2], CN=[77],
00164>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00165> *%-----------------|---------------------------------------------------------|
00166> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00167> *%-----------------|---------------------------------------------------------|
00168> DESIGN NASHYD       ID=[6], NHYD=["UNC4"], DT=[1]min, AREA=[0.16](ha),
00169>                     DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00170>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00171> *%-----------------|---------------------------------------------------------|
00172> * Total Uncontrolled Flow
00173> *%-----------------|---------------------------------------------------------|
00174> ADD HYD             IDsum=[7], NHYD=["TotUnc"], IDs to add=[5,6]
00175> *%-----------------|---------------------------------------------------------|
00176> * Total Flow to Pond
00177> *%-----------------|---------------------------------------------------------|
00178> ADD HYD             IDsum=[8], NHYD=["TotPond"], IDs to add=[4,1,2]
00179> *%-----------------|---------------------------------------------------------|
00180> *%-----------------|---------------------------------------------------------|
00181> FINISH
00182>
00183>
00184>
00185>
00186>
00187>
00188>
00189>
00190>
00191>
00192>
```

OUTPUT FILE: North Side, Post- Development, 100-Year Storm

(C:\...Post1.out)

```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
00008>                                                           9   9  9   9   # 3877524
00009>          StormWater Management HYdrologic Model            999    999    =========
00010>
00011> ********************************************************************************
00012> ***************************** SWMHYMO Ver/4.05  ********************************
00013> *********  A single event and continuous hydrologic simulation model  *********
00014> *********     based on the principles of HYMO and its successors      *********
00015> *********                    OTTHYMO-83 and OTTHYMO-89.                *********
00016> ********************************************************************************
00017> ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
00018> *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019> *********                  Gatineau, Quebec: (819) 243-6858           *********
00020> *********                  E-Mail: swmhymo@jfsa.com                   *********
00021> ********************************************************************************
00022>
00023> +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024> +++++++++ Licensed user: R.J. Burnside & Associates Ltd                +++++++++
00025> +++++++++                Brampton             SERIAL#:3877524        +++++++++
00026> +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028> ********************************************************************************
00029> *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030> *********           Maximum value for ID numbers  :     10            *********
00031> *********           Max. number of rainfall points: 105408            *********
00032> *********           Max. number of flow points    : 105408            *********
00033> ********************************************************************************
00034>
00035>
00036> *********************   D E T A I L E D   O U T P U T   **********************
00037> ********************************************************************************
00038> *         DATE: 2020-01-31     TIME: 11:52:26     RUN COUNTER: 002327         *
00039> ********************************************************************************
00040> * Input   filename: C:\SWMHYM~1\Niagara\Post1.dat                               *
00041> * Output  filename: C:\SWMHYM~1\Niagara\Post1.out                               *
00042> * Summary filename: C:\SWMHYM~1\Niagara\Post1.sum                               *
00043> * User comments:                                                               *
00044> * 1:_____________________________________________________________________________*
00045> * 2:_____________________________________________________________________________*
00046> * 3:_____________________________________________________________________________*
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00053> *#  Date        : 01-31-2020
00054> *#  Modeller    : [L.Garner]
00055> *#  Company     : R. J. Burnside & Associates Ltd.
00056> *#  License #   :  3877524
00057> *#*****************************************************************************
00058> --------------------
00059> | START            |  Project  dir.: C:\SWMHYM~1\Niagara\
00060> --------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\
00061>     TZERO =   .00 hrs on        0
00062>     METOUT=   2 (output = METRIC)
00063>     NRUN  = 001
00064>     NSTORM=   0
00065> --------------------------------------------------------------------------------
00066> 001:0002--------------------------------------------------------------------------
00067> *#
00068> *#  Model created to confirm pond volumes required for the north pond based on
00069> *#  meeting pre-development release rates
00070> *#
00071> *#
00072> *#  CN as per Ontario Soils Map for Welland County
00073> *#  TIMP / XIMP and TP as per RJB investigation
00074> *#
00075> *#  100yr - 3 hr Chicago
00076> --------------------
00077> | CHICAGO STORM    |    IDF curve parameters: A=1264.570
00078> | Ptotal= 63.46 mm |                          B=   7.720
00079> --------------------                          C=    .781
00080>                         used in:   INTENSITY =  A / (t + B)^C
00081>
00082>                         Duration of storm  =  3.00 hrs
00083>                         Storm time step    =  5.00 min
00084>                         Time to peak ratio =   .30
00085>
00086>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00087>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00088>               .08   5.780 |    .83  65.130 |   1.58  14.790 |   2.33   7.441
00089>               .17   6.357 |    .92 173.339 |   1.67  13.260 |   2.42   7.073
00090>               .25   7.080 |   1.00  86.681 |   1.75  12.031 |   2.50   6.743
00091>               .33   8.014 |   1.08  51.858 |   1.83  11.023 |   2.58   6.445
00092>               .42   9.270 |   1.17  36.584 |   1.92  10.181 |   2.67   6.175
00093>               .50  11.054 |   1.25  28.183 |   2.00   9.467 |   2.75   5.929
00094>               .58  13.793 |   1.33  22.923 |   2.08   8.854 |   2.83   5.703
00095>               .67  18.543 |   1.42  19.339 |   2.17   8.321 |   2.92   5.496
00096>               .75  28.749 |   1.50  16.748 |   2.25   7.854 |   3.00   5.305
00097>
00098> --------------------------------------------------------------------------------
00099> 001:0003--------------------------------------------------------------------------
00100> * Catchment 209 - North Side Post-Development Controlled
00101> ----------------------
00102> | DESIGN STANDHYD    |   Area    (ha)=    8.27
00103> | 01:209    DT= 1.00 |   Total Imp(%)=   56.00   Dir. Conn.(%)=   39.00
00104> ----------------------
00105>                              IMPERVIOUS    PERVIOUS (i)
00106>      Surface Area     (ha)=       4.63         3.64
00107>      Dep. Storage     (mm)=        .80         1.50
00108>      Average Slope     (%)=        .50          .50
00109>      Length            (m)=     234.81        40.00
00110>      Mannings n            =       .013         .250
00111>
00112>      Max.eff.Inten.(mm/hr)=     173.34        65.56
00113>                    over (min)       4.00        17.00
00114>      Storage Coeff.  (min)=       4.21 (ii)   16.88 (ii)
00115>      Unit Hyd. Tpeak (min)=       4.00        17.00
00116>      Unit Hyd. peak  (cms)=        .27          .07
00117>                                                          *TOTALS*
00118>      PEAK FLOW       (cms)=       1.14          .40         1.254 (iii)
00119>      TIME TO PEAK    (hrs)=        .95         1.23          .950
00120>      RUNOFF VOLUME    (mm)=      62.66        30.70        43.163
00121>      TOTAL RAINFALL   (mm)=      63.46        63.46        63.460
00122>      RUNOFF COEFFICIENT   =        .99          .48          .680
00123>
00124>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00125>            CN* =  74.0    Ia = Dep. Storage  (Above)
00126>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00127>            THAN THE STORAGE COEFFICIENT.
00128>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00129>
00130> --------------------------------------------------------------------------------
00131> 001:0004--------------------------------------------------------------------------
00132> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00133> ----------------------
00134> | DESIGN STANDHYD    |   Area    (ha)=    2.68
00135> | 02:210    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00136> ----------------------
00137>                              IMPERVIOUS    PERVIOUS (i)
00138>      Surface Area     (ha)=       2.41          .27
00139>      Dep. Storage     (mm)=        .80         1.50
00140>      Average Slope     (%)=        .50          .50
00141>      Length            (m)=     133.67        40.00
00142>      Mannings n            =       .013         .250
00143>
00144>      Max.eff.Inten.(mm/hr)=     173.34       274.78
00145>                    over (min)       3.00        10.00
00146>      Storage Coeff.  (min)=       3.00 (ii)   10.14 (ii)
00147>      Unit Hyd. Tpeak (min)=       3.00        10.00
00148>      Unit Hyd. peak  (cms)=        .37          .11
00149>                                                          *TOTALS*
00150>      PEAK FLOW       (cms)=        .75          .13          .808 (iii)
00151>      TIME TO PEAK    (hrs)=        .93         1.07          .933
00152>      RUNOFF VOLUME    (mm)=      62.66        43.47        56.904
00153>      TOTAL RAINFALL   (mm)=      63.46        63.46        63.460
00154>      RUNOFF COEFFICIENT   =        .99          .69          .897
00155>
00156>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00157>            CN* =  75.0    Ia = Dep. Storage  (Above)
00158>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00159>            THAN THE STORAGE COEFFICIENT.
00160>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00161>
00162> --------------------------------------------------------------------------------
00163> 001:0005--------------------------------------------------------------------------
00164> * Catchment 205 - DUALHYD Max 5 Year Flow to Pond
00165> ----------------------
00166> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .460  (cms)
00167> | TotalHyd 02:210    |   Number of inlets in system [NINLET] =      1
00168> ----------------------   Total minor system capacity          =    .460  (cms)
00169>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00170>
00171>                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00172>                                  (ha)     (cms)     (hrs)     (mm)    (cms)
00173>      TOTAL HYD.   02:210          2.68      .808      .933   56.904     .000
00174>      ================================================================
00175>      MAJOR SYST   03:OnSite         .26      .348      .933   56.904     .000
00176>      MINOR SYST   04:ToPond       2.42      .460      .867   56.904     .000
00177>
00178>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00179>
00180> --------------------------------------------------------------------------------
00181> 001:0006--------------------------------------------------------------------------
00182> * Catchment EXT4 - Rear Lots - North Side of Site
00183> ----------------------
00184> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00185> | 02:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00186> ----------------------   U.H. Tp(hrs)=    .090
00187>
00188>      Unit Hyd Qpeak  (cms)=     .106
00189>
00190>      PEAK FLOW       (cms)=     .028 (i)
00191>      TIME TO PEAK    (hrs)=    1.017
00192>      RUNOFF VOLUME    (mm)=   25.389
00193>      TOTAL RAINFALL   (mm)=   63.460
00194>      RUNOFF COEFFICIENT   =     .400
00195>
00196>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00197>
00198> --------------------------------------------------------------------------------
00199> 001:0007--------------------------------------------------------------------------
00200> * Catchment UNC3 - ROW Post-Development Uncontrolled
00201> ----------------------
00202> | DESIGN STANDHYD    |   Area    (ha)=     .89
00203> | 05:UNC3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00204> ----------------------
00205>                              IMPERVIOUS    PERVIOUS (i)
00206>      Surface Area     (ha)=        .80          .09
00207>      Dep. Storage     (mm)=        .80         1.50
00208>      Average Slope     (%)=        .50          .50
00209>      Length            (m)=      77.03        40.00
00210>      Mannings n            =       .013         .250
00211>
00212>      Max.eff.Inten.(mm/hr)=     173.34       293.75
00213>                    over (min)       2.00         9.00
00214>      Storage Coeff.  (min)=       2.16 (ii)    9.11 (ii)
00215>      Unit Hyd. Tpeak (min)=       2.00         9.00
00216>      Unit Hyd. peak  (cms)=        .53          .12
00217>                                                          *TOTALS*
00218>      PEAK FLOW       (cms)=        .27          .05          .296 (iii)
00219>      TIME TO PEAK    (hrs)=        .92         1.05          .917
00220>      RUNOFF VOLUME    (mm)=      62.66        44.92        57.337
00221>      TOTAL RAINFALL   (mm)=      63.46        63.46        63.460
00222>      RUNOFF COEFFICIENT   =        .99          .71          .904
00223>
00224>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00225>            CN* =  77.0    Ia = Dep. Storage  (Above)
00226>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00227>            THAN THE STORAGE COEFFICIENT.
00228>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00229>
00230> --------------------------------------------------------------------------------
00231> 001:0008--------------------------------------------------------------------------
00232> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00233> ----------------------
00234> | DESIGN NASHYD      |   Area    (ha)=     .16   Curve Number   (CN)=74.00
00235> | 06:UNC4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00236> ----------------------   U.H. Tp(hrs)=    .110
00237>
00238>      Unit Hyd Qpeak  (cms)=     .056
00239>
00240>      PEAK FLOW       (cms)=     .016 (i)
00241>      TIME TO PEAK    (hrs)=    1.050
00242>      RUNOFF VOLUME    (mm)=   25.389
00243>      TOTAL RAINFALL   (mm)=   63.460
00244>      RUNOFF COEFFICIENT   =     .400
00245>
00246>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00247>
00248> --------------------------------------------------------------------------------
00249> 001:0009--------------------------------------------------------------------------
00250> * Total Uncontrolled Flow
00251> ------------------------
00252> | ADD HYD (TotUnc    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00253> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00254>                         ID1 05:UNC3         .89     .296     .92  57.34    .000
00255>                        +ID2 06:UNC4         .16     .016    1.05  25.39    .000
00256>                         ========================================================
00257>                         SUM 07:TotUnc       1.05     .304     .92  52.47    .000
00258>
00259>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00260>
00261> --------------------------------------------------------------------------------
00262> 001:0010--------------------------------------------------------------------------
00263> * Total Flow to Pond
00264> ------------------------
00265> | ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00266> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00267>                         ID1 04:ToPond       2.42     .460     .87  56.90    .000
00268>                        +ID2 01:209          8.27    1.254     .95  43.16    .000
00269>                        +ID3 02:EXT4          .25     .028    1.02  25.39    .000
00270>                         ========================================================
```

```
                    SUM 08:TotPond       10.94    1.737     .95  45.80    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0011--------------------------------------------------------------------------
 ---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(TotPon)   |
| OUT<09:(NorthP)   |    =========  OUTLFOW STORAGE TABLE  =========
 ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00   |     .300  .3300E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (TotPon)       10.94     1.737      .950      45.797
     OUTFLOW<09: (NorthP)       10.94      .287     2.133      45.796

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   16.495
                   TIME SHIFT OF PEAK FLOW         (min)=    71.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3152E+00

001:0012--------------------------------------------------------------------------
*#  100yr - 12 hr AES (NPCA)
 --------------------
| MASS STORM        |    Filename: C:\SWMHYM~1\Niagara\AES-12HR.mst
| Ptotal= 88.06 mm  |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
 --------------------
                        Duration of storm        =   12.00 hrs
                        Mass curve time step     =   60.00 min
                        Selected storm time step =    5.00 min
                        Volume of derived storm  =   88.06 mm

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   4.403 |   3.08   9.687 |   6.08   7.925 |   9.08   5.284
               .17   4.403 |   3.17   9.687 |   6.17   7.925 |   9.17   5.284
               .25   4.403 |   3.25   9.687 |   6.25   7.925 |   9.25   5.284
               .33   4.403 |   3.33   9.687 |   6.33   7.925 |   9.33   5.284
               .42   4.403 |   3.42   9.687 |   6.42   7.925 |   9.42   5.284
               .50   4.403 |   3.50   9.687 |   6.50   7.925 |   9.50   5.284
               .58   4.403 |   3.58   9.687 |   6.58   7.925 |   9.58   5.284
               .67   4.403 |   3.67   9.687 |   6.67   7.925 |   9.67   5.284
               .75   4.403 |   3.75   9.687 |   6.75   7.925 |   9.75   5.284
               .83   4.403 |   3.83   9.687 |   6.83   7.925 |   9.83   5.284
               .92   4.403 |   3.92   9.687 |   6.92   7.925 |   9.92   5.284
              1.00   4.403 |   4.00   9.687 |   7.00   7.925 |  10.00   5.284
              1.08   8.806 |   4.08  13.209 |   7.08   7.925 |  10.08   1.761
              1.17   8.806 |   4.17  13.209 |   7.17   7.925 |  10.17   1.761
              1.25   8.806 |   4.25  13.209 |   7.25   7.925 |  10.25   1.761
              1.33   8.806 |   4.33  13.209 |   7.33   7.925 |  10.33   1.761
              1.42   8.806 |   4.42  13.209 |   7.42   7.925 |  10.42   1.761
              1.50   8.806 |   4.50  13.209 |   7.50   7.925 |  10.50   1.761
              1.58   8.806 |   4.58  13.209 |   7.58   7.925 |  10.58   1.761
              1.67   8.806 |   4.67  13.209 |   7.67   7.925 |  10.67   1.761
              1.75   8.806 |   4.75  13.209 |   7.75   7.925 |  10.75   1.761
              1.83   8.806 |   4.83  13.209 |   7.83   7.925 |  10.83   1.761
              1.92   8.806 |   4.92  13.209 |   7.92   7.925 |  10.92   1.761
              2.00   8.806 |   5.00  13.209 |   8.00   7.925 |  11.00   1.761
              2.08  10.567 |   5.08  12.328 |   8.08   5.284 |  11.08    .881
              2.17  10.567 |   5.17  12.328 |   8.17   5.284 |  11.17    .881
              2.25  10.567 |   5.25  12.328 |   8.25   5.284 |  11.25    .881
              2.33  10.567 |   5.33  12.328 |   8.33   5.284 |  11.33    .881
              2.42  10.567 |   5.42  12.328 |   8.42   5.284 |  11.42    .881
              2.50  10.567 |   5.50  12.328 |   8.50   5.284 |  11.50    .881
              2.58  10.567 |   5.58  12.328 |   8.58   5.284 |  11.58    .881
              2.67  10.567 |   5.67  12.328 |   8.67   5.284 |  11.67    .881
              2.75  10.567 |   5.75  12.328 |   8.75   5.284 |  11.75    .881
              2.83  10.567 |   5.83  12.328 |   8.83   5.284 |  11.83    .881
              2.92  10.567 |   5.92  12.328 |   8.92   5.284 |  11.92    .881
              3.00  10.567 |   6.00  12.328 |   9.00   5.284 |  12.00    .881

001:0013--------------------------------------------------------------------------
* Catchment 209 - North Side Post-Development Controlled
 ---------------------
| DESIGN STANDHYD    |   Area    (ha)=    8.27
| 01:209    DT= 1.00 |   Total Imp(%)=   56.00   Dir. Conn.(%)=   39.00
 ---------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       4.63         3.64
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     234.81        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        12.04
                   over (min)        12.00        37.00
     Storage Coeff.  (min)=      11.80 (ii)   36.74 (ii)
     Unit Hyd. Tpeak (min)=      12.00        37.00
     Unit Hyd. peak  (cms)=        .10          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .12          .11          .225 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.13         6.000
     RUNOFF VOLUME    (mm)=      87.25        49.97        64.522
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .57          .733

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    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.

001:0014--------------------------------------------------------------------------
* Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
 ---------------------
| DESIGN STANDHYD    |   Area    (ha)=    2.68
| 02:210    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
 ---------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.41         .27
     Dep. Storage     (mm)=        .80        1.50
     Average Slope     (%)=        .50         .50
     Length            (m)=     133.67        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      13.21        33.47
                   over (min)        8.00        25.00
     Storage Coeff.  (min)=       8.41 (ii)   24.99 (ii)
     Unit Hyd. Tpeak (min)=       8.00        25.00
     Unit Hyd. peak  (cms)=        .14          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .07          .02          .092 (iii)
     TIME TO PEAK    (hrs)=       5.00         6.02         5.017
     RUNOFF VOLUME    (mm)=      87.25        66.20        80.947
     TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
     RUNOFF COEFFICIENT   =        .99          .75          .919

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    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.

001:0015--------------------------------------------------------------------------
* Catchment 205 - DUALHYD Max 5 Year Flow to Pond
 ---------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .054  (cms)
| TotalHyd 02:210    |   Number of inlets in system [NINLET] =      1
 ---------------------   Total minor system capacity           =    .054  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                    ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                     (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   02:210          2.68      .092     5.017   80.947     .000
     ==========================================================================
     MAJOR SYST   03:OnSite        .47      .038     5.017   80.947     .000
     MINOR SYST   04:ToPond       2.21      .054     2.067   80.947     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0016--------------------------------------------------------------------------
* Catchment EXT4 - Rear Lots - North Side of Site
 ---------------------
| DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
| 02:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
 ---------------------   U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .106

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    6.000
     RUNOFF VOLUME    (mm)=   42.619
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .484

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0017--------------------------------------------------------------------------
* Catchment UNC3 - ROW Post-Development Uncontrolled
 ---------------------
| DESIGN STANDHYD    |   Area    (ha)=     .89
| 05:UNC3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
 ---------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .80          .09
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=       .50          .50
     Length            (m)=     77.03        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     13.21        34.30
                   over (min)        6.00        22.00
     Storage Coeff.  (min)=      6.04 (ii)   22.46 (ii)
     Unit Hyd. Tpeak (min)=      6.00        22.00
     Unit Hyd. peak  (cms)=       .19          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       .02          .01          .031 (iii)
     TIME TO PEAK    (hrs)=      5.00         6.00         5.000
     RUNOFF VOLUME    (mm)=     87.25        67.93        81.463
     TOTAL RAINFALL   (mm)=     88.06        88.06        88.060
     RUNOFF COEFFICIENT   =       .99          .77          .925

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  77.0    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.

001:0018--------------------------------------------------------------------------
* Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
 ---------------------
| DESIGN NASHYD      |   Area    (ha)=     .16   Curve Number   (CN)=74.00
| 06:UNC4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
 ---------------------   U.H. Tp(hrs)=    .110

     Unit Hyd Qpeak  (cms)=     .056

     PEAK FLOW       (cms)=     .003 (i)
     TIME TO PEAK    (hrs)=    6.000
     RUNOFF VOLUME    (mm)=   42.618
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .484

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0019--------------------------------------------------------------------------
* Total Uncontrolled Flow
 ------------------------
| ADD HYD (TotUnc    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
 ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 05:UNC3          .89     .031    5.00  81.46    .000
                      +ID2 06:UNC4           .16     .003    6.00  42.62    .000
                        ==========================================================
                        SUM 07:TotUnc        1.05     .034    5.00  75.54    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0020--------------------------------------------------------------------------
* Total Flow to Pond
 ------------------------
| ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
 ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 04:ToPond        2.21     .054    2.07  80.95    .000
                      +ID2 01:209            8.27     .225    6.00  64.52    .000
                      +ID3 02:EXT4            .25     .005    6.00  42.62    .000
                        ==========================================================
                        SUM 08:TotPond      10.73     .284    6.00  67.40    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0021--------------------------------------------------------------------------
*#  100yr - 24 hr SCS (NPCA)
 --------------------
| READ STORM        |    Filename: 100yr/24hr
| Ptotal= 102.88 mm |    Comments: 100yr/24hr
 --------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   6.50   2.060 |  12.75  14.820 |  19.00   1.850
               .50   1.130 |   6.75   2.060 |  13.00   7.610 |  19.25   1.850
               .75   1.130 |   7.00   2.060 |  13.25   7.610 |  19.50   1.850
              1.00   1.130 |   7.25   2.060 |  13.50   1.440 |  19.75   1.850
              1.25   1.130 |   7.50   2.060 |  13.75   1.440 |  20.00   1.850
              1.50   1.130 |   7.75   2.060 |  14.00   8.440 |  20.25   1.850
              1.75   1.130 |   8.00   2.060 |  14.25   8.440 |  20.50   1.230
              2.00   1.130 |   8.25   2.060 |  14.50   3.090 |  20.75   1.230
              2.25   1.130 |   8.50   2.780 |  14.75   3.090 |  21.00   1.230
              2.50   1.340 |   8.75   2.780 |  15.00   3.090 |  21.25   1.230
```

```
00541>              2.75   1.340 |   9.00   2.780 |  15.25   3.090 |  21.50   1.230
00542>              3.00   1.340 |   9.25   2.780 |  15.50   3.090 |  21.75   1.230
00543>              3.25   1.340 |   9.50   3.290 |  15.75   3.090 |  22.00   1.230
00544>              3.50   1.340 |   9.75   3.290 |  16.00   3.090 |  22.25   1.230
00545>              3.75   1.340 |  10.00   3.700 |  16.25   3.090 |  22.50   1.230
00546>              4.00   1.340 |  10.25   3.700 |  16.50   1.850 |  22.75   1.230
00547>              4.25   1.340 |  10.50   4.730 |  16.75   1.850 |  23.00   1.230
00548>              4.50   1.650 |  10.75   4.730 |  17.00   1.850 |  23.25   1.230
00549>              4.75   1.650 |  11.00   6.380 |  17.25   1.850 |  23.50   1.230
00550>              5.00   1.650 |  11.25   6.380 |  17.50   1.850 |  23.75   1.230
00551>              5.25   1.650 |  11.50   9.880 |  17.75   1.850 |  24.00   1.230
00552>              5.50   1.650 |  11.75   9.880 |  18.00   1.850 |  24.25   1.230
00553>              5.75   1.650 |  12.00  42.800 |  18.25   1.850 |
00554>              6.00   1.650 |  12.25 113.590 |  18.50   1.850 |
00555>              6.25   1.650 |  12.50  14.820 |  18.75   1.850 |
00556>
00557> --------------------------------------------------------------------------------
00558> 001:0022------------------------------------------------------------------------
00559> * Catchment 209 - North Side Post-Development Controlled
00560> ----------------------
00561> | DESIGN STANDHYD    |   Area    (ha)=    8.27
00562> | 01:209    DT= 1.00 |   Total Imp(%)=   56.00   Dir. Conn.(%)=   39.00
00563> ----------------------
00564>                             IMPERVIOUS    PERVIOUS (i)
00565>      Surface Area     (ha)=       4.63         3.64
00566>      Dep. Storage     (mm)=        .80         1.50
00567>      Average Slope     (%)=        .50          .50
00568>      Length            (m)=     234.81        40.00
00569>      Mannings n             =       .013         .250
00570>
00571>      Max.eff.Inten.(mm/hr)=     113.59       109.36
00572>                    over (min)        5.00        15.00
00573>      Storage Coeff.  (min)=       4.99 (ii)    15.31 (ii)
00574>      Unit Hyd. Tpeak (min)=       5.00        15.00
00575>      Unit Hyd. peak  (cms)=        .23          .07
00576>                                                          *TOTALS*
00577>      PEAK FLOW       (cms)=        .97          .67         1.514 (iii)
00578>      TIME TO PEAK    (hrs)=      12.25        12.38        12.267
00579>      RUNOFF VOLUME    (mm)=     102.07        62.35        77.855
00580>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00581>      RUNOFF COEFFICIENT   =        .99          .61          .757
00582>
00583>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00584>            CN* =  74.0    Ia = Dep. Storage  (Above)
00585>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00586>            THAN THE STORAGE COEFFICIENT.
00587>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00588>
00589> --------------------------------------------------------------------------------
00590> 001:0023------------------------------------------------------------------------
00591> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00592> ----------------------
00593> | DESIGN STANDHYD    |   Area    (ha)=    2.68
00594> | 02:210    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00595> ----------------------
00596>                             IMPERVIOUS    PERVIOUS (i)
00597>      Surface Area     (ha)=       2.41         .27
00598>      Dep. Storage     (mm)=        .80        1.50
00599>      Average Slope     (%)=        .50         .50
00600>      Length            (m)=     133.67       40.00
00601>      Mannings n             =       .013         .250
00602>
00603>      Max.eff.Inten.(mm/hr)=     113.59       304.04
00604>                    over (min)        4.00        10.00
00605>      Storage Coeff.  (min)=       3.56 (ii)    10.41 (ii)
00606>      Unit Hyd. Tpeak (min)=       4.00        10.00
00607>      Unit Hyd. peak  (cms)=        .30          .11
00608>                                                          *TOTALS*
00609>      PEAK FLOW       (cms)=        .58          .17          .740 (iii)
00610>      TIME TO PEAK    (hrs)=      12.25        12.30        12.250
00611>      RUNOFF VOLUME    (mm)=     102.07        80.24        95.536
00612>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00613>      RUNOFF COEFFICIENT   =        .99          .78          .929
00614>
00615>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00616>            CN* =  75.0    Ia = Dep. Storage  (Above)
00617>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00618>            THAN THE STORAGE COEFFICIENT.
00619>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00620>
00621> --------------------------------------------------------------------------------
00622> 001:0024------------------------------------------------------------------------
00623> * Catchment 205 - DUALHYD Max 5 Year Flow to Pond
00624> ----------------------
00625> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .430  (cms)
00626> | TotalHyd 02:210    |   Number of inlets in system [NINLET] =       1
00627> ----------------------   Total minor system capacity         =    .430  (cms)
00628>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00629>
00630>                   ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00631>                                    (ha)     (cms)     (hrs)     (mm)    (cms)
00632>      TOTAL HYD.   02:210          2.68      .740    12.250   95.536     .000
00633>      ================================================================================
00634>      MAJOR SYST   03:OnSite         .21      .310    12.250   95.536     .000
00635>      MINOR SYST   04:ToPond       2.47      .430    12.067   95.536     .000
00636>
00637>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00638>
00639> --------------------------------------------------------------------------------
00640> 001:0025------------------------------------------------------------------------
00641> * Catchment EXT4 - Rear Lots - North Side of Site
00642> ----------------------
00643> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00644> | 02:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00645> ----------------------   U.H. Tp(hrs)=    .090
00646>
00647>      Unit Hyd Qpeak  (cms)=     .106
00648>
00649>      PEAK FLOW       (cms)=     .046 (i)
00650>      TIME TO PEAK    (hrs)=   12.267
00651>      RUNOFF VOLUME    (mm)=   53.919
00652>      TOTAL RAINFALL   (mm)=  102.883
00653>      RUNOFF COEFFICIENT   =     .524
00654>
00655>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00656>
00657> --------------------------------------------------------------------------------
00658> 001:0026------------------------------------------------------------------------
00659> * Catchment UNC3 - ROW Post-Development Uncontrolled
00660> ----------------------
00661> | DESIGN STANDHYD    |   Area    (ha)=     .89
00662> | 05:UNC3   DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00663> ----------------------
00664>                             IMPERVIOUS    PERVIOUS (i)
00665>      Surface Area     (ha)=        .80          .09
00666>      Dep. Storage     (mm)=        .80         1.50
00667>      Average Slope     (%)=        .50          .50
00668>      Length            (m)=      77.03        40.00
00669>      Mannings n             =       .013         .250
00670>
00671>      Max.eff.Inten.(mm/hr)=     113.59       309.93
00672>                    over (min)        3.00         9.00
00673>      Storage Coeff.  (min)=       2.56 (ii)    9.36 (ii)
00674>      Unit Hyd. Tpeak (min)=       3.00         9.00
00675>      Unit Hyd. peak  (cms)=        .42          .12
00676>                                                          *TOTALS*
00677>      PEAK FLOW       (cms)=        .20          .06          .253 (iii)
00678>      TIME TO PEAK    (hrs)=      12.25        12.30        12.250
00679>      RUNOFF VOLUME    (mm)=     102.08        82.09        96.089
00680>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00681>      RUNOFF COEFFICIENT   =        .99          .80          .934
00682>
00683>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00684>            CN* =  77.0    Ia = Dep. Storage  (Above)
00685>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00686>            THAN THE STORAGE COEFFICIENT.
00687>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00688>
00689> --------------------------------------------------------------------------------
00690> 001:0027------------------------------------------------------------------------
00691> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00692> ----------------------
00693> | DESIGN NASHYD      |   Area    (ha)=     .16   Curve Number   (CN)=74.00
00694> | 06:UNC4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00695> ----------------------   U.H. Tp(hrs)=    .110
00696>
00697>      Unit Hyd Qpeak  (cms)=     .056
00698>
00699>      PEAK FLOW       (cms)=     .028 (i)
00700>      TIME TO PEAK    (hrs)=   12.267
00701>      RUNOFF VOLUME    (mm)=   53.918
00702>      TOTAL RAINFALL   (mm)=  102.883
00703>      RUNOFF COEFFICIENT   =     .524
00704>
00705>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00706>
00707> --------------------------------------------------------------------------------
00708> 001:0028------------------------------------------------------------------------
00709> * Total Uncontrolled Flow
00710> ------------------------
00711> | ADD HYD (TotUnc     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00712> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00713>                          ID1 05:UNC3          .89     .253   12.25  96.09    .000
00714>                         +ID2 06:UNC4          .16     .028   12.27  53.92    .000
00715>                          ============================================================
00716>                          SUM 07:TotUnc        1.05     .280   12.25  89.66    .000
00717>
00718>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00719>
00720> --------------------------------------------------------------------------------
00721> 001:0029------------------------------------------------------------------------
00722> * Total Flow to Pond
00723> ------------------------
00724> | ADD HYD (TotPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00725> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00726>                          ID1 04:ToPond        2.47     .430   12.07  95.54    .000
00727>                         +ID2 01:209           8.27    1.514   12.27  77.86    .000
00728>                         +ID3 02:EXT4           .25     .046   12.27  53.92    .000
00729>                          ============================================================
00730>                          SUM 08:TotPond      10.99    1.990   12.27  81.28    .000
00731>
00732>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00733>
00734> --------------------------------------------------------------------------------
00735> 001:0030------------------------------------------------------------------------
00736>       FINISH
00737> --------------------------------------------------------------------------------
00738> ********************************************************************************
00739>      WARNINGS / ERRORS / NOTES
00740>      -------------------------
00741>    Simulation ended on 2020-01-31     at 11:52:26
00742> ================================================================================
00743>
00744>
```

(C:\...Post2.dat)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00004> *#  Date        : 11-29-2019
00005> *#  Modeller    : [L.Garner]
00006> *#  Company     : R. J. Burnside & Associates Ltd.
00007> *#  License #   :  3877524
00008> *#*************************************************************************
00009> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00010> *%                    [  ] <--storm filename, one per line for NSTORM time
00011> *%-----------------|-------------------------------------------------------|
00012> *%-----------------|-------------------------------------------------------|
00013> *%-----------------|-------------------------------------------------------|
00014> *#
00015> *#  Model created to confirm 5 year flow rates
00016> *#
00017> *#
00018> *#  CN as per Ontario Soils Map for Welland County
00019> *#  TIMP / XIMP and TP as per RJB investigation
00020> *#
00021> *%-----------------|-------------------------------------------------------|
00022> *#  5yr - 3 hr Chicago
00023> CHICAGO STORM       IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00024>                     ICASEcs=[1],
00025>                      A=[719.5],  B=[6.34], and C=[0.769],
00026> *%-----------------|-------------------------------------------------------|
00027> * Catchment 209 - North Side Post-Development Controlled
00028> *%-----------------|-------------------------------------------------------|
00029> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.27](ha),
00030>                     XIMP=[0.39], TIMP=[0.56], DWF=[0](cms), LOSS=[2], CN=[74],
00031>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00032> *%-----------------|-------------------------------------------------------|
00033> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00034> *%-----------------|-------------------------------------------------------|
00035> DESIGN STANDHYD     ID=[2], NHYD=["210"], DT=[1]min, AREA=[2.68](ha),
00036>                     XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[75],
00037>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00038> *%-----------------|-------------------------------------------------------|
00039> * Total Flow to Pond
00040> *%-----------------|-------------------------------------------------------|
00041> ADD HYD             IDsum=[3], NHYD=["TotPond"], IDs to add=[1,2]
00042> *%-----------------|-------------------------------------------------------|
00043> *#  5yr - 12 hr AES (NPCA)
00044> MASS STORM          PTOTAL=[54.56](mm), CSDT=[5](min),
00045>                     CURVE_FILENAME=["AES-12HR.mst"]
00046> *%-----------------|-------------------------------------------------------|
00047> * Catchment 209 - North Side Post-Development Controlled
00048> *%-----------------|-------------------------------------------------------|
00049> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.27](ha),
00050>                     XIMP=[0.39], TIMP=[0.56], DWF=[0](cms), LOSS=[2], CN=[74],
00051>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00052> *%-----------------|-------------------------------------------------------|
00053> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00054> *%-----------------|-------------------------------------------------------|
00055> DESIGN STANDHYD     ID=[2], NHYD=["210"], DT=[1]min, AREA=[2.68](ha),
00056>                     XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[75],
00057>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00058> *%-----------------|-------------------------------------------------------|
00059> * Total Flow to Pond
00060> *%-----------------|-------------------------------------------------------|
00061> ADD HYD             IDsum=[3], NHYD=["TotPond"], IDs to add=[1,2]
00062> *%-----------------|-------------------------------------------------------|
00063> *%-----------------|-------------------------------------------------------|
00064> *% 5-year 24-hr SCS
00065> READ STORM          STORM_FILENAME=["5Y24.STM"]
00066> *%-----------------|-------------------------------------------------------|
00067> * Catchment 209 - North Side Post-Development Controlled
00068> *%-----------------|-------------------------------------------------------|
00069> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.27](ha),
00070>                     XIMP=[0.39], TIMP=[0.56], DWF=[0](cms), LOSS=[2], CN=[74],
00071>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00072> *%-----------------|-------------------------------------------------------|
00073> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00074> *%-----------------|-------------------------------------------------------|
00075> DESIGN STANDHYD     ID=[2], NHYD=["210"], DT=[1]min, AREA=[2.68](ha),
00076>                     XIMP=[0.70], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[75],
00077>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00078> *%-----------------|-------------------------------------------------------|
00079> * Total Flow to Pond
00080> *%-----------------|-------------------------------------------------------|
00081> ADD HYD             IDsum=[3], NHYD=["TotPond"], IDs to add=[1,2]
00082> *%-----------------|-------------------------------------------------------|
00083> *%-----------------|-------------------------------------------------------|
00084> FINISH
00085>
00086>
00087>
00088>
00089>
```

OUTPUT FILE: North Side, Post- Development, 5-Year Storm

(C:\...Post2.out)

```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS  W W W  M   M  H   H    Y    M   M   OOO            9      9   =========
00008>                                                           9   9  9   9   # 3877524
00009>          StormWater Management HYdrologic Model            999    999    =========
00010>
00011>  ********************************************************************************
00012>  ***************************** SWMHYMO Ver/4.05  ********************************
00013>  *********  A single event and continuous hydrologic simulation model  *********
00014>  *********     based on the principles of HYMO and its successors      *********
00015>  *********                    OTTHYMO-83 and OTTHYMO-89.                *********
00016>  ********************************************************************************
00017>  ******** Distributed by:  J.F. Sabourin and Associates Inc.          *********
00018>  *********                  Ottawa,  Ontario: (613) 836-3884          *********
00019>  *********                  Gatineau, Quebec: (819) 243-6858          *********
00020>  *********                  E-Mail: swmhymo@jfsa.com                  *********
00021>  ********************************************************************************
00022>
00023>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++++ Licensed user: R.J. Burnside & Associates Ltd                +++++++++
00025>  +++++++++                 Brampton             SERIAL#:3877524        +++++++++
00026>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ********************************************************************************
00029>  *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030>  *********          Maximum value for ID numbers  :     10            *********
00031>  *********          Max. number of rainfall points: 105408            *********
00032>  *********          Max. number of flow points    : 105408            *********
00033>  ********************************************************************************
00034>
00035>
00036>  *********************   D E T A I L E D   O U T P U T   **********************
00037>  ********************************************************************************
00038>  *         DATE: 2020-01-31     TIME: 11:21:12     RUN COUNTER: 002325         *
00039>  ********************************************************************************
00040>  * Input   filename: C:\SWMHYM~1\Niagara\Post2.dat                               *
00041>  * Output  filename: C:\SWMHYM~1\Niagara\Post2.out                              *
00042>  * Summary filename: C:\SWMHYM~1\Niagara\Post2.sum                              *
00043>  * User comments:                                                              *
00044>  * 1:_____________________________________________________________________     *
00045>  * 2:_____________________________________________________________________     *
00046>  * 3:_____________________________________________________________________     *
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*******************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00053> *#  Date        : 11-29-2019
00054> *#  Modeller    : [L.Garner]
00055> *#  Company     : R. J. Burnside & Associates Ltd.
00056> *#  License #   :  3877524
00057> *#*******************************************************************************
00058> -------------------
00059> | START            |  Project  dir.: C:\SWMHYM~1\Niagara\
00060> -------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\
00061>     TZERO =   .00 hrs on        0
00062>     METOUT=   2 (output = METRIC)
00063>     NRUN  = 001
00064>     NSTORM=   0
00065> --------------------------------------------------------------------------------
00066> 001:0002--------------------------------------------------------------------------
00067> *#
00068> *#  Model created to confirm 5 year flow rates
00069> *#
00070> *#
00071> *#  CN as per Ontario Soils Map for Welland County
00072> *#  TIMP / XIMP and TP as per RJB investigation
00073> *#
00074> *#  5yr - 3 hr Chicago
00075> --------------------
00076> | CHICAGO STORM    |    IDF curve parameters: A= 719.500
00077> | Ptotal= 38.75 mm |                          B=   6.340
00078> --------------------                          C=    .769
00079>                          used in:   INTENSITY =  A / (t + B)^C
00080>
00081>                          Duration of storm  =  3.00 hrs
00082>                          Storm time step    =  5.00 min
00083>                          Time to peak ratio =   .30
00084>
00085>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00086>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00087>               .08   3.608 |    .83  38.761 |   1.58   8.907 |   2.33   4.602
00088>               .17   3.955 |    .92 111.182 |   1.67   8.018 |   2.42   4.382
00089>               .25   4.387 |   1.00  51.991 |   1.75   7.302 |   2.50   4.185
00090>               .33   4.942 |   1.08  30.552 |   1.83   6.713 |   2.58   4.007
00091>               .42   5.684 |   1.17  21.536 |   1.92   6.220 |   2.67   3.846
00092>               .50   6.731 |   1.25  16.651 |   2.00   5.800 |   2.75   3.698
00093>               .58   8.328 |   1.33  13.610 |   2.08   5.439 |   2.83   3.562
00094>               .67  11.079 |   1.42  11.540 |   2.17   5.124 |   2.92   3.437
00095>               .75  16.983 |   1.50  10.041 |   2.25   4.847 |   3.00   3.322
00096>
00097> --------------------------------------------------------------------------------
00098> 001:0003--------------------------------------------------------------------------
00099> * Catchment 209 - North Side Post-Development Controlled
00100> ----------------------
00101> | DESIGN STANDHYD    |   Area    (ha)=    8.27
00102> | 01:209    DT= 1.00 |   Total Imp(%)=   56.00   Dir. Conn.(%)=   39.00
00103> ----------------------
00104>                                  IMPERVIOUS    PERVIOUS (i)
00105>      Surface Area     (ha)=        4.63         3.64
00106>      Dep. Storage     (mm)=         .80         1.50
00107>      Average Slope     (%)=         .50          .50
00108>      Length            (m)=      234.81        40.00
00109>      Mannings n            =        .013         .250
00110>
00111>      Max.eff.Inten.(mm/hr)=      111.18        24.28
00112>                 over (min)        5.00        24.00
00113>      Storage Coeff.  (min)=        5.03 (ii)   23.87 (ii)
00114>      Unit Hyd. Tpeak (min)=        5.00        24.00
00115>      Unit Hyd. peak  (cms)=         .23          .05
00116>                                                          *TOTALS*
00117>      PEAK FLOW       (cms)=         .67          .14          .697 (iii)
00118>      TIME TO PEAK    (hrs)=         .97         1.38          .967
00119>      RUNOFF VOLUME    (mm)=       37.95        13.90        23.281
00120>      TOTAL RAINFALL   (mm)=       38.75        38.75        38.747
00121>      RUNOFF COEFFICIENT   =         .98          .36          .601
00122>
00123>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00124>            CN* =  74.0    Ia = Dep. Storage  (Above)
00125>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00126>            THAN THE STORAGE COEFFICIENT.
00127>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00128>
00129> --------------------------------------------------------------------------------
00130> 001:0004--------------------------------------------------------------------------
00131> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00132> ----------------------
00133> | DESIGN STANDHYD    |   Area    (ha)=    2.68
00134> | 02:210    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00135> ----------------------
00136>                                  IMPERVIOUS    PERVIOUS (i)
00137>      Surface Area     (ha)=        2.41         .27
00138>      Dep. Storage     (mm)=         .80        1.50
00139>      Average Slope     (%)=         .50         .50
00140>      Length            (m)=      133.67       40.00
00141>      Mannings n            =        .013         .250
00142>
00143>      Max.eff.Inten.(mm/hr)=      111.18       116.59
00144>                 over (min)        4.00        14.00
00145>      Storage Coeff.  (min)=        3.59 (ii)   13.65 (ii)
00146>      Unit Hyd. Tpeak (min)=        4.00        14.00
00147>      Unit Hyd. peak  (cms)=         .30          .08
00148>                                                          *TOTALS*
00149>      PEAK FLOW       (cms)=         .44          .05          .460 (iii)
00150>      TIME TO PEAK    (hrs)=         .95         1.17          .950
00151>      RUNOFF VOLUME    (mm)=       37.95        22.01        33.166
00152>      TOTAL RAINFALL   (mm)=       38.75        38.75        38.747
00153>      RUNOFF COEFFICIENT   =         .98          .57          .856
00154>
00155>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00156>            CN* =  75.0    Ia = Dep. Storage  (Above)
00157>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00158>            THAN THE STORAGE COEFFICIENT.
00159>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00160>
00161> --------------------------------------------------------------------------------
00162> 001:0005--------------------------------------------------------------------------
00163> * Total Flow to Pond
00164> ----------------------
00165> | ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00166> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00167>                       ID1 01:209          8.27     .697     .97  23.28    .000
00168>                     +ID2 02:210           2.68     .460     .95  33.17    .000
00169>                      ========================================================
00170>                      SUM 03:TotPond      10.95    1.143     .97  25.70    .000
00171>
00172>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00173>
00174> --------------------------------------------------------------------------------
00175> 001:0006--------------------------------------------------------------------------
00176> *#  5yr - 12 hr AES (NPCA)
00177> --------------------
00178> | MASS STORM      |    Filename: C:\SWMHYM~1\Niagara\AES-12HR.mst
00179> | Ptotal= 54.66 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
00180> --------------------
00181>                          Duration of storm        =   12.00 hrs
00182>                          Mass curve time step     =   60.00 min
00183>                          Selected storm time step =    5.00 min
00184>                          Volume of derived storm  =   54.56 mm
00185>
00186>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00187>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00188>               .08   2.728 |   3.08   6.002 |   6.08   4.910 |   9.08   3.274
00189>               .17   2.728 |   3.17   6.002 |   6.17   4.910 |   9.17   3.274
00190>               .25   2.728 |   3.25   6.002 |   6.25   4.910 |   9.25   3.274
00191>               .33   2.728 |   3.33   6.002 |   6.33   4.910 |   9.33   3.274
00192>               .42   2.728 |   3.42   6.002 |   6.42   4.910 |   9.42   3.274
00193>               .50   2.728 |   3.50   6.002 |   6.50   4.910 |   9.50   3.274
00194>               .58   2.728 |   3.58   6.002 |   6.58   4.910 |   9.58   3.274
00195>               .67   2.728 |   3.67   6.002 |   6.67   4.910 |   9.67   3.274
00196>               .75   2.728 |   3.75   6.002 |   6.75   4.910 |   9.75   3.274
00197>               .83   2.728 |   3.83   6.002 |   6.83   4.910 |   9.83   3.274
00198>               .92   2.728 |   3.92   6.002 |   6.92   4.910 |   9.92   3.274
00199>              1.00   2.728 |   4.00   6.002 |   7.00   4.910 |  10.00   3.274
00200>              1.08   5.456 |   4.08   8.184 |   7.08   4.910 |  10.08   1.091
00201>              1.17   5.456 |   4.17   8.184 |   7.17   4.910 |  10.17   1.091
00202>              1.25   5.456 |   4.25   8.184 |   7.25   4.910 |  10.25   1.091
00203>              1.33   5.456 |   4.33   8.184 |   7.33   4.910 |  10.33   1.091
00204>              1.42   5.456 |   4.42   8.184 |   7.42   4.910 |  10.42   1.091
00205>              1.50   5.456 |   4.50   8.184 |   7.50   4.910 |  10.50   1.091
00206>              1.58   5.456 |   4.58   8.184 |   7.58   4.910 |  10.58   1.091
00207>              1.67   5.456 |   4.67   8.184 |   7.67   4.910 |  10.67   1.091
00208>              1.75   5.456 |   4.75   8.184 |   7.75   4.910 |  10.75   1.091
00209>              1.83   5.456 |   4.83   8.184 |   7.83   4.910 |  10.83   1.091
00210>              1.92   5.456 |   4.92   8.184 |   7.92   4.910 |  10.92   1.091
00211>              2.00   5.456 |   5.00   8.184 |   8.00   4.910 |  11.00   1.091
00212>              2.08   6.547 |   5.08   7.638 |   8.08   3.274 |  11.08    .546
00213>              2.17   6.547 |   5.17   7.638 |   8.17   3.274 |  11.17    .546
00214>              2.25   6.547 |   5.25   7.638 |   8.25   3.274 |  11.25    .546
00215>              2.33   6.547 |   5.33   7.638 |   8.33   3.274 |  11.33    .546
00216>              2.42   6.547 |   5.42   7.638 |   8.42   3.274 |  11.42    .546
00217>              2.50   6.547 |   5.50   7.638 |   8.50   3.274 |  11.50    .546
00218>              2.58   6.547 |   5.58   7.638 |   8.58   3.274 |  11.58    .546
00219>              2.67   6.547 |   5.67   7.638 |   8.67   3.274 |  11.67    .546
00220>              2.75   6.547 |   5.75   7.638 |   8.75   3.274 |  11.75    .546
00221>              2.83   6.547 |   5.83   7.638 |   8.83   3.274 |  11.83    .546
00222>              2.92   6.547 |   5.92   7.638 |   8.92   3.274 |  11.92    .546
00223>              3.00   6.547 |   6.00   7.638 |   9.00   3.274 |  12.00    .546
00224>
00225> --------------------------------------------------------------------------------
00226> 001:0007--------------------------------------------------------------------------
00227> * Catchment 209 - North Side Post-Development Controlled
00228> ----------------------
00229> | DESIGN STANDHYD    |   Area    (ha)=    8.27
00230> | 01:209    DT= 1.00 |   Total Imp(%)=   56.00   Dir. Conn.(%)=   39.00
00231> ----------------------
00232>                                  IMPERVIOUS    PERVIOUS (i)
00233>      Surface Area     (ha)=        4.63         3.64
00234>      Dep. Storage     (mm)=         .80         1.50
00235>      Average Slope     (%)=         .50          .50
00236>      Length            (m)=      234.81        40.00
00237>      Mannings n            =        .013         .250
00238>
00239>      Max.eff.Inten.(mm/hr)=       8.18         5.91
00240>                 over (min)       14.00        47.00
00241>      Storage Coeff.  (min)=       14.29 (ii)   47.45 (ii)
00242>      Unit Hyd. Tpeak (min)=       14.00        47.00
00243>      Unit Hyd. peak  (cms)=         .08          .02
00244>                                                          *TOTALS*
00245>      PEAK FLOW       (cms)=         .07          .05          .121 (iii)
00246>      TIME TO PEAK    (hrs)=        5.02         6.33         6.017
00247>      RUNOFF VOLUME    (mm)=       53.75        24.26        35.769
00248>      TOTAL RAINFALL   (mm)=       54.56        54.56        54.560
00249>      RUNOFF COEFFICIENT   =         .99          .44          .656
00250>
00251>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00252>            CN* =  74.0    Ia = Dep. Storage  (Above)
00253>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00254>            THAN THE STORAGE COEFFICIENT.
00255>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00256>
00257> --------------------------------------------------------------------------------
00258> 001:0008--------------------------------------------------------------------------
00259> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00260> ----------------------
00261> | DESIGN STANDHYD    |   Area    (ha)=    2.68
00262> | 02:210    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00263> ----------------------
00264>                                  IMPERVIOUS    PERVIOUS (i)
00265>      Surface Area     (ha)=        2.41         .27
00266>      Dep. Storage     (mm)=         .80        1.50
00267>      Average Slope     (%)=         .50         .50
00268>      Length            (m)=      133.67       40.00
00269>      Mannings n            =        .013         .250
00270>
```

```
00271>      Max.eff.Inten.(mm/hr)=      8.18       18.21
00272>                   over (min)      10.00       31.00
00273>      Storage Coeff.  (min)=      10.19 (ii)  31.33 (ii)
00274>      Unit Hyd. Tpeak (min)=      10.00       31.00
00275>      Unit Hyd. peak  (cms)=        .11         .04
00276>                                                      *TOTALS*
00277>      PEAK FLOW       (cms)=        .04         .01          .054 (iii)
00278>      TIME TO PEAK    (hrs)=       5.00        6.07         5.033
00279>      RUNOFF VOLUME    (mm)=      53.76       35.51        48.287
00280>      TOTAL RAINFALL   (mm)=      54.56       54.56        54.560
00281>      RUNOFF COEFFICIENT   =        .99         .65          .885
00282>
00283>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00284>            CN* =  75.0    Ia = Dep. Storage  (Above)
00285>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00286>            THAN THE STORAGE COEFFICIENT.
00287>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00288>
00289> ---------------------------------------------------------------------------
00290> 001:0009-----------------------------------------------------------------
00291> * Total Flow to Pond
00292> ----------------------
00293> | ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00294> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00295>                       ID1 01:209           8.27     .121    6.02  35.77    .000
00296>                      +ID2 02:210           2.68     .054    5.03  48.29    .000
00297>                       ========================================================
00298>                       SUM 03:TotPond       10.95     .174    6.00  38.83    .000
00299>
00300>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00301>
00302> ---------------------------------------------------------------------------
00303> 001:0010-----------------------------------------------------------------
00304> --------------------
00305> | READ STORM      |    Filename: 5yr/24hr
00306> | Ptotal=  64.31 mm|    Comments: 5yr/24hr
00307> --------------------
00308>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00309>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00310>                .25    .000 |   6.50   1.290 |  12.75   9.250 |  19.00   1.160
00311>                .50    .710 |   6.75   1.290 |  13.00   4.760 |  19.25   1.160
00312>                .75    .710 |   7.00   1.290 |  13.25   4.760 |  19.50   1.160
00313>               1.00    .710 |   7.25   1.290 |  13.50    .900 |  19.75   1.160
00314>               1.25    .710 |   7.50   1.290 |  13.75    .900 |  20.00   1.160
00315>               1.50    .710 |   7.75   1.290 |  14.00   5.270 |  20.25   1.160
00316>               1.75    .710 |   8.00   1.290 |  14.25   5.270 |  20.50    .770
00317>               2.00    .710 |   8.25   1.290 |  14.50   1.930 |  20.75    .770
00318>               2.25    .710 |   8.50   1.740 |  14.75   1.930 |  21.00    .770
00319>               2.50    .840 |   8.75   1.740 |  15.00   1.930 |  21.25    .770
00320>               2.75    .840 |   9.00   1.740 |  15.25   1.930 |  21.50    .770
00321>               3.00    .840 |   9.25   1.740 |  15.50   1.930 |  21.75    .770
00322>               3.25    .840 |   9.50   2.060 |  15.75   1.930 |  22.00    .770
00323>               3.50    .840 |   9.75   2.060 |  16.00   1.930 |  22.25    .770
00324>               3.75    .840 |  10.00   2.310 |  16.25   1.930 |  22.50    .770
00325>               4.00    .840 |  10.25   2.310 |  16.50   1.160 |  22.75    .770
00326>               4.25    .840 |  10.50   2.960 |  16.75   1.160 |  23.00    .770
00327>               4.50   1.030 |  10.75   2.960 |  17.00   1.160 |  23.25    .770
00328>               4.75   1.030 |  11.00   3.980 |  17.25   1.160 |  23.50    .770
00329>               5.00   1.030 |  11.25   3.980 |  17.50   1.160 |  23.75    .770
00330>               5.25   1.030 |  11.50   6.170 |  17.75   1.160 |  24.00    .770
00331>               5.50   1.030 |  11.75   6.170 |  18.00   1.160 |  24.25    .770
00332>               5.75   1.030 |  12.00  26.730 |  18.25   1.160 |
00333>               6.00   1.030 |  12.25  70.940 |  18.50   1.160 |
00334>               6.25   1.030 |  12.50   9.250 |  18.75   1.160 |
00335>
00336> ---------------------------------------------------------------------------
00337> 001:0011-----------------------------------------------------------------
00338> * Catchment 209 - North Side Post-Development Controlled
00339> ----------------------
00340> | DESIGN STANDHYD    |   Area    (ha)=    8.27
00341> | 01:209    DT= 1.00 |   Total Imp(%)=   56.00   Dir. Conn.(%)=   39.00
00342> ----------------------
00343>                              IMPERVIOUS    PERVIOUS (i)
00344>      Surface Area     (ha)=       4.63         3.64
00345>      Dep. Storage     (mm)=        .80         1.50
00346>      Average Slope     (%)=        .50          .50
00347>      Length            (m)=     234.81        40.00
00348>      Mannings n            =       .013         .250
00349>
00350>      Max.eff.Inten.(mm/hr)=      70.94       43.86
00351>                   over (min)       6.00       21.00
00352>      Storage Coeff.  (min)=       6.02 (ii)  20.90 (ii)
00353>      Unit Hyd. Tpeak (min)=       6.00       21.00
00354>      Unit Hyd. peak  (cms)=        .19         .05
00355>                                                      *TOTALS*
00356>      PEAK FLOW       (cms)=        .58         .28          .760 (iii)
00357>      TIME TO PEAK    (hrs)=      12.25       12.48        12.267
00358>      RUNOFF VOLUME    (mm)=      63.49       31.32        43.879
00359>      TOTAL RAINFALL   (mm)=      64.31       64.31        64.308
00360>      RUNOFF COEFFICIENT   =        .99         .49          .682
00361>
00362>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00363>            CN* =  74.0    Ia = Dep. Storage  (Above)
00364>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00365>            THAN THE STORAGE COEFFICIENT.
00366>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00367>
00368> ---------------------------------------------------------------------------
00369> 001:0012-----------------------------------------------------------------
00370> * Catchment 210 - Medium Density Block to Pond, 5 Year Control Provided
00371> ----------------------
00372> | DESIGN STANDHYD    |   Area    (ha)=    2.68
00373> | 02:210    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   70.00
00374> ----------------------
00375>                              IMPERVIOUS    PERVIOUS (i)
00376>      Surface Area     (ha)=       2.41         .27
00377>      Dep. Storage     (mm)=        .80         1.50
00378>      Average Slope     (%)=        .50          .50
00379>      Length            (m)=     133.67        40.00
00380>      Mannings n            =       .013         .250
00381>
00382>      Max.eff.Inten.(mm/hr)=      70.94      169.01
00383>                   over (min)       4.00        13.00
00384>      Storage Coeff.  (min)=       4.29 (ii)  12.97 (ii)
00385>      Unit Hyd. Tpeak (min)=       4.00        13.00
00386>      Unit Hyd. peak  (cms)=        .27          .09
00387>                                                      *TOTALS*
00388>      PEAK FLOW       (cms)=        .36          .08          .430 (iii)
00389>      TIME TO PEAK    (hrs)=      12.25        12.35        12.250
00390>      RUNOFF VOLUME    (mm)=      63.51        44.23        57.728
00391>      TOTAL RAINFALL   (mm)=      64.31        64.31        64.308
00392>      RUNOFF COEFFICIENT   =        .99          .69          .898
00393>
00394>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00395>            CN* =  75.0    Ia = Dep. Storage  (Above)
00396>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00397>            THAN THE STORAGE COEFFICIENT.
00398>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00399>
00400> ---------------------------------------------------------------------------
00401> 001:0013-----------------------------------------------------------------
00402> * Total Flow to Pond
00403> ----------------------
00404> | ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00405> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00406>                       ID1 01:209           8.27     .760   12.27  43.88    .000
00407>                      +ID2 02:210           2.68     .430   12.25  57.73    .000
00408>                       ========================================================
00409>                       SUM 03:TotPond       10.95    1.183   12.27  47.27    .000
00410>
00411>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00412>
00413> ---------------------------------------------------------------------------
00414> 001:0014-----------------------------------------------------------------
00415>       FINISH
00416> ---------------------------------------------------------------------------
00417> ***************************************************************************
00418>      WARNINGS / ERRORS / NOTES
00419>      -------------------------
00420>    Simulation ended on 2020-01-31     at 11:21:12
00421> ===========================================================================
00422>
00423>
```

THUNDERING WATERS VILLAGE
STORM DRAINAGE AREA PLAN

LIONSHEAD AVENUE
DRUMMOND ROAD
EAGLEWOOD DRIVE
OLDFIELD ROAD
CLUBVIEW LANE
JOHN DAY WAY
GREEN VISTA GATE
THUNDERING WATERS BOULEVARD
CONRAIL DRAINAGE CHANNEL
EXASPHALT PARKING LOT
EXISTING POND (WATER FEATURE)
EXISTING CHANNEL (WATER FEATURE)
FUTURE CONDOMINIUM TOWER (10 STOREYS, 150 UNITS)

STORM OUTFALL #1
STORM OUTFALL #2
STORM OUTFALL #3
STORM OUTFALL #4

DRAINAGE AREAS 25, 28 & 30 DELETED

FOR CONTINUATION REFER TO INSET

LEGEND:
- AREA NUMBER
- AREA (ha) 0.157 | 0.75 RUNOFF COEFFICIENT
- OVERLAND FLOW

RECEIVED JUN 16 2011 ENGINEERING

ACCEPTED
DATE: June 20/11
ENGINEERING DEPT.
CITY OF NIAGARA FALLS

No.	DATE	REVISION	BY	APVD
6	JUN 13/11	REVISED PER COMMENT & ISSUED FOR APPROVAL	BM	BM
7	MAY 16/11	ISSUED FOR APPROVAL	BM	BM
6	MAR 16/11	REVISED PER CITY COMMENTS	RM	RM
5	FEB 3/11	STORM SEWER B/W LOTS 147 & 148 REVISED AND ACCESS ROAD REMOVAL REVISED	RM	RM
4	DEC 1/10	LOTTING REVISED	GW	RM

NOTES
1. The position of pole lines, conduits, watermains, sewers, and other underground and above ground utilities and structures is not necessarily shown on the contract drawings, and, where shown the accuracy of the position of such utilities and structures is not guaranteed. Before starting work, the contractor shall identify the exact location of all such utilities and structures and shall assume liability for damage to them.
2. Check all dimensions and report any inconsistencies to the Engineer before proceding with the work – DO NOT SCALE DRAWINGS.
3. This drawing is an instrument of Professional Service and is intended for use only in connection with the project covered by the Engineering Agreement
4. Urban & Environmental Management Inc., does not assume any responsibility for losses, damages, and costs arising from use or misuse of this drawing by persons, firms, or corporations without prior written consent of Urban & Environmental Management Inc.
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MOUNTAINVIEW HOMES

VERIFY SCALE
BAR IS 25mm ON ORIGINAL DRAWING.
0 25mm
IF NOT 25mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DSGN GW
DR AK/EL
CHK BM/RM
APVD BM

LICENSED PROFESSIONAL ENGINEER B.MONDAL 100067214 13/06/11 PROVINCE OF ONTARIO

UEM URBAN & ENVIRONMENTAL MANAGEMENT INC. PROFESSIONAL CONSULTING SERVICES

DATE April, 2008
SCALE HORZ. 1:1000
DWG. No. 08-100-15
MUN. REF No. 00-00

PROJ. NO. 08-100

Plotted: Jun 14, 2011 – 9:34pm File: C:\CAD file Current\08-100 TWE ISSUED FOR APPROVAL 20110609.dwg