BURNSIDE

Stormwater Management Report
Niagara Village Development

2592693 Ontario Inc.
c/o 4308 Village Centre Court,
Mississauga, ON L4Z 1S2

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Niagara Village Development

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Mississauga, ON L4Z 1S2

R.J. Burnside & Associates Limited
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Mississauga ON L5N 8R9 CANADA

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Record of Revisions

Revision	Date	Description
0	February 6, 2020	Internal Submission for Client and Planner
1	March 11, 2020	Final Submission to Client and Planner
2	July 21, 2021	Revised Submission to Client and Planner

R.J. Burnside & Associates Limited

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LG:bs

Report Reviewed By:

Steven Roorda, P.Eng.
Vice President, Land Development
SR:bs

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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

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Client

2592693 ONTARIO INC.

Figure Title

NIAGARA VILLAGE DEVELOPMENT

SITE LOCATION PLAN

Drawn	Checked	Date	Figure No.
KT	DN	21/07/21	**FIG1**
Scale		Project No.	
N.T.S.		041230.0500	

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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, July 2021.
- Environmental Impact Study – Niagara Village Residential Development, R.J. Burnside & Associates Limited, July 2021.

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 Ltd., May 31, 2018.
- Phase Two Environmental Site Assessment – 600 Marineland Parkway, Golder Associates Ltd., June 2018.
- Baseline Hydrogeological Assessment, Proposed Residential Development, Golder Associates Ltd., 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

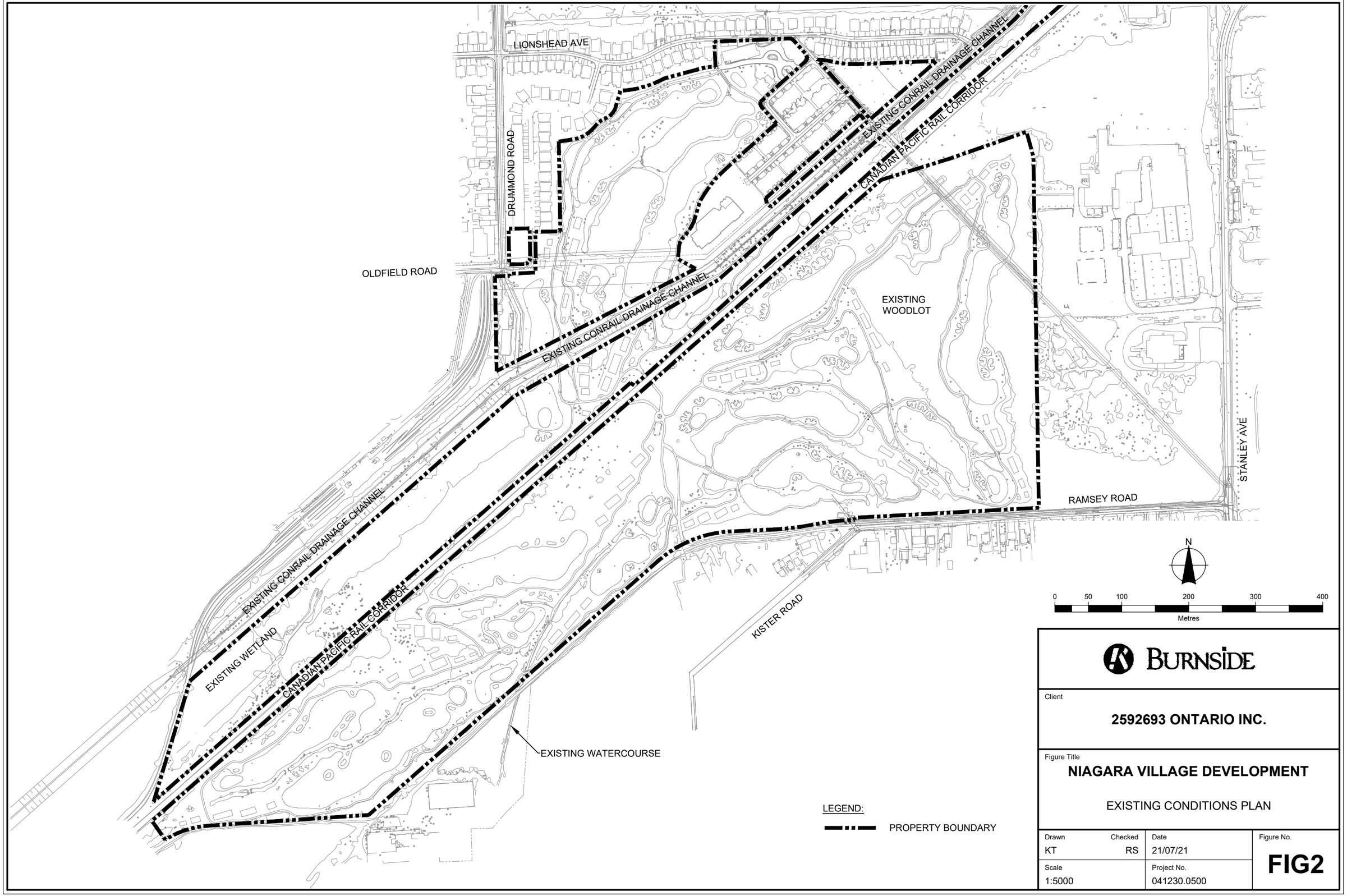
A Geotechnical Investigation for the study area was completed by Golder Associates Ltd. Based upon the findings, the site is covered by a topsoil and/or sand and gravel, overlying silty clay and/or silty sand fill. Bedrock is approximately 29 m below the surface on the east side of the site and 18 m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

2.3 Groundwater Conditions

Groundwater conditions were monitored as part of the Hydrogeological Assessment completed by Golder Associates Ltd. 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 northeast portion of the site. The overall direction of the groundwater flows to the south/southwest.

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, July 2021.



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2592693 ONTARIO INC.

Figure Title

NIAGARA VILLAGE DEVELOPMENT

EXISTING CONDITIONS PLAN

Drawn	Checked	Date	Figure No.
KT	RS	21/07/21	**FIG2**
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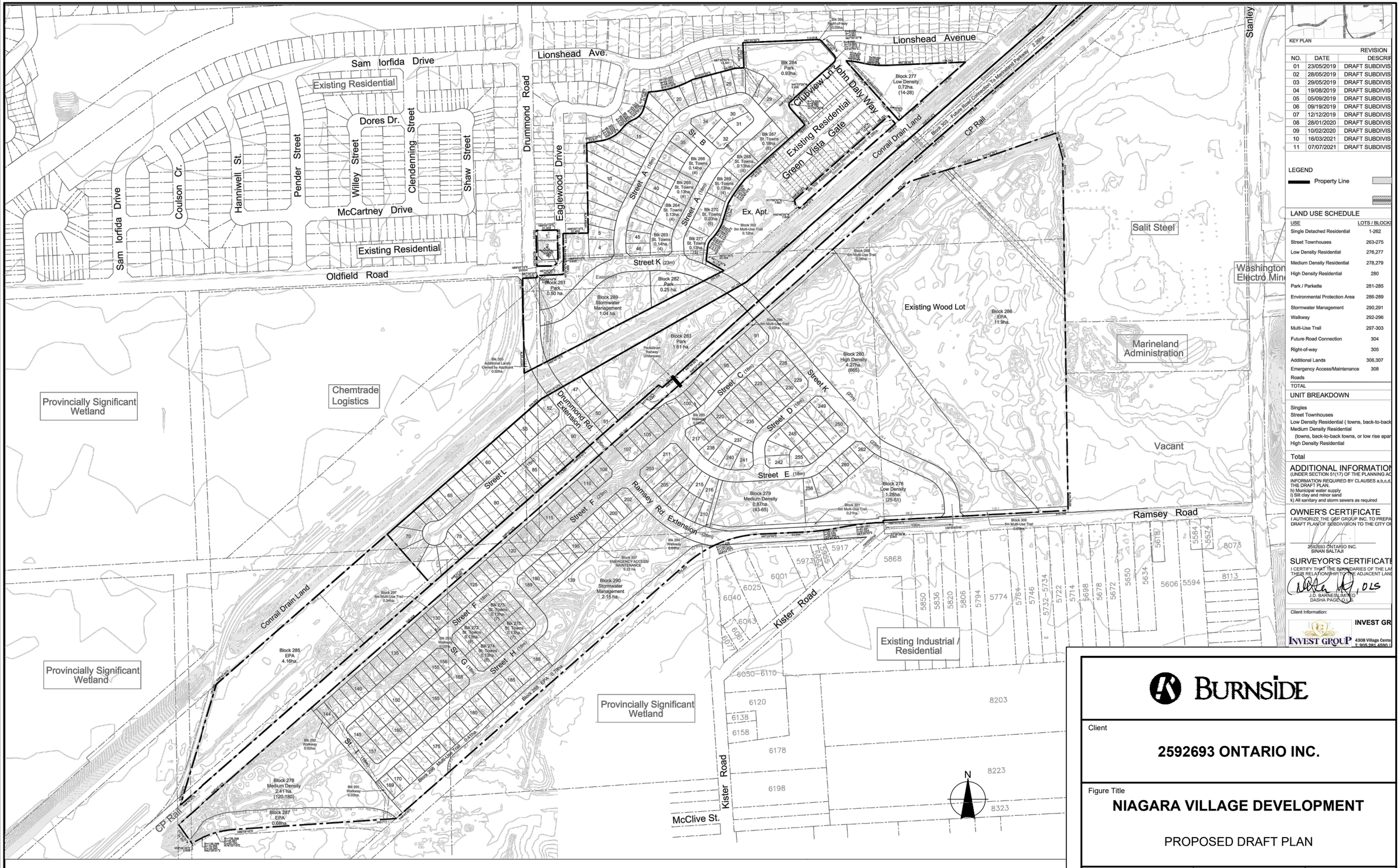
3.0 Proposed Land Use

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 July 7, 2021. 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	15.49	262
Street Townhouses	2.10	69
Low Density Residential	2.00	39-79
Medium Density Residential	3.59	163-247
High Density Residential	4.27	665
Park/Parkette	3.29	
Environmental Protection Area	17.53	
Stormwater Management	3.19	
Walkway	0.13	
Multi-Use Trail	1.45	
Future Road Connection	2.26	
Right-of-Way	0.05	
Additional Lands	0.30	
Emergency Access/Maintenance	0.22	
Roads	8.63	
Total	**64.50**	**1198-1322**



KEY PLAN

REVISION		
NO.	DATE	DESCRIP
01	23/05/2019	DRAFT SUBDIVIS
02	28/05/2019	DRAFT SUBDIVIS
03	29/05/2019	DRAFT SUBDIVIS
04	19/08/2019	DRAFT SUBDIVIS
05	05/09/2019	DRAFT SUBDIVIS
06	09/19/2019	DRAFT SUBDIVIS
07	12/12/2019	DRAFT SUBDIVIS
08	28/01/2020	DRAFT SUBDIVIS
09	10/02/2020	DRAFT SUBDIVIS
10	16/03/2021	DRAFT SUBDIVIS
11	07/07/2021	DRAFT SUBDIVIS

LEGEND

Property Line

LAND USE SCHEDULE

USE	LOTS / BLOCKS
Single Detached Residential	1-262
Street Townhouses	263-275
Low Density Residential	276,277
Medium Density Residential	278,279
High Density Residential	280
Park / Parkette	281-285
Environmental Protection Area	286-289
Stormwater Management	290,291
Walkway	292-296
Multi-Use Trail	297-303
Future Road Connection	304
Right-of-way	305
Additional Lands	306,307
Emergency Access/Maintenance Roads	308
TOTAL	

UNIT BREAKDOWN

Singles	
Street Townhouses	
Low Density Residential (towns, back-to-back	
Medium Density Residential (towns, back-to-back towns, or low rise apar	
High Density Residential	
Total	

ADDITIONAL INFORMATION
(UNDER SECTION 51(17) OF THE PLANNING AC
INFORMATION REQUIRED BY CLAUSES a,b,c,d,
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 PREPA
DRAFT PLAN OF SUBDIVISION TO THE CITY OF

2592693 ONTARIO INC.
SINAN BALTAJI

SURVEYOR'S CERTIFICATE
I CERTIFY THAT THE BOUNDARIES OF THE LA
THEIR RELATIONSHIP TO THE ADJACENT LAN

, OLS
J.D. BARNES LIMITED
DASHA PAGE, O.L.S.

Client Information:

INVEST GR
INVEST GROUP
4308 Village Cente
T: 905.281.4690

DRAFT PLAN OF SUBDIVISION AS PROVIDED BY GSP GROUP, JULY 8/2021

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2592693 ONTARIO INC.

Figure Title

NIAGARA VILLAGE DEVELOPMENT

PROPOSED DRAFT PLAN

Drawn	Checked	Date	Figure No.
BF	RS	21/07/21	**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 July 2021 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 six 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)	Outlet Location	Time to Peak (hrs)
101	0.49	Wetland	0.10
102	2.60	CP Rail	0.08
103	25.84	Existing Watercourse	2.06
108	1.05	Self-Contained Pond	0.23
EPA1	4.93	Existing Watercourse	0.43
EPA2	5.91	Existing Watercourse	0.79
Total	**40.82**	**-**	**-**

Catchment 101 drains to an existing wetland that is located southwest 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 southwest 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 southwest of the Ramsey Road dead-end. Catchment 108 drains to what appears to be a self-contained pond at the southwest side of the development, the spill point from this area appears to be to the development just south of the site at the west end.

Catchment areas EPA1 and EPA2 are located within the site area, east of the area proposed to be developed as part of this application. These two catchment areas are

primarily comprised of existing golf course and ultimately outlet at the existing watercourse described above, consistent with Catchment 103.

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 1,050 mm to 1,200 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 southeast 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.

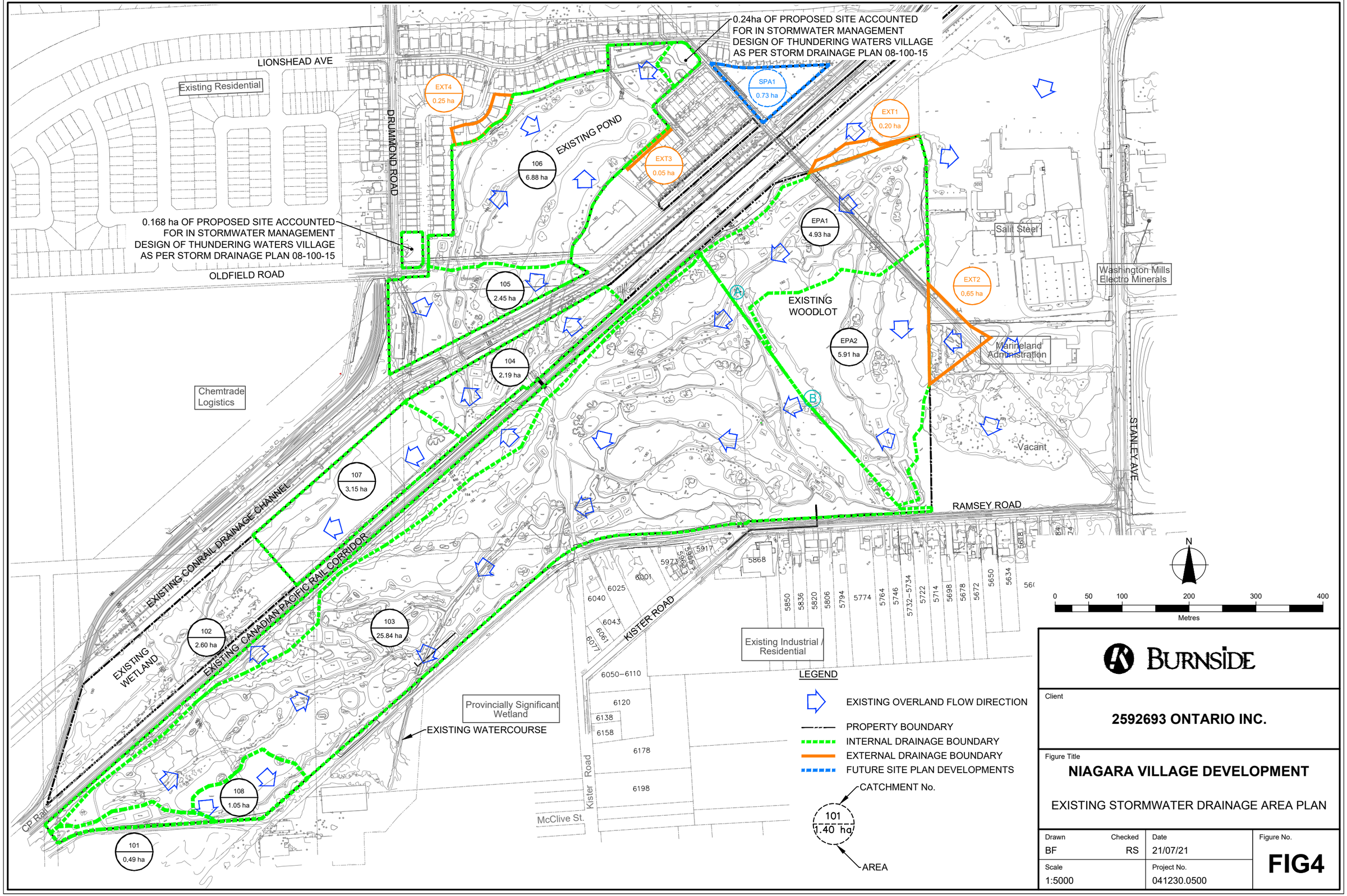

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

EXISTING STORMWATER DRAINAGE AREA PLAN

Drawn	Checked	Date	Figure No.
BF	RS	21/07/21	**FIG4**
Scale		Project No.	
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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 four drainage sub-catchments. 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)	Outlet Location	Time to Peak (hrs)
104	2.19	Conrail Drain	0.23
105	2.45	Conrail Drain	0.33
106	6.88	Conrail Drain	0.45
107	3.15	Wetland	0.55
SPA1	0.72	N/A – Future Development TBD	
Total	**15.39**		**-**

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 northeast 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. Catchment 107 drains to an existing wetland area at the west end of the site, south of the Conrail Drain and north of the CP Rail tracks, which is proposed to remain.

4.2 External Drainage Conveyance

4.2.1 South

There are two small external drainage areas on the east side of the development, south of the CP Rail corridor that drain towards the subject site. A portion of these external lands are part of the industrial site located to the east. These two external areas are 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	0.2	0.08
EXT2	0.65	0.19
Total	**0.85**	**-**

Similar to existing Catchments EPA1 and EPA2 described above, both of the external areas drain through a series of ponds and channels and ultimately discharge to the same existing watercourse.

4.2.2 North

The existing Thundering Waters Village development is located at the northeast 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. From the survey information available, there does not appear to be any control provided in the existing pond for these flows. 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 is 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 (Drawing 08-100-15) provided in Appendix D.

On the west side of the existing site, north of the railway tracks, there is an existing 1,650 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 northwest 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.

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 two forebays, each with their own inlet, 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 to 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	Time to Peak (Tp)
201	2.37	80%	
202	8.99	57%	
203	4.39	90%	

Catchment ID	Area (ha)	Total Imperviousness	Time to Peak (Tp)
205	2.50	53%	
206	0.87	80%	
207	9.42	58%	
208	0.62	90%	
UNC1	2.11	20%	
UNC2	0.36	43%	
UNC7	0.40	Nashyd – N/A	0.1
UNC8	0.49	Nashyd – N/A	0.1
Total	**32.52**	**-**	**-**

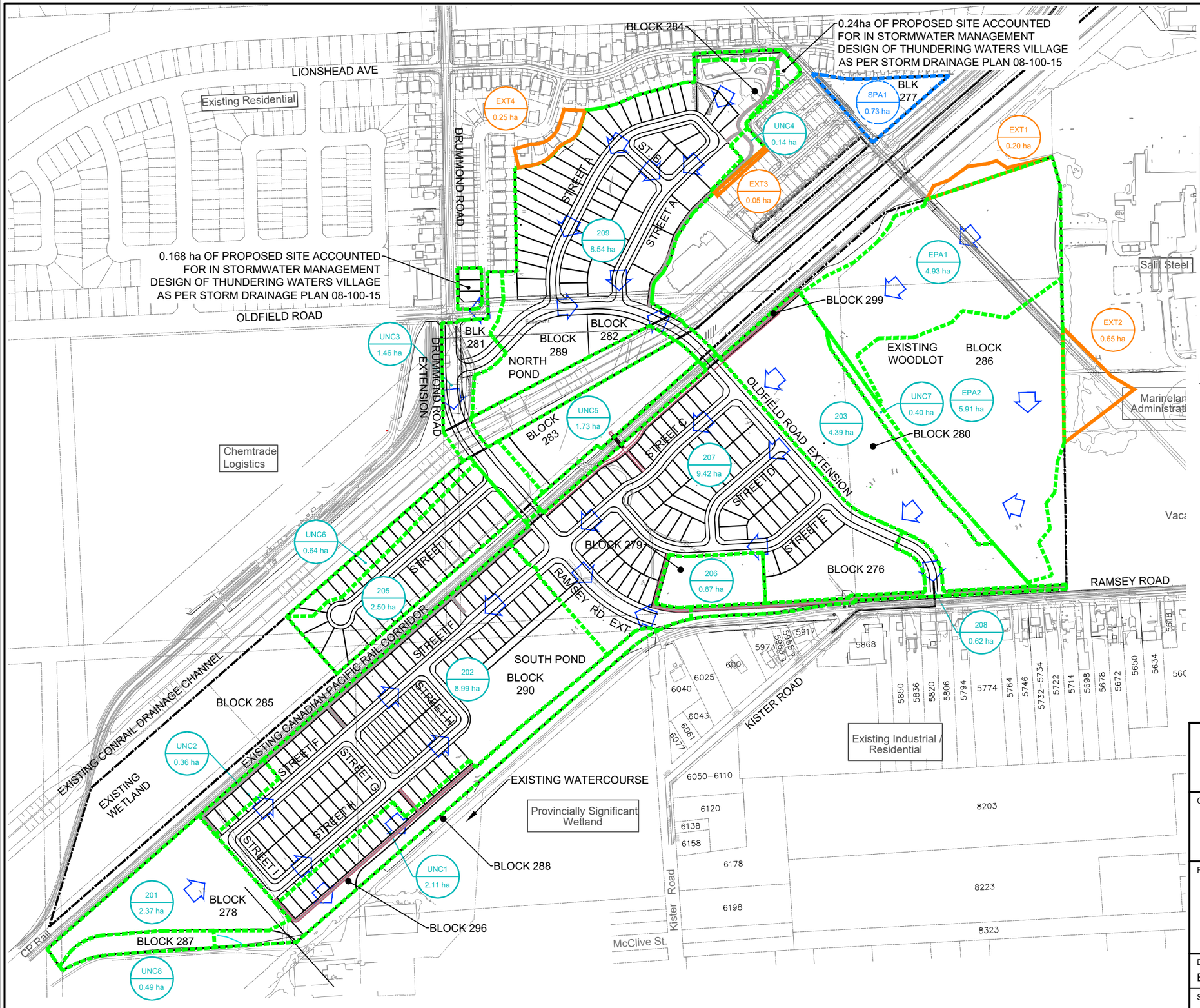
Similar to existing conditions, under post-development there will remain multiple discharge points from the site. The discharge locations have been maintained due to grading constraints as well as to mimic existing drainage patterns. Catchments 202 and 207 are comprised of low density residential, ROWs, 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 forebay and Catchments 203, 205, 206 and 207 discharge to the east forebay. Catchments 201, and 206 are medium density blocks and Catchment 203 is a high density block. The stormwater management design proposes that the medium and high 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 four uncontrolled areas on the south side of the site. Catchment UNC1 is made up of the rear of some single-family lots as well as a channel that has been designed as an ecological feature that ultimately outlets at the existing watercourse. For additional information on this channel, refer to the Environmental Impact Study. Catchment UNC2 includes the rear of a few single-family lots and will outlet to the CP Rail corridor. Catchment UNC7 is comprised of a woodlot buffer along the back of high density Block 280, this area will drain to the woodlot at the east end of the site as discussed further below. Catchment UNC8 will remain consistent with existing conditions and will discharge to the existing wetland located at the southwest corner of the site.

As previously mentioned, under existing conditions there are two catchments that are a portion of the golf course that is not proposed to be developed that currently discharges through the site (Catchments EPA1 and EPA2). As shown on Drawing GRD2, the site is proposed to be elevated above existing elevations in this area, causing the 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 July 2021, which is included under separate cover.

A small portion of these catchments is proposed to be regraded, as shown on Drawing GRD2, to promote proper conveyance of this area 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.



ON-SITE PEAK FLOW CONTROL REQUIREMENTS			
CATCHMENT	BLOCK AREA (ha)	BLOCK #	100-YR PEAK CONTROLLED FLOW (L/s)
201	2.37	278	420.43
203	4.27	280	827.26
206	0.87	279	154.34

NOTE: ALL CONTROLLED FLOWS BASED ON 5-YEAR RATIONAL METHOD FLOW IN ACCORDANCE WITH ANTICIPATED SPA REQUIREMENTS.

DRAINAGE AREAS ARE IN ACCORDANCE WITH BLOCK AREAS FROM THE DRAFT PLAN.

LEGEND

- PROPOSED OVERLAND FLOW DIRECTION
- PROPERTY BOUNDARY
- INTERNAL DRAINAGE BOUNDARY
- EXTERNAL DRAINAGE BOUNDARY
- FUTURE SITE PLAN DEVELOPMENTS

CATCHMENT No.
101
1.40 ha
AREA

N

0 50 100 200 300 400
Metres

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Figure Title
NIAGARA VILLAGE DEVELOPMENT

POST-DEVELOPMENT STORMWATER DRAINAGE AREA PLAN

Drawn	Checked	Date	Figure No.
BF	RS	21/07/21	**FIG5**
Scale		Project No.	
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4.3.1.1 External System Conveyance

As previously mentioned, under existing conditions there is a small amount of external drainage (Catchments EXT1 and EXT2) that drains to Catchments EPA1 and EPA2. In post-development, as mentioned in the section above, it is proposed that these catchments drain consistent with Drainage Areas EPA1 and EPA1 which are proposed to be conveyed towards the environmental compensation area at the east end of the site.

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 Street K 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 to 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	8.54	54%	
UNC3	1.46	73%	
UNC4	0.14		0.11
UNC5	1.73		0.19
UNC6	0.64	43%	
SPA1	0.73	N/A – Future Development TBD	
Total	**13.24**	**-**	**-**

Within the site boundary, one catchment is proposed to drain to the north stormwater management pond (Catchment 209). Catchment 209 is comprised of single-family, townhouse, right-of-way and park areas and drains the minor and major system to the

pond. The results of the modelling and allowable release rate will be discussed further in Section 5.3.2.1.

There are four 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. Catchment UNC5 is the Park Block that is located between the CP Rail tracks and the Conrail Drainage Channel, Block 284, that will drain directly to the Conrail Drainage Channel. Lastly, Catchment UNC6 is the rear portion of the northern lots along Street L. The rear yard and back half of roof drainage will be captured in a rear yard swale or catchbasins and directed to the existing wetland at the west end of the site consistent with the existing drainage pattern for this area.

Within the site area on the north side of the CP Rail tracks, there is one area that is within the property boundary that are isolated from the storm network. This area is shown as SPA1 on Figure 4. It is proposed that this area be developed under a Site Plan Application to address all servicing and stormwater management requirements as an individual entity. Since this area is separated by existing roads and development, it is applicable to be developed under a Site Plan Application.

Overall, the post-development drainage area is smaller than the pre-development drainage area as there is a proposed drainage area (Catchment 205) on the north side of the CP Rail that previously drained to the existing wetland at the west end of the site and is now proposed to drain to the South Pond and outlet at the Southern watercourse. Catchment 205 has been incorporated into the design of the South Pond in the following sections.

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 EXT3 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 remain and continue to drain to the Conrail Drainage Channel. This pipe will continue to run in an easement adjacent to the Drummond Road Extension as a separate system and will bypass the stormwater management measures proposed for the site.

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 25 mm 4-hour Chicago design storm over a 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	C	77
Forest	D	83

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. The XIMP values are based on the Visual OTTHYMO Reference Guide which establish typical XIMP values to be used in stormwater management modelling for different catchment types; refer to Appendix B for an excerpt from this Guide. These examples and typical modelling practice demonstrate

that residential development generally has a XIMP value of approximately 50% to 75% of the TIMP value.

Table 9: Post-Development Impervious Values

Land Use	TIMP	XIMP
Right-of-Ways	90%	80%
Parkland	10%	5%
SWM Block	50%	50%
Townhomes	64%	48%
Low-Density Residential	43%	32%
Medium Density Residential	80%	60%
High Density Residential	90%	80%

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 generally 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 Figure 4 and Figure 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	0.673	4.799	4.13
12-hour AES	0.609	0.811	0.20
24-hour SCS Type II	1.016	5.483	**4.47**

*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 for the 24-hour SCS Type II storm distribution.

Table 11: South – Post Development Flows

Catchment	Outlet	Post-Development Flow (m^3/s)
201	South Pond – to Existing Watercourse	0.420 [1]
202		1.803 [2]
203		0.827 [1]
205		0.517 [2]
206		0.154 [1]
207		1.850 [2]
208	Ramsey Road	0.178 [2]
UNC1	Eco Channel – to Existing Watercourse	0.275 [2]
UNC2	CP Rail Corridor	0.072 [2]
UNC7	EPA Compensation Area	0.072 [2]
UNC8	Existing Wetland	0.088 [2]

[1] 5-year post-development flow rate (calculated using the Rational Method).

[2] 100-year uncontrolled post-development flow rate from SWMHYMO.

Some of the catchments represent medium and high density blocks (refer to Figure 5), which as mentioned previously, will have an allowable release rate equivalent to the 5-year post-development flow (calculated using the rational method to replicate how the blocks will be designed in the future). 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 Roof Drain Collection System

Catchment Areas 201 and 206 also incorporate a drainage split to account for a Roof Drain Collection (RDC) system that is proposed to provide drainage to the channel located within Catchment Area UNC1 that will act as an ecological feature as mentioned in Section 4.3.1 above. Catchment Area 201 is proposed to drain the 2-year flow (9.2 L/s) from 556 m^2 of roof drainage to the channel which is equivalent to approximately one townhouse block roof area. Catchment Area 206 is proposed to drain the 2-year flow (28.7 L/s) from 1,740 m^2 of roof drainage to the channel which is equivalent to approximately half of the anticipated roof areas from this block. The drainage for the RDC system has been modelled in SWMHYMO using a Dualhyd command. Catchment UNC1 as mentioned above incorporates the channel as well as some roof and rear yard drainage that will flow uncontrolled to the channel, all of which ultimately outlets to the existing watercourse.

5.3.1.4 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

Pre-Development Catchment	Outlet	100-Year Pre-Development Flow (m^3/s)	100-Year Post-Development Uncontrolled Flow (m^3/s)	100-Year Post-Development Allowable Flow (m^3/s)
101	Existing Wetland	0.088	0.088	-
102	CP Rail Corridor	0.552	0.072	-
103, EPA1, EPA2, EXT1, EXT2	Existing Watercourse	1.016	0.313*	0.703
108	Self-Contained	0.130	-	-
-	Ramsey Road	0.0	0.178	-

Note: All flows for the South Pond design are based on the 24-hr SCS Type II storm distribution.

* The proposed 100-year uncontrolled flow to the existing watercourse includes the RDC flows from Catchment Area 206 and Catchment Area 201 as well as UNC1. These are the uncontrolled flows that are directed to the existing watercourse in post-development.

The drainage catchments which outlet to the CP Rail corridor and to the existing wetland are equal to or smaller than the pre-development flows; therefore, no quantity control is required. All other outlet locations require a level of quantity control to meet the allowable release rate. As Catchment 108 was previously self-contained and spilled

onto an adjacent developed property; therefore, it is proposed that this drainage be re-directed to the existing watercourse.

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. Details of the pond design are included in the sections to follow.

5.3.1.5 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 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.

5.3.1.6 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
28.54	65%	54%

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)
172.45	4,922	10,081

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 (176.00 m) to the normal water level (NWL) for the pond which is set at 178.00 m. The majority of the pond has a bottom elevation of 176.50 m with a deeper pool (176.00 m) located at the outlet. The plan view of the proposed pond is shown on Figure 6.

The other component of quality control in the pond is the forebay. There are two forebays proposed for this pond, 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	0.108	2	26.8	13.4	40.0	20.0
	Dispersion Length	1.910	2	35.1	17.5	40.0	20.0
West	Settling Length	0.108	2	26.8	13.4	40.0	20.0
	Dispersion Length	1.226	2	33.3	16.6	40.0	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)
16.34	4,663	4,912

[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 minimum 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. Based on preliminary calculations, using a 250 mm diameter orifice a drawdown time of 28 hours can be achieved. Further detail of this structure as well as confirmation of the orifice sizes will be completed during Detailed Design. The preliminary schematic of the proposed outlet structure layout is shown on Figure 6 and Figure 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 separate route reservoir command was added into the SWMHYMO modelling to replicate the on-site storage that will be provided in the medium density blocks to restrict the flows to the allowable release rate from these blocks. Table 17 outlines the requirements to ensure quantity control is achieved in the South Pond.

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)
14,630	27,623	0.618	0.703

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.

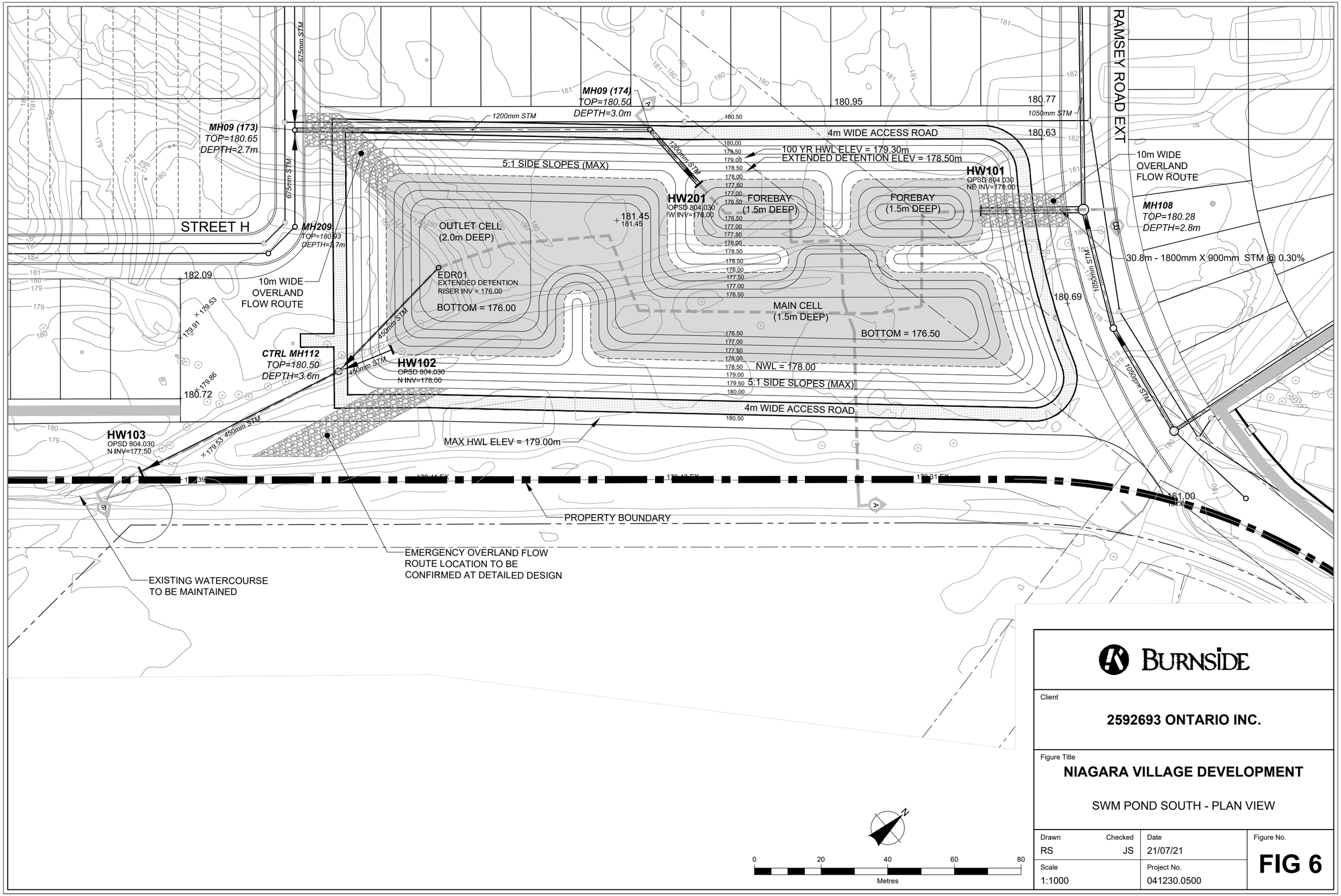

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

SWM POND SOUTH - PLAN VIEW

Drawn	Checked	Date	Figure No.
RS	JS	21/07/21	**FIG 6**
Scale		Project No.	
1:1000		041230.0500	

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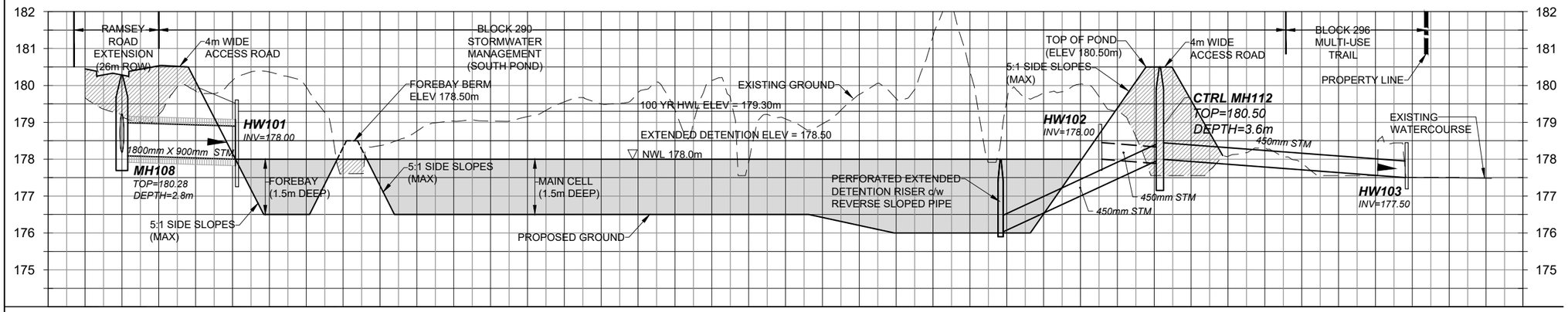
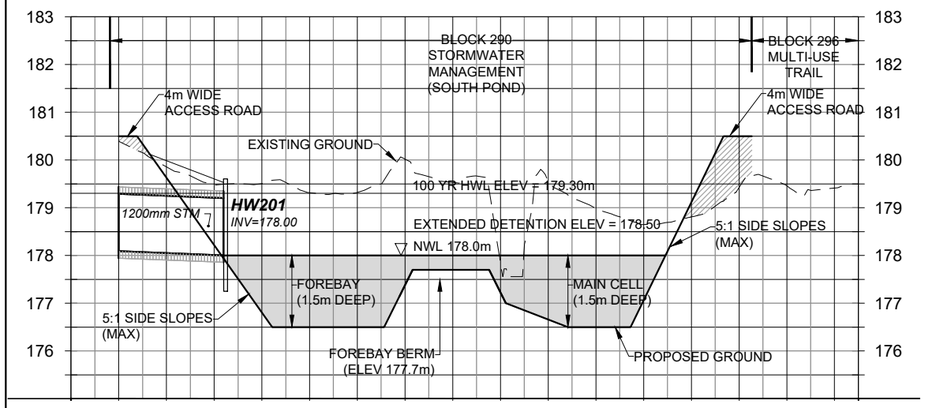


SOUTH SWM POND
SECTION B-B



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	21/07/21	**FIG 7**
Scale: H 1:1250 V 1:125		Project No.: 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 Conrail Drain.

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 Figure 4 and Figure 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	0.825	2.033	**1.208**
12-hour AES	0.335	0.349	0.014
24-hour SCS Type II	1.293	2.421	1.128

*Note: This flow is the sum of the existing flows (Catchments 104, 105, 106, 107, EXT4).
**Note: This flow is the total post-development flow for the catchments on the north side.

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	1.447
EXT4		0.028
UNC3	Direct to Conrail	0.408
UNC4		0.014
UNC5		0.171
UNC6	Wetland	0.119

Note: All flows are based on the 3-hr Chicago storm distribution.

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 that drain to the Conrail Drainage Channel. Table 20 identifies the results of the SWMHYMO modelling and the allowable release rates from the North Pond. The 100-year uncontrolled flow summarized in the table below is the sum of the three uncontrolled drainage areas that flow to the Conrail Drainage Channel (UNC3, UNC4, UNC5). Catchment Area UNC6 drains to the wetland at the west end of the site, consistent with existing conditions.

Table 20: North – Allowable Release Rate

Catchment	Outlet	100-Year Pre-Development Flow (m^3/s)	100-Year Uncontrolled Flow (m^3/s)	100-Year Allowable Flow (m^3/s)
104, 105 106, EXT4	Conrail Drainage Channel	0.677	0.478	0.199
107	Wetland	0.170	-	0.170

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

As described in the section above, the post-development flow rate from Catchment Area UNC6 is 0.119 m^3/s which is less than the 100-year allowable of 0.17 m^3/s; therefore, no flow control is required for Catchment Area UNC6.

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 three 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.

Catchment UNC5 is a park area located between the Conrail Drainage Channel and the CP Rail. It is proposed that this uncontrolled area outlet directly 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 UNC5.

Catchment UNC6 is comprised of rear lots that back onto the Conrail Drain. It is proposed that this uncontrolled area be conveyed via a rear yard swale or catchbasin and outlet to the wetland to the west, consistent with existing conditions. As this area is comprised of landscaping and clean rooftop, no quality control is proposed for Catchment UNC6.

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

5.3.2.5 Stormwater Management Pond Design

The north stormwater management pond is located on Block 290 within the proposed DPOS with an outlet to the 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 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
8.79	52.74%	43.79%

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 a depth of 1.3 m as shown on Figure 8. The pond water level of the permanent pool is 178.2 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 144 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)
144	1,269	2,567

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	0.083	2	23.5	11.8	35	17.5
Dispersion Length	0.826	2	**26.8**	**13.4**	35	17.5

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. 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. Refer to Appendix D for a copy of the SWMHYMO modelling. Table 24 outlines the requirements to ensure quantity control is achieved in the North Pond.

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)
2,892	10,792	0.134	0.199

The volume provided is at the maximum high-water level for the pond, which allows for a 0.4 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.

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

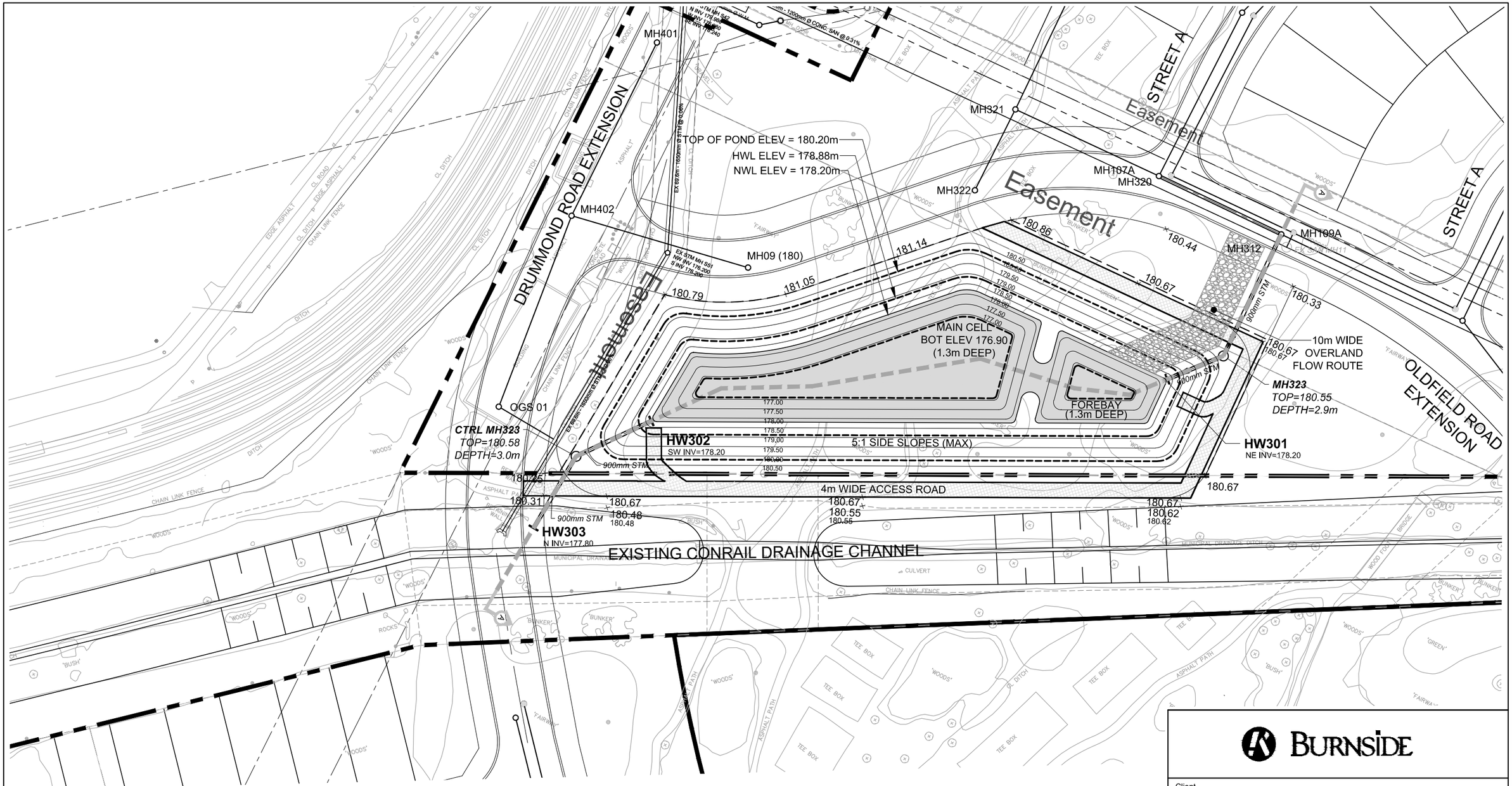

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Figure Title

NIAGARA VILLAGE DEVELOPMENT

SWM POND NORTH - PLAN VIEW

Drawn	Checked	Date	Figure No.
RS	LG	21/07/21	**FIG 8**
Scale		Project No.	
1:1000		041230.0500	

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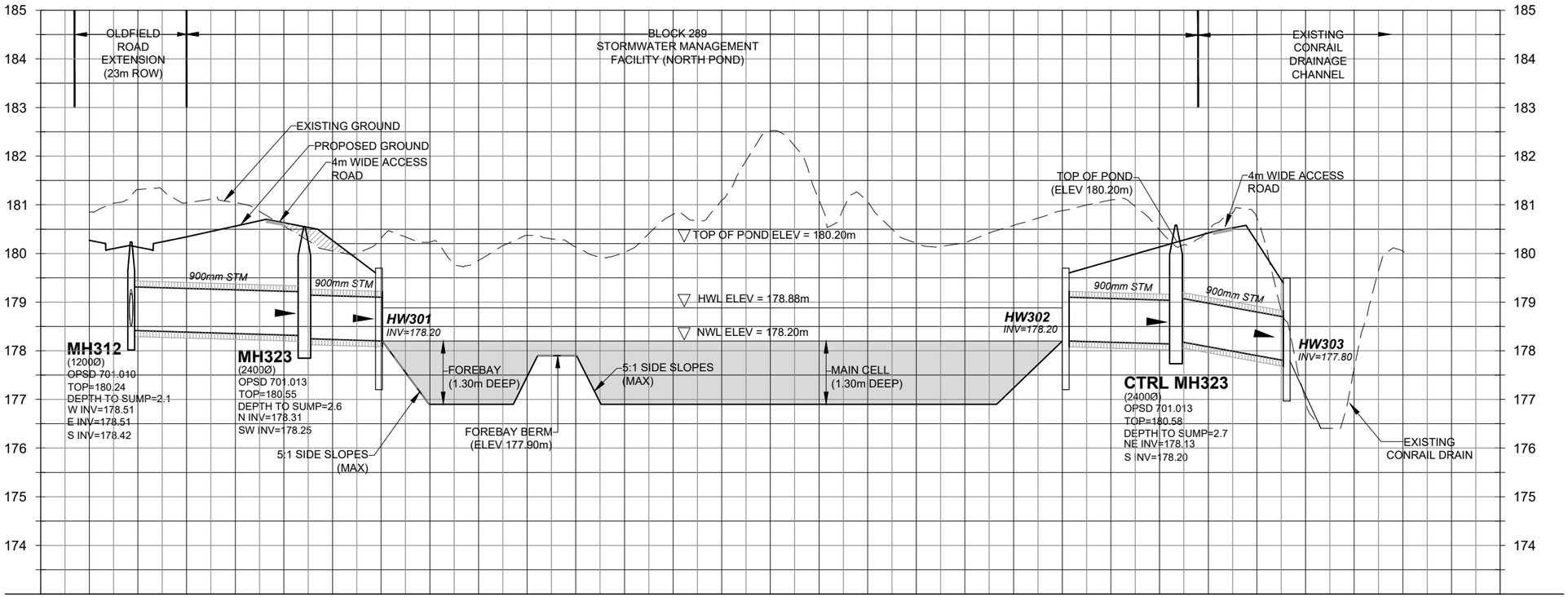

NORTH SWM POND
SECTION A-A

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	21/07/21	**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: July 15, 2021 - 2:47 PM

6.0 Water Balance

A water balance analysis has been completed for the surface features under a separate cover. Refer to the Feature Based Water Balance Memorandum prepared by Burnside, dated July 2021.

In general, 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 overall 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 EPA1, EPA2, EXT1, EXT2, and UNC7 on the south side of the CP Rail corridor 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 0.894 m^3/s. This flow will help 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 Erosion and Sediment Control

The erosion and sediment control plan for the site will be designed in conformance with the City of Niagara Falls Guidelines, Niagara Peninsula Conservation Authority Guidelines, and Erosion and Sediment Control Guidelines for Urban Construction Manual. Refer to ESC drawing included with this report providing a preliminary erosion and sediment control plan. Detailed erosion and sediment control plans will be prepared at the Detailed Design stage. Erosion and sediment control will be implemented for all construction activities including topsoil stripping, foundation excavation and stockpiling of materials.

The erosion and sediment control strategy includes the following:

- Temporary sediment control fence at construction limits and/or downstream of any disturbed areas prior to grading;
- Gravel mud mats at construction vehicle access points to minimize off-site tracking of sediments;
- Temporary sediment ponds as required utilizing the permanent stormwater management facility;
- Check dams, etc., for erosion/velocity control;
- Sediment traps in catchbasins;
- Routine inspection, monitoring, and repair as necessary of all temporary erosion and sediment control measures during construction; and,
- Removal of temporary controls once the areas they serve are restored and stable.

All reasonable measures will be taken to ensure that sediment loading to the Conrail Drain the existing southern watercourse is minimized both during and following construction.

8.0 Conclusions and 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:	L.Garner
Niagara Village	Project No:	300041230
Overland Flow in ROW (SOUTH)	Date:	July 14, 2021

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**
90487 m^2	0.60	72200 m^2	0.62

(Pond Drainage less Medium/High Density with 5 Year Control & Pond Block Area)

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	1267.28 L/s
WEST	719.5	6.3	0.77	10.000 min	84.02 mm/hr	1044.88 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	2017.73 L/s
WEST	1264.6	7.7	0.78	10.000 min	133.78 mm/hr	1663.62 L/s

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

EAST	**750.45 L/s**
WEST	**618.74 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

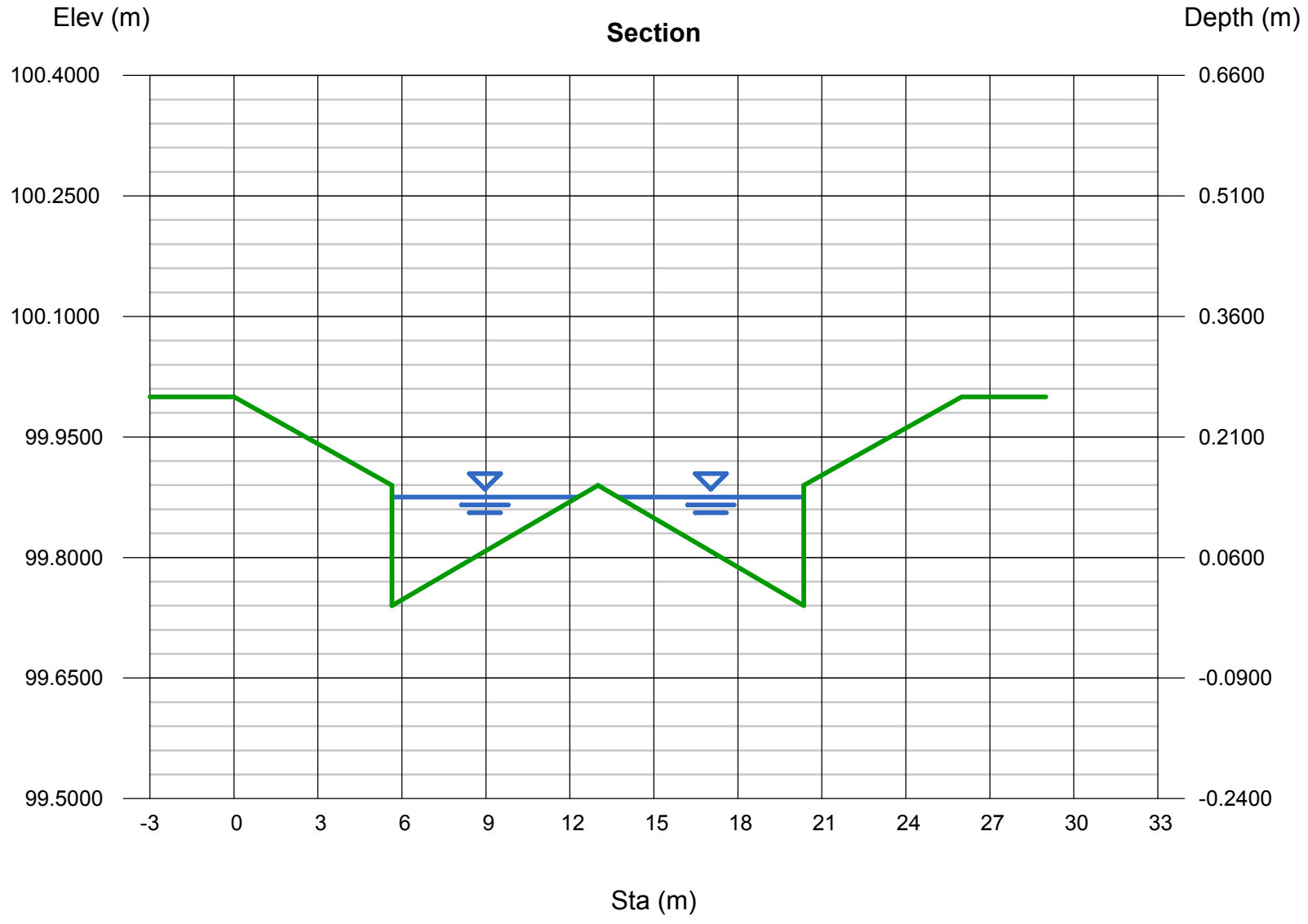
Compute by:	Q vs Depth
No. Increments	= 25

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. Wednesday, Jun 9 2021

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	= 48

Highlighted

Depth (m)	= 0.1200
Q (cms)	= 0.6208
Area (sqm)	= 0.6525
Velocity (m/s)	= 0.9515
Wetted Perim (m)	= 8.9418
Crit Depth, Yc (m)	= 0.1280
Top Width (m)	= 8.7000
EGL (m)	= 0.1662

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

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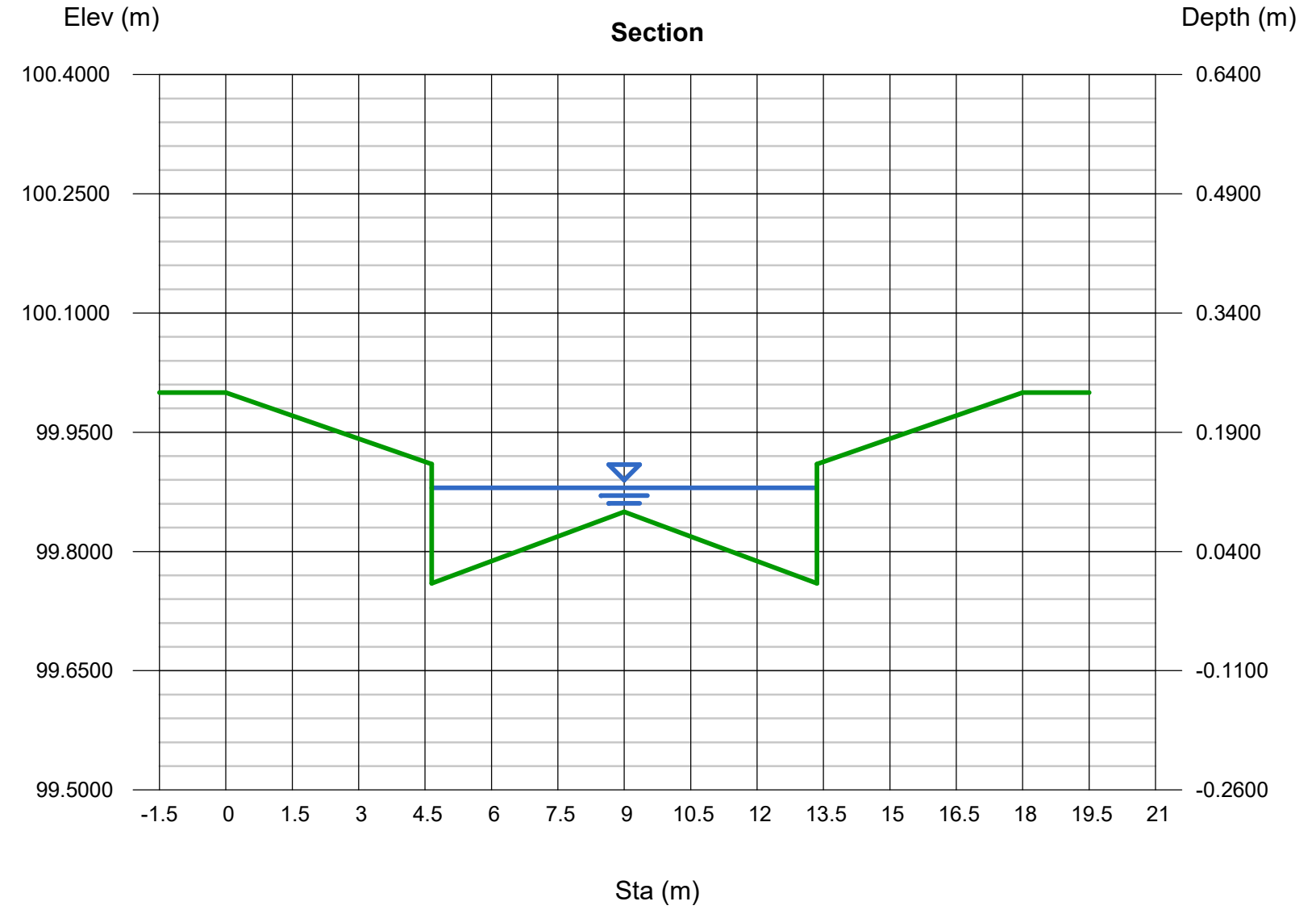

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CALCULATION SHEET

Project:	Prepared by:	L.Garner
Niagara Village	Project No:	300041230
Overland Flow in ROW (NORTH)	Date:	June 2, 2021

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**	
87900 m^2	0.57	(Pond Drainage Area)

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	1169.50 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	1862.04 L/s

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

NORTH **692.54 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)...

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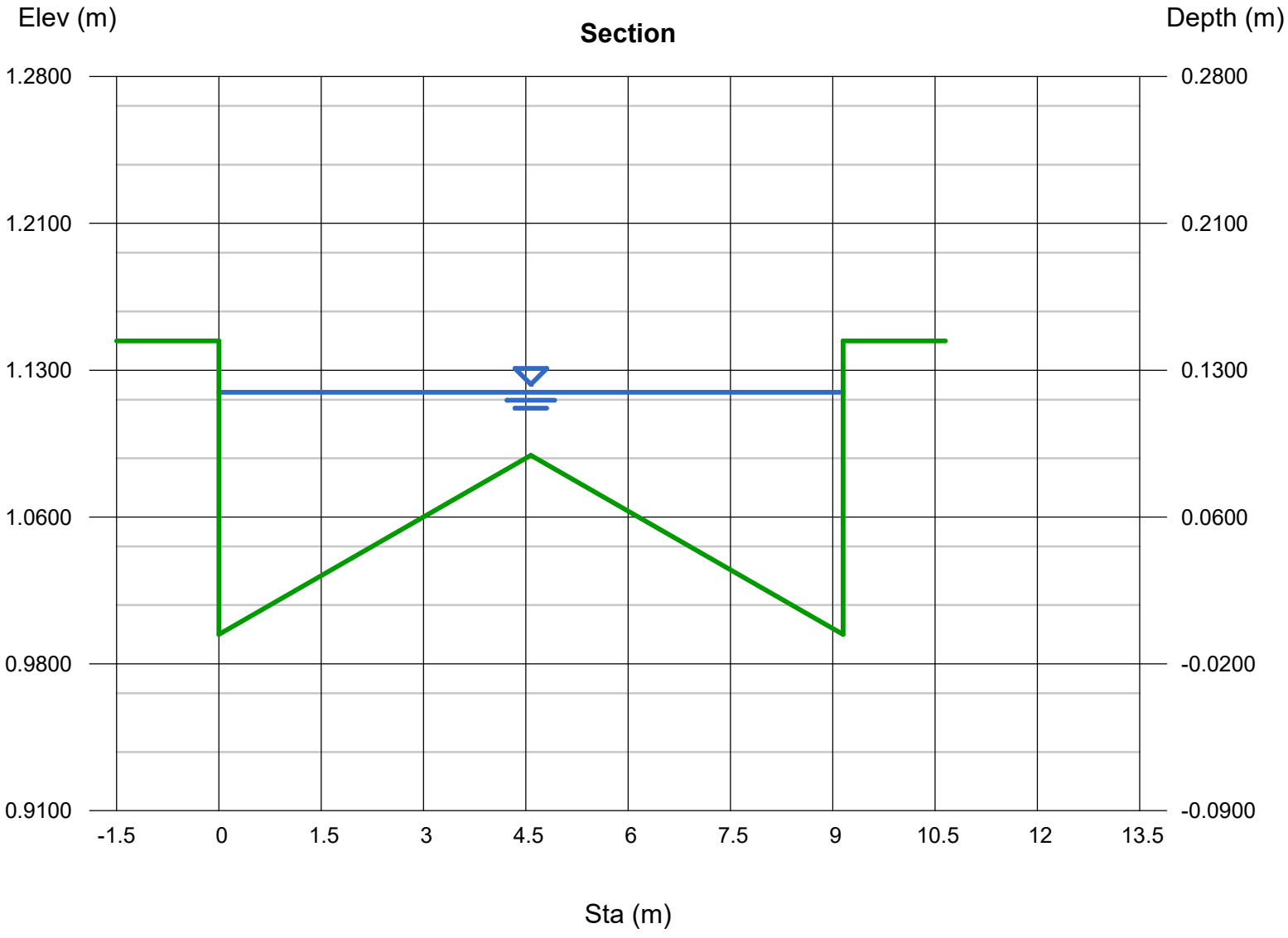

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Appendix B

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
Jeddo Clay = Soil Group D

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.

2 TIPS FOR MODELLING UNGAUGED URBAN CATCHMENTS

This section provides direction for modellers who are modelling ungauged urban catchments. In most cases, urban catchments are not gauged since the response to rainfall can be accurately simulated. However, like any model the user should be aware that the inappropriate selection of parameters can lead to erroneous output. This section will guide the modeller in selecting parameters that have been successfully used in the water resources industry.

2.1 IMPERVIOUSNESS

There are two impervious ratios required, the amount of directly connected imperviousness, **XIMP**, and the total imperviousness, **TIMP**. **XIMP** must be less than or equal to **TIMP**.

TIMP is a function of the land use of the catchment. Land use is a planning term that describes the approved, or proposed, use for the catchment (e.g. residential, commercial, industrial). Water resources studies are generally tied to planning applications and depending on the level of planning application, (i.e. Secondary Plan, Official Plan Amendment, Draft Plan), the modeller will have a little or a lot of information about the land use. Therefore it is important to select a conservative value for the imperviousness when performing more macro level studies so that when the subsequent more detailed studies are completed, the more refined land use calculations will still be valid in the overall model.

The following table gives examples of suggested **TIMP** and **XIMP** values, based on land use, for the macro-level studies. These values can be used with the information supplied by the planner to determine area weighted values for the catchment of interest.

Land Use	**XIMP**	**TIMP**
Estate Residential	20	40
Low Density Residential (e.g. Single Units)	25	50
Medium Density Residential (e.g. Semi-detached Units)	35	55
High Density Residential (e.g. Townhouse Units)	50	60
School	55	55
Commercial	85	85
Park	0	0

For more detailed level studies (i.e. Site Plan), there should be more information available so that the **XIMP** and **TIMP** can be calculated.

BURNSIDE

Project: **Niagara Village**

Task: **CN Number Summary - South**

Date: **31-May-21**

Prepared by: **L.Garner**

Project no.: **300041230**

	Soil Name	Jeddo Clay	Jeddo Clay	Welland Clay	Welland Clay		
	Land Cover	Golf Course	Forest	Golf Course	Forest		
	Soil Group	D	D	C	C		
	CN Number	80	83	74	77		
Catchment	**Total Area**	**Jeddo Golf**	**Jeddo Forest**	**Welland Golf**	**Welland Forest**	**CN Number**	
EPA1	4.93	0.00	0.00	4.03	0.90	75	
EPA2	5.91	0.00	0.00	3.08	2.83	75	
EXT1	0.20	0.00	0.00	0.00	0.20	77	
EXT2	0.65	0.00	0.00	0.00	0.65	77	
101	0.49	0.00	0.00	0.49	0.00	74	
102	2.60	2.33	0.00	0.28	0.00	79	
103	25.84	13.32	0.00	9.98	2.54	77	
108	1.05	0.00	0.00	0.85	0.20	75	
201	2.37	0.05	0.00	2.32	0.00	74	(Block 278)
202	8.99	8.71	0.00	0.28	0.00	80	
203	4.39	0.00	0.00	4.04	0.35	74	(Block 280)
205	2.50	1.73	0.77	0.00	0.00	81	
206	0.87	0.31	0.00	0.56	0.00	76	(Block 279)
207	9.42	4.62	0.00	3.34	1.46	77	
208	0.62	0.00	0.00	0.12	0.50	76	
UNC1	2.11	1.36	0.08	0.44	0.23	76	
UNC2	0.36	0.25	0.11	0.00	0.00	81	
UNC7	0.40	0.00	0.00	0.40	0.00	74	
UNC8	0.49	0.00	0.00	0.49	0.00	74	

Project: **Niagara Village**
Project #: 300041230
Designed By: L.Garner
Date: 6-Jul-2021

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)
EXISTING						
EPA1	4.93	303	0.20	1.65	43.29	0.43
EPA2	5.91	489	0.20	0.55	79.03	0.79
101	0.49	37.00	0.20	5.05	10.46	0.10
102	2.60	44.00	0.20	13.20	8.31	0.08
103	25.84	798.00	0.20	0.06	206.39	2.06
108	1.05	97.00	0.20	1.91	23.35	0.23
EXTERNAL						
EXT1	0.2	37	0.20	10.38	8.25	0.08
EXT2	0.65	91	0.20	3.35	18.78	0.19
PROPOSED						
UNC7	0.4	11	0.20	3.36	6.52	0.07
UNC8	0.49	37	0.20	5.05	10.46	0.10

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: **31-May-21**

Project no.: **300041230**

	Soil Name	Jeddo Clay	Jeddo Clay	Welland Clay	Welland Clay	
	Land Cover	Golf Course	Forest	Golf Course	Forest	
	Soil Group	D	D	C	C	
	CN Number	80	83	74	77	
Catchment	**Total Area**	**Jeddo Golf**	**Jeddo Forest**	**Welland Golf**	**Welland Forest**	**CN Number**
104	2.19	2.03		0.16		80
105	2.45	2.43		0.03		80
106	6.88	0.86	0.39	5.15	0.48	75
107	3.15	1.76	1.39			81
EXT3	0.05			0.05		74
EXT4	0.25			0.25		74
209	8.54	3.04		5.50		76
UNC3	1.46	1.46				80
UNC4	0.14			0.14		74
UNC5	1.73	1.66		0.07		80
UNC6	0.64	0.64				80

Project: **Niagara Village**
Project #: 300041230
Designed By: L.Garner
Date: 7-Jun-2021

BURNSIDE

Airport Method for Time to Peak Calculations - NORTH

Natural Area Watershed Information

WS	Area (ha)	Length (m)	RC	Slope (%)	Time of Concentration (min)	Time to Peak (hrs)
EXISTING						
104	2.19	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
107	3.15	267	0.2	0.663	54.91	0.55
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	0.14	36	0.2	4.50	10.72	0.11
UNC5	1.73	82	0.2	2.59	19.42	0.19
UNC6	0.64	30	0.2	5.20	9.33	0.09

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

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Stormwater Management Calculations – South

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS - CATCHMENT 202 - TO WEST FOREBAY

Pond Drainage Area = **89851** **m2** **or** **8.99** **ha**

Right of Ways (m2)

20497	ROW

Total Area= 2.05 ha

		Area
TIMP	90%	1.84 ha
XIMP	80%	1.64 ha

Parkland Areas (m2)

Total Area= 0.00 ha

		Area
TIMP	10%	0.00 ha
XIMP	5%	0.00 ha

SWM Block (m2)

17652	West Portion

Total Area = 1.77 ha

		Area
TIMP	50%	0.88 ha
XIMP	50%	0.88 ha

Medium Density (m2)

Total Area = 0.00 ha

		Area
TIMP	80%	1.41 ha
XIMP	60%	1.06 ha

Low-Density Residential Areas (m2)

43728	

Total Area 4.37 ha

		Area
TIMP	43%	1.88 ha
XIMP	32%	1.40 ha

Townhouses (m2)

7974	Block 272-275

Total Area 0.80 ha

		Area
TIMP	64%	2.80 ha
XIMP	48%	2.10 ha

IMPERVIOUSNESS			
TOTAL Modelled Area=	**8.99 ha**	**TOTAL Pervious Area=**	**3.87 ha**
OVERALL TIMP	**0.570**		
OVERALL XIMP	**0.479**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS - CATCHMENT 205 - TO EAST FOREBAY

Pond Drainage Area = **24953** **m2** **or** **2.50** **ha**

Right of Ways (m2)

5472	ROW

Total Area= 0.55 ha

		Area
TIMP	90%	0.49 ha
XIMP	80%	0.44 ha

Parkland Areas (m2)

Total Area= 0 ha

		Area
TIMP	10%	0.00 ha
XIMP	5%	0.00 ha

SWM Block (m2)

Total Area = 0.00 ha

		Area
TIMP	50%	0.00 ha
XIMP	50%	0.00 ha

Medium Density (m2)

Total Area = 0.00 ha

		Area
TIMP	80%	0.00 ha
XIMP	60%	0.00 ha

Low-Density Residential Areas (m2)

19481	

Total Area 1.95 ha

		Area
TIMP	43%	0.84 ha
XIMP	32%	0.62 ha

Townhouses (m2)

Total Area 0.00 ha

		Area
TIMP	64%	1.25 ha
XIMP	48%	0.94 ha

IMPERVIOUSNESS

TOTAL Modelled Area=	**2.50 ha**	**TOTAL Pervious Area=**	**1.17 ha**
OVERALL TIMP	**0.533**		
OVERALL XIMP	**0.425**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS - CATCHMENT 207 - TO EAST FOREBAY

Pond Drainage Area = **94184** **m2** **or** **9.42** **ha**

Right of Ways (m2)

29150	ROW

Total Area= 2.92 ha

		Area
TIMP	90%	2.62 ha
XIMP	80%	2.33 ha

Parkland Areas (m2)

Total Area= 0 ha

		Area
TIMP	10%	0.00 ha
XIMP	5%	0.00 ha

SWM Block (m2)

3734	East Portion

Total Area = 0.37 ha

		Area
TIMP	50%	0.19 ha
XIMP	50%	0.19 ha

Medium Density (m2)

Total Area = 0.00 ha

		Area
TIMP	80%	0.30 ha
XIMP	60%	0.22 ha

Low-Density Residential Areas (m2)

61300	

Total Area 6.13 ha

		Area
TIMP	43%	2.64 ha
XIMP	32%	1.96 ha

Townhouses (m2)

Total Area 0.00 ha

		Area
TIMP	64%	3.92 ha
XIMP	48%	2.94 ha

IMPERVIOUSNESS			
TOTAL Modelled Area=	**9.42 ha**	**TOTAL Pervious Area=**	**3.97 ha**
OVERALL TIMP	**0.578**		
OVERALL XIMP	**0.476**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS - TO RAMSEY (CATCHMENT 208)

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	80%	0.50 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	**0.800**		

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS - UNCONTROLLED TO RAILWAY (UNC2)

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

Low-Density Residential Areas (m2)

3595	

Medium Density (m2)

Total Area 0.36 ha

		Area
TIMP	43%	0.15 ha
XIMP	32%	0.12 ha

Total Area 0.00 ha

		Area
TIMP	80%	0.29 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 0.320

IMPERVIOUS CALCULATIONS - UNCONTROLLED TO CHANNEL (UNC1)

Drainage Area = **21100** **m2** **or** **2.11** **ha**

Parkland Areas (m2)

15036	

Low-Density Residential Areas (m2)

6064	

Total Area= 1.5036 ha

		Area
TIMP	10%	0.15 ha
XIMP	5%	0.08 ha

Total Area 0.61 ha

		Area
TIMP	43%	0.15 ha
XIMP	32%	0.12 ha

IMPERVIOUSNESS (UNCONTROLLED TO WETLAND)

TOTAL Modelled Area= 2.11 ha **TOTAL Pervious Area= 1.70 ha**

OVERALL TIMP 0.195
OVERALL XIMP 0.128

BURNSIDE

CALCULATION SHEET

Project: **Niagara Village - SOUTH**

Prepared by: L.Garner
Project No: 300041230
Date: Feb 1, 2021

Rational Method 5 Year Flow Control - Medium Density Blocks

Runoff Equation $Q = 2.78CIA$ (l/s)

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

$$I = \frac{A}{T^c}$$

I= Rainfall Intensity (mm/hr)
T= Time of concentration (min)
(use T=10 min)

Catchment 201
BLOCK 278 - Medium Density

Area	C
23,700 m^2	0.76

Return Period	A	B	C	T	I	Q
2 year	521.970	5.280	0.759	10 min	65.94 mm/hr	329.93 L/s
5 year	719.500	6.340	0.769	10 min	84.02 mm/hr	420.43 L/s
10 year	577.930	2.483	0.669	10 min	106.77 mm/hr	534.23 L/s
25 year	1020.690	7.290	0.779	10 min	110.83 mm/hr	554.56 L/s
100 year	1264.570	7.720	0.781	10 min	133.78 mm/hr	669.40 L/s

Catchment 206
BLOCK 279 - Medium Density

Area	C
8,700 m^2	0.76

Return Period	A	B	C	T	I	Q
2 year	521.970	5.280	0.759	10 min	65.94 mm/hr	121.11 L/s
5 year	719.500	6.340	0.769	10 min	84.02 mm/hr	154.34 L/s
10 year	577.930	2.483	0.669	10 min	106.77 mm/hr	196.11 L/s
25 year	1020.690	7.290	0.779	10 min	110.83 mm/hr	203.57 L/s
100 year	1264.570	7.720	0.781	10 min	133.78 mm/hr	245.73 L/s

Catchment 203
BLOCK 280 - High Density

Area	C
42,700 m^2	0.83

Return Period	A	B	C	T	I	Q
2 year	521.970	5.280	0.759	10 min	65.94 mm/hr	649.19 L/s
5 year	719.500	6.340	0.769	10 min	84.02 mm/hr	827.26 L/s
10 year	577.930	2.483	0.669	10 min	106.77 mm/hr	1051.18 L/s
25 year	1020.690	7.290	0.779	10 min	110.83 mm/hr	1091.16 L/s
100 year	1264.570	7.720	0.781	10 min	133.78 mm/hr	1317.14 L/s

IDF Parameters from NPCA Stormwater Management Guidelines
Block Areas as per the Draft Plan have been used to determine the allowable release rates from the Blocks

BURNSIDE

CALCULATION SHEET

Project: **Niagara Village - SOUTH**

Prepared by: L.Garner
Project No: 300041230
Date: Feb 1, 2021

Rational Method Flows - 2 Year Flow Roof Drain Collector

Runoff Equation $Q = 2.78CIA$ (l/s)

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

$$I = AT^c$$

- I = Rainfall Intensity (mm/hr)
- T = Time of concentration (min) (use T=10 min)

CATCHMENT 201 - BLOCK 278 - (RDC to Channel UNC)

Area		C	
556	m^2	0.90	(1 Block of Stacked Townhomes)

Return Period	A	B	C	T	I	Q
2 year	521.970	5.280	0.759	10 min	65.94 mm/hr	9.17 L/s
5 year	719.500	6.340	0.769	10 min	84.02 mm/hr	11.68 L/s
10 year	577.930	2.483	0.669	10 min	106.77 mm/hr	14.84 L/s
25 year	1020.690	7.290	0.779	10 min	110.83 mm/hr	15.41 L/s
100 year	1264.570	7.720	0.781	10 min	133.78 mm/hr	18.60 L/s

CATCHMENT 206 - BLOCK 279 - (RDC to Channel UNC)

Area		C	
1,740	m^2	0.90	(40% of Block assumed to be roof, half of roof area to RDC)

Return Period	A	B	C	T	I	Q
2 year	521.970	5.280	0.759	10 min	65.94 mm/hr	28.69 L/s
5 year	719.500	6.340	0.769	10 min	84.02 mm/hr	36.55 L/s
10 year	577.930	2.483	0.669	10 min	106.77 mm/hr	46.45 L/s
25 year	1020.690	7.290	0.779	10 min	110.83 mm/hr	48.21 L/s
100 year	1264.570	7.720	0.781	10 min	133.78 mm/hr	58.20 L/s

IDF Parameters from NPCA Stormwater Management Guidelines

Project: Niagara Village - SOUTH
File: 300041230.0000
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

Wet Pond Permament Pool Requirement - Total Pond

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

IMPERVIOUSNESS	64.62 %
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	64.62	172.45	4921.84
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	64.62	82.83	1524.38
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	64.62	41.42	762.19
55	35			
70	45			
85	55			
99.0	**61**	**Extrapolated**		

EXTENDED DETENTION CALCULATIONS

Project: Niagara Village - SOUTH
File: 300041230.00
Designed by: L.Garner
Date: 31-May-21

Extended Detention Storage Required - SCS Method

Q = (P-IA)^2/P-(IA-S)
S = -254+25400/CN
T IMP = **64.62** %

Pervious Area			**Impervious Area**		
P =	25	mm	P =	25	mm
IA =	2.5	mm	IA =	2.5	mm
CN =	76		CN =	98	
S =	80.2		S =	5.2	
Q =	4.9	mm	Q =	18.3	mm

	per	**imp**	**total**	
SCS Runoff Volume	4.9	18.3		mm
Drainage Area	10.10	18.44	**28.54**	ha
Storage Volume	498	3373	3870	cu.m

Extended Detention Component of Pond: 3870 cu.m

HYMO OUTPUT 16.34 mm
4663 cu.m

EXTENDED DETENTION REQUIRED 4663 cu.m

Orifice Sizing per MOE 2003 SWM Manual - Falling Head Equation

t = 2*Ap*(h^0.5)/(C*Ao*(g*2)^0.5)

t =	drawdown time	86400	seconds	*based on 24hr ED req.
Ao =	cross sectional area of orifice		sq.m	*to be calculated
h =	maximum water elevation above orifice (depth of ED)	0.50	m	*depth of ED
C =	discharge coefficient	0.64		
Ap =	average pond surface area for extended detention	9797.50	sq.m	*based on pond design

Ao = 0.0566 sq.m d = 268 mm
Actual Diameter d = 250 mm Ao = 0.049
Actual Drawdown Time 27.658 hrs

SEDIMENT FOREBAY SIZING

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

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 = 0.10795 cms *see below
Vs = 0.0003 m/s

therefore:
Dist = 26.8 metres
Width= 13.4 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 4663 cu.m (extended det. volume)
Release Rate 24 hrs (typically 24 or 48)
Qp 0.10795 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 = 1.91 cms *see below
d = 1.5 m
Vf = 0.5 m/s

therefore:
Dist = 20.4 metres
Width= 10.2 metres
Min Bottom Width= 2.5 metres *MOE equation 4.6
Pond Side Slopes: 5
Calc. Top Width= 17.547 metres
Calc. Top Length= 35.093 meters

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

Minimum Forebay Dimension:

Length= 35.1 meters
Width= 17.5 meters

Actual Forebay Design:

Length= 40.0 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 = 1.91 A = 19 sq.metres

therefore: V = 0.1019 m/s
Design: **OK**

SEDIMENT FOREBAY SIZING

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

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 = 0.10795 cms *see below
Vs = 0.0003 m/s

therefore:
Dist = 26.8 metres
Width= 13.4 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 4663 cu.m (extended det. volume)
Release Rate 24 hrs (typically 24 or 48)
Qp 0.10795 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 = 1.226 cms *see below
d = 1.5 m
Vf = 0.5 m/s

therefore:
Dist = 13.1 metres
Width= 6.5 metres
Min Bottom Width= 1.6 metres *MOE equation 4.6
Pond Side Slopes: 5
Calc. Top Width= 16.635 metres
Calc. Top Length= 33.269 meters

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

Minimum Forebay Dimension:

Length= 33.3 meters
Width= 16.6 meters

Actual Forebay Design:

Length= 40.0 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 = 1.226 A = 19 sq.metres

therefore: V = 0.0654 m/s
Design: **OK**

Project: Niagara Village - SOUTH
File: 300041230.0000
Designed by: L.Garner
Date: 5/31/2021

BURNSIDE

South SWM Pond Storage Calculations

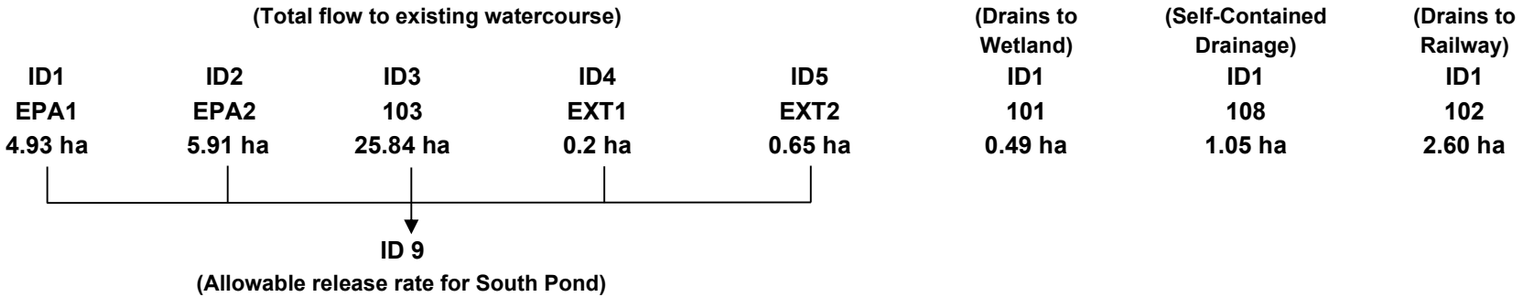
INPUT AREA

Base of Pond:	176.00	
N.W.L.:	178.00	masl
Required Permanent Pool Volume:	4922	m^3
Permanent Pool Volume Provided:	10081	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)
	176.50	-1.50		727.47	
	177.00	-1.00		2965.74	
NWL	178.00	0.00	0.00	10080.89	0.00
Extended Detention	178.50	0.50	0.50	14993.01	4912.12
	179.50	1.50	1.50	27414.53	17333.64
	180.20	2.20	2.20	37704.38	27623.49
Freeboard	180.50	2.50	2.50	42486.86	32405.97

South Pond – SWMHYMO Model Schematic – EXISTING



(C:\...100.DAT)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date         : 12-9-2019 updated 06-07-2021
00005> *#  Modeller     : [L.Garner]
00006> *#  Company      : R. J. Burnside & Associates Ltd.
00007> *#  License #    :  3877524
00008> *#*************************************************************************
00009> *# Existing Development Model for the Site
00010> *#
00011> *#  CN as per Ontario Soils Map for Welland County
00012> *#
00013> *#  TIMP / XIMP and TP as per RJB prelim investigation
00014> *#*************************************************************************
00015> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00016> *%                   [  ] <--storm filename, one per line for NSTORM time
00017> *%-----------------|-------------------------------------------------------|
00018> *#*************************************************************************
00019> *% 100-year 24-hr SCS
00020> READ STORM          STORM_FILENAME=["100Y24.STM"]
00021> *%-----------------|-------------------------------------------------------|
00022> *#*************************************************************************
00023> *%-----------------|-------------------------------------------------------|
00024> * EPA1 - (lands are owned by applicant by will not be developed
00025> * as part of this application)
00026> * Flow to Point A
00027> DESIGN NASHYD       ID=[1], NHYD=[1], DT=[1]min, AREA=[4.93](ha),
00028>                     DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00029>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00030> *%-----------------|-------------------------------------------------------|
00031> * EPA2 - (lands are owned by applicant by will not be developed
00032> * as part of this application)
00033> * Flow to Point B
00034> DESIGN NASHYD       ID=[2], NHYD=[2], DT=[1]min, AREA=[5.91](ha),
00035>                     DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00036>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00037> *%-----------------|-------------------------------------------------------|
00038> * 103 - lands owned by applicant that are to be developed
00039> * Discharges to existing watercourse
00040> DESIGN NASHYD       ID=[3], NHYD=[3], DT=[1]min, AREA=[25.84](ha),
00041>                     DWF=[0](cms), CN/C=[77], TP=[2.06]hrs,
00042>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00043> *%-----------------|-------------------------------------------------------|
00044> * EXT1 - external lands
00045> * Discharges to Point A
00046> DESIGN NASHYD       ID=[4], NHYD=[4], DT=[1]min, AREA=[0.2](ha),
00047>                     DWF=[0](cms), CN/C=[77], TP=[0.08]hrs,
00048>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00049> *%-----------------|-------------------------------------------------------|
00050> * EXT2 - external lands
00051> * Discharges to Point B
00052> DESIGN NASHYD       ID=[5], NHYD=[5], DT=[1]min, AREA=[0.65](ha),
00053>                     DWF=[0](cms), CN/C=[77], TP=[0.19]hrs,
00054>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00055> *%-----------------|-------------------------------------------------------|
00056> * Total to existing watercourse
00057> * Allowable release rate from post development pond
00058> ADD HYD             IDsum=[9], NHYD=[Total1], IDs to add=[1,2,3,4,5]
00059> *%-----------------|-------------------------------------------------------|
00060> * 101 - lands owned by applicant that are to be developed
00061> * Discharges to existing wetland
00062> DESIGN NASHYD       ID=[1], NHYD=[101], DT=[1]min, AREA=[0.49](ha),
00063>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00064>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00065> *%-----------------|-------------------------------------------------------|
00066> * 108 - Self Contained Drainage
00067> *Spills to adjacent development
00068> DESIGN NASHYD       ID=[1], NHYD=[108], DT=[1]min, AREA=[1.05](ha),
00069>                     DWF=[0](cms), CN/C=[75], TP=[0.23]hrs,
00070>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00071> *%-----------------|-------------------------------------------------------|
00072> * 102 - lands owned by applicant that are to be developed
00073> * Discharges to railway
00074> DESIGN NASHYD       ID=[1], NHYD=[102], DT=[1]min, AREA=[2.60](ha),
00075>                     DWF=[0](cms), CN/C=[79], TP=[0.08]hrs,
00076>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00077> *%-----------------|-------------------------------------------------------|
00078>
00079> FINISH
00080>
00081>
00082>
00083>
00084>
00085>
00086>
00087>
00088>
00089>
00090>
```

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

   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   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: 2021-06-08     TIME: 09:04:34     RUN COUNTER: 002425          *
 ********************************************************************************
 * Input   filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\SCS\100.DAT           *
 * Output  filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\SCS\100.out           *
 * Summary filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\SCS\100.sum           *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
001:0001--------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019 updated 06-07-2021
*#  Modeller    : [L.Garner]
*#  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:\SWMHYM~1\NIAGARA\210201~1\Existing\SCS\
-------------------- Rainfall dir.: C:\SWMHYM~1\NIAGARA\210201~1\Existing\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    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
               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--------------------------------------------------------------------------
*#*****************************************************************************
* EPA1 - (lands are owned by applicant by will not be developed
* as part of this application)
* Flow to Point A
----------------------
| DESIGN NASHYD      |   Area    (ha)=    4.93   Curve Number   (CN)=75.00
| 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .438

     PEAK FLOW       (cms)=     .401 (i)
     TIME TO PEAK    (hrs)=   12.567
     RUNOFF VOLUME    (mm)=   55.246
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .537

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

--------------------------------------------------------------------------------
001:0004--------------------------------------------------------------------------
* EPA2 - (lands are owned by applicant by will not be developed
* as part of this application)
* Flow to Point B
----------------------
| DESIGN NASHYD      |   Area    (ha)=    5.91   Curve Number   (CN)=75.00
| 02:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .286

     PEAK FLOW       (cms)=     .312 (i)
     TIME TO PEAK    (hrs)=   12.983
     RUNOFF VOLUME    (mm)=   55.246
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .537

     (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)=   25.84   Curve Number   (CN)=77.00
| 03:000003 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)=     .689 (i)
     TIME TO PEAK    (hrs)=   14.433
     RUNOFF VOLUME    (mm)=   57.988
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .564

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

--------------------------------------------------------------------------------
001:0006--------------------------------------------------------------------------
* EXT1 - external lands
* Discharges to Point A
----------------------
| DESIGN NASHYD      |   Area    (ha)=    .20   Curve Number   (CN)=77.00
| 04:000004 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .040 (i)
     TIME TO PEAK    (hrs)=   12.250
     RUNOFF VOLUME    (mm)=   57.987
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .564

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

--------------------------------------------------------------------------------
001:0007--------------------------------------------------------------------------
* EXT2 - external lands
* Discharges to Point B
----------------------
| DESIGN NASHYD      |   Area    (ha)=    .65   Curve Number   (CN)=77.00
| 05:000005 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .190

     Unit Hyd Qpeak  (cms)=     .131

     PEAK FLOW       (cms)=     .095 (i)
     TIME TO PEAK    (hrs)=   12.333
     RUNOFF VOLUME    (mm)=   57.987
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .564

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

--------------------------------------------------------------------------------
001:0008--------------------------------------------------------------------------
* 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     4.93     .401   12.57  55.25    .000
                     +ID2 02:         2     5.91     .312   12.98  55.25    .000
                     +ID3 03:         3    25.84     .689   14.43  57.99    .000
                     +ID4 04:         4      .20     .040   12.25  57.99    .000
                     +ID5 05:         5      .65     .095   12.33  57.99    .000
                     ==========================================================
                      SUM 09:         1    37.53    1.016   12.93  57.20    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009--------------------------------------------------------------------------
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .49   Curve Number   (CN)=74.00
| 01:000101 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .187

     PEAK FLOW       (cms)=     .088 (i)
     TIME TO PEAK    (hrs)=   12.267
     RUNOFF VOLUME    (mm)=   53.919
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .524

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

--------------------------------------------------------------------------------
001:0010--------------------------------------------------------------------------
* 108 -
----------------------
| DESIGN NASHYD      |   Area    (ha)=    1.05   Curve Number   (CN)=75.00
| 01:000108 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .174

     PEAK FLOW       (cms)=     .130 (i)
     TIME TO PEAK    (hrs)=   12.367
     RUNOFF VOLUME    (mm)=   55.246
     TOTAL RAINFALL   (mm)=  102.883
     RUNOFF COEFFICIENT   =     .537

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

--------------------------------------------------------------------------------
001:0011--------------------------------------------------------------------------
* 102 - lands owned by applicant that are to be developed
* Discharges to railway
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.60   Curve Number   (CN)=79.00
| 01:000102 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=    1.241

     PEAK FLOW       (cms)=     .552 (i)
     TIME TO PEAK    (hrs)=   12.250
```

```
00271>      RUNOFF VOLUME     (mm)=   60.855
00272>      TOTAL RAINFALL    (mm)=  102.883
00273>      RUNOFF COEFFICIENT    =     .591
00274>
00275>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00276>
00277> ---------------------------------------------------------------------------
00278> 001:0012----------------------------------------------------------------------
00279>       FINISH
00280> ---------------------------------------------------------------------------
00281> ***************************************************************************
00282>      WARNINGS / ERRORS / NOTES
00283>      -------------------------
00284>    Simulation ended on 2021-06-08     at 09:04:34
00285> ===========================================================================
00286>
00287>
```

INPUT FILE: South Side, Pre- Development, 100-Year Storm - 12 hr AES

(C:\...100.DAT)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date         : 12-9-2019 updated 06-07-2021
00005> *#  Modeller     : [L.Garner]
00006> *#  Company      : R. J. Burnside & Associates Ltd.
00007> *#  License #    :  3877524
00008> *#*************************************************************************
00009> *# Existing Development Model for the Site
00010> *#
00011> *#  CN as per Ontario Soils Map for Welland County
00012> *#
00013> *#  TIMP / XIMP and TP as per RJB prelim investigation
00014> *#*************************************************************************
00015> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00016> *%                   [  ] <--storm filename, one per line for NSTORM time
00017> *%-----------------|-------------------------------------------------------|
00018> *#*************************************************************************
00019> *% 100-year 12-hr AES
00020> MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
00021>                     CURVE_FILENAME=["AES-12HR.mst"]
00022> *%-----------------|-------------------------------------------------------|
00023> *#*************************************************************************
00024> * EPA1 - (lands are owned by applicant by will not be developed
00025> * as part of this application)
00026> * Flow to Point A
00027> DESIGN NASHYD       ID=[1], NHYD=[1], DT=[1]min, AREA=[4.93](ha),
00028>                     DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00029>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00030> *%-----------------|-------------------------------------------------------|
00031> * EPA2 - (lands are owned by applicant by will not be developed
00032> * as part of this application)
00033> * Flow to Point B
00034> DESIGN NASHYD       ID=[2], NHYD=[2], DT=[1]min, AREA=[5.91](ha),
00035>                     DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00036>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00037> *%-----------------|-------------------------------------------------------|
00038> * 103 - lands owned by applicant that are to be developed
00039> * Discharges to existing watercourse
00040> DESIGN NASHYD       ID=[3], NHYD=[3], DT=[1]min, AREA=[25.84](ha),
00041>                     DWF=[0](cms), CN/C=[77], TP=[2.06]hrs,
00042>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00043> *%-----------------|-------------------------------------------------------|
00044> * EXT1 - external lands
00045> * Discharges to Point A
00046> DESIGN NASHYD       ID=[4], NHYD=[4], DT=[1]min, AREA=[0.2](ha),
00047>                     DWF=[0](cms), CN/C=[77], TP=[0.08]hrs,
00048>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00049> *%-----------------|-------------------------------------------------------|
00050> * EXT2 - external lands
00051> * Discharges to Point B
00052> DESIGN NASHYD       ID=[5], NHYD=[5], DT=[1]min, AREA=[0.65](ha),
00053>                     DWF=[0](cms), CN/C=[77], TP=[0.19]hrs,
00054>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00055> *%-----------------|-------------------------------------------------------|
00056> * Total to existing watercourse
00057> * Allowable release rate from post development pond
00058> ADD HYD             IDsum=[9], NHYD=[Total1], IDs to add=[1,2,3,4,5]
00059> *%-----------------|-------------------------------------------------------|
00060> * 101 - lands owned by applicant that are to be developed
00061> * Discharges to existing wetland
00062> DESIGN NASHYD       ID=[1], NHYD=[101], DT=[1]min, AREA=[0.49](ha),
00063>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00064>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00065> *%-----------------|-------------------------------------------------------|
00066> * 108 -
00067> DESIGN NASHYD       ID=[1], NHYD=[108], DT=[1]min, AREA=[1.05](ha),
00068>                     DWF=[0](cms), CN/C=[75], TP=[0.23]hrs,
00069>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00070> *%-----------------|-------------------------------------------------------|
00071> * 102 - lands owned by applicant that are to be developed
00072> * Discharges to railway
00073> DESIGN NASHYD       ID=[1], NHYD=[102], DT=[1]min, AREA=[2.60](ha),
00074>                     DWF=[0](cms), CN/C=[79], TP=[0.08]hrs,
00075>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00076> *%-----------------|-------------------------------------------------------|
00077> *%-----------------|-------------------------------------------------------|
00078> FINISH
00079>
00080>
00081>
00082>
00083>
00084>
```

OUTPUT FILE: South Side, Pre- Development, 100-Year Storm - 12 hr AES

(C:\...100.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: 2021-06-08     TIME: 09:06:57     RUN COUNTER: 002426      *
 ************************************************************************
 * Input   filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\AES\100.DAT       *
 * Output  filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\AES\100.out       *
 * Summary filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\AES\100.sum       *
 * User comments:                                                           *
 * 1:_______________________________________________________________________*
 * 2:_______________________________________________________________________*
 * 3:_______________________________________________________________________*
 ************************************************************************

--------------------------------------------------------------------------------
001:0001--------------------------------------------------------------------------
*#*********************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 12-9-2019 updated 06-07-2021
*#  Modeller    : [L.Garner]
*#  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:\SWMHYM~1\NIAGARA\210201~1\Existing\AES\
-------------------- Rainfall dir.: C:\SWMHYM~1\NIAGARA\210201~1\Existing\AES\
    TZERO =   .00 hrs on       0
    METOUT=  2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------------
*#*********************************************************************************
--------------------
| MASS STORM       |    Filename: C:\SWMHYM~1\NIAGARA\210201~1\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

--------------------------------------------------------------------------------
003:0003--------------------------------------------------------------------------
*#*********************************************************************************
* EPA1 - (lands are owned by applicant by will not be developed
* as part of this application)
* Flow to Point A
----------------------
| DESIGN NASHYD      |   Area     (ha)=    4.93   Curve Number   (CN)=75.00
| 01:000001 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .438

     PEAK FLOW       (cms)=     .103 (i)
     TIME TO PEAK    (hrs)=    6.083
     RUNOFF VOLUME    (mm)=   43.758
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .497

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

--------------------------------------------------------------------------------
001:0004--------------------------------------------------------------------------
* EPA2 - (lands are owned by applicant by will not be developed
* as part of this application)
* Flow to Point B
----------------------
| DESIGN NASHYD      |   Area     (ha)=    5.91   Curve Number   (CN)=75.00
| 02:000002 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .286

     PEAK FLOW       (cms)=     .116 (i)
     TIME TO PEAK    (hrs)=    6.283
     RUNOFF VOLUME    (mm)=   43.758
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .497

     (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)=   25.84   Curve Number   (CN)=77.00
| 03:000003 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)=     .430 (i)
     TIME TO PEAK    (hrs)=    8.367
     RUNOFF VOLUME    (mm)=   46.128
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .524

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

--------------------------------------------------------------------------------
001:0006--------------------------------------------------------------------------
* EXT1 - external lands
* Discharges to Point A
----------------------
| DESIGN NASHYD      |   Area     (ha)=     .20   Curve Number   (CN)=77.00
| 04:000004 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    6.000
     RUNOFF VOLUME    (mm)=   46.127
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .524

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

--------------------------------------------------------------------------------
001:0007--------------------------------------------------------------------------
* EXT2 - external lands
* Discharges to Point B
----------------------
| DESIGN NASHYD      |   Area     (ha)=     .65   Curve Number   (CN)=77.00
| 05:000005 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .190

     Unit Hyd Qpeak  (cms)=     .131

     PEAK FLOW       (cms)=     .015 (i)
     TIME TO PEAK    (hrs)=    6.017
     RUNOFF VOLUME    (mm)=   46.128
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .524

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

--------------------------------------------------------------------------------
001:0008--------------------------------------------------------------------------
* 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     4.93     .103    6.08  43.76    .000
                      +ID2 02:        2     5.91     .116    6.28  43.76    .000
                      +ID3 03:        3    25.84     .430    8.37  46.13    .000
                      +ID4 04:        4     .20      .005    6.00  46.13    .000
                      +ID5 05:        5     .65      .015    6.02  46.13    .000
                       ==========================================================
                       SUM 09:        1   37.53     .609    8.05  45.44    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009--------------------------------------------------------------------------
* 101 - lands owned by applicant that are to be developed
* Discharges to existing wetland
----------------------
| DESIGN NASHYD      |   Area     (ha)=     .49   Curve Number   (CN)=74.00
| 01:000101 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .187

     PEAK FLOW       (cms)=     .010 (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.

--------------------------------------------------------------------------------
001:0010--------------------------------------------------------------------------
* 108 -
----------------------
| DESIGN NASHYD      |   Area     (ha)=    1.05   Curve Number   (CN)=75.00
| 01:000108 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .174

     PEAK FLOW       (cms)=     .022 (i)
     TIME TO PEAK    (hrs)=    6.033
     RUNOFF VOLUME    (mm)=   43.758
     TOTAL RAINFALL   (mm)=   88.060
     RUNOFF COEFFICIENT   =     .497
```

```
00271>
00272>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00273>
00274> ------------------------------------------------------------------------------
00275> 001:0011------------------------------------------------------------------------
00276> * 102 - lands owned by applicant that are to be developed
00277> * Discharges to railway
00278> ----------------------
00279> | DESIGN NASHYD      |   Area    (ha)=    2.60   Curve Number    (CN)=79.00
00280> | 01:000102 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00281> ----------------------   U.H. Tp(hrs)=    .080
00282>
00283>      Unit Hyd Qpeak  (cms)=    1.241
00284>
00285>      PEAK FLOW       (cms)=     .062 (i)
00286>      TIME TO PEAK    (hrs)=    6.000
00287>      RUNOFF VOLUME    (mm)=   48.628
00288>      TOTAL RAINFALL   (mm)=   88.060
00289>      RUNOFF COEFFICIENT   =     .552
00290>
00291>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00292>
00293> ------------------------------------------------------------------------------
00294> 001:0012------------------------------------------------------------------------
00295>      FINISH
00296> ------------------------------------------------------------------------------
00297> ********************************************************************************
00298>      WARNINGS / ERRORS / NOTES
00299>      -------------------------
00300>    Simulation ended on 2021-06-08     at 09:06:57
00301> ================================================================================
00302>
00303>
```

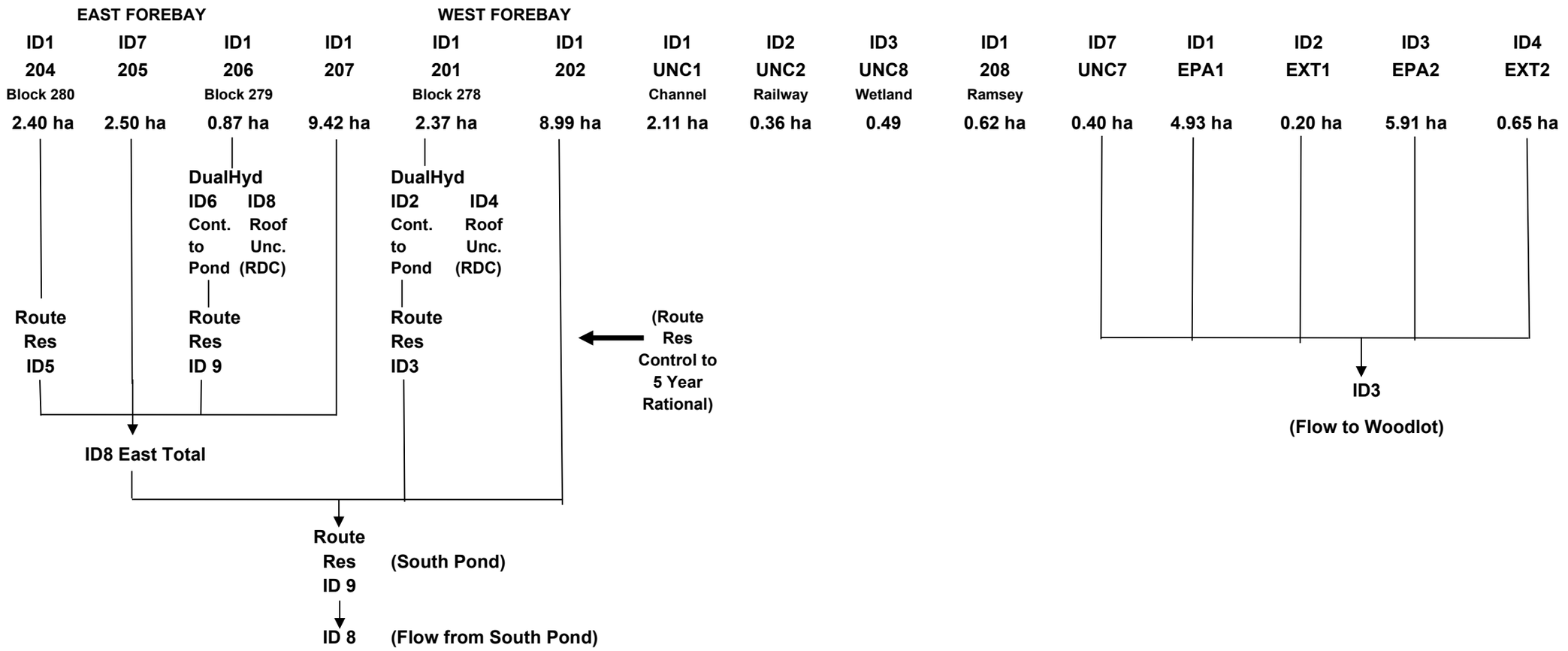
(C:\...100.DAT)

```
00001> 2     Metric units
00002> *#*****************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date         : 12-9-2019 updated 06-07-2021
00005> *#  Modeller     : [L.Garner]
00006> *#  Company      : R. J. Burnside & Associates Ltd.
00007> *#  License #    :  3877524
00008> *#*****************************************************************************
00009> *# Existing Development Model for the Site
00010> *#
00011> *#  CN as per Ontario Soils Map for Welland County
00012> *#
00013> *#  TIMP / XIMP and TP as per RJB prelim investigation
00014> *#*****************************************************************************
00015> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00016> *%                   [  ] <--storm filename, one per line for NSTORM time
00017> *%-----------------|-------------------------------------------------------|
00018> *#*****************************************************************************
00019> *% 100-year 3-hr Chicago
00020> CHICAGO STORM       IUNITS=[2],  TD=[3](hrs), TPRAT=[0.333],  CSDT=[5](min),
00021>                     ICASEcs=[1],
00022>                      A=[1264.57],  B=[7.72], and C=[0.7814],
00023> *%-----------------|-------------------------------------------------------|
00024> *#*****************************************************************************
00025> * EPA1 - (lands are owned by applicant by will not be developed
00026> * as part of this application)
00027> * Flow to Point A
00028> DESIGN NASHYD       ID=[1], NHYD=[1], DT=[1]min, AREA=[4.93](ha),
00029>                     DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00030>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00031> *%-----------------|-------------------------------------------------------|
00032> * EPA2 - (lands are owned by applicant by will not be developed
00033> * as part of this application)
00034> * Flow to Point B
00035> DESIGN NASHYD       ID=[2], NHYD=[2], DT=[1]min, AREA=[5.91](ha),
00036>                     DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00037>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00038> *%-----------------|-------------------------------------------------------|
00039> * 103 - lands owned by applicant that are to be developed
00040> * Discharges to existing watercourse
00041> DESIGN NASHYD       ID=[3], NHYD=[3], DT=[1]min, AREA=[25.84](ha),
00042>                     DWF=[0](cms), CN/C=[77], TP=[2.06]hrs,
00043>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00044> *%-----------------|-------------------------------------------------------|
00045> * EXT1 - external lands
00046> * Discharges to Point A
00047> DESIGN NASHYD       ID=[4], NHYD=[4], DT=[1]min, AREA=[0.2](ha),
00048>                     DWF=[0](cms), CN/C=[77], TP=[0.08]hrs,
00049>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00050> *%-----------------|-------------------------------------------------------|
00051> * EXT2 - external lands
00052> * Discharges to Point B
00053> DESIGN NASHYD       ID=[5], NHYD=[5], DT=[1]min, AREA=[0.65](ha),
00054>                     DWF=[0](cms), CN/C=[77], TP=[0.19]hrs,
00055>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00056> *%-----------------|-------------------------------------------------------|
00057> * Total to existing watercourse
00058> * Allowable release rate from post development pond
00059> ADD HYD             IDsum=[9], NHYD=[Total1], IDs to add=[1,2,3,4,5]
00060> *%-----------------|-------------------------------------------------------|
00061> * 101 - lands owned by applicant that are to be developed
00062> * Discharges to existing wetland
00063> DESIGN NASHYD       ID=[1], NHYD=[101], DT=[1]min, AREA=[0.49](ha),
00064>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00065>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00066> *%-----------------|-------------------------------------------------------|
00067> * 108 -
00068> DESIGN NASHYD       ID=[1], NHYD=[108], DT=[1]min, AREA=[1.05](ha),
00069>                     DWF=[0](cms), CN/C=[75], TP=[0.23]hrs,
00070>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00071> *%-----------------|-------------------------------------------------------|
00072> * 102 - lands owned by applicant that are to be developed
00073> * Discharges to railway
00074> DESIGN NASHYD       ID=[1], NHYD=[102], DT=[1]min, AREA=[2.60](ha),
00075>                     DWF=[0](cms), CN/C=[79], TP=[0.08]hrs,
00076>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00077> *%-----------------|-------------------------------------------------------|
00078> *%-----------------|-------------------------------------------------------|
00079> FINISH
00080>
00081>
00082>
00083>
00084>
```

```
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: 2021-06-08     TIME: 09:09:43     RUN COUNTER: 002427         *
00039> ********************************************************************************
00040> * Input   filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\Chicago\100.DAT     *
00041> * Output  filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\Chicago\100.out     *
00042> * Summary filename: C:\SWMHYM~1\NIAGARA\210201~1\Existing\Chicago\100.sum     *
00043> * User comments:                                                            *
00044> * 1:_____________________________________________________________________*
00045> * 2:_____________________________________________________________________*
00046> * 3:_____________________________________________________________________*
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [041230]
00053> *#  Date        : 12-9-2019 updated 06-07-2021
00054> *#  Modeller    : [L.Garner]
00055> *#  Company     : R. J. Burnside & Associates Ltd.
00056> *#  License #   :  3877524
00057> *#*****************************************************************************
00058> *# Existing Development Model for the Site
00059> *#
00060> *#  CN as per Ontario Soils Map for Welland County
00061> *#
00062> *#  TIMP / XIMP and TP as per RJB prelim investigation
00063> *#*****************************************************************************
00064> --------------------
00065> | START            |  Project  dir.: C:\SWMHYM~1\NIAGARA\210201~1\Existing\Chica
00066> --------------------  Rainfall dir.: C:\SWMHYM~1\NIAGARA\210201~1\Existing\Chica
00067>     TZERO =   .00 hrs on       0
00068>     METOUT=   2 (output = METRIC)
00069>     NRUN  = 001
00070>     NSTORM=   0
00071> --------------------------------------------------------------------------------
00072> 001:0002--------------------------------------------------------------------------
00073> *#*****************************************************************************
00074> --------------------
00075> | CHICAGO STORM    |    IDF curve parameters: A=1264.570
00076> | Ptotal= 63.46 mm |                          B=   7.720
00077> --------------------                          C=    .781
00078>                          used in:   INTENSITY =  A / (t + B)^C
00079>
00080>                          Duration of storm  =  3.00 hrs
00081>                          Storm time step    =  5.00 min
00082>                          Time to peak ratio =   .33
00083>
00084>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00085>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00086>               .08   5.800 |    .83  31.177 |   1.58  16.063 |   2.33   7.533
00087>               .17   6.318 |    .92  67.936 |   1.67  14.182 |   2.42   7.138
00088>               .25   6.952 |   1.00 173.339 |   1.75  12.713 |   2.50   6.785
00089>               .33   7.747 |   1.08  85.572 |   1.83  11.535 |   2.58   6.469
00090>               .42   8.773 |   1.17  50.381 |   1.92  10.569 |   2.67   6.184
00091>               .50  10.152 |   1.25  35.310 |   2.00   9.762 |   2.75   5.925
00092>               .58  12.108 |   1.33  27.116 |   2.08   9.078 |   2.83   5.690
00093>               .67  15.103 |   1.42  22.018 |   2.17   8.491 |   2.92   5.474
00094>               .75  20.262 |   1.50  18.558 |   2.25   7.980 |   3.00   5.275
00095>
00096> --------------------------------------------------------------------------------
00097> 001:0003--------------------------------------------------------------------------
00098> *#*****************************************************************************
00099> * EPA1 - (lands are owned by applicant by will not be developed
00100> * as part of this application)
00101> * Flow to Point A
00102> ----------------------
00103> | DESIGN NASHYD      |   Area    (ha)=    4.93   Curve Number   (CN)=75.00
00104> | 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00105> ----------------------   U.H. Tp(hrs)=    .430
00106>
00107>      Unit Hyd Qpeak  (cms)=     .438
00108>
00109>      PEAK FLOW       (cms)=     .261 (i)
00110>      TIME TO PEAK    (hrs)=    1.567
00111>      RUNOFF VOLUME    (mm)=   26.180
00112>      TOTAL RAINFALL   (mm)=   63.456
00113>      RUNOFF COEFFICIENT   =     .413
00114>
00115>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00116>
00117> --------------------------------------------------------------------------------
00118> 001:0004--------------------------------------------------------------------------
00119> * EPA2 - (lands are owned by applicant by will not be developed
00120> * as part of this application)
00121> * Flow to Point B
00122> ----------------------
00123> | DESIGN NASHYD      |   Area    (ha)=    5.91   Curve Number   (CN)=75.00
00124> | 02:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00125> ----------------------   U.H. Tp(hrs)=    .790
00126>
00127>      Unit Hyd Qpeak  (cms)=     .286
00128>
00129>      PEAK FLOW       (cms)=     .209 (i)
00130>      TIME TO PEAK    (hrs)=    2.050
00131>      RUNOFF VOLUME    (mm)=   26.180
00132>      TOTAL RAINFALL   (mm)=   63.456
00133>      RUNOFF COEFFICIENT   =     .413
00134>
00135>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00136>
00137> --------------------------------------------------------------------------------
00138> 001:0005--------------------------------------------------------------------------
00139> * 103 - lands owned by applicant that are to be developed
00140> * Discharges to existing watercourse
00141> ----------------------
00142> | DESIGN NASHYD      |   Area    (ha)=   25.84   Curve Number   (CN)=77.00
00143> | 03:000003 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00144> ----------------------   U.H. Tp(hrs)=   2.060
00145>
00146>      Unit Hyd Qpeak  (cms)=     .479
00147>
00148>      PEAK FLOW       (cms)=     .486 (i)
00149>      TIME TO PEAK    (hrs)=    3.583
00150>      RUNOFF VOLUME    (mm)=   27.850
00151>      TOTAL RAINFALL   (mm)=   63.456
00152>      RUNOFF COEFFICIENT   =     .439
00153>
00154>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00155>
00156> --------------------------------------------------------------------------------
00157> 001:0006--------------------------------------------------------------------------
00158> * EXT1 - external lands
00159> * Discharges to Point A
00160> ----------------------
00161> | DESIGN NASHYD      |   Area    (ha)=     .20   Curve Number   (CN)=77.00
00162> | 04:000004 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00163> ----------------------   U.H. Tp(hrs)=    .080
00164>
00165>      Unit Hyd Qpeak  (cms)=     .095
00166>
00167>      PEAK FLOW       (cms)=     .027 (i)
00168>      TIME TO PEAK    (hrs)=    1.083
00169>      RUNOFF VOLUME    (mm)=   27.850
00170>      TOTAL RAINFALL   (mm)=   63.456
00171>      RUNOFF COEFFICIENT   =     .439
00172>
00173>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00174>
00175> --------------------------------------------------------------------------------
00176> 001:0007--------------------------------------------------------------------------
00177> * EXT2 - external lands
00178> * Discharges to Point B
00179> ----------------------
00180> | DESIGN NASHYD      |   Area    (ha)=     .65   Curve Number   (CN)=77.00
00181> | 05:000005 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00182> ----------------------   U.H. Tp(hrs)=    .190
00183>
00184>      Unit Hyd Qpeak  (cms)=     .131
00185>
00186>      PEAK FLOW       (cms)=     .060 (i)
00187>      TIME TO PEAK    (hrs)=    1.233
00188>      RUNOFF VOLUME    (mm)=   27.850
00189>      TOTAL RAINFALL   (mm)=   63.456
00190>      RUNOFF COEFFICIENT   =     .439
00191>
00192>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00193>
00194> --------------------------------------------------------------------------------
00195> 001:0008--------------------------------------------------------------------------
00196> * Total to existing watercourse
00197> * Allowable release rate from post development pond
00198> ------------------------
00199> | ADD HYD (         1) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00200> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
00201>                        ID1 01:         1     4.93     .261    1.57  26.18    .000
00202>                       +ID2 02:         2     5.91     .209    2.05  26.18    .000
00203>                       +ID3 03:         3    25.84     .486    3.58  27.85    .000
00204>                       +ID4 04:         4      .20     .027    1.08  27.85    .000
00205>                       +ID5 05:         5      .65     .060    1.23  27.85    .000
00206>                        ==========================================================
00207>                        SUM 09:         1    37.53     .673    2.68  27.37    .000
00208>
00209>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00210>
00211> --------------------------------------------------------------------------------
00212> 001:0009--------------------------------------------------------------------------
00213> * 101 - lands owned by applicant that are to be developed
00214> * Discharges to existing wetland
00215> ----------------------
00216> | DESIGN NASHYD      |   Area    (ha)=     .49   Curve Number   (CN)=74.00
00217> | 01:000101 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00218> ----------------------   U.H. Tp(hrs)=    .100
00219>
00220>      Unit Hyd Qpeak  (cms)=     .187
00221>
00222>      PEAK FLOW       (cms)=     .055 (i)
00223>      TIME TO PEAK    (hrs)=    1.117
00224>      RUNOFF VOLUME    (mm)=   25.387
00225>      TOTAL RAINFALL   (mm)=   63.456
00226>      RUNOFF COEFFICIENT   =     .400
00227>
00228>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00229>
00230> --------------------------------------------------------------------------------
00231> 001:0010--------------------------------------------------------------------------
00232> * 108 -
00233> ----------------------
00234> | DESIGN NASHYD      |   Area    (ha)=    1.05   Curve Number   (CN)=75.00
00235> | 01:000108 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00236> ----------------------   U.H. Tp(hrs)=    .230
00237>
00238>      Unit Hyd Qpeak  (cms)=     .174
00239>
00240>      PEAK FLOW       (cms)=     .081 (i)
00241>      TIME TO PEAK    (hrs)=    1.300
00242>      RUNOFF VOLUME    (mm)=   26.179
00243>      TOTAL RAINFALL   (mm)=   63.456
00244>      RUNOFF COEFFICIENT   =     .413
00245>
00246>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00247>
00248> --------------------------------------------------------------------------------
00249> 001:0011--------------------------------------------------------------------------
00250> * 102 - lands owned by applicant that are to be developed
00251> * Discharges to railway
00252> ----------------------
00253> | DESIGN NASHYD      |   Area    (ha)=    2.60   Curve Number   (CN)=79.00
00254> | 01:000102 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00255> ----------------------   U.H. Tp(hrs)=    .080
00256>
00257>      Unit Hyd Qpeak  (cms)=    1.241
00258>
00259>      PEAK FLOW       (cms)=     .379 (i)
00260>      TIME TO PEAK    (hrs)=    1.083
00261>      RUNOFF VOLUME    (mm)=   29.647
00262>      TOTAL RAINFALL   (mm)=   63.456
00263>      RUNOFF COEFFICIENT   =     .467
00264>
00265>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00266>
00267> --------------------------------------------------------------------------------
00268> 001:0012--------------------------------------------------------------------------
00269>       FINISH
00270> --------------------------------------------------------------------------------
```

```
00271> ********************************************************************************
00272>       WARNINGS / ERRORS / NOTES
00273>       -------------------------
00274>    Simulation ended on 2021-06-08     at 09:09:44
00275> ================================================================================
00276>
00277>
```

South Pond – SWMHYMO Model Schematic – PROPOSED



Project Name	Niagara Village Development
Project No.	300041230.0000
Date	May 28, 2021

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

INPUT FILE: South Side, Post- Development, 100-Year Storm - 24 hr SCS Type II

(C:\...100.DAT)

```
00001> 2     Metric units
00002> *#*****************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date        : 6-8-2021
00005> *#  Modeller    : [L.Garner]
00006> *#  Company     : R. J. Burnside & Associates Ltd.
00007> *#  License #   :  3877524
00008> *#*****************************************************************************
00009> *# Post Development Model for the Site
00010> *#
00011> *#  CN as per Ontario Soils Map for Welland County
00012> *#*****************************************************************************
00013> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00014> *%                   [  ] <--storm filename, one per line for NSTORM time
00015> *%------------------|-------------------------------------------------------|
00016> *#*****************************************************************************
00017> *% 100-year 24-hr SCS
00018> READ STORM           STORM_FILENAME=["100Y24.STM"]
00019> *%------------------|-------------------------------------------------------|
00020> *#*****************************************************************************
00021> *%------------------|-------------------------------------------------------|
00022> * TO EAST FOREBAY
00023> *%------------------|-------------------------------------------------------|
00024> * Catchment 203 - Block 280 - lands that will be developed as site plan
00025> * Release rate controlled to 5-year post-dev flow (Rational Method)
00026> * Discharges to east forebay
00027> DESIGN STANDHYD      ID=[1], NHYD=[204], DT=[1]min, AREA=[4.39](ha),
00028>                       XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[74],
00029>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00030> *%------------------|-------------------------------------------------------|
00031> *  Release rate controlled to 5-year post-dev flow
00032> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00033> ROUTE RESERVOIR      IDout=[ 5 ],   NHYD=[203C],  IDin=[  1 ],
00034>                       RDT=[1](min),
00035>                             TABLE of ( OUTFLOW-STORAGE ) values
00036>                                   (cms) - (ha-m)
00037>                                  [   0.0 ,  0.0 ]
00038>                                  [   0.827,  0.0687 ]
00039>                                  [   -1  ,  -1  ]  (max twenty pts)
00040>                             IDovf=[   ], NHYDovf=[   ]
00041> *%------------------|-------------------------------------------------------|
00042> * Catchment 205
00043> * Discharges to east forebay, Street L from north of tracks
00044> DESIGN STANDHYD      ID=[7], NHYD=[205], DT=[1]min, AREA=[2.50](ha),
00045>                       XIMP=[0.43], TIMP=[0.53], DWF=[0](cms), LOSS=[2],CN=[81],
00046>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00047> *%------------------|-------------------------------------------------------|
00048> * Catchment 206 - Block 279 - lands that will be developed as site plan
00049> * Release rate controlled to 5-year post-dev flow (Rational Method)
00050> * Discharges to east forebay
00051> DESIGN STANDHYD      ID=[1], NHYD=[206], DT=[1]min, AREA=[0.87](ha),
00052>                       XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[76],
00053>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00054> *%------------------|-------------------------------------------------------|
00055> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00056> * 2-year flow from roof area (1740 m2) - Rational Method
00057> COMPUTE DUALHYD      IDin=[1], CINLET=[0.029](cms), NINLET=[1],
00058>                       MAJID=[6], MajNHYD=["pond"],
00059>                       MINID=[8], MinNHYD=["envunc"],
00060>                       TMJSTO=[   ](cu-m)
00061> *%------------------|-------------------------------------------------------|
00062> *  Release rate controlled to 5-year post-dev flow
00063> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00064> ROUTE RESERVOIR      IDout=[ 9 ],   NHYD=[206C],  IDin=[  6 ],
00065>                       RDT=[1](min),
00066>                             TABLE of ( OUTFLOW-STORAGE ) values
00067>                                   (cms) - (ha-m)
00068>                                  [   0.0 ,  0.0 ]
00069>                                  [   0.154,  0.00825 ]
00070>                                  [   -1  ,  -1  ]  (max twenty pts)
00071>                             IDovf=[   ], NHYDovf=[   ]
00072> *%------------------|-------------------------------------------------------|
00073> * Catchment 207
00074> * Discharges to east forebay
00075> DESIGN STANDHYD      ID=[1], NHYD=[207], DT=[1]min, AREA=[9.42](ha),
00076>                       XIMP=[0.48], TIMP=[0.58], DWF=[0](cms), LOSS=[2],CN=[77],
00077>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00078> *%------------------|-------------------------------------------------------|
00079> * Total to east side of forebay
00080> ADD HYD              IDsum=[8], NHYD=["EastForebay1"], IDs to add=[5,7,9,1]
00081> *%------------------|-------------------------------------------------------|
00082> * TO WEST FOREBAY
00083> *%------------------|-------------------------------------------------------|
00084> * Catchment 201 - Block 278 - lands that will be developed as site plan
00085> * Release rate controlled to 5-year post-dev flow
00086> * Discharges to west forebay
00087> DESIGN STANDHYD      ID=[1], NHYD=[201], DT=[1]min, AREA=[2.37](ha),
00088>                       XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74],
00089>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00090> *%------------------|-------------------------------------------------------|
00091> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00092> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00093> COMPUTE DUALHYD      IDin=[1], CINLET=[0.009](cms), NINLET=[1],
00094>                       MAJID=[2], MajNHYD=["pond"],
00095>                       MINID=[4], MinNHYD=["envunc"],
00096>                       TMJSTO=[   ](cu-m)
00097> *%------------------|-------------------------------------------------------|
00098> *  Release rate controlled to 5-year post-dev flow
00099> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00100> ROUTE RESERVOIR     IDout=[ 3 ],   NHYD=[201C],  IDin=[ 2],
00101>                       RDT=[1](min),
00102>                             TABLE of ( OUTFLOW-STORAGE ) values
00103>                                   (cms) - (ha-m)
00104>                                  [   0.0 ,  0.0 ]
00105>                                  [   0.420,  0.029 ]
00106>                                  [   -1  ,  -1  ]  (max twenty pts)
00107>                             IDovf=[   ], NHYDovf=[   ]
00108> *%------------------|-------------------------------------------------------|
00109> * Catchment 202 - lands that will be developed
00110> * Discharges to west forebay
00111> DESIGN STANDHYD      ID=[1], NHYD=[202], DT=[1]min, AREA=[8.99](ha),
00112>                       XIMP=[0.48], TIMP=[0.57], DWF=[0](cms), LOSS=[2],CN=[80],
00113>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00114> *%------------------|-------------------------------------------------------|
00115> * Total to pond (east and west forebays)
00116> ADD HYD              IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
00117> *%------------------|-------------------------------------------------------|
00118> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00119> * external areas that discharge through the pond)
00120> ROUTE RESERVOIR     IDout=[8],   NHYD=["Pond"],  IDin=[9],
00121>                       RDT=[1](min),
00122>                             TABLE of ( OUTFLOW-STORAGE ) values
00123>                                   (cms) - (ha-m)
00124>                                  [   0.0 ,  0.0 ]
00125>                                  [   0.011, 0.4404  ]
00126>                                  [   0.70, 1.6 ]
00127>                                  [   -1  ,  -1  ]  (max twenty pts)
00128>                             IDovf=[], NHYDovf=[overflow]
00129> *%------------------|-------------------------------------------------------|
00130> *%------------------|-------------------------------------------------------|
00131> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00132> *%------------------|-------------------------------------------------------|
00133> * UNC1 - lands that will be developed
00134> * Discharge to environmental channel (rear of single lots)
00135> DESIGN STANDHYD      ID=[1], NHYD=[UNC1], DT=[1]min, AREA=[2.11](ha),
00136>                       XIMP=[0.13], TIMP=[0.20], DWF=[0](cms), LOSS=[2],CN=[76],
00137>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00138> *%------------------|-------------------------------------------------------|
00139> * UNC2 - lands that will be developed
00140> * Discharge to railway (rear of single lots)
00141> DESIGN STANDHYD      ID=[2], NHYD=[UNC2], DT=[1]min, AREA=[0.36](ha),
00142>                       XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2],CN=[81],
00143>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00144> *%------------------|-------------------------------------------------------|
00145> * UNC8 - lands that will remain undeveloped
00146> * Discharge to existing wetland
00147> DESIGN NASHYD        ID=[3], NHYD=[UNC8], DT=[1]min, AREA=[0.49](ha),
00148>                       DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00149>                       RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00150> *%------------------|-------------------------------------------------------|
00151> *%------------------|-------------------------------------------------------|
00152> * AREA TO RAMSEY
00153> *%------------------|-------------------------------------------------------|
00154> * Catchment 208 - lands that will be developed
00155> * Includes ROW and multi-use trail
00156> * This area is to be controlled using LIDs
00157> DESIGN STANDHYD      ID=[1], NHYD=[208], DT=[1]min, AREA=[0.62](ha),
00158>                       XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2],CN=[76],
00159>                       SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00160> *%------------------|-------------------------------------------------------|
00161> *%------------------|-------------------------------------------------------|
00162> * AREA TO EXISTING WOODLOT
00163> *%------------------|-------------------------------------------------------|
00164> * UNC7 - sloping to match development grade
00165> * Discharge to woodlot
00166> DESIGN NASHYD        ID=[7], NHYD=[UNC7], DT=[1]min, AREA=[0.40](ha),
00167>                       DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00168>                       RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00169> *%------------------|-------------------------------------------------------|
00170> * EPA1 - (lands are owned by applicant by will not be developed
00171> * as part of this application)
00172> * Flow to Point A
00173> DESIGN NASHYD        ID=[1], NHYD=[EPA1], DT=[1]min, AREA=[4.93](ha),
00174>                       DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00175>                       RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00176> *%------------------|-------------------------------------------------------|
00177> * EXT1 - External Flow to Point A
00178> DESIGN NASHYD        ID=[2], NHYD=[EXT1], DT=[1]min, AREA=[0.2](ha),
00179>                       DWF=[0](cms), CN/C=[77], TP=[0.43]hrs,
00180>                       RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00181> *%------------------|-------------------------------------------------------|
00182> * EPA2 - (lands are owned by applicant by will not be developed
00183> * as part of this application)
00184> * Flow to Point B
00185> DESIGN NASHYD        ID=[3], NHYD=[EPA2], DT=[1]min, AREA=[5.91](ha),
00186>                       DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00187>                       RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00188> *%------------------|-------------------------------------------------------|
00189> * EXT2 - External Flow to Point B
00190> DESIGN NASHYD        ID=[4], NHYD=[EXT2], DT=[1]min, AREA=[0.65](ha),
00191>                       DWF=[0](cms), CN/C=[77], TP=[0.79]hrs,
00192>                       RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00193> *%------------------|-------------------------------------------------------|
00194> * Total to existing woodlot (for water balance)
00195> ADD HYD              IDsum=[3], NHYD=["WOOD"], IDs to add=[7,1,2,3,4]
00196> *%------------------|-------------------------------------------------------|
00197> *%------------------|-------------------------------------------------------|
00198> FINISH
00199>
00200>
00201>
00202>
00203>
00204>
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00233>
00234>
```

```
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: 2021-07-14     TIME: 11:00:00     RUN COUNTER: 002493         *
00039>  ********************************************************************************
00040>  * Input   filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\100.DAT          *
00041>  * Output  filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\100.out          *
00042>  * Summary filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\100.sum          *
00043>  * User comments:                                                             *
00044>  * 1:_____________________________________________________________________*
00045>  * 2:_____________________________________________________________________*
00046>  * 3:_____________________________________________________________________*
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [041230]
00053> *#  Date        : 6-8-2021
00054> *#  Modeller    : [L.Garner]
00055> *#  Company     : R. J. Burnside & Associates Ltd.
00056> *#  License #   :  3877524
00057> *#*****************************************************************************
00058> *# Post Development Model for the Site
00059> *#
00060> *#  CN as per Ontario Soils Map for Welland County
00061> *#*****************************************************************************
00062> --------------------
00063> | START            |  Project  dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\
00064> --------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\
00065>     TZERO =   .00 hrs on        0
00066>     METOUT=   2 (output = METRIC)
00067>     NRUN  = 001
00068>     NSTORM=   0
00069> --------------------------------------------------------------------------------
00070> 001:0002--------------------------------------------------------------------------
00071> *#*****************************************************************************
00072> --------------------
00073> | READ STORM       |    Filename: 100yr/24hr
00074> | Ptotal= 102.88 mm|    Comments: 100yr/24hr
00075> --------------------
00076>                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00077>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00078>                 .25    .000 |   6.50   2.060 |  12.75  14.820 |  19.00   1.850
00079>                 .50   1.130 |   6.75   2.060 |  13.00   7.610 |  19.25   1.850
00080>                 .75   1.130 |   7.00   2.060 |  13.25   7.610 |  19.50   1.850
00081>                1.00   1.130 |   7.25   2.060 |  13.50   1.440 |  19.75   1.850
00082>                1.25   1.130 |   7.50   2.060 |  13.75   1.440 |  20.00   1.850
00083>                1.50   1.130 |   7.75   2.060 |  14.00   8.440 |  20.25   1.850
00084>                1.75   1.130 |   8.00   2.060 |  14.25   8.440 |  20.50   1.230
00085>                2.00   1.130 |   8.25   2.060 |  14.50   3.090 |  20.75   1.230
00086>                2.25   1.130 |   8.50   2.780 |  14.75   3.090 |  21.00   1.230
00087>                2.50   1.340 |   8.75   2.780 |  15.00   3.090 |  21.25   1.230
00088>                2.75   1.340 |   9.00   2.780 |  15.25   3.090 |  21.50   1.230
00089>                3.00   1.340 |   9.25   2.780 |  15.50   3.090 |  21.75   1.230
00090>                3.25   1.340 |   9.50   3.290 |  15.75   3.090 |  22.00   1.230
00091>                3.50   1.340 |   9.75   3.290 |  16.00   3.090 |  22.25   1.230
00092>                3.75   1.340 |  10.00   3.700 |  16.25   3.090 |  22.50   1.230
00093>                4.00   1.340 |  10.25   3.700 |  16.50   1.850 |  22.75   1.230
00094>                4.25   1.340 |  10.50   4.730 |  16.75   1.850 |  23.00   1.230
00095>                4.50   1.650 |  10.75   4.730 |  17.00   1.850 |  23.25   1.230
00096>                4.75   1.650 |  11.00   6.380 |  17.25   1.850 |  23.50   1.230
00097>                5.00   1.650 |  11.25   6.380 |  17.50   1.850 |  23.75   1.230
00098>                5.25   1.650 |  11.50   9.880 |  17.75   1.850 |  24.00   1.230
00099>                5.50   1.650 |  11.75   9.880 |  18.00   1.850 |  24.25   1.230
00100>                5.75   1.650 |  12.00  42.800 |  18.25   1.850 |
00101>                6.00   1.650 |  12.25 113.590 |  18.50   1.850 |
00102>                6.25   1.650 |  12.50  14.820 |  18.75   1.850 |
00103>
00104> --------------------------------------------------------------------------------
00105> 001:0003--------------------------------------------------------------------------
00106> *#*****************************************************************************
00107> * TO EAST FOREBAY
00108> * Catchment 203 - Block 280 - lands that will be developed as site plan
00109> * Release rate controlled to 5-year post-dev flow (Rational Method)
00110> * Discharges to east forebay
00111> ----------------------
00112> | DESIGN STANDHYD    |   Area    (ha)=    4.39
00113> | 01:000204 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00114> ----------------------
00115>                              IMPERVIOUS    PERVIOUS (i)
00116>      Surface Area     (ha)=       3.95         .44
00117>      Dep. Storage     (mm)=        .80        1.50
00118>      Average Slope     (%)=        .50         .50
00119>      Length            (m)=     171.08       40.00
00120>      Mannings n            =       .013        .250
00121>
00122>      Max.eff.Inten.(mm/hr)=     113.59      181.06
00123>                  over (min)       4.00       13.00
00124>      Storage Coeff.  (min)=       4.13 (ii)  12.56 (ii)
00125>      Unit Hyd. Tpeak (min)=       4.00       13.00
00126>      Unit Hyd. peak  (cms)=        .28         .09
00127>                                                      *TOTALS*
00128>      PEAK FLOW       (cms)=       1.08         .15       1.207 (iii)
00129>      TIME TO PEAK    (hrs)=      12.25       12.35      12.250
00130>      RUNOFF VOLUME    (mm)=     102.08       71.06      95.882
00131>      TOTAL RAINFALL   (mm)=     102.88      102.88     102.883
00132>      RUNOFF COEFFICIENT   =        .99         .69        .932
00133>
00134>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00135>            CN* =  74.0    Ia = Dep. Storage  (Above)
00136>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00137>            THAN THE STORAGE COEFFICIENT.
00138>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00139>
00140> --------------------------------------------------------------------------------
00141> 001:0004--------------------------------------------------------------------------
00142> *  Release rate controlled to 5-year post-dev flow
00143> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00144> ----------------------
00145> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00146> |  IN>01:(000204)    |
00147> | OUT<05:(000203)    |   =========  OUTLFOW STORAGE TABLE  =========
00148> ----------------------   OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00149>                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
00150>                            .000  .0000E+00   |     .827  .6870E-01
00151>
00152>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00153>      ---------------------      (ha)     (cms)     (hrs)       (mm)
00154>      INFLOW >01: (000204)       4.39     1.207    12.250     95.882
00155>      OUTFLOW<05: (000203)       4.39      .827    12.317     95.882
00156>
00157>                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   68.507
00158>                   TIME SHIFT OF PEAK FLOW          (min)=    4.00
00159>                   MAXIMUM  STORAGE   USED       (ha.m.)=.6875E-01
00160>
00161> --------------------------------------------------------------------------------
00162> 001:0005--------------------------------------------------------------------------
00163> * Catchment 205
00164> * Discharges to east forebay, Street L from north of tracks
00165> ----------------------
00166> | DESIGN STANDHYD    |   Area    (ha)=    2.50
00167> | 07:000205 DT= 1.00 |   Total Imp(%)=   53.00   Dir. Conn.(%)=   43.00
00168> ----------------------
00169>                              IMPERVIOUS    PERVIOUS (i)
00170>      Surface Area     (ha)=       1.32        1.18
00171>      Dep. Storage     (mm)=        .80        1.50
00172>      Average Slope     (%)=        .50         .50
00173>      Length            (m)=     129.10       40.00
00174>      Mannings n            =       .013        .250
00175>
00176>      Max.eff.Inten.(mm/hr)=     113.59      105.81
00177>                  over (min)       3.00       14.00
00178>      Storage Coeff.  (min)=       3.48 (ii)  13.94 (ii)
00179>      Unit Hyd. Tpeak (min)=       3.00       14.00
00180>      Unit Hyd. peak  (cms)=        .34         .08
00181>                                                      *TOTALS*
00182>      PEAK FLOW       (cms)=        .34         .22        .517 (iii)
00183>      TIME TO PEAK    (hrs)=      12.25       12.37      12.250
00184>      RUNOFF VOLUME    (mm)=     102.07       68.51      82.955
00185>      TOTAL RAINFALL   (mm)=     102.88      102.88     102.883
00186>      RUNOFF COEFFICIENT   =        .99         .67        .806
00187>
00188>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00189>            CN* =  81.0    Ia = Dep. Storage  (Above)
00190>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00191>            THAN THE STORAGE COEFFICIENT.
00192>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00193>
00194> --------------------------------------------------------------------------------
00195> 001:0006--------------------------------------------------------------------------
00196> * Catchment 206 - Block 279 - lands that will be developed as site plan
00197> * Release rate controlled to 5-year post-dev flow (Rational Method)
00198> * Discharges to east forebay
00199> ----------------------
00200> | DESIGN STANDHYD    |   Area    (ha)=     .87
00201> | 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00202> ----------------------
00203>                              IMPERVIOUS    PERVIOUS (i)
00204>      Surface Area     (ha)=        .70         .17
00205>      Dep. Storage     (mm)=        .80        1.50
00206>      Average Slope     (%)=        .50         .50
00207>      Length            (m)=      76.16       40.00
00208>      Mannings n            =       .013        .250
00209>
00210>      Max.eff.Inten.(mm/hr)=     113.59      188.03
00211>                  over (min)       3.00       11.00
00212>      Storage Coeff.  (min)=       2.54 (ii)  10.85 (ii)
00213>      Unit Hyd. Tpeak (min)=       3.00       11.00
00214>      Unit Hyd. peak  (cms)=        .42         .10
00215>                                                      *TOTALS*
00216>      PEAK FLOW       (cms)=        .16         .07        .224 (iii)
00217>      TIME TO PEAK    (hrs)=      12.25       12.32      12.250
00218>      RUNOFF VOLUME    (mm)=     102.08       73.32      90.584
00219>      TOTAL RAINFALL   (mm)=     102.88      102.88     102.883
00220>      RUNOFF COEFFICIENT   =        .99         .71        .880
00221>
00222>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00223>            CN* =  76.0    Ia = Dep. Storage  (Above)
00224>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00225>            THAN THE STORAGE COEFFICIENT.
00226>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00227>
00228> --------------------------------------------------------------------------------
00229> 001:0007--------------------------------------------------------------------------
00230> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00231> * 2-year flow from roof area (1740 m2) - Rational Method
00232> ----------------------
00233> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .029  (cms)
00234> | TotalHyd 01:000206 |   Number of inlets in system [NINLET] =      1
00235> ----------------------   Total minor system capacity         =    .029  (cms)
00236>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00237>
00238>                    ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00239>                                    (ha)     (cms)      (hrs)     (mm)     (cms)
00240>      TOTAL HYD.   01:000206         .87      .224    12.250   90.584     .000
00241>      ==========================================================================
00242>      MAJOR SYST   06:pond           .28      .195    12.250   90.584     .000
00243>      MINOR SYST   08:envunc         .59      .029    11.783   90.584     .000
00244>
00245>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00246>
00247> --------------------------------------------------------------------------------
00248> 001:0008--------------------------------------------------------------------------
00249> *  Release rate controlled to 5-year post-dev flow
00250> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00251> ----------------------
00252> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00253> |  IN>06:(pond  )    |
00254> | OUT<09:(000206)    |   =========  OUTLFOW STORAGE TABLE  =========
00255> ----------------------   OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00256>                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
00257>                            .000  .0000E+00   |     .154  .8250E-02
00258>
00259>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00260>      ---------------------      (ha)     (cms)     (hrs)       (mm)
00261>      INFLOW >06: (pond  )        .28      .195    12.250     90.584
00262>      OUTFLOW<09: (000206)        .28      .148    12.283     90.584
00263>
00264>                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   75.881
00265>                   TIME SHIFT OF PEAK FLOW          (min)=    2.00
00266>                   MAXIMUM  STORAGE   USED       (ha.m.)=.7972E-02
00267>
00268> --------------------------------------------------------------------------------
00269> 001:0009--------------------------------------------------------------------------
00270> * Catchment 207
```

```
00271> * Discharges to east forebay
00272> ----------------------
00273> | DESIGN STANDHYD    |   Area    (ha)=    9.42
00274> | 01:000207 DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   48.00
00275> ----------------------
00276>                              IMPERVIOUS    PERVIOUS (i)
00277>      Surface Area     (ha)=       5.46         3.96
00278>      Dep. Storage     (mm)=        .80         1.50
00279>      Average Slope     (%)=        .50          .50
00280>      Length            (m)=     250.60        40.00
00281>      Mannings n             =      .013         .250
00282>
00283>      Max.eff.Inten.(mm/hr)=     113.59        95.27
00284>                  over (min)        5.00        16.00
00285>      Storage Coeff.  (min)=       5.19 (ii)   16.09 (ii)
00286>      Unit Hyd. Tpeak (min)=       5.00        16.00
00287>      Unit Hyd. peak  (cms)=        .22          .07
00288>                                                          *TOTALS*
00289>      PEAK FLOW       (cms)=       1.35          .65          1.850 (iii)
00290>      TIME TO PEAK    (hrs)=      12.25        12.40         12.267
00291>      RUNOFF VOLUME    (mm)=     102.07        63.42         81.987
00292>      TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
00293>      RUNOFF COEFFICIENT   =        .99          .62           .797
00294>
00295>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00296>            CN* =  77.0    Ia = Dep. Storage  (Above)
00297>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00298>            THAN THE STORAGE COEFFICIENT.
00299>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00300>
00301> ------------------------------------------------------------------------------
00302> 001:0010----------------------------------------------------------------------
00303> * Total to east side of forebay
00304> ----------------------
00305> | ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00306> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00307>                        ID1 05:       203     4.39     .827   12.32  95.88    .000
00308>                       +ID2 07:       205     2.50     .517   12.25  82.96    .000
00309>                       +ID3 09:       206      .28     .148   12.28  90.58    .000
00310>                       +ID4 01:       207     9.42    1.850   12.27  81.99    .000
00311>                        ================================================================
00312>                        SUM 08:EastForeba    16.59    3.279   12.27  85.96    .000
00313>
00314>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00315>
00316> ------------------------------------------------------------------------------
00317> 001:0011----------------------------------------------------------------------
00318> * TO WEST FOREBAY
00319> * Catchment 201 - Block 278 - lands that will be developed as site plan
00320> * Release rate controlled to 5-year post-dev flow
00321> * Discharges to west forebay
00322> ----------------------
00323> | DESIGN STANDHYD    |   Area    (ha)=    2.37
00324> | 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00325> ----------------------
00326>                              IMPERVIOUS    PERVIOUS (i)
00327>      Surface Area     (ha)=       1.90          .47
00328>      Dep. Storage     (mm)=        .80         1.50
00329>      Average Slope     (%)=        .50          .50
00330>      Length            (m)=     125.70        40.00
00331>      Mannings n             =      .013         .250
00332>
00333>      Max.eff.Inten.(mm/hr)=     113.59       182.03
00334>                  over (min)        3.00        12.00
00335>      Storage Coeff.  (min)=       3.43 (ii)   11.85 (ii)
00336>      Unit Hyd. Tpeak (min)=       3.00        12.00
00337>      Unit Hyd. peak  (cms)=        .34          .10
00338>                                                          *TOTALS*
00339>      PEAK FLOW       (cms)=        .44          .16          .590 (iii)
00340>      TIME TO PEAK    (hrs)=      12.25        12.33        12.250
00341>      RUNOFF VOLUME    (mm)=     102.08        71.06        89.681
00342>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00343>      RUNOFF COEFFICIENT   =        .99          .69          .872
00344>
00345>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00346>            CN* =  74.0    Ia = Dep. Storage  (Above)
00347>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00348>            THAN THE STORAGE COEFFICIENT.
00349>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00350>
00351> ------------------------------------------------------------------------------
00352> 001:0012----------------------------------------------------------------------
00353> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00354> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00355> ----------------------
00356> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .009  (cms)
00357> | TotalHyd 01:000201 |   Number of inlets in system [NINLET] =       1
00358> ----------------------   Total minor system capacity         =    .009  (cms)
00359>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00360>
00361>                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00362>                                  (ha)     (cms)     (hrs)     (mm)     (cms)
00363>      TOTAL HYD.   01:000201       2.37      .590    12.250    89.681     .000
00364>      ================================================================
00365>      MAJOR SYST   02:pond         1.61      .581    12.250    89.681     .000
00366>      MINOR SYST   04:envunc        .76      .009     6.383    89.681     .000
00367>
00368>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00369>
00370> ------------------------------------------------------------------------------
00371> 001:0013----------------------------------------------------------------------
00372> *  Release rate controlled to 5-year post-dev flow
00373> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00374> ----------------------
00375> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00376> |  IN>02:(pond  )    |
00377> | OUT<03:(000201)    |    =========  OUTLFOW STORAGE TABLE  =========
00378> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00379>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00380>                              .000  .0000E+00    |     .420  .2900E-01
00381>
00382>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00383>      ----------------------      (ha)     (cms)     (hrs)       (mm)
00384>      INFLOW >02: (pond  )       1.61      .581    12.250     89.681
00385>      OUTFLOW<03: (000201)       1.61      .418    12.300     89.681
00386>
00387>                       PEAK   FLOW   REDUCTION [Qout/Qin](%)=   71.949
00388>                       TIME SHIFT OF PEAK FLOW          (min)=    3.00
00389>                       MAXIMUM  STORAGE   USED       (ha.m.)=.2894E-01
00390>
00391> ------------------------------------------------------------------------------
00392> 001:0014----------------------------------------------------------------------
00393> * Catchment 202 - lands that will be developed
00394> * Discharges to west forebay
00395> ----------------------
00396> | DESIGN STANDHYD    |   Area    (ha)=    8.99
00397> | 01:000202 DT= 1.00 |   Total Imp(%)=   57.00   Dir. Conn.(%)=   48.00
00398> ----------------------
00399>                              IMPERVIOUS    PERVIOUS (i)
00400>      Surface Area     (ha)=       5.12         3.87
00401>      Dep. Storage     (mm)=        .80         1.50
00402>      Average Slope     (%)=        .50          .50
00403>      Length            (m)=     244.81        40.00
00404>      Mannings n             =      .013         .250
00405>
00406>      Max.eff.Inten.(mm/hr)=     113.59        98.31
00407>                  over (min)        5.00        16.00
00408>      Storage Coeff.  (min)=       5.11 (ii)   15.89 (ii)
00409>      Unit Hyd. Tpeak (min)=       5.00        16.00
00410>      Unit Hyd. peak  (cms)=        .22          .07
00411>                                                          *TOTALS*
00412>      PEAK FLOW       (cms)=       1.29          .66          1.803 (iii)
00413>      TIME TO PEAK    (hrs)=      12.25        12.40         12.267
00414>      RUNOFF VOLUME    (mm)=     102.07        67.00         83.850
00415>      TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
00416>      RUNOFF COEFFICIENT   =        .99          .65           .815
00417>
00418>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00419>            CN* =  80.0    Ia = Dep. Storage  (Above)
00420>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00421>            THAN THE STORAGE COEFFICIENT.
00422>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00423>
00424> ------------------------------------------------------------------------------
00425> 001:0015----------------------------------------------------------------------
00426> * Total to pond (east and west forebays)
00427> ----------------------
00428> | ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00429> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00430>                        ID1 08:EastForeba    16.59    3.279   12.27  85.96    .000
00431>                       +ID2 03:       201     1.61     .418   12.30  89.68    .000
00432>                       +ID3 01:       202     8.99    1.803   12.27  83.85    .000
00433>                        ================================================================
00434>                        SUM 09:toPond        27.19    5.483   12.27  85.48    .000
00435>
00436>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00437>
00438> ------------------------------------------------------------------------------
00439> 001:0016----------------------------------------------------------------------
00440> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00441> * external areas that discharge through the pond)
00442> ----------------------
00443> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00444> |  IN>09:(toPond)    |
00445> | OUT<08:(Pond  )    |    =========  OUTFLOW STORAGE TABLE  =========
00446> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00447>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00448>                              .000  .0000E+00    |     .700  .1600E+01
00449>                              .011  .4404E+00    |     .000  .0000E+00
00450>
00451>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00452>      ----------------------      (ha)     (cms)     (hrs)       (mm)
00453>      INFLOW >09: (toPond)       27.19     5.483    12.267     85.480
00454>      OUTFLOW<08: (Pond  )       27.19      .618    13.300     85.466
00455>
00456>                       PEAK   FLOW   REDUCTION [Qout/Qin](%)=   11.276
00457>                       TIME SHIFT OF PEAK FLOW          (min)=   62.00
00458>                       MAXIMUM  STORAGE   USED       (ha.m.)=.1463E+01
00459>
00460> ------------------------------------------------------------------------------
00461> 001:0017----------------------------------------------------------------------
00462> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00463> * UNC1 - lands that will be developed
00464> * Discharge to environmental channel (rear of single lots)
00465> ----------------------
00466> | DESIGN STANDHYD    |   Area    (ha)=    2.11
00467> | 01:000001 DT= 1.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   13.00
00468> ----------------------
00469>                              IMPERVIOUS    PERVIOUS (i)
00470>      Surface Area     (ha)=        .42         1.69
00471>      Dep. Storage     (mm)=        .80         1.50
00472>      Average Slope     (%)=        .50          .50
00473>      Length            (m)=     118.60        40.00
00474>      Mannings n             =      .013         .250
00475>
00476>      Max.eff.Inten.(mm/hr)=     113.59        80.93
00477>                  over (min)        3.00        15.00
00478>      Storage Coeff.  (min)=       3.31 (ii)   14.95 (ii)
00479>      Unit Hyd. Tpeak (min)=       3.00        15.00
00480>      Unit Hyd. peak  (cms)=        .35          .08
00481>                                                          *TOTALS*
00482>      PEAK FLOW       (cms)=        .09          .23          .275 (iii)
00483>      TIME TO PEAK    (hrs)=      12.25        12.38        12.267
00484>      RUNOFF VOLUME    (mm)=     102.08        58.77        64.416
00485>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00486>      RUNOFF COEFFICIENT   =        .99          .57          .626
00487>
00488>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00489>            CN* =  76.0    Ia = Dep. Storage  (Above)
00490>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00491>            THAN THE STORAGE COEFFICIENT.
00492>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00493>
00494> ------------------------------------------------------------------------------
00495> 001:0018----------------------------------------------------------------------
00496> * UNC2 - lands that will be developed
00497> * Discharge to railway (rear of single lots)
00498> ----------------------
00499> | DESIGN STANDHYD    |   Area    (ha)=     .36
00500> | 02:000002 DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00501> ----------------------
00502>                              IMPERVIOUS    PERVIOUS (i)
00503>      Surface Area     (ha)=        .15          .21
00504>      Dep. Storage     (mm)=        .80         1.50
00505>      Average Slope     (%)=        .50          .50
00506>      Length            (m)=      48.99        40.00
00507>      Mannings n             =      .013         .250
00508>
00509>      Max.eff.Inten.(mm/hr)=     113.59       104.82
00510>                  over (min)        2.00        12.00
00511>      Storage Coeff.  (min)=       1.95 (ii)   12.45 (ii)
00512>      Unit Hyd. Tpeak (min)=       2.00        12.00
00513>      Unit Hyd. peak  (cms)=        .57          .09
00514>                                                          *TOTALS*
00515>      PEAK FLOW       (cms)=        .04          .04          .072 (iii)
00516>      TIME TO PEAK    (hrs)=      12.25        12.33        12.250
00517>      RUNOFF VOLUME    (mm)=     102.08        68.12        79.001
00518>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00519>      RUNOFF COEFFICIENT   =        .99          .66          .768
00520>
00521>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00522>            CN* =  81.0    Ia = Dep. Storage  (Above)
00523>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00524>            THAN THE STORAGE COEFFICIENT.
00525>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00526>
00527> ------------------------------------------------------------------------------
00528> 001:0019----------------------------------------------------------------------
00529> * UNC8 - lands that will remain undeveloped
00530> * Discharge to existing wetland
00531> ----------------------
00532> | DESIGN NASHYD      |   Area    (ha)=     .49   Curve Number   (CN)=74.00
00533> | 03:000008 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00534> ----------------------   U.H. Tp(hrs)=    .100
00535>
00536>      Unit Hyd Qpeak  (cms)=     .187
00537>
00538>      PEAK FLOW       (cms)=     .088 (i)
00539>      TIME TO PEAK    (hrs)=   12.267
00540>      RUNOFF VOLUME    (mm)=   53.919
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00541>      TOTAL RAINFALL   (mm)=  102.883
00542>      RUNOFF COEFFICIENT   =     .524
00543>
00544>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00545>
00546> ---------------------------------------------------------------------------
00547> 001:0020-----------------------------------------------------------------
00548> * AREA TO RAMSEY
00549> * Catchment 208 - lands that will be developed
00550> * Includes ROW and multi-use trail
00551> * This area is to be controlled using LIDs
00552> ----------------------
00553> | DESIGN STANDHYD    |   Area    (ha)=     .62
00554> | 01:000208 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00555> ----------------------
00556>                              IMPERVIOUS    PERVIOUS (i)
00557>      Surface Area     (ha)=        .56          .06
00558>      Dep. Storage     (mm)=        .80         1.50
00559>      Average Slope     (%)=        .50          .50
00560>      Length            (m)=      64.29        40.00
00561>      Mannings n             =       .013         .250
00562>
00563>      Max.eff.Inten.(mm/hr)=     113.59       188.03
00564>                over (min)        2.00        11.00
00565>      Storage Coeff.  (min)=       2.29 (ii)   10.60 (ii)
00566>      Unit Hyd. Tpeak (min)=       2.00        11.00
00567>      Unit Hyd. peak  (cms)=        .51          .11
00568>                                                          *TOTALS*
00569>      PEAK FLOW       (cms)=        .16          .02          .178 (iii)
00570>      TIME TO PEAK    (hrs)=      12.25        12.32        12.250
00571>      RUNOFF VOLUME    (mm)=     102.08        73.32        96.333
00572>      TOTAL RAINFALL   (mm)=     102.88       102.88       102.883
00573>      RUNOFF COEFFICIENT   =        .99          .71          .936
00574>
00575>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00576>            CN* =  76.0    Ia = Dep. Storage  (Above)
00577>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00578>            THAN THE STORAGE COEFFICIENT.
00579>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00580>
00581> ---------------------------------------------------------------------------
00582> 001:0021-----------------------------------------------------------------
00583> * AREA TO EXISTING WOODLOT
00584> * UNC7 - sloping to match development grade
00585> * Discharge to woodlot
00586> ----------------------
00587> | DESIGN NASHYD      |   Area    (ha)=     .40   Curve Number   (CN)=74.00
00588> | 07:000007 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00589> ----------------------   U.H. Tp(hrs)=    .100
00590>
00591>      Unit Hyd Qpeak  (cms)=     .153
00592>
00593>      PEAK FLOW       (cms)=     .072 (i)
00594>      TIME TO PEAK    (hrs)=   12.267
00595>      RUNOFF VOLUME    (mm)=   53.919
00596>      TOTAL RAINFALL   (mm)=  102.883
00597>      RUNOFF COEFFICIENT   =     .524
00598>
00599>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00600>
00601> ---------------------------------------------------------------------------
00602> 001:0022-----------------------------------------------------------------
00603> * EPA1 - (lands are owned by applicant by will not be developed
00604> * as part of this application)
00605> * Flow to Point A
00606> ----------------------
00607> | DESIGN NASHYD      |   Area    (ha)=    4.93   Curve Number   (CN)=75.00
00608> | 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00609> ----------------------   U.H. Tp(hrs)=    .430
00610>
00611>      Unit Hyd Qpeak  (cms)=     .438
00612>
00613>      PEAK FLOW       (cms)=     .401 (i)
00614>      TIME TO PEAK    (hrs)=   12.567
00615>      RUNOFF VOLUME    (mm)=   55.246
00616>      TOTAL RAINFALL   (mm)=  102.883
00617>      RUNOFF COEFFICIENT   =     .537
00618>
00619>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00620>
00621> ---------------------------------------------------------------------------
00622> 001:0023-----------------------------------------------------------------
00623> * EXT1 - External Flow to Point A
00624> ----------------------
00625> | DESIGN NASHYD      |   Area    (ha)=     .20   Curve Number   (CN)=77.00
00626> | 02:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00627> ----------------------   U.H. Tp(hrs)=    .430
00628>
00629>      Unit Hyd Qpeak  (cms)=     .018
00630>
00631>      PEAK FLOW       (cms)=     .017 (i)
00632>      TIME TO PEAK    (hrs)=   12.567
00633>      RUNOFF VOLUME    (mm)=   57.984
00634>      TOTAL RAINFALL   (mm)=  102.883
00635>      RUNOFF COEFFICIENT   =     .564
00636>
00637>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00638>
00639> ---------------------------------------------------------------------------
00640> 001:0024-----------------------------------------------------------------
00641> * EPA2 - (lands are owned by applicant by will not be developed
00642> * as part of this application)
00643> * Flow to Point B
00644> ----------------------
00645> | DESIGN NASHYD      |   Area    (ha)=    5.91   Curve Number   (CN)=75.00
00646> | 03:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00647> ----------------------   U.H. Tp(hrs)=    .790
00648>
00649>      Unit Hyd Qpeak  (cms)=     .286
00650>
00651>      PEAK FLOW       (cms)=     .312 (i)
00652>      TIME TO PEAK    (hrs)=   12.983
00653>      RUNOFF VOLUME    (mm)=   55.246
00654>      TOTAL RAINFALL   (mm)=  102.883
00655>      RUNOFF COEFFICIENT   =     .537
00656>
00657>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00658>
00659> ---------------------------------------------------------------------------
00660> 001:0025-----------------------------------------------------------------
00661> * EXT2 - External Flow to Point B
00662> ----------------------
00663> | DESIGN NASHYD      |   Area    (ha)=     .65   Curve Number   (CN)=77.00
00664> | 04:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00665> ----------------------   U.H. Tp(hrs)=    .790
00666>
00667>      Unit Hyd Qpeak  (cms)=     .031
00668>
00669>      PEAK FLOW       (cms)=     .036 (i)
00670>      TIME TO PEAK    (hrs)=   12.983
00671>      RUNOFF VOLUME    (mm)=   57.986
00672>      TOTAL RAINFALL   (mm)=  102.883
00673>      RUNOFF COEFFICIENT   =     .564
00674>
00675>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00676>
00677> ---------------------------------------------------------------------------
00678> 001:0026-----------------------------------------------------------------
00679> * Total to existing woodlot (for water balance)
00680> ----------------------
00681> | ADD HYD (WOOD      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00682> ----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00683>                        ID1 07:         7      .40     .072   12.27  53.92    .000
00684>                       +ID2 01:         1     4.93     .401   12.57  55.25    .000
00685>                       +ID3 02:         1      .20     .017   12.57  57.98    .000
00686>                       +ID4 03:WOOD             5.91     .312   12.98  55.25    .000
00687>                       +ID5 04:         2      .65     .036   12.98  57.99    .000
00688>                        ==========================================================
00689>                        SUM 03:WOOD             11.71     .894   12.57  55.40    .000
00690>
00691>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00692>
00693> ---------------------------------------------------------------------------
00694> 001:0027-----------------------------------------------------------------
00695>       FINISH
00696> ---------------------------------------------------------------------------
00697> ***************************************************************************
00698>      WARNINGS / ERRORS / NOTES
00699>      -------------------------
00700>    Simulation ended on 2021-07-14     at 11:00:01
00701> ===========================================================================
00702>
00703>
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```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date        : 6-8-2021
00005> *#  Modeller    : [L.Garner]
00006> *#  Company     : R. J. Burnside & Associates Ltd.
00007> *#  License #   :  3877524
00008> *#*************************************************************************
00009> *# Model used to determine required Extended Detention volume
00010> *#*************************************************************************
00011> START              TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00012> *%                   [   ] <--storm filename, one per line for NSTORM time
00013> *%-----------------|-------------------------------------------------------|
00014> *#*************************************************************************
00015> *% 25mm 4-hr Chicago
00016> MASS STORM          PTOTAL=[25](mm), CSDT=[10](min),
00017>                     CURVE_FILENAME=["4hr-chi.mst"]
00018> *%-----------------|-------------------------------------------------------|
00019> *#*************************************************************************
00020> *%-----------------|-------------------------------------------------------|
00021> * TO EAST FOREBAY
00022> *%-----------------|-------------------------------------------------------|
00023> * Catchment 203 - Block 280 - lands that will be developed as site plan
00024> * Release rate controlled to 5-year post-dev flow (Rational Method)
00025> * Discharges to east forebay
00026> DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[4.39](ha),
00027>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[74],
00028>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00029> *%-----------------|-------------------------------------------------------|
00030> *  Release rate controlled to 5-year post-dev flow
00031> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00032> ROUTE RESERVOIR     IDout=[ 5 ],   NHYD=[203C],  IDin=[  1 ],
00033>                     RDT=[1](min),
00034>                           TABLE of ( OUTFLOW-STORAGE ) values
00035>                                     (cms) - (ha-m)
00036>                                  [   0.0 ,  0.0 ]
00037>                                  [   0.827,  0.0687 ]
00038>                                  [   -1  ,  -1  ]  (max twenty pts)
00039>                           IDovf=[   ], NHYDovf=[   ]
00040> *%-----------------|-------------------------------------------------------|
00041> * Catchment 205
00042> * Discharges to east forebay, Street L from north of tracks
00043> DESIGN STANDHYD     ID=[7], NHYD=[205], DT=[1]min, AREA=[2.50](ha),
00044>                     XIMP=[0.43], TIMP=[0.53], DWF=[0](cms), LOSS=[2],CN=[81],
00045>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00046> *%-----------------|-------------------------------------------------------|
00047> * Catchment 206 - Block 279 - lands that will be developed as site plan
00048> * Release rate controlled to 5-year post-dev flow (Rational Method)
00049> * Discharges to east forebay
00050> DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.87](ha),
00051>                     XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[76],
00052>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00053> *%-----------------|-------------------------------------------------------|
00054> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00055> * 2-year flow from roof area (1740 m2) - Rational Method
00056> COMPUTE DUALHYD     IDin=[1], CINLET=[0.029](cms), NINLET=[1],
00057>                     MAJID=[6], MajNHYD=["pond"],
00058>                     MINID=[8], MinNHYD=["envunc"],
00059>                     TMJSTO=[   ](cu-m)
00060> *%-----------------|-------------------------------------------------------|
00061> *  Release rate controlled to 5-year post-dev flow
00062> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00063> ROUTE RESERVOIR     IDout=[ 9 ],   NHYD=[206C],  IDin=[  6 ],
00064>                     RDT=[1](min),
00065>                           TABLE of ( OUTFLOW-STORAGE ) values
00066>                                     (cms) - (ha-m)
00067>                                  [   0.0 ,  0.0 ]
00068>                                  [   0.154,  0.00825 ]
00069>                                  [   -1  ,  -1  ]  (max twenty pts)
00070>                           IDovf=[   ], NHYDovf=[   ]
00071> *%-----------------|-------------------------------------------------------|
00072> * Catchment 207
00073> * Discharges to east forebay
00074> DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[9.42](ha),
00075>                     XIMP=[0.48], TIMP=[0.58], DWF=[0](cms), LOSS=[2],CN=[77],
00076>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00077> *%-----------------|-------------------------------------------------------|
00078> * Total to east side of forebay
00079> ADD HYD            IDsum=[8], NHYD=["EastForebay1"], IDs to add=[5,7,9,1]
00080> *%-----------------|-------------------------------------------------------|
00081> * TO WEST FOREBAY
00082> *%-----------------|-------------------------------------------------------|
00083> * Catchment 201 - Block 278 - lands that will be developed as site plan
00084> * Release rate controlled to 5-year post-dev flow
00085> * Discharges to west forebay
00086> DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[2.37](ha),
00087>                     XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74],
00088>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00089> *%-----------------|-------------------------------------------------------|
00090> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00091> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00092> COMPUTE DUALHYD     IDin=[1], CINLET=[0.009](cms), NINLET=[1],
00093>                     MAJID=[2], MajNHYD=["pond"],
00094>                     MINID=[4], MinNHYD=["envunc"],
00095>                     TMJSTO=[   ](cu-m)
00096> *%-----------------|-------------------------------------------------------|
00097> *  Release rate controlled to 5-year post-dev flow
00098> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00099> ROUTE RESERVOIR     IDout=[ 3 ],   NHYD=[201C],  IDin=[ 2],
00100>                     RDT=[1](min),
00101>                           TABLE of ( OUTFLOW-STORAGE ) values
00102>                                     (cms) - (ha-m)
00103>                                  [   0.0 ,  0.0 ]
00104>                                  [   0.420,  0.029 ]
00105>                                  [   -1  ,  -1  ]  (max twenty pts)
00106>                           IDovf=[   ], NHYDovf=[   ]
00107> *%-----------------|-------------------------------------------------------|
00108> * Catchment 202 - lands that will be developed
00109> * Discharges to west forebay
00110> DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[8.99](ha),
00111>                     XIMP=[0.48], TIMP=[0.57], DWF=[0](cms), LOSS=[2],CN=[80],
00112>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00113> *%-----------------|-------------------------------------------------------|
00114> * Total to pond (east and west forebays)
00115> ADD HYD            IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
00116> *%-----------------|-------------------------------------------------------|
00117> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00118> * external areas that discharge through the pond)
00119> ROUTE RESERVOIR     IDout=[8],   NHYD=["Pond"],  IDin=[9],
00120>                     RDT=[1](min),
00121>                           TABLE of ( OUTFLOW-STORAGE ) values
00122>                                     (cms) - (ha-m)
00123>                                  [   0.0 ,  0.0 ]
00124>                                  [   0.011, 0.4404  ]
00125>                                  [   0.70, 1.6 ]
00126>                                  [   -1  ,  -1  ]  (max twenty pts)
00127>                           IDovf=[], NHYDovf=[overflow]
00128> *%-----------------|-------------------------------------------------------|
00129> *%-----------------|-------------------------------------------------------|
00130> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00131> *%-----------------|-------------------------------------------------------|
00132> * UNC1 - lands that will be developed
00133> * Discharge to environmental channel (rear of single lots)
00134> DESIGN STANDHYD     ID=[1], NHYD=[UNC1], DT=[1]min, AREA=[2.11](ha),
00135>                     XIMP=[0.13], TIMP=[0.20], DWF=[0](cms), LOSS=[2],CN=[76],
00136>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00137> *%-----------------|-------------------------------------------------------|
00138> * UNC2 - lands that will be developed
00139> * Discharge to railway (rear of single lots)
00140> DESIGN STANDHYD     ID=[2], NHYD=[UNC2], DT=[1]min, AREA=[0.36](ha),
00141>                     XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2],CN=[81],
00142>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00143> *%-----------------|-------------------------------------------------------|
00144> * UNC8 - lands that will remain undeveloped
00145> * Discharge to existing wetland
00146> DESIGN NASHYD       ID=[3], NHYD=[UNC8], DT=[1]min, AREA=[0.49](ha),
00147>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00148>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00149> *%-----------------|-------------------------------------------------------|
00150> *%-----------------|-------------------------------------------------------|
00151> * AREA TO RAMSEY
00152> *%-----------------|-------------------------------------------------------|
00153> * Catchment 208 - lands that will be developed
00154> * Includes ROW and multi-use trail
00155> * This area is to be controlled using LIDs
00156> DESIGN STANDHYD     ID=[1], NHYD=[208], DT=[1]min, AREA=[0.62](ha),
00157>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2],CN=[76],
00158>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00159> *%-----------------|-------------------------------------------------------|
00160> *%-----------------|-------------------------------------------------------|
00161> * AREA TO EXISTING WOODLOT
00162> *%-----------------|-------------------------------------------------------|
00163> * UNC7 - sloping to match development grade
00164> * Discharge to woodlot
00165> DESIGN NASHYD       ID=[7], NHYD=[UNC7], DT=[1]min, AREA=[0.40](ha),
00166>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00167>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00168> *%-----------------|-------------------------------------------------------|
00169> * EPA1 - (lands are owned by applicant by will not be developed
00170> * as part of this application)
00171> * Flow to Point A
00172> DESIGN NASHYD       ID=[1], NHYD=[EPA1], DT=[1]min, AREA=[4.93](ha),
00173>                     DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00174>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00175> *%-----------------|-------------------------------------------------------|
00176> * EXT1 - External Flow to Point A
00177> DESIGN NASHYD       ID=[2], NHYD=[EXT1], DT=[1]min, AREA=[0.2](ha),
00178>                     DWF=[0](cms), CN/C=[77], TP=[0.43]hrs,
00179>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00180> *%-----------------|-------------------------------------------------------|
00181> * EPA2 - (lands are owned by applicant by will not be developed
00182> * as part of this application)
00183> * Flow to Point B
00184> DESIGN NASHYD       ID=[3], NHYD=[EPA2], DT=[1]min, AREA=[5.91](ha),
00185>                     DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00186>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00187> *%-----------------|-------------------------------------------------------|
00188> * EXT2 - External Flow to Point B
00189> DESIGN NASHYD       ID=[4], NHYD=[EXT2], DT=[1]min, AREA=[0.65](ha),
00190>                     DWF=[0](cms), CN/C=[77], TP=[0.79]hrs,
00191>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00192> *%-----------------|-------------------------------------------------------|
00193> * Total to existing woodlot (for water balance)
00194> ADD HYD            IDsum=[3], NHYD=["WOOD"], IDs to add=[7,1,2,3,4]
00195> *%-----------------|-------------------------------------------------------|
00196> *%-----------------|-------------------------------------------------------|
00197> FINISH
00198>
00199>
00200>
00201>
00202>
00203>
00204>
00205>
00206>
00207>
00208>
00209>
```

OUTPUT FILE: South Side, Post- Development, 25mm Event

(C:\...25mm.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: 2021-07-14     TIME: 11:19:26     RUN COUNTER: 002496         *
00039>  ********************************************************************************
00040>  * Input   filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\25mm.DAT         *
00041>  * Output  filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\25mm.out         *
00042>  * Summary filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\25mm.sum         *
00043>  * User comments:                                                             *
00044>  * 1:_____________________________________________________________________    *
00045>  * 2:_____________________________________________________________________    *
00046>  * 3:_____________________________________________________________________    *
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001-----------------------------------------------------------------------
00051> *#*****************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [041230]
00053> *#  Date        : 6-8-2021
00054> *#  Modeller    : [L.Garner]
00055> *#  Company     : R. J. Burnside & Associates Ltd.
00056> *#  License #   :  3877524
00057> *#*****************************************************************************
00058> *# Model used to determine required Extended Detention volume
00059> *#*****************************************************************************
00060> --------------------
00061> | START            |  Project  dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\
00062> -------------------- Rainfall dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\
00063>     TZERO =   .00 hrs on        0
00064>     METOUT=   2 (output = METRIC)
00065>     NRUN  = 001
00066>     NSTORM=   0
00067> --------------------------------------------------------------------------------
00068> 001:0002-----------------------------------------------------------------------
00069> *#*****************************************************************************
00070> --------------------
00071> | MASS STORM       |    Filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SC
00072> | Ptotal= 25.00 mm |    Comments: 4 Hour, Chicago Distribution with 10 min
00073> --------------------
00074>                         Duration of storm        =    4.17 hrs
00075>                         Mass curve time step     =   10.00 min
00076>                         Selected storm time step =   10.00 min
00077>                         Volume of derived storm  =   25.00 mm
00078>
00079>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00080>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00081>                .17   1.500 |   1.33  36.300 |   2.50   2.850 |   3.67   1.500
00082>                .33   2.100 |   1.50  23.550 |   2.67   2.400 |   3.83   1.050
00083>                .50   2.250 |   1.67   9.900 |   2.83   2.250 |   4.00    .600
00084>                .67   2.550 |   1.83   6.300 |   3.00   2.100 |   4.17    .300
00085>                .83   4.050 |   2.00   4.800 |   3.17   1.800 |
00086>               1.00   7.500 |   2.17   3.900 |   3.33   1.650 |
00087>               1.17  24.000 |   2.33   3.150 |   3.50   1.650 |
00088>
00089> --------------------------------------------------------------------------------
00090> 001:0003-----------------------------------------------------------------------
00091> *#*****************************************************************************
00092> * TO EAST FOREBAY
00093> * Catchment 203 - Block 280 - lands that will be developed as site plan
00094> * Release rate controlled to 5-year post-dev flow (Rational Method)
00095> * Discharges to east forebay
00096> ----------------------
00097> | DESIGN STANDHYD    |   Area    (ha)=    4.39
00098> | 01:000204 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00099> ----------------------
00100>                              IMPERVIOUS    PERVIOUS (i)
00101>      Surface Area     (ha)=       3.95         .44
00102>      Dep. Storage     (mm)=        .80        1.50
00103>      Average Slope     (%)=        .50         .50
00104>      Length            (m)=     171.08       40.00
00105>      Mannings n            =       .013        .250
00106>
00107>      Max.eff.Inten.(mm/hr)=      36.30       18.72
00108>                over (min)        7.00       27.00
00109>      Storage Coeff.  (min)=       6.51 (ii)  27.42 (ii)
00110>      Unit Hyd. Tpeak (min)=       7.00       27.00
00111>      Unit Hyd. peak  (cms)=        .17         .04
00112>                                                          *TOTALS*
00113>      PEAK FLOW       (cms)=        .31         .01          .310 (iii)
00114>      TIME TO PEAK    (hrs)=       1.38        1.85         1.383
00115>      RUNOFF VOLUME    (mm)=      24.20        8.54        21.068
00116>      TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00117>      RUNOFF COEFFICIENT   =        .97         .34          .843
00118>
00119>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00120>            CN* =  74.0    Ia = Dep. Storage  (Above)
00121>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00122>            THAN THE STORAGE COEFFICIENT.
00123>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00124>
00125> --------------------------------------------------------------------------------
00126> 001:0004-----------------------------------------------------------------------
00127> *  Release rate controlled to 5-year post-dev flow
00128> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00129> ----------------------
00130> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00131> |  IN>01:(000204)    |
00132> | OUT<05:(000203)    |    =========  OUTLFOW STORAGE TABLE  =========
00133> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00134>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00135>                              .000  .0000E+00    |     .827  .6870E-01
00136>
00137>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00138>      -------------------        (ha)     (cms)     (hrs)       (mm)
00139>      INFLOW >01: (000204)       4.39      .310     1.383     21.068
00140>      OUTFLOW<05: (000203)       4.39      .236     1.567     21.068
00141>
00142>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   76.169
00143>                    TIME SHIFT OF PEAK FLOW          (min)=    11.00
00144>                    MAXIMUM  STORAGE   USED        (ha.m.)=.1965E-01
00145>
00146> --------------------------------------------------------------------------------
00147> 001:0005-----------------------------------------------------------------------
00148> * Catchment 205
00149> * Discharges to east forebay, Street L from north of tracks
00150> ----------------------
00151> | DESIGN STANDHYD    |   Area    (ha)=    2.50
00152> | 07:000205 DT= 1.00 |   Total Imp(%)=   53.00   Dir. Conn.(%)=   43.00
00153> ----------------------
00154>                              IMPERVIOUS    PERVIOUS (i)
00155>      Surface Area     (ha)=       1.32        1.18
00156>      Dep. Storage     (mm)=        .80        1.50
00157>      Average Slope     (%)=        .50         .50
00158>      Length            (m)=     129.10       40.00
00159>      Mannings n            =       .013        .250
00160>
00161>      Max.eff.Inten.(mm/hr)=      36.30        9.38
00162>                over (min)        5.00       33.00
00163>      Storage Coeff.  (min)=       5.50 (ii)  33.07 (ii)
00164>      Unit Hyd. Tpeak (min)=       5.00       33.00
00165>      Unit Hyd. peak  (cms)=        .21         .03
00166>                                                          *TOTALS*
00167>      PEAK FLOW       (cms)=        .10         .02          .101 (iii)
00168>      TIME TO PEAK    (hrs)=       1.35        1.97         1.367
00169>      RUNOFF VOLUME    (mm)=      24.20        7.75        14.822
00170>      TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00171>      RUNOFF COEFFICIENT   =        .97         .31          .593
00172>
00173>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00174>            CN* =  81.0    Ia = Dep. Storage  (Above)
00175>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00176>            THAN THE STORAGE COEFFICIENT.
00177>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00178>
00179> --------------------------------------------------------------------------------
00180> 001:0006-----------------------------------------------------------------------
00181> * Catchment 206 - Block 279 - lands that will be developed as site plan
00182> * Release rate controlled to 5-year post-dev flow (Rational Method)
00183> * Discharges to east forebay
00184> ----------------------
00185> | DESIGN STANDHYD    |   Area    (ha)=     .87
00186> | 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00187> ----------------------
00188>                              IMPERVIOUS    PERVIOUS (i)
00189>      Surface Area     (ha)=        .70         .17
00190>      Dep. Storage     (mm)=        .80        1.50
00191>      Average Slope     (%)=        .50         .50
00192>      Length            (m)=      76.16       40.00
00193>      Mannings n            =       .013        .250
00194>
00195>      Max.eff.Inten.(mm/hr)=      36.30       21.43
00196>                over (min)        4.00       24.00
00197>      Storage Coeff.  (min)=       4.01 (ii)  23.82 (ii)
00198>      Unit Hyd. Tpeak (min)=       4.00       24.00
00199>      Unit Hyd. peak  (cms)=        .28         .05
00200>                                                          *TOTALS*
00201>      PEAK FLOW       (cms)=        .05         .01          .052 (iii)
00202>      TIME TO PEAK    (hrs)=       1.33        1.78         1.350
00203>      RUNOFF VOLUME    (mm)=      24.20        9.14        18.175
00204>      TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00205>      RUNOFF COEFFICIENT   =        .97         .37          .727
00206>
00207>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00208>            CN* =  76.0    Ia = Dep. Storage  (Above)
00209>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00210>            THAN THE STORAGE COEFFICIENT.
00211>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00212>
00213> --------------------------------------------------------------------------------
00214> 001:0007-----------------------------------------------------------------------
00215> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00216> * 2-year flow from roof area (1740 m2) - Rational Method
00217> ----------------------
00218> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .029  (cms)
00219> | TotalHyd 01:000206 |   Number of inlets in system [NINLET] =      1
00220> ----------------------   Total minor system capacity         =    .029  (cms)
00221>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00222>
00223>                    ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00224>                                    (ha)     (cms)     (hrs)     (mm)     (cms)
00225>      TOTAL HYD.   01:000206         .87      .052     1.350   18.175     .000
00226>      ==========================================================================
00227>      MAJOR SYST   06:pond           .11      .023     1.350   18.175     .000
00228>      MINOR SYST   08:envunc        .76      .029     1.133   18.175     .000
00229>
00230>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00231>
00232> --------------------------------------------------------------------------------
00233> 001:0008-----------------------------------------------------------------------
00234> *  Release rate controlled to 5-year post-dev flow
00235> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00236> ----------------------
00237> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00238> |  IN>06:(pond  )    |
00239> | OUT<09:(000206)    |    =========  OUTLFOW STORAGE TABLE  =========
00240> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00241>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00242>                              .000  .0000E+00    |     .154  .8250E-02
00243>
00244>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00245>      -------------------        (ha)     (cms)     (hrs)       (mm)
00246>      INFLOW >06: (pond  )        .11      .023     1.350     18.175
00247>      OUTFLOW<09: (000206)        .11      .015     1.433     18.175
00248>
00249>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   65.213
00250>                    TIME SHIFT OF PEAK FLOW          (min)=     5.00
00251>                    MAXIMUM  STORAGE   USED        (ha.m.)=.7968E-03
00252>
00253> --------------------------------------------------------------------------------
00254> 001:0009-----------------------------------------------------------------------
00255> * Catchment 207
00256> * Discharges to east forebay
00257> ----------------------
00258> | DESIGN STANDHYD    |   Area    (ha)=    9.42
00259> | 01:000207 DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   48.00
00260> ----------------------
00261>                              IMPERVIOUS    PERVIOUS (i)
00262>      Surface Area     (ha)=       5.46        3.96
00263>      Dep. Storage     (mm)=        .80        1.50
00264>      Average Slope     (%)=        .50         .50
00265>      Length            (m)=     250.60       40.00
00266>      Mannings n            =       .013        .250
00267>
00268>      Max.eff.Inten.(mm/hr)=      36.30        7.53
00269>                over (min)        8.00       38.00
00270>      Storage Coeff.  (min)=       8.19 (ii)  38.28 (ii)
```

```
00271>     Unit Hyd. Tpeak (min)=       8.00        38.00
00272>     Unit Hyd. peak  (cms)=        .14          .03
00273>                                                        *TOTALS*
00274>     PEAK FLOW       (cms)=        .37          .05          .383 (iii)
00275>     TIME TO PEAK    (hrs)=       1.40         2.05         1.417
00276>     RUNOFF VOLUME    (mm)=      24.20         6.65        15.075
00277>     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
00278>     RUNOFF COEFFICIENT   =        .97          .27          .603
00279>
00280>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00281>           CN* =  77.0    Ia = Dep. Storage  (Above)
00282>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00283>           THAN THE STORAGE COEFFICIENT.
00284>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00285>
00286> ------------------------------------------------------------------------------
00287> 001:0010------------------------------------------------------------------------
00288> * Total to east side of forebay
00289> ------------------------
00290> | ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00291> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00292>                      ID1 05:      203     4.39      .236    1.57  21.07    .000
00293>                     +ID2 07:      205     2.50      .101    1.37  14.82    .000
00294>                     +ID3 09:      206      .11      .015    1.43  18.18    .000
00295>                     +ID4 01:      207     9.42      .383    1.42  15.08    .000
00296>                      ============================================================
00297>                      SUM 08:EastForeba    16.42     .699    1.43  16.66    .000
00298>
00299>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00300>
00301> ------------------------------------------------------------------------------
00302> 001:0011------------------------------------------------------------------------
00303> * TO WEST FOREBAY
00304> * Catchment 201 - Block 278 - lands that will be developed as site plan
00305> * Release rate controlled to 5-year post-dev flow
00306> * Discharges to west forebay
00307> ----------------------
00308> | DESIGN STANDHYD    |   Area    (ha)=    2.37
00309> | 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00310> ----------------------
00311>                              IMPERVIOUS    PERVIOUS (i)
00312>     Surface Area     (ha)=       1.90         .47
00313>     Dep. Storage     (mm)=        .80        1.50
00314>     Average Slope     (%)=        .50         .50
00315>     Length            (m)=     125.70       40.00
00316>     Mannings n            =       .013        .250
00317>
00318>     Max.eff.Inten.(mm/hr)=      36.30       19.08
00319>                 over (min)       5.00       26.00
00320>     Storage Coeff.  (min)=       5.41 (ii)  26.16 (ii)
00321>     Unit Hyd. Tpeak (min)=       5.00       26.00
00322>     Unit Hyd. peak  (cms)=        .21         .04
00323>                                                        *TOTALS*
00324>     PEAK FLOW       (cms)=        .13         .02          .134 (iii)
00325>     TIME TO PEAK    (hrs)=       1.35        1.82         1.350
00326>     RUNOFF VOLUME    (mm)=      24.20        8.54        17.935
00327>     TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00328>     RUNOFF COEFFICIENT   =        .97         .34          .717
00329>
00330>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00331>           CN* =  74.0    Ia = Dep. Storage  (Above)
00332>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00333>           THAN THE STORAGE COEFFICIENT.
00334>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00335>
00336> ------------------------------------------------------------------------------
00337> 001:0012------------------------------------------------------------------------
00338> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00339> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00340> ----------------------
00341> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .009  (cms)
00342> | TotalHyd 01:000201 |   Number of inlets in system [NINLET] =      1
00343> ----------------------   Total minor system capacity          =    .009  (cms)
00344>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00345>
00346>                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00347>                                  (ha)     (cms)     (hrs)     (mm)     (cms)
00348>     TOTAL HYD.   01:000201       2.37      .134     1.350   17.935     .000
00349>     ================================================================
00350>     MAJOR SYST   02:pond         1.71      .125     1.350   17.935     .000
00351>     MINOR SYST   04:envunc        .66      .009      .683   17.935     .000
00352>
00353>     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00354>
00355> ------------------------------------------------------------------------------
00356> 001:0013------------------------------------------------------------------------
00357> *  Release rate controlled to 5-year post-dev flow
00358> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00359> ---------------------
00360> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00361> |  IN>02:(pond  )   |
00362> | OUT<03:(000201)   |    =========  OUTLFOW STORAGE TABLE  =========
00363> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00364>                            (cms)     (ha.m.)  |    (cms)    (ha.m.)
00365>                           .000  .0000E+00   |     .420  .2900E-01
00366>
00367>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00368>     --------------------       (ha)     (cms)     (hrs)       (mm)
00369>     INFLOW >02: (pond  )       1.71      .125     1.350     17.935
00370>     OUTFLOW<03: (000201)       1.71      .097     1.533     17.935
00371>
00372>                      PEAK   FLOW   REDUCTION [Qout/Qin](%)=   77.444
00373>                      TIME SHIFT OF PEAK FLOW         (min)=    11.00
00374>                      MAXIMUM  STORAGE   USED       (ha.m.)=.6687E-02
00375>
00376> ------------------------------------------------------------------------------
00377> 001:0014------------------------------------------------------------------------
00378> * Catchment 202 - lands that will be developed
00379> * Discharges to west forebay
00380> ----------------------
00381> | DESIGN STANDHYD    |   Area    (ha)=    8.99
00382> | 01:000202 DT= 1.00 |   Total Imp(%)=   57.00   Dir. Conn.(%)=   48.00
00383> ----------------------
00384>                              IMPERVIOUS    PERVIOUS (i)
00385>     Surface Area     (ha)=       5.12        3.87
00386>     Dep. Storage     (mm)=        .80        1.50
00387>     Average Slope     (%)=        .50         .50
00388>     Length            (m)=     244.81       40.00
00389>     Mannings n            =       .013        .250
00390>
00391>     Max.eff.Inten.(mm/hr)=      36.30        8.38
00392>                 over (min)       8.00       37.00
00393>     Storage Coeff.  (min)=       8.07 (ii)  36.91 (ii)
00394>     Unit Hyd. Tpeak (min)=       8.00       37.00
00395>     Unit Hyd. peak  (cms)=        .14         .03
00396>                                                        *TOTALS*
00397>     PEAK FLOW       (cms)=        .36         .05          .369 (iii)
00398>     TIME TO PEAK    (hrs)=       1.40        2.03         1.417
00399>     RUNOFF VOLUME    (mm)=      24.20        7.40        15.465
00400>     TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00401>     RUNOFF COEFFICIENT   =        .97         .30          .619
00402>
00403>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00404>           CN* =  80.0    Ia = Dep. Storage  (Above)
00405>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00406>           THAN THE STORAGE COEFFICIENT.
00407>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00408>
00409> ------------------------------------------------------------------------------
00410> 001:0015------------------------------------------------------------------------
00411> * Total to pond (east and west forebays)
00412> ------------------------
00413> | ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00414> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00415>                       ID1 08:EastForeba    16.42     .699    1.43  16.66    .000
00416>                      +ID2 03:              201      1.71     .097    1.53  17.94    .000
00417>                      +ID3 01:              202      8.99     .369    1.42  15.46    .000
00418>                       ============================================================
00419>                       SUM 09:toPond        27.13    1.158    1.43  16.34    .000
00420>
00421>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00422>
00423> ------------------------------------------------------------------------------
00424> 001:0016------------------------------------------------------------------------
00425> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00426> * external areas that discharge through the pond)
00427> ---------------------
00428> | ROUTE RESERVOIR   |     Requested routing time step =  1.0 min.
00429> |  IN>09:(toPond)   |
00430> | OUT<08:(Pond  )   |    =========  OUTLFOW STORAGE TABLE  =========
00431> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00432>                            (cms)     (ha.m.)  |    (cms)    (ha.m.)
00433>                            .000  .0000E+00   |     .700  .1600E+01
00434>                            .011  .4404E+00   |     .000  .0000E+00
00435>
00436>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00437>     --------------------       (ha)     (cms)     (hrs)       (mm)
00438>     INFLOW >09: (toPond)      27.13     1.158     1.433     16.344
00439>     OUTFLOW<08: (Pond  )      27.13      .011     4.983     16.341
00440>
00441>                      PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .926
00442>                      TIME SHIFT OF PEAK FLOW         (min)=   213.00
00443>                      MAXIMUM  STORAGE   USED       (ha.m.)=.4293E+00
00444>
00445> ------------------------------------------------------------------------------
00446> 001:0017------------------------------------------------------------------------
00447> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00448> * UNC1 - lands that will be developed
00449> * Discharge to environmental channel (rear of single lots)
00450> ----------------------
00451> | DESIGN STANDHYD    |   Area    (ha)=    2.11
00452> | 01:000001 DT= 1.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   13.00
00453> ----------------------
00454>                              IMPERVIOUS    PERVIOUS (i)
00455>     Surface Area     (ha)=        .42        1.69
00456>     Dep. Storage     (mm)=        .80        1.50
00457>     Average Slope     (%)=        .50         .50
00458>     Length            (m)=     118.60       40.00
00459>     Mannings n            =       .013        .250
00460>
00461>     Max.eff.Inten.(mm/hr)=      36.30        5.57
00462>                 over (min)       5.00       39.00
00463>     Storage Coeff.  (min)=       5.23 (ii)  39.19 (ii)
00464>     Unit Hyd. Tpeak (min)=       5.00       39.00
00465>     Unit Hyd. peak  (cms)=        .22         .03
00466>                                                        *TOTALS*
00467>     PEAK FLOW       (cms)=        .03         .02          .027 (iii)
00468>     TIME TO PEAK    (hrs)=       1.35        2.08         1.367
00469>     RUNOFF VOLUME    (mm)=      24.20        5.73         8.131
00470>     TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00471>     RUNOFF COEFFICIENT   =        .97         .23          .325
00472>
00473>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00474>           CN* =  76.0    Ia = Dep. Storage  (Above)
00475>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00476>           THAN THE STORAGE COEFFICIENT.
00477>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00478>
00479> ------------------------------------------------------------------------------
00480> 001:0018------------------------------------------------------------------------
00481> * UNC2 - lands that will be developed
00482> * Discharge to railway (rear of single lots)
00483> ----------------------
00484> | DESIGN STANDHYD    |   Area    (ha)=     .36
00485> | 02:000002 DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00486> ----------------------
00487>                              IMPERVIOUS    PERVIOUS (i)
00488>     Surface Area     (ha)=        .15         .21
00489>     Dep. Storage     (mm)=        .80        1.50
00490>     Average Slope     (%)=        .50         .50
00491>     Length            (m)=      48.99       40.00
00492>     Mannings n            =       .013        .250
00493>
00494>     Max.eff.Inten.(mm/hr)=      36.30        9.35
00495>                 over (min)       3.00       31.00
00496>     Storage Coeff.  (min)=       3.07 (ii)  30.67 (ii)
00497>     Unit Hyd. Tpeak (min)=       3.00       31.00
00498>     Unit Hyd. peak  (cms)=        .37         .04
00499>                                                        *TOTALS*
00500>     PEAK FLOW       (cms)=        .01         .00          .012 (iii)
00501>     TIME TO PEAK    (hrs)=       1.33        1.92         1.333
00502>     RUNOFF VOLUME    (mm)=      24.20        7.65        12.946
00503>     TOTAL RAINFALL   (mm)=      25.00       25.00        25.000
00504>     RUNOFF COEFFICIENT   =        .97         .31          .518
00505>
00506>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00507>           CN* =  81.0    Ia = Dep. Storage  (Above)
00508>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00509>           THAN THE STORAGE COEFFICIENT.
00510>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00511>
00512> ------------------------------------------------------------------------------
00513> 001:0019------------------------------------------------------------------------
00514> * UNC8 - lands that will remain undeveloped
00515> * Discharge to existing wetland
00516> ----------------------
00517> | DESIGN NASHYD      |   Area    (ha)=     .49   Curve Number   (CN)=74.00
00518> | 03:000008 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00519> ----------------------   U.H. Tp(hrs)=    .100
00520>
00521>     Unit Hyd Qpeak  (cms)=     .187
00522>
00523>     PEAK FLOW       (cms)=     .008 (i)
00524>     TIME TO PEAK    (hrs)=    1.500
00525>     RUNOFF VOLUME    (mm)=    4.898
00526>     TOTAL RAINFALL   (mm)=   25.000
00527>     RUNOFF COEFFICIENT   =     .196
00528>
00529>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00530>
00531> ------------------------------------------------------------------------------
00532> 001:0020------------------------------------------------------------------------
00533> * AREA TO RAMSEY
00534> * Catchment 208 - lands that will be developed
00535> * Includes ROW and multi-use trail
00536> * This area is to be controlled using LIDs
00537> ----------------------
00538> | DESIGN STANDHYD    |   Area    (ha)=     .62
00539> | 01:000208 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00540> ----------------------
```

```
                                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)=        36.30        21.91
                   over (min)       4.00        23.00
     Storage Coeff.  (min)=        3.62 (ii)   23.25 (ii)
     Unit Hyd. Tpeak (min)=        4.00        23.00
     Unit Hyd. peak  (cms)=         .30          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .05          .00          .049 (iii)
     TIME TO PEAK    (hrs)=        1.33         1.77         1.333
     RUNOFF VOLUME    (mm)=       24.20         9.14        21.188
     TOTAL RAINFALL   (mm)=       25.00        25.00        25.000
     RUNOFF COEFFICIENT   =         .97          .37          .848

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  76.0    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.

--------------------------------------------------------------------------------
001:0021--------------------------------------------------------------------------
* AREA TO EXISTING WOODLOT
* UNC7 - sloping to match development grade
* Discharge to woodlot
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .40   Curve Number   (CN)=74.00
| 07:000007 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .153

     PEAK FLOW       (cms)=     .007 (i)
     TIME TO PEAK    (hrs)=    1.500
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

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

--------------------------------------------------------------------------------
001:0022--------------------------------------------------------------------------
* EPA1 - (lands are owned by applicant by will not be developed
* as part of this application)
* Flow to Point A
----------------------
| DESIGN NASHYD      |   Area    (ha)=    4.93   Curve Number   (CN)=75.00
| 01:000001 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .438

     PEAK FLOW       (cms)=     .047 (i)
     TIME TO PEAK    (hrs)=    1.883
     RUNOFF VOLUME    (mm)=    5.105
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .204

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

--------------------------------------------------------------------------------
001:0023--------------------------------------------------------------------------
* EXT1 - External Flow to Point A
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .20   Curve Number   (CN)=77.00
| 02:000001 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .430

     Unit Hyd Qpeak  (cms)=     .018

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.883
     RUNOFF VOLUME    (mm)=    5.553
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .222

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

--------------------------------------------------------------------------------
001:0024--------------------------------------------------------------------------
* EPA2 - (lands are owned by applicant by will not be developed
* as part of this application)
* Flow to Point B
----------------------
| DESIGN NASHYD      |   Area    (ha)=    5.91   Curve Number   (CN)=75.00
| 03:000002 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .286

     PEAK FLOW       (cms)=     .038 (i)
     TIME TO PEAK    (hrs)=    2.367
     RUNOFF VOLUME    (mm)=    5.105
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .204

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

--------------------------------------------------------------------------------
001:0025--------------------------------------------------------------------------
* EXT2 - External Flow to Point B
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .65   Curve Number   (CN)=77.00
| 04:000002 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .790

     Unit Hyd Qpeak  (cms)=     .031

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    2.367
     RUNOFF VOLUME    (mm)=    5.556
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .222

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

--------------------------------------------------------------------------------
001:0026--------------------------------------------------------------------------
* Total to existing woodlot (for water balance)
------------------------
| ADD HYD (WOOD      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 07:         7     .40     .007    1.50    4.90    .000
                     +ID2 01:         1    4.93     .047    1.88    5.11    .000
                     +ID3 02:         1     .20     .002    1.88    5.55    .000
                     +ID4 03:WOOD           5.91     .038    2.37    5.11    .000
                     +ID5 04:         2     .65     .005    2.37    5.56    .000
                      ============================================================
                      SUM 03:WOOD          11.71     .106    1.88    5.13    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0027--------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2021-07-14     at 11:19:26
================================================================================
```

INPUT FILE: South Side, Post- Development, 5-Year - 24 hr SCS Type II

(C:\...5Q.DAT)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date         : 6-8-2021
00005> *#  Modeller     : [L.Garner]
00006> *#  Company      : R. J. Burnside & Associates Ltd.
00007> *#  License #    :  3877524
00008> *#*************************************************************************
00009> *# 5-years flows to each forebay (to size forebays)
00010> *#
00011> *# CN as per Ontario Soils Map for Welland County
00012> *#*************************************************************************
00013> START              TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00014> *%                  [  ] <--storm filename, one per line for NSTORM time
00015> *%-----------------|-------------------------------------------------------|
00016> *#*************************************************************************
00017> *% 5-year 24-hr SCS
00018> READ STORM          STORM_FILENAME=["5Y24.STM"]
00019> *%-----------------|-------------------------------------------------------|
00020> *#*************************************************************************
00021> *Flow to East Forebay (to size forebay)(Catchments 203-207)
00022> DESIGN STANDHYD     ID=[1], NHYD=[EAST1], DT=[1]min, AREA=[17.18](ha),
00023>                     XIMP=[0.56], TIMP=[0.67], DWF=[0](cms), LOSS=[2], CN=[77],
00024>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00025> *%-----------------|-------------------------------------------------------|
00026> *Flow to West Forebay (to size forebay) (Catchment 201 and 202)
00027> DESIGN STANDHYD     ID=[1], NHYD=[WEST1], DT=[1]min, AREA=[11.36](ha),
00028>                     XIMP=[0.50], TIMP=[0.62], DWF=[0](cms), LOSS=[2], CN=[79],
00029>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00030> *%-----------------|-------------------------------------------------------|
00031> *%-----------------|-------------------------------------------------------|
00032> FINISH
00033>
00034>
00035>
00036>
00037>
```

```
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: 2021-07-14     TIME: 11:28:52     RUN COUNTER: 002497         *
00039>  ********************************************************************************
00040>  * Input   filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\5Q.DAT           *
00041>  * Output  filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\5Q.out           *
00042>  * Summary filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\5Q.sum           *
00043>  * User comments:                                                             *
00044>  * 1:_____________________________________________________________________    *
00045>  * 2:_____________________________________________________________________    *
00046>  * 3:_____________________________________________________________________    *
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [041230]
00053> *#  Date         : 6-8-2021
00054> *#  Modeller     : [L.Garner]
00055> *#  Company      : R. J. Burnside & Associates Ltd.
00056> *#  License #    :  3877524
00057> *#*****************************************************************************
00058> *# 5-years flows to each forebay (to size forebays)
00059> *#
00060> *# CN as per Ontario Soils Map for Welland County
00061> *#*****************************************************************************
00062> --------------------
00063> | START            |  Project  dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\
00064> --------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\SCS\
00065>     TZERO =   .00 hrs on        0
00066>     METOUT=   2 (output = METRIC)
00067>     NRUN  = 001
00068>     NSTORM=   0
00069> --------------------------------------------------------------------------------
00070> 001:0002--------------------------------------------------------------------------
00071> *#*****************************************************************************
00072> --------------------
00073> | READ STORM       |    Filename: 5yr/24hr
00074> | Ptotal=  64.31 mm|    Comments: 5yr/24hr
00075> --------------------
00076>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00077>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00078>                 .25    .000 |   6.50   1.290 |  12.75   9.250 |  19.00   1.160
00079>                 .50    .710 |   6.75   1.290 |  13.00   4.760 |  19.25   1.160
00080>                 .75    .710 |   7.00   1.290 |  13.25   4.760 |  19.50   1.160
00081>                1.00    .710 |   7.25   1.290 |  13.50    .900 |  19.75   1.160
00082>                1.25    .710 |   7.50   1.290 |  13.75    .900 |  20.00   1.160
00083>                1.50    .710 |   7.75   1.290 |  14.00   5.270 |  20.25   1.160
00084>                1.75    .710 |   8.00   1.290 |  14.25   5.270 |  20.50    .770
00085>                2.00    .710 |   8.25   1.290 |  14.50   1.930 |  20.75    .770
00086>                2.25    .710 |   8.50   1.740 |  14.75   1.930 |  21.00    .770
00087>                2.50    .840 |   8.75   1.740 |  15.00   1.930 |  21.25    .770
00088>                2.75    .840 |   9.00   1.740 |  15.25   1.930 |  21.50    .770
00089>                3.00    .840 |   9.25   1.740 |  15.50   1.930 |  21.75    .770
00090>                3.25    .840 |   9.50   2.060 |  15.75   1.930 |  22.00    .770
00091>                3.50    .840 |   9.75   2.060 |  16.00   1.930 |  22.25    .770
00092>                3.75    .840 |  10.00   2.310 |  16.25   1.930 |  22.50    .770
00093>                4.00    .840 |  10.25   2.310 |  16.50   1.160 |  22.75    .770
00094>                4.25    .840 |  10.50   2.960 |  16.75   1.160 |  23.00    .770
00095>                4.50   1.030 |  10.75   2.960 |  17.00   1.160 |  23.25    .770
00096>                4.75   1.030 |  11.00   3.980 |  17.25   1.160 |  23.50    .770
00097>                5.00   1.030 |  11.25   3.980 |  17.50   1.160 |  23.75    .770
00098>                5.25   1.030 |  11.50   6.170 |  17.75   1.160 |  24.00    .770
00099>                5.50   1.030 |  11.75   6.170 |  18.00   1.160 |  24.25    .770
00100>                5.75   1.030 |  12.00  26.730 |  18.25   1.160 |
00101>                6.00   1.030 |  12.25  70.940 |  18.50   1.160 |
00102>                6.25   1.030 |  12.50   9.250 |  18.75   1.160 |
00103>
00104> --------------------------------------------------------------------------------
00105> 001:0003--------------------------------------------------------------------------
00106> *#*****************************************************************************
00107> *Flow to East Forebay (to size forebay)(Catchments 203-207)
00108> ----------------------
00109> | DESIGN STANDHYD    |   Area    (ha)=   17.18
00110> | 01:000001 DT= 1.00 |   Total Imp(%)=   67.00   Dir. Conn.(%)=   56.00
00111> ----------------------
00112>                                IMPERVIOUS    PERVIOUS (i)
00113>      Surface Area     (ha)=      11.51          5.67
00114>      Dep. Storage     (mm)=        .80          1.50
00115>      Average Slope     (%)=        .50           .50
00116>      Length            (m)=     338.43         40.00
00117>      Mannings n            =       .013          .250
00118>
00119>      Max.eff.Inten.(mm/hr)=      70.94         43.66
00120>                 over (min)        7.00         22.00
00121>      Storage Coeff.  (min)=       7.50 (ii)    22.40 (ii)
00122>      Unit Hyd. Tpeak (min)=       7.00         22.00
00123>      Unit Hyd. peak  (cms)=        .15           .05
00124>                                                          *TOTALS*
00125>      PEAK FLOW       (cms)=       1.63           .42          1.910 (iii)
00126>      TIME TO PEAK    (hrs)=      12.27         12.50         12.283
00127>      RUNOFF VOLUME    (mm)=      63.50         33.23         50.192
00128>      TOTAL RAINFALL   (mm)=      64.31         64.31         64.308
00129>      RUNOFF COEFFICIENT   =        .99           .52           .780
00130>
00131>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00132>            CN* =  77.0    Ia = Dep. Storage  (Above)
00133>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00134>            THAN THE STORAGE COEFFICIENT.
00135>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00136>
00137> --------------------------------------------------------------------------------
00138> 001:0004--------------------------------------------------------------------------
00139> *Flow to West Forebay (to size forebay) (Catchment 201 and 202)
00140> ----------------------
00141> | DESIGN STANDHYD    |   Area    (ha)=   11.36
00142> | 01:000001 DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   50.00
00143> ----------------------
00144>                                IMPERVIOUS    PERVIOUS (i)
00145>      Surface Area     (ha)=       7.04          4.32
00146>      Dep. Storage     (mm)=        .80          1.50
00147>      Average Slope     (%)=        .50           .50
00148>      Length            (m)=     275.20         40.00
00149>      Mannings n            =       .013          .250
00150>
00151>      Max.eff.Inten.(mm/hr)=      70.94         46.66
00152>                 over (min)        7.00         21.00
00153>      Storage Coeff.  (min)=       6.62 (ii)    21.13 (ii)
00154>      Unit Hyd. Tpeak (min)=       7.00         21.00
00155>      Unit Hyd. peak  (cms)=        .17           .05
00156>                                                          *TOTALS*
00157>      PEAK FLOW       (cms)=        .99           .35          1.226 (iii)
00158>      TIME TO PEAK    (hrs)=      12.27         12.48         12.283
00159>      RUNOFF VOLUME    (mm)=      63.50         34.84         49.181
00160>      TOTAL RAINFALL   (mm)=      64.31         64.31         64.308
00161>      RUNOFF COEFFICIENT   =        .99           .54           .765
00162>
00163>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00164>            CN* =  79.0    Ia = Dep. Storage  (Above)
00165>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00166>            THAN THE STORAGE COEFFICIENT.
00167>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00168>
00169> --------------------------------------------------------------------------------
00170> 001:0005--------------------------------------------------------------------------
00171>       FINISH
00172> --------------------------------------------------------------------------------
00173> ********************************************************************************
00174>      WARNINGS / ERRORS / NOTES
00175>      -------------------------
00176>    Simulation ended on 2021-07-14     at 11:28:53
00177> ================================================================================
00178>
00179>
```

INPUT FILE: South Side, Post- Development, 100-Year - 12 hr AES

(C:\...100.DAT)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date        : 6-8-2021
00005> *#  Modeller    : [L.Garner]
00006> *#  Company     : R. J. Burnside & Associates Ltd.
00007> *#  License #   :  3877524
00008> *#*************************************************************************
00009> *# Post Development Model for the Site
00010> *#
00011> *#  CN as per Ontario Soils Map for Welland County
00012> *#*************************************************************************
00013> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00014> *%                   [  ] <--storm filename, one per line for NSTORM time
00015> *%-----------------|-------------------------------------------------------|
00016> *#*************************************************************************
00017> *% 100-year 12-hr AES
00018> MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
00019>                     CURVE_FILENAME=["AES-12HR.MST"]
00020> *%-----------------|-------------------------------------------------------|
00021> *#*************************************************************************
00022> *%-----------------|-------------------------------------------------------|
00023> * TO EAST FOREBAY
00024> *%-----------------|-------------------------------------------------------|
00025> * Catchment 203 - Block 280 - lands that will be developed as site plan
00026> * Release rate controlled to 5-year post-dev flow (Rational Method)
00027> * Discharges to east forebay
00028> DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[4.39](ha),
00029>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[74],
00030>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00031> *%-----------------|-------------------------------------------------------|
00032> *  Release rate controlled to 5-year post-dev flow
00033> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00034> ROUTE RESERVOIR     IDout=[ 5 ],   NHYD=[203C],  IDin=[  1 ],
00035>                     RDT=[1](min),
00036>                           TABLE of ( OUTFLOW-STORAGE ) values
00037>                                      (cms) - (ha-m)
00038>                                    [   0.0 ,  0.0 ]
00039>                                    [   0.827,  0.0687 ]
00040>                                    [   -1  ,  -1  ]  (max twenty pts)
00041>                           IDovf=[   ], NHYDovf=[   ]
00042> *%-----------------|-------------------------------------------------------|
00043> * Catchment 205
00044> * Discharges to east forebay, Street L from north of tracks
00045> DESIGN STANDHYD     ID=[7], NHYD=[205], DT=[1]min, AREA=[2.50](ha),
00046>                     XIMP=[0.43], TIMP=[0.53], DWF=[0](cms), LOSS=[2],CN=[81],
00047>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00048> *%-----------------|-------------------------------------------------------|
00049> * Catchment 206 - Block 279 - lands that will be developed as site plan
00050> * Release rate controlled to 5-year post-dev flow (Rational Method)
00051> * Discharges to east forebay
00052> DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.87](ha),
00053>                     XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[76],
00054>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00055> *%-----------------|-------------------------------------------------------|
00056> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00057> * 2-year flow from roof area (1740 m2) - Rational Method
00058> COMPUTE DUALHYD     IDin=[1], CINLET=[0.029](cms), NINLET=[1],
00059>                     MAJID=[6], MajNHYD=["pond"],
00060>                     MINID=[8], MinNHYD=["envunc"],
00061>                     TMJSTO=[   ](cu-m)
00062> *%-----------------|-------------------------------------------------------|
00063> *  Release rate controlled to 5-year post-dev flow
00064> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00065> ROUTE RESERVOIR     IDout=[ 9 ],   NHYD=[206C],  IDin=[  6 ],
00066>                     RDT=[1](min),
00067>                           TABLE of ( OUTFLOW-STORAGE ) values
00068>                                      (cms) - (ha-m)
00069>                                    [   0.0 ,  0.0 ]
00070>                                    [   0.154,  0.00825 ]
00071>                                    [   -1  ,  -1  ]  (max twenty pts)
00072>                           IDovf=[   ], NHYDovf=[   ]
00073> *%-----------------|-------------------------------------------------------|
00074> * Catchment 207
00075> * Discharges to east forebay
00076> DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[9.42](ha),
00077>                     XIMP=[0.48], TIMP=[0.58], DWF=[0](cms), LOSS=[2],CN=[77],
00078>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00079> *%-----------------|-------------------------------------------------------|
00080> * Total to east side of forebay
00081> ADD HYD             IDsum=[8], NHYD=["EastForebay1"], IDs to add=[5,7,9,1]
00082> *%-----------------|-------------------------------------------------------|
00083> * TO WEST FOREBAY
00084> *%-----------------|-------------------------------------------------------|
00085> * Catchment 201 - Block 278 - lands that will be developed as site plan
00086> * Release rate controlled to 5-year post-dev flow
00087> * Discharges to west forebay
00088> DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[2.37](ha),
00089>                     XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74],
00090>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00091> *%-----------------|-------------------------------------------------------|
00092> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00093> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00094> COMPUTE DUALHYD     IDin=[1], CINLET=[0.009](cms), NINLET=[1],
00095>                     MAJID=[2], MajNHYD=["pond"],
00096>                     MINID=[4], MinNHYD=["envunc"],
00097>                     TMJSTO=[   ](cu-m)
00098> *%-----------------|-------------------------------------------------------|
00099> *  Release rate controlled to 5-year post-dev flow
00100> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00101> ROUTE RESERVOIR     IDout=[ 3 ],   NHYD=[201C],  IDin=[ 2],
00102>                     RDT=[1](min),
00103>                           TABLE of ( OUTFLOW-STORAGE ) values
00104>                                      (cms) - (ha-m)
00105>                                    [   0.0 ,  0.0 ]
00106>                                    [   0.420,  0.029 ]
00107>                                    [   -1  ,  -1  ]  (max twenty pts)
00108>                           IDovf=[   ], NHYDovf=[   ]
00109> *%-----------------|-------------------------------------------------------|
00110> * Catchment 202 - lands that will be developed
00111> * Discharges to west forebay
00112> DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[8.99](ha),
00113>                     XIMP=[0.48], TIMP=[0.57], DWF=[0](cms), LOSS=[2],CN=[80],
00114>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00115> *%-----------------|-------------------------------------------------------|
00116> * Total to pond (east and west forebays)
00117> ADD HYD             IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
00118> *%-----------------|-------------------------------------------------------|
00119> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00120> * external areas that discharge through the pond)
00121> ROUTE RESERVOIR     IDout=[8],   NHYD=["Pond"],  IDin=[9],
00122>                     RDT=[1](min),
00123>                           TABLE of ( OUTFLOW-STORAGE ) values
00124>                                      (cms) - (ha-m)
00125>                                    [   0.0 ,  0.0 ]
00126>                                    [   0.011, 0.4404  ]
00127>                                    [   0.70, 1.6 ]
00128>                                    [   -1  ,  -1  ]  (max twenty pts)
00129>                           IDovf=[], NHYDovf=[overflow]
00130> *%-----------------|-------------------------------------------------------|
00131> *%-----------------|-------------------------------------------------------|
00132> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00133> *%-----------------|-------------------------------------------------------|
00134> * UNC1 - lands that will be developed
00135> * Discharge to environmental channel (rear of single lots)
00136> DESIGN STANDHYD     ID=[1], NHYD=[UNC1], DT=[1]min, AREA=[2.11](ha),
00137>                     XIMP=[0.13], TIMP=[0.20], DWF=[0](cms), LOSS=[2],CN=[76],
00138>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00139> *%-----------------|-------------------------------------------------------|
00140> * UNC2 - lands that will be developed
00141> * Discharge to railway (rear of single lots)
00142> DESIGN STANDHYD     ID=[2], NHYD=[UNC2], DT=[1]min, AREA=[0.36](ha),
00143>                     XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2],CN=[81],
00144>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00145> *%-----------------|-------------------------------------------------------|
00146> * UNC8 - lands that will remain undeveloped
00147> * Discharge to existing wetland
00148> DESIGN NASHYD       ID=[3], NHYD=[UNC8], DT=[1]min, AREA=[0.49](ha),
00149>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00150>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00151> *%-----------------|-------------------------------------------------------|
00152> *%-----------------|-------------------------------------------------------|
00153> * AREA TO RAMSEY
00154> *%-----------------|-------------------------------------------------------|
00155> * Catchment 208 - lands that will be developed
00156> * Includes ROW and multi-use trail
00157> * This area is to be controlled using LIDs
00158> DESIGN STANDHYD     ID=[1], NHYD=[208], DT=[1]min, AREA=[0.62](ha),
00159>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2],CN=[76],
00160>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00161> *%-----------------|-------------------------------------------------------|
00162> *%-----------------|-------------------------------------------------------|
00163> * AREA TO EXISTING WOODLOT
00164> *%-----------------|-------------------------------------------------------|
00165> * UNC7 - sloping to match development grade
00166> * Discharge to woodlot
00167> DESIGN NASHYD       ID=[7], NHYD=[UNC7], DT=[1]min, AREA=[0.40](ha),
00168>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00169>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00170> *%-----------------|-------------------------------------------------------|
00171> * EPA1 - (lands are owned by applicant by will not be developed
00172> * as part of this application)
00173> * Flow to Point A
00174> DESIGN NASHYD       ID=[1], NHYD=[EPA1], DT=[1]min, AREA=[4.93](ha),
00175>                     DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00176>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00177> *%-----------------|-------------------------------------------------------|
00178> * EXT1 - External Flow to Point A
00179> DESIGN NASHYD       ID=[2], NHYD=[EXT1], DT=[1]min, AREA=[0.2](ha),
00180>                     DWF=[0](cms), CN/C=[77], TP=[0.43]hrs,
00181>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00182> *%-----------------|-------------------------------------------------------|
00183> * EPA2 - (lands are owned by applicant by will not be developed
00184> * as part of this application)
00185> * Flow to Point B
00186> DESIGN NASHYD       ID=[3], NHYD=[EPA2], DT=[1]min, AREA=[5.91](ha),
00187>                     DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00188>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00189> *%-----------------|-------------------------------------------------------|
00190> * EXT2 - External Flow to Point B
00191> DESIGN NASHYD       ID=[4], NHYD=[EXT2], DT=[1]min, AREA=[0.65](ha),
00192>                     DWF=[0](cms), CN/C=[77], TP=[0.79]hrs,
00193>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00194> *%-----------------|-------------------------------------------------------|
00195> * Total to existing woodlot (for water balance)
00196> ADD HYD             IDsum=[3], NHYD=["WOOD"], IDs to add=[7,1,2,3,4]
00197> *%-----------------|-------------------------------------------------------|
00198> *%-----------------|-------------------------------------------------------|
00199> FINISH
00200>
00201>
00202>
00203>
00204>
00205>
```

OUTPUT FILE: South Side, Post- Development, 100-Year - 12 hr AES

(C:\...100.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: 2021-07-14     TIME: 11:11:23     RUN COUNTER: 002495         *
00039> ********************************************************************************
00040> * Input   filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\AES\100.DAT          *
00041> * Output  filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\AES\100.out          *
00042> * Summary filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\AES\100.sum          *
00043> * User comments:                                                             *
00044> * 1:_____________________________________________________________________    *
00045> * 2:_____________________________________________________________________    *
00046> * 3:_____________________________________________________________________    *
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************
00052> *#  Project Name: [Niagara Village]    Project Number: [041230]
00053> *#  Date        : 6-8-2021
00054> *#  Modeller    : [L.Garner]
00055> *#  Company     : R. J. Burnside & Associates Ltd.
00056> *#  License #   :  3877524
00057> *#*****************************************************************************
00058> *# Post Development Model for the Site
00059> *#
00060> *#  CN as per Ontario Soils Map for Welland County
00061> *#*****************************************************************************
00062> --------------------
00063> | START            |  Project  dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\AES\
00064> --------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\AES\
00065>     TZERO =   .00 hrs on        0
00066>     METOUT=   2 (output = METRIC)
00067>     NRUN  = 001
00068>     NSTORM=   0
00069> --------------------------------------------------------------------------------
00070> 001:0002--------------------------------------------------------------------------
00071> *#*****************************************************************************
00072> --------------------
00073> | MASS STORM       |    Filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\AE
00074> | Ptotal= 88.06 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
00075> --------------------
00076>                         Duration of storm        =  12.00 hrs
00077>                         Mass curve time step     =  60.00 min
00078>                         Selected storm time step =   5.00 min
00079>                         Volume of derived storm  =  88.06 mm
00080>
00081>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00082>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00083>               .08   4.403 |   3.08   9.687 |   6.08   7.925 |   9.08   5.284
00084>               .17   4.403 |   3.17   9.687 |   6.17   7.925 |   9.17   5.284
00085>               .25   4.403 |   3.25   9.687 |   6.25   7.925 |   9.25   5.284
00086>               .33   4.403 |   3.33   9.687 |   6.33   7.925 |   9.33   5.284
00087>               .42   4.403 |   3.42   9.687 |   6.42   7.925 |   9.42   5.284
00088>               .50   4.403 |   3.50   9.687 |   6.50   7.925 |   9.50   5.284
00089>               .58   4.403 |   3.58   9.687 |   6.58   7.925 |   9.58   5.284
00090>               .67   4.403 |   3.67   9.687 |   6.67   7.925 |   9.67   5.284
00091>               .75   4.403 |   3.75   9.687 |   6.75   7.925 |   9.75   5.284
00092>               .83   4.403 |   3.83   9.687 |   6.83   7.925 |   9.83   5.284
00093>               .92   4.403 |   3.92   9.687 |   6.92   7.925 |   9.92   5.284
00094>              1.00   4.403 |   4.00   9.687 |   7.00   7.925 |  10.00   5.284
00095>              1.08   8.806 |   4.08  13.209 |   7.08   7.925 |  10.08   1.761
00096>              1.17   8.806 |   4.17  13.209 |   7.17   7.925 |  10.17   1.761
00097>              1.25   8.806 |   4.25  13.209 |   7.25   7.925 |  10.25   1.761
00098>              1.33   8.806 |   4.33  13.209 |   7.33   7.925 |  10.33   1.761
00099>              1.42   8.806 |   4.42  13.209 |   7.42   7.925 |  10.42   1.761
00100>              1.50   8.806 |   4.50  13.209 |   7.50   7.925 |  10.50   1.761
00101>              1.58   8.806 |   4.58  13.209 |   7.58   7.925 |  10.58   1.761
00102>              1.67   8.806 |   4.67  13.209 |   7.67   7.925 |  10.67   1.761
00103>              1.75   8.806 |   4.75  13.209 |   7.75   7.925 |  10.75   1.761
00104>              1.83   8.806 |   4.83  13.209 |   7.83   7.925 |  10.83   1.761
00105>              1.92   8.806 |   4.92  13.209 |   7.92   7.925 |  10.92   1.761
00106>              2.00   8.806 |   5.00  13.209 |   8.00   7.925 |  11.00   1.761
00107>              2.08  10.567 |   5.08  12.328 |   8.08   5.284 |  11.08    .881
00108>              2.17  10.567 |   5.17  12.328 |   8.17   5.284 |  11.17    .881
00109>              2.25  10.567 |   5.25  12.328 |   8.25   5.284 |  11.25    .881
00110>              2.33  10.567 |   5.33  12.328 |   8.33   5.284 |  11.33    .881
00111>              2.42  10.567 |   5.42  12.328 |   8.42   5.284 |  11.42    .881
00112>              2.50  10.567 |   5.50  12.328 |   8.50   5.284 |  11.50    .881
00113>              2.58  10.567 |   5.58  12.328 |   8.58   5.284 |  11.58    .881
00114>              2.67  10.567 |   5.67  12.328 |   8.67   5.284 |  11.67    .881
00115>              2.75  10.567 |   5.75  12.328 |   8.75   5.284 |  11.75    .881
00116>              2.83  10.567 |   5.83  12.328 |   8.83   5.284 |  11.83    .881
00117>              2.92  10.567 |   5.92  12.328 |   8.92   5.284 |  11.92    .881
00118>              3.00  10.567 |   6.00  12.328 |   9.00   5.284 |  12.00    .881
00119>
00120> --------------------------------------------------------------------------------
00121> 001:0003--------------------------------------------------------------------------
00122> *#*****************************************************************************
00123> * TO EAST FOREBAY
00124> * Catchment 203 - Block 280 - lands that will be developed as site plan
00125> * Release rate controlled to 5-year post-dev flow (Rational Method)
00126> * Discharges to east forebay
00127> ----------------------
00128> | DESIGN STANDHYD    |   Area    (ha)=    4.39
00129> | 01:000204 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00130> ----------------------
00131>                              IMPERVIOUS    PERVIOUS (i)
00132>      Surface Area     (ha)=       3.95         .44
00133>      Dep. Storage     (mm)=        .80        1.50
00134>      Average Slope     (%)=        .50         .50
00135>      Length            (m)=     171.08       40.00
00136>      Mannings n             =       .013         .250
00137>
00138>      Max.eff.Inten.(mm/hr)=      13.21        19.72
00139>                 over (min)       10.00        30.00
00140>      Storage Coeff.  (min)=       9.75 (ii)   30.23 (ii)
00141>      Unit Hyd. Tpeak (min)=      10.00        30.00
00142>      Unit Hyd. peak  (cms)=        .12          .04
00143>                                                          *TOTALS*
00144>      PEAK FLOW       (cms)=        .13          .02          .150 (iii)
00145>      TIME TO PEAK    (hrs)=       5.00         6.05         5.017
00146>      RUNOFF VOLUME    (mm)=      87.25        57.76        81.364
00147>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00148>      RUNOFF COEFFICIENT   =        .99          .66          .924
00149>
00150>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00151>            CN* =  74.0    Ia = Dep. Storage  (Above)
00152>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00153>            THAN THE STORAGE COEFFICIENT.
00154>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00155>
00156> --------------------------------------------------------------------------------
00157> 001:0004--------------------------------------------------------------------------
00158> *  Release rate controlled to 5-year post-dev flow
00159> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00160> --------------------
00161> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00162> |  IN>01:(000204)   |
00163> | OUT<05:(000203)   |    =========  OUTFLOW STORAGE TABLE  =========
00164> --------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00165>                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
00166>                           .000  .0000E+00     |     .827  .6870E-01
00167>
00168>      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
00169>      -----------------------     (ha)     (cms)     (hrs)       (mm)
00170>      INFLOW >01: (000204)        4.39      .150     5.017     81.364
00171>      OUTFLOW<05: (000203)        4.39      .148     5.150     81.364
00172>
00173>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.601
00174>                    TIME SHIFT OF PEAK FLOW          (min)=     8.00
00175>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1226E-01
00176>
00177> --------------------------------------------------------------------------------
00178> 001:0005--------------------------------------------------------------------------
00179> * Catchment 205
00180> * Discharges to east forebay, Street L from north of tracks
00181> ----------------------
00182> | DESIGN STANDHYD    |   Area    (ha)=    2.50
00183> | 07:000205 DT= 1.00 |   Total Imp(%)=   53.00   Dir. Conn.(%)=   43.00
00184> ----------------------
00185>                              IMPERVIOUS    PERVIOUS (i)
00186>      Surface Area     (ha)=       1.32         1.18
00187>      Dep. Storage     (mm)=        .80         1.50
00188>      Average Slope     (%)=        .50          .50
00189>      Length            (m)=     129.10        40.00
00190>      Mannings n             =       .013         .250
00191>
00192>      Max.eff.Inten.(mm/hr)=      13.21        11.57
00193>                 over (min)        8.00        34.00
00194>      Storage Coeff.  (min)=       8.24 (ii)   33.58 (ii)
00195>      Unit Hyd. Tpeak (min)=       8.00        34.00
00196>      Unit Hyd. peak  (cms)=        .14          .03
00197>                                                          *TOTALS*
00198>      PEAK FLOW       (cms)=        .04          .04          .073 (iii)
00199>      TIME TO PEAK    (hrs)=       5.00         6.08         6.000
00200>      RUNOFF VOLUME    (mm)=      87.25        55.43        69.127
00201>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00202>      RUNOFF COEFFICIENT   =        .99          .63          .785
00203>
00204>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00205>            CN* =  81.0    Ia = Dep. Storage  (Above)
00206>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00207>            THAN THE STORAGE COEFFICIENT.
00208>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00209>
00210> --------------------------------------------------------------------------------
00211> 001:0006--------------------------------------------------------------------------
00212> * Catchment 206 - Block 279 - lands that will be developed as site plan
00213> * Release rate controlled to 5-year post-dev flow (Rational Method)
00214> * Discharges to east forebay
00215> ----------------------
00216> | DESIGN STANDHYD    |   Area    (ha)=     .87
00217> | 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00218> ----------------------
00219>                              IMPERVIOUS    PERVIOUS (i)
00220>      Surface Area     (ha)=        .70          .17
00221>      Dep. Storage     (mm)=        .80         1.50
00222>      Average Slope     (%)=        .50          .50
00223>      Length            (m)=      76.16        40.00
00224>      Mannings n             =       .013         .250
00225>
00226>      Max.eff.Inten.(mm/hr)=      13.21        20.32
00227>                 over (min)        6.00        26.00
00228>      Storage Coeff.  (min)=       6.00 (ii)   26.24 (ii)
00229>      Unit Hyd. Tpeak (min)=       6.00        26.00
00230>      Unit Hyd. peak  (cms)=        .19          .04
00231>                                                          *TOTALS*
00232>      PEAK FLOW       (cms)=        .02          .01          .028 (iii)
00233>      TIME TO PEAK    (hrs)=       5.00         6.03         5.017
00234>      RUNOFF VOLUME    (mm)=      87.25        59.82        76.287
00235>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00236>      RUNOFF COEFFICIENT   =        .99          .68          .866
00237>
00238>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00239>            CN* =  76.0    Ia = Dep. Storage  (Above)
00240>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00241>            THAN THE STORAGE COEFFICIENT.
00242>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00243>
00244> --------------------------------------------------------------------------------
00245> 001:0007--------------------------------------------------------------------------
00246> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00247> * 2-year flow from roof area (1740 m2) - Rational Method
00248> ----------------------
00249> | COMPUTE DUALHYD    |  Average inlet capacities   [CINLET] =    .029  (cms)
00250> | TotalHyd 01:000206 |  Number of inlets in system [NINLET] =      1
00251> ----------------------  Total minor system capacity         =    .029  (cms)
00252>                         Total major system storage [TMJSTO] =      0.(cu.m.)
00253>
00254>                   ID: NHYD       AREA     QPEAK     TPEAK     R.V.      DWF
00255>                                   (ha)     (cms)     (hrs)     (mm)     (cms)
00256>      TOTAL HYD.   01:000206        .87      .028     5.017   76.287     .000
00257>      ================================================================
00258>      MAJOR SYST   06:pond          .00      .000      .000     .000     .000
00259>      MINOR SYST   08:envunc       .87      .028     5.017   76.287     .000
00260>
00261>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00262>
00263> --------------------------------------------------------------------------------
00264> 001:0008--------------------------------------------------------------------------
00265> *  Release rate controlled to 5-year post-dev flow
00266> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00267> --------------------
00268> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00269> |  IN>06:(pond  )   |
00270> | OUT<09:(000206)   |    =========  OUTFLOW STORAGE TABLE  =========
```

```
00271> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00272>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
00273>                              .000  .0000E+00   |     .154  .8250E-02
00274>      *** WARNING: Inflow hydrograph is dry.
00275>
00276>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00277>      ---------------------       (ha)     (cms)     (hrs)       (mm)
00278>      INFLOW >06: (pond  )         .00      .000      .000       .000
00279>      OUTFLOW<09: (000206)         .00      .000      .000       .000
00280>
00281> *** WARNING: Inflow and ouflow hydrographs are dry.
00282>
00283> ------------------------------------------------------------------------------
00284> 001:0009----------------------------------------------------------------------
00285> * Catchment 207
00286> * Discharges to east forebay
00287> ----------------------
00288> | DESIGN STANDHYD    |   Area    (ha)=    9.42
00289> | 01:000207 DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   48.00
00290> ----------------------
00291>                              IMPERVIOUS    PERVIOUS (i)
00292>      Surface Area     (ha)=       5.46         3.96
00293>      Dep. Storage     (mm)=        .80         1.50
00294>      Average Slope     (%)=        .50          .50
00295>      Length            (m)=     250.60        40.00
00296>      Mannings n             =       .013         .250
00297>
00298>      Max.eff.Inten.(mm/hr)=      13.21        10.94
00299>                  over (min)       12.00        38.00
00300>      Storage Coeff.  (min)=      12.27 (ii)   38.19 (ii)
00301>      Unit Hyd. Tpeak (min)=      12.00        38.00
00302>      Unit Hyd. peak  (cms)=        .09          .03
00303>                                                          *TOTALS*
00304>      PEAK FLOW       (cms)=        .17          .11          .267 (iii)
00305>      TIME TO PEAK    (hrs)=       5.00         6.15         6.000
00306>      RUNOFF VOLUME    (mm)=      87.24        50.90        68.363
00307>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00308>      RUNOFF COEFFICIENT   =        .99          .58          .776
00309>
00310>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00311>            CN* =  77.0    Ia = Dep. Storage  (Above)
00312>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00313>            THAN THE STORAGE COEFFICIENT.
00314>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00315>
00316> ------------------------------------------------------------------------------
00317> 001:0010----------------------------------------------------------------------
00318> * Total to east side of forebay
00319> ----------------------
00320> | ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00321> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00322>                        ID1 05:       203     4.39     .148    5.15  81.36    .000
00323>                       +ID2 07:       205     2.50     .073    6.00  69.13    .000
00324>                       +ID3 09:       206      .00     .000     .00    .00    .000
00325>                       +ID4 01:       207     9.42     .267    6.00  68.36    .000
00326>                        ================================================================
00327>                        SUM 08:EastForeba    16.31     .484    6.00  71.98    .000
00328>
00329>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00330>
00331> ------------------------------------------------------------------------------
00332> 001:0011----------------------------------------------------------------------
00333> * TO WEST FOREBAY
00334> * Catchment 201 - Block 278 - lands that will be developed as site plan
00335> * Release rate controlled to 5-year post-dev flow
00336> * Discharges to west forebay
00337> ----------------------
00338> | DESIGN STANDHYD    |   Area    (ha)=    2.37
00339> | 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00340> ----------------------
00341>                              IMPERVIOUS    PERVIOUS (i)
00342>      Surface Area     (ha)=       1.90         .47
00343>      Dep. Storage     (mm)=        .80        1.50
00344>      Average Slope     (%)=        .50         .50
00345>      Length            (m)=     125.70       40.00
00346>      Mannings n             =       .013         .250
00347>
00348>      Max.eff.Inten.(mm/hr)=      13.21        19.73
00349>                  over (min)        8.00        29.00
00350>      Storage Coeff.  (min)=       8.11 (ii)   28.58 (ii)
00351>      Unit Hyd. Tpeak (min)=       8.00        29.00
00352>      Unit Hyd. peak  (cms)=        .14          .04
00353>                                                          *TOTALS*
00354>      PEAK FLOW       (cms)=        .05          .03          .075 (iii)
00355>      TIME TO PEAK    (hrs)=       5.00         6.05         5.033
00356>      RUNOFF VOLUME    (mm)=      87.25        57.76        75.468
00357>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00358>      RUNOFF COEFFICIENT   =        .99          .66          .857
00359>
00360>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00361>            CN* =  74.0    Ia = Dep. Storage  (Above)
00362>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00363>            THAN THE STORAGE COEFFICIENT.
00364>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00365>
00366> ------------------------------------------------------------------------------
00367> 001:0012----------------------------------------------------------------------
00368> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00369> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00370> ----------------------
00371> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .009  (cms)
00372> | TotalHyd 01:000201 |   Number of inlets in system [NINLET] =      1
00373> ----------------------   Total minor system capacity          =    .009  (cms)
00374>                          Total major system storage [TMJSTO] =      0.(cu.m.)
00375>
00376>                    ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00377>                                     (ha)     (cms)     (hrs)     (mm)    (cms)
00378>      TOTAL HYD.   01:000201       2.37      .075     5.033   75.468     .000
00379>      ================================================================
00380>      MAJOR SYST   02:pond         1.86      .066     5.033   75.468     .000
00381>      MINOR SYST   04:envunc        .51      .009      .367   75.468     .000
00382>
00383>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00384>
00385> ------------------------------------------------------------------------------
00386> 001:0013----------------------------------------------------------------------
00387> *  Release rate controlled to 5-year post-dev flow
00388> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00389> ----------------------
00390> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00391> |  IN>02:(pond  )    |
00392> | OUT<03:(000201)    |    =========  OUTLFOW STORAGE TABLE  =========
00393> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00394>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
00395>                              .000  .0000E+00   |     .420  .2900E-01
00396>
00397>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00398>      ---------------------       (ha)     (cms)     (hrs)       (mm)
00399>      INFLOW >02: (pond  )         1.86      .066     5.033     75.468
00400>      OUTFLOW<03: (000201)         1.86      .065     5.167     75.468
00401>
00402>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.521
00403>                     TIME SHIFT OF PEAK FLOW         (min)=     8.00
00404>                     MAXIMUM  STORAGE   USED       (ha.m.)=.4497E-02
00405>
00406> ------------------------------------------------------------------------------
00407> 001:0014----------------------------------------------------------------------
00408> * Catchment 202 - lands that will be developed
00409> * Discharges to west forebay
00410> ----------------------
00411> | DESIGN STANDHYD    |   Area    (ha)=    8.99
00412> | 01:000202 DT= 1.00 |   Total Imp(%)=   57.00   Dir. Conn.(%)=   48.00
00413> ----------------------
00414>                              IMPERVIOUS    PERVIOUS (i)
00415>      Surface Area     (ha)=       5.12         3.87
00416>      Dep. Storage     (mm)=        .80         1.50
00417>      Average Slope     (%)=        .50          .50
00418>      Length            (m)=     244.81        40.00
00419>      Mannings n             =       .013         .250
00420>
00421>      Max.eff.Inten.(mm/hr)=      13.21        11.27
00422>                  over (min)       12.00        38.00
00423>      Storage Coeff.  (min)=      12.09 (ii)   37.71 (ii)
00424>      Unit Hyd. Tpeak (min)=      12.00        38.00
00425>      Unit Hyd. peak  (cms)=        .09          .03
00426>                                                          *TOTALS*
00427>      PEAK FLOW       (cms)=        .16          .11          .262 (iii)
00428>      TIME TO PEAK    (hrs)=       5.00         6.13         6.000
00429>      RUNOFF VOLUME    (mm)=      87.25        54.08        70.016
00430>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00431>      RUNOFF COEFFICIENT   =        .99          .61          .795
00432>
00433>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00434>            CN* =  80.0    Ia = Dep. Storage  (Above)
00435>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00436>            THAN THE STORAGE COEFFICIENT.
00437>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00438>
00439> ------------------------------------------------------------------------------
00440> 001:0015----------------------------------------------------------------------
00441> * Total to pond (east and west forebays)
00442> ----------------------
00443> | ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00444> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00445>                        ID1 08:EastForeba    16.31     .484    6.00  71.98    .000
00446>                       +ID2 03:       201     1.86     .065    5.17  75.47    .000
00447>                       +ID3 01:       202     8.99     .262    6.00  70.02    .000
00448>                        ================================================================
00449>                        SUM 09:toPond        27.16     .811    6.00  71.57    .000
00450>
00451>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00452>
00453> ------------------------------------------------------------------------------
00454> 001:0016----------------------------------------------------------------------
00455> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00456> * external areas that discharge through the pond)
00457> ----------------------
00458> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00459> |  IN>09:(toPond)    |
00460> | OUT<08:(Pond  )    |    =========  OUTLFOW STORAGE TABLE  =========
00461> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00462>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
00463>                              .000  .0000E+00   |     .700  .1600E+01
00464>                              .011  .4404E+00   |     .000  .0000E+00
00465>
00466>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00467>      ---------------------       (ha)     (cms)     (hrs)       (mm)
00468>      INFLOW >09: (toPond)       27.16      .811     6.000     71.569
00469>      OUTFLOW<08: (Pond  )       27.16      .415     8.733     71.555
00470>
00471>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   51.203
00472>                     TIME SHIFT OF PEAK FLOW         (min)=   164.00
00473>                     MAXIMUM  STORAGE   USED       (ha.m.)=.1121E+01
00474>
00475> ------------------------------------------------------------------------------
00476> 001:0017----------------------------------------------------------------------
00477> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00478> * UNC1 - lands that will be developed
00479> * Discharge to environmental channel (rear of single lots)
00480> ----------------------
00481> | DESIGN STANDHYD    |   Area    (ha)=    2.11
00482> | 01:000001 DT= 1.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   13.00
00483> ----------------------
00484>                              IMPERVIOUS    PERVIOUS (i)
00485>      Surface Area     (ha)=        .42         1.69
00486>      Dep. Storage     (mm)=        .80         1.50
00487>      Average Slope     (%)=        .50          .50
00488>      Length            (m)=     118.60        40.00
00489>      Mannings n             =       .013         .250
00490>
00491>      Max.eff.Inten.(mm/hr)=      13.21         8.93
00492>                  over (min)        8.00        36.00
00493>      Storage Coeff.  (min)=       7.83 (ii)   35.95 (ii)
00494>      Unit Hyd. Tpeak (min)=       8.00        36.00
00495>      Unit Hyd. peak  (cms)=        .14          .03
00496>                                                          *TOTALS*
00497>      PEAK FLOW       (cms)=        .01          .04          .049 (iii)
00498>      TIME TO PEAK    (hrs)=       5.00         6.15         6.017
00499>      RUNOFF VOLUME    (mm)=      87.25        46.82        52.088
00500>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00501>      RUNOFF COEFFICIENT   =        .99          .53          .592
00502>
00503>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00504>            CN* =  76.0    Ia = Dep. Storage  (Above)
00505>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00506>            THAN THE STORAGE COEFFICIENT.
00507>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00508>
00509> ------------------------------------------------------------------------------
00510> 001:0018----------------------------------------------------------------------
00511> * UNC2 - lands that will be developed
00512> * Discharge to railway (rear of single lots)
00513> ----------------------
00514> | DESIGN STANDHYD    |   Area    (ha)=     .36
00515> | 02:000002 DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00516> ----------------------
00517>                              IMPERVIOUS    PERVIOUS (i)
00518>      Surface Area     (ha)=        .15          .21
00519>      Dep. Storage     (mm)=        .80         1.50
00520>      Average Slope     (%)=        .50          .50
00521>      Length            (m)=      48.99        40.00
00522>      Mannings n             =       .013         .250
00523>
00524>      Max.eff.Inten.(mm/hr)=      13.21        11.35
00525>                  over (min)        5.00        30.00
00526>      Storage Coeff.  (min)=       4.61 (ii)   30.15 (ii)
00527>      Unit Hyd. Tpeak (min)=       5.00        30.00
00528>      Unit Hyd. peak  (cms)=        .24          .04
00529>                                                          *TOTALS*
00530>      PEAK FLOW       (cms)=        .00          .01          .010 (iii)
00531>      TIME TO PEAK    (hrs)=       4.87         6.07         6.000
00532>      RUNOFF VOLUME    (mm)=      87.26        55.09        65.392
00533>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00534>      RUNOFF COEFFICIENT   =        .99          .63          .743
00535>
00536>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00537>            CN* =  81.0    Ia = Dep. Storage  (Above)
00538>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00539>            THAN THE STORAGE COEFFICIENT.
00540>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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00541>
00542> ------------------------------------------------------------------------------
00543> 001:0019--------------------------------------------------------------------
00544> * UNC8 - lands that will remain undeveloped
00545> * Discharge to existing wetland
00546> ----------------------
00547> | DESIGN NASHYD      |   Area    (ha)=     .49   Curve Number   (CN)=74.00
00548> | 03:000008 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00549> ----------------------   U.H. Tp(hrs)=    .100
00550>
00551>      Unit Hyd Qpeak  (cms)=     .187
00552>
00553>      PEAK FLOW       (cms)=     .010 (i)
00554>      TIME TO PEAK    (hrs)=    6.000
00555>      RUNOFF VOLUME    (mm)=   42.619
00556>      TOTAL RAINFALL   (mm)=   88.060
00557>      RUNOFF COEFFICIENT   =     .484
00558>
00559>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00560>
00561> ------------------------------------------------------------------------------
00562> 001:0020--------------------------------------------------------------------
00563> * AREA TO RAMSEY
00564> * Catchment 208 - lands that will be developed
00565> * Includes ROW and multi-use trail
00566> * This area is to be controlled using LIDs
00567> ----------------------
00568> | DESIGN STANDHYD    |   Area    (ha)=     .62
00569> | 01:000208 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00570> ----------------------
00571>                              IMPERVIOUS    PERVIOUS (i)
00572>      Surface Area     (ha)=        .56          .06
00573>      Dep. Storage     (mm)=        .80         1.50
00574>      Average Slope     (%)=        .50          .50
00575>      Length            (m)=      64.29        40.00
00576>      Mannings n             =      .013         .250
00577>
00578>      Max.eff.Inten.(mm/hr)=      13.21        20.32
00579>                  over (min)        5.00        26.00
00580>      Storage Coeff.  (min)=       5.42 (ii)   25.66 (ii)
00581>      Unit Hyd. Tpeak (min)=       5.00        26.00
00582>      Unit Hyd. peak  (cms)=        .21          .04
00583>                                                          *TOTALS*
00584>      PEAK FLOW       (cms)=        .02          .00          .021 (iii)
00585>      TIME TO PEAK    (hrs)=       5.00         6.03         5.000
00586>      RUNOFF VOLUME    (mm)=      87.26        59.82        81.774
00587>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00588>      RUNOFF COEFFICIENT   =        .99          .68          .929
00589>
00590>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00591>            CN* =  76.0    Ia = Dep. Storage  (Above)
00592>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00593>            THAN THE STORAGE COEFFICIENT.
00594>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00595>
00596> ------------------------------------------------------------------------------
00597> 001:0021--------------------------------------------------------------------
00598> * AREA TO EXISTING WOODLOT
00599> * UNC7 - sloping to match development grade
00600> * Discharge to woodlot
00601> ----------------------
00602> | DESIGN NASHYD      |   Area    (ha)=     .40   Curve Number   (CN)=74.00
00603> | 07:000007 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00604> ----------------------   U.H. Tp(hrs)=    .100
00605>
00606>      Unit Hyd Qpeak  (cms)=     .153
00607>
00608>      PEAK FLOW       (cms)=     .009 (i)
00609>      TIME TO PEAK    (hrs)=    6.000
00610>      RUNOFF VOLUME    (mm)=   42.619
00611>      TOTAL RAINFALL   (mm)=   88.060
00612>      RUNOFF COEFFICIENT   =     .484
00613>
00614>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00615>
00616> ------------------------------------------------------------------------------
00617> 001:0022--------------------------------------------------------------------
00618> * EPA1 - (lands are owned by applicant by will not be developed
00619> * as part of this application)
00620> * Flow to Point A
00621> ----------------------
00622> | DESIGN NASHYD      |   Area    (ha)=    4.93   Curve Number   (CN)=75.00
00623> | 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00624> ----------------------   U.H. Tp(hrs)=    .430
00625>
00626>      Unit Hyd Qpeak  (cms)=     .438
00627>
00628>      PEAK FLOW       (cms)=     .103 (i)
00629>      TIME TO PEAK    (hrs)=    6.083
00630>      RUNOFF VOLUME    (mm)=   43.758
00631>      TOTAL RAINFALL   (mm)=   88.060
00632>      RUNOFF COEFFICIENT   =     .497
00633>
00634>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00635>
00636> ------------------------------------------------------------------------------
00637> 001:0023--------------------------------------------------------------------
00638> * EXT1 - External Flow to Point A
00639> ----------------------
00640> | DESIGN NASHYD      |   Area    (ha)=     .20   Curve Number   (CN)=77.00
00641> | 02:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00642> ----------------------   U.H. Tp(hrs)=    .430
00643>
00644>      Unit Hyd Qpeak  (cms)=     .018
00645>
00646>      PEAK FLOW       (cms)=     .004 (i)
00647>      TIME TO PEAK    (hrs)=    6.067
00648>      RUNOFF VOLUME    (mm)=   46.124
00649>      TOTAL RAINFALL   (mm)=   88.060
00650>      RUNOFF COEFFICIENT   =     .524
00651>
00652>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00653>
00654> ------------------------------------------------------------------------------
00655> 001:0024--------------------------------------------------------------------
00656> * EPA2 - (lands are owned by applicant by will not be developed
00657> * as part of this application)
00658> * Flow to Point B
00659> ----------------------
00660> | DESIGN NASHYD      |   Area    (ha)=    5.91   Curve Number   (CN)=75.00
00661> | 03:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00662> ----------------------   U.H. Tp(hrs)=    .790
00663>
00664>      Unit Hyd Qpeak  (cms)=     .286
00665>
00666>      PEAK FLOW       (cms)=     .116 (i)
00667>      TIME TO PEAK    (hrs)=    6.283
00668>      RUNOFF VOLUME    (mm)=   43.758
00669>      TOTAL RAINFALL   (mm)=   88.060
00670>      RUNOFF COEFFICIENT   =     .497
00671>
00672>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00673>
00674> ------------------------------------------------------------------------------
00675> 001:0025--------------------------------------------------------------------
00676> * EXT2 - External Flow to Point B
00677> ----------------------
00678> | DESIGN NASHYD      |   Area    (ha)=     .65   Curve Number   (CN)=77.00
00679> | 04:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00680> ----------------------   U.H. Tp(hrs)=    .790
00681>
00682>      Unit Hyd Qpeak  (cms)=     .031
00683>
00684>      PEAK FLOW       (cms)=     .013 (i)
00685>      TIME TO PEAK    (hrs)=    6.267
00686>      RUNOFF VOLUME    (mm)=   46.127
00687>      TOTAL RAINFALL   (mm)=   88.060
00688>      RUNOFF COEFFICIENT   =     .524
00689>
00690>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00691>
00692> ------------------------------------------------------------------------------
00693> 001:0026--------------------------------------------------------------------
00694> * Total to existing woodlot (for water balance)
00695> ----------------------
00696> | ADD HYD (WOOD      ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00697> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00698>                       ID1 07:          7      .40     .009    6.00  42.62    .000
00699>                     +ID2 01:           1     4.93     .103    6.08  43.76    .000
00700>                     +ID3 02:           1      .20     .004    6.07  46.12    .000
00701>                     +ID4 03:WOOD            5.91     .116    6.28  43.76    .000
00702>                     +ID5 04:         2      .65     .013    6.27  46.13    .000
00703>                      ================================================================
00704>                      SUM 03:WOOD           11.71     .244    6.03  43.89    .000
00705>
00706>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00707>
00708> ------------------------------------------------------------------------------
00709> 001:0027--------------------------------------------------------------------
00710>       FINISH
00711> ------------------------------------------------------------------------------
00712> ********************************************************************************
00713>      WARNINGS / ERRORS / NOTES
00714>      -------------------------
00715>  001:0008 ROUTE RESERVOIR
00716>       *** WARNING: Inflow hydrograph is dry.
00717>    Simulation ended on 2021-07-14     at 11:11:24
00718> ================================================================================
00719>
00720>
```

```
00001> 2     Metric units
00002> *#************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [041230]
00004> *#  Date        : 2-4-2021
00005> *#  Modeller    : [L.Garner]
00006> *#  Company     : R. J. Burnside & Associates Ltd.
00007> *#  License #   :  3877524
00008> *#************************************************************************
00009> *# Post Development Model for the Site
00010> *#
00011> *#  CN as per Ontario Soils Map for Welland County
00012> *#************************************************************************
00013> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00014> *%                   [  ] <--storm filename, one per line for NSTORM time
00015> *%-----------------|------------------------------------------------------|
00016> *#************************************************************************
00017> *% 100-year 3-hr Chicago
00018> CHICAGO STORM       IUNITS=[2],  TD=[3](hrs), TPRAT=[0.333],  CSDT=[5](min),
00019>                     ICASEcs=[1],
00020>                      A=[1264.57],  B=[7.72], and C=[0.7814],
00021> *%-----------------|------------------------------------------------------|
00022> *#************************************************************************
00023> *%-----------------|------------------------------------------------------|
00024> * TO EAST FOREBAY
00025> *%-----------------|------------------------------------------------------|
00026> * Catchment 203 - Block 280 - lands that will be developed as site plan
00027> * Release rate controlled to 5-year post-dev flow (Rational Method)
00028> * Discharges to east forebay
00029> DESIGN STANDHYD     ID=[1], NHYD=[204], DT=[1]min, AREA=[4.39](ha),
00030>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2], CN=[74],
00031>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00032> *%-----------------|------------------------------------------------------|
00033> *  Release rate controlled to 5-year post-dev flow
00034> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00035> ROUTE RESERVOIR     IDout=[ 5 ],   NHYD=[203C],  IDin=[  1 ],
00036>                     RDT=[1](min),
00037>                           TABLE of ( OUTFLOW-STORAGE ) values
00038>                                     (cms) - (ha-m)
00039>                                 [   0.0 ,  0.0 ]
00040>                                 [   0.827,  0.0687 ]
00041>                                 [   -1  ,  -1  ]  (max twenty pts)
00042>                           IDovf=[   ], NHYDovf=[   ]
00043> *%-----------------|------------------------------------------------------|
00044> * Catchment 205
00045> * Discharges to east forebay, Street L from north of tracks
00046> DESIGN STANDHYD     ID=[7], NHYD=[205], DT=[1]min, AREA=[2.50](ha),
00047>                     XIMP=[0.43], TIMP=[0.53], DWF=[0](cms), LOSS=[2],CN=[81],
00048>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00049> *%-----------------|------------------------------------------------------|
00050> * Catchment 206 - Block 279 - lands that will be developed as site plan
00051> * Release rate controlled to 5-year post-dev flow (Rational Method)
00052> * Discharges to east forebay
00053> DESIGN STANDHYD     ID=[1], NHYD=[206], DT=[1]min, AREA=[0.87](ha),
00054>                     XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[76],
00055>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00056> *%-----------------|------------------------------------------------------|
00057> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00058> * 2-year flow from roof area (1740 m2) - Rational Method
00059> COMPUTE DUALHYD     IDin=[1], CINLET=[0.029](cms), NINLET=[1],
00060>                     MAJID=[6], MajNHYD=["pond"],
00061>                     MINID=[8], MinNHYD=["envunc"],
00062>                     TMJSTO=[   ](cu-m)
00063> *%-----------------|------------------------------------------------------|
00064> *  Release rate controlled to 5-year post-dev flow
00065> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00066> ROUTE RESERVOIR     IDout=[ 9 ],   NHYD=[206C],  IDin=[  6 ],
00067>                     RDT=[1](min),
00068>                           TABLE of ( OUTFLOW-STORAGE ) values
00069>                                     (cms) - (ha-m)
00070>                                 [   0.0 ,  0.0 ]
00071>                                 [   0.154,  0.00825 ]
00072>                                 [   -1  ,  -1  ]  (max twenty pts)
00073>                           IDovf=[   ], NHYDovf=[   ]
00074> *%-----------------|------------------------------------------------------|
00075> * Catchment 207
00076> * Discharges to east forebay
00077> DESIGN STANDHYD     ID=[1], NHYD=[207], DT=[1]min, AREA=[9.42](ha),
00078>                     XIMP=[0.48], TIMP=[0.58], DWF=[0](cms), LOSS=[2],CN=[77],
00079>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00080> *%-----------------|------------------------------------------------------|
00081> * Total to east side of forebay
00082> ADD HYD             IDsum=[8], NHYD=["EastForebay1"], IDs to add=[5,7,9,1]
00083> *%-----------------|------------------------------------------------------|
00084> * TO WEST FOREBAY
00085> *%-----------------|------------------------------------------------------|
00086> * Catchment 201 - Block 278 - lands that will be developed as site plan
00087> * Release rate controlled to 5-year post-dev flow
00088> * Discharges to west forebay
00089> DESIGN STANDHYD     ID=[1], NHYD=[201], DT=[1]min, AREA=[2.37](ha),
00090>                     XIMP=[0.60], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[74],
00091>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00092> *%-----------------|------------------------------------------------------|
00093> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00094> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00095> COMPUTE DUALHYD     IDin=[1], CINLET=[0.009](cms), NINLET=[1],
00096>                     MAJID=[2], MajNHYD=["pond"],
00097>                     MINID=[4], MinNHYD=["envunc"],
00098>                     TMJSTO=[   ](cu-m)
00099> *%-----------------|------------------------------------------------------|
00100> *  Release rate controlled to 5-year post-dev flow
00101> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00102> ROUTE RESERVOIR     IDout=[ 3 ],   NHYD=[201C],  IDin=[ 2],
00103>                     RDT=[1](min),
00104>                           TABLE of ( OUTFLOW-STORAGE ) values
00105>                                     (cms) - (ha-m)
00106>                                 [   0.0 ,  0.0 ]
00107>                                 [   0.420,  0.029 ]
00108>                                 [   -1  ,  -1  ]  (max twenty pts)
00109>                           IDovf=[   ], NHYDovf=[   ]
00110> *%-----------------|------------------------------------------------------|
00111> * Catchment 202 - lands that will be developed
00112> * Discharges to west forebay
00113> DESIGN STANDHYD     ID=[1], NHYD=[202], DT=[1]min, AREA=[8.99](ha),
00114>                     XIMP=[0.48], TIMP=[0.57], DWF=[0](cms), LOSS=[2],CN=[80],
00115>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00116> *%-----------------|------------------------------------------------------|
00117> * Total to pond (east and west forebays)
00118> ADD HYD             IDsum=[9], NHYD=["toPond"], IDs to add=[8,3,1]
00119> *%-----------------|------------------------------------------------------|
00120> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00121> * external areas that discharge through the pond)
00122> ROUTE RESERVOIR     IDout=[8],   NHYD=["Pond"],  IDin=[9],
00123>                     RDT=[1](min),
00124>                           TABLE of ( OUTFLOW-STORAGE ) values
00125>                                     (cms) - (ha-m)
00126>                                 [   0.0 ,  0.0 ]
00127>                                 [   0.011, 0.4404  ]
00128>                                 [   0.70, 1.6 ]
00129>                                 [   -1  ,  -1  ]  (max twenty pts)
00130>                           IDovf=[], NHYDovf=[overflow]
00131> *%-----------------|------------------------------------------------------|
00132> *%-----------------|------------------------------------------------------|
00133> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00134> *%-----------------|------------------------------------------------------|
00135> * UNC1 - lands that will be developed
00136> * Discharge to environmental channel (rear of single lots)
00137> DESIGN STANDHYD     ID=[1], NHYD=[UNC1], DT=[1]min, AREA=[2.11](ha),
00138>                     XIMP=[0.13], TIMP=[0.20], DWF=[0](cms), LOSS=[2],CN=[76],
00139>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00140> *%-----------------|------------------------------------------------------|
00141> * UNC2 - lands that will be developed
00142> * Discharge to railway (rear of single lots)
00143> DESIGN STANDHYD     ID=[2], NHYD=[UNC2], DT=[1]min, AREA=[0.36](ha),
00144>                     XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2],CN=[81],
00145>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00146> *%-----------------|------------------------------------------------------|
00147> * UNC8 - lands that will remain undeveloped
00148> * Discharge to existing wetland
00149> DESIGN NASHYD       ID=[3], NHYD=[UNC8], DT=[1]min, AREA=[0.49](ha),
00150>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00151>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00152> *%-----------------|------------------------------------------------------|
00153> *%-----------------|------------------------------------------------------|
00154> * AREA TO RAMSEY
00155> *%-----------------|------------------------------------------------------|
00156> * Catchment 208 - lands that will be developed
00157> * Includes ROW and multi-use trail
00158> * This area is to be controlled using LIDs
00159> DESIGN STANDHYD     ID=[1], NHYD=[208], DT=[1]min, AREA=[0.62](ha),
00160>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms), LOSS=[2],CN=[76],
00161>                     SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00162> *%-----------------|------------------------------------------------------|
00163> *%-----------------|------------------------------------------------------|
00164> * AREA TO EXISTING WOODLOT
00165> *%-----------------|------------------------------------------------------|
00166> * UNC7 - sloping to match development grade
00167> * Discharge to woodlot
00168> DESIGN NASHYD       ID=[7], NHYD=[UNC7], DT=[1]min, AREA=[0.40](ha),
00169>                     DWF=[0](cms), CN/C=[74], TP=[0.1]hrs,
00170>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00171> *%-----------------|------------------------------------------------------|
00172> * EPA1 - (lands are owned by applicant by will not be developed
00173> * as part of this application)
00174> * Flow to Point A
00175> DESIGN NASHYD       ID=[1], NHYD=[EPA1], DT=[1]min, AREA=[4.93](ha),
00176>                     DWF=[0](cms), CN/C=[75], TP=[0.43]hrs,
00177>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00178> *%-----------------|------------------------------------------------------|
00179> * EXT1 - External Flow to Point A
00180> DESIGN NASHYD       ID=[2], NHYD=[EXT1], DT=[1]min, AREA=[0.2](ha),
00181>                     DWF=[0](cms), CN/C=[77], TP=[0.43]hrs,
00182>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00183> *%-----------------|------------------------------------------------------|
00184> * EPA2 - (lands are owned by applicant by will not be developed
00185> * as part of this application)
00186> * Flow to Point B
00187> DESIGN NASHYD       ID=[3], NHYD=[EPA2], DT=[1]min, AREA=[5.91](ha),
00188>                     DWF=[0](cms), CN/C=[75], TP=[0.79]hrs,
00189>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00190> *%-----------------|------------------------------------------------------|
00191> * EXT2 - External Flow to Point B
00192> DESIGN NASHYD       ID=[4], NHYD=[EXT2], DT=[1]min, AREA=[0.65](ha),
00193>                     DWF=[0](cms), CN/C=[77], TP=[0.79]hrs,
00194>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00195> *%-----------------|------------------------------------------------------|
00196> * Total to existing woodlot (for water balance)
00197> ADD HYD             IDsum=[3], NHYD=["WOOD"], IDs to add=[7,1,2,3,4]
00198> *%-----------------|------------------------------------------------------|
00199> *%-----------------|------------------------------------------------------|
00200> FINISH
00201>
00202>
00203>
00204>
00205>
00206>
00207>
00208>
00209>
00210>
```

OUTPUT FILE: South Side, Post- Development, 100-Year - 3 hr Chicago

(C:\...100.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   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.          *********
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 *********                    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: 2021-07-14     TIME: 11:06:44     RUN COUNTER: 002494         *
 ***************************************************************************
 * Input   filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\Chicago\100.DAT     *
 * Output  filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\Chicago\100.out     *
 * Summary filename: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\Chicago\100.sum     *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ***************************************************************************

--------------------------------------------------------------------------------
001:0001--------------------------------------------------------------------------
*#*************************************************************************
*#  Project Name: [Niagara Village]    Project Number: [041230]
*#  Date        : 2-4-2021
*#  Modeller    : [L.Garner]
*#  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:\SWMHYM~1\Niagara\210201~1\Post-Dev\Chica
--------------------  Rainfall dir.: C:\SWMHYM~1\Niagara\210201~1\Post-Dev\Chica
    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 280 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow (Rational Method)
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area     (ha)=    4.39
| 01:000204 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        3.95          .44
     Dep. Storage     (mm)=         .80         1.50
     Average Slope     (%)=         .50          .50
     Length            (m)=      171.08        40.00
     Mannings n            =        .013         .250

     Max.eff.Inten.(mm/hr)=      173.34       134.39
                 over (min)         3.00        13.00
     Storage Coeff.  (min)=        3.48 (ii)   12.99 (ii)
     Unit Hyd. Tpeak (min)=        3.00        13.00
     Unit Hyd. peak  (cms)=         .34          .09
                                                          *TOTALS*
     PEAK FLOW       (cms)=        1.35          .10       1.387 (iii)
     TIME TO PEAK    (hrs)=        1.02         1.22       1.017
     RUNOFF VOLUME    (mm)=       62.66        36.63      57.452
     TOTAL RAINFALL   (mm)=       63.46        63.46      63.456
     RUNOFF COEFFICIENT   =         .99          .58        .905

       (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.

--------------------------------------------------------------------------------
001:0004--------------------------------------------------------------------------
*  Release rate controlled to 5-year post-dev flow
* 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(000204)   |
| OUT<05:(000203)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .827  .6870E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (000204)        4.39     1.387     1.017     57.452
     OUTFLOW<05: (000203)        4.39      .759     1.167     57.452

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   54.700
                   TIME SHIFT OF PEAK FLOW       (min)=     9.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6306E-01

--------------------------------------------------------------------------------
001:0005--------------------------------------------------------------------------
* Catchment 205
* Discharges to east forebay, Street L from north of tracks
----------------------
| DESIGN STANDHYD    |   Area     (ha)=    2.50
| 07:000205 DT= 1.00 |   Total Imp(%)=   53.00   Dir. Conn.(%)=   43.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        1.32          1.18
     Dep. Storage     (mm)=         .80         1.50
     Average Slope     (%)=         .50          .50
     Length            (m)=      129.10        40.00
     Mannings n            =        .013         .250

     Max.eff.Inten.(mm/hr)=      173.34        72.40
                 over (min)         3.00        15.00
     Storage Coeff.  (min)=        2.94 (ii)   15.12 (ii)
     Unit Hyd. Tpeak (min)=        3.00        15.00
     Unit Hyd. peak  (cms)=         .38          .08
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .43          .14        .475 (iii)
     TIME TO PEAK    (hrs)=        1.02         1.27       1.017
     RUNOFF VOLUME    (mm)=       62.66        34.77      46.759
     TOTAL RAINFALL   (mm)=       63.46        63.46      63.456
     RUNOFF COEFFICIENT   =         .99          .55        .737

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  81.0    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.

--------------------------------------------------------------------------------
001:0006--------------------------------------------------------------------------
* Catchment 206 - Block 279 - lands that will be developed as site plan
* Release rate controlled to 5-year post-dev flow (Rational Method)
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area     (ha)=     .87
| 01:000206 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .70          .17
     Dep. Storage     (mm)=         .80         1.50
     Average Slope     (%)=         .50          .50
     Length            (m)=      76.16        40.00
     Mannings n            =        .013         .250

     Max.eff.Inten.(mm/hr)=      173.34       153.25
                 over (min)         2.00        11.00
     Storage Coeff.  (min)=        2.14 (ii)   11.16 (ii)
     Unit Hyd. Tpeak (min)=        2.00        11.00
     Unit Hyd. peak  (cms)=         .53          .10
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .23          .05        .248 (iii)
     TIME TO PEAK    (hrs)=        1.00         1.18       1.000
     RUNOFF VOLUME    (mm)=       62.66        38.24      52.891
     TOTAL RAINFALL   (mm)=       63.46        63.46      63.456
     RUNOFF COEFFICIENT   =         .99          .60        .834

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  76.0    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.

--------------------------------------------------------------------------------
001:0007--------------------------------------------------------------------------
* Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
* 2-year flow from roof area (1740 m2) - Rational Method
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .029  (cms)
| TotalHyd 01:000206 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity          =    .029  (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          .87      .248     1.000   52.891     .000
     ==========================================================================
     MAJOR SYST   06:pond            .43      .219     1.000   52.891     .000
     MINOR SYST   08:envunc          .44      .029      .733   52.891     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0008--------------------------------------------------------------------------
*  Release rate controlled to 5-year post-dev flow
* 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>06:(pond  )   |
| OUT<09:(000206)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .154  .8250E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >06: (pond  )         .43      .219     1.000     52.891
     OUTFLOW<09: (000206)         .43      .124     1.117     52.891

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   56.453
                   TIME SHIFT OF PEAK FLOW       (min)=     7.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6637E-02

--------------------------------------------------------------------------------
001:0009--------------------------------------------------------------------------
* Catchment 207
* Discharges to east forebay
----------------------
| DESIGN STANDHYD    |   Area     (ha)=    9.42
| 01:000207 DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   48.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        5.46          3.96
     Dep. Storage     (mm)=         .80         1.50
     Average Slope     (%)=         .50          .50
     Length            (m)=      250.60        40.00
```

```
00271>      Mannings n          =       .013         .250
00272>
00273>      Max.eff.Inten.(mm/hr)=     173.34        61.40
00274>                 over (min)        4.00        17.00
00275>      Storage Coeff.  (min)=       4.38 (ii)   17.38 (ii)
00276>      Unit Hyd. Tpeak (min)=       4.00        17.00
00277>      Unit Hyd. peak  (cms)=        .27          .07
00278>                                                        *TOTALS*
00279>      PEAK FLOW       (cms)=       1.59          .41          1.714 (iii)
00280>      TIME TO PEAK    (hrs)=       1.03         1.32          1.033
00281>      RUNOFF VOLUME    (mm)=      62.65        31.36         46.385
00282>      TOTAL RAINFALL   (mm)=      63.46        63.46         63.456
00283>      RUNOFF COEFFICIENT   =         .99          .49           .731
00284>
00285>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00286>            CN* =  77.0    Ia = Dep. Storage  (Above)
00287>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00288>            THAN THE STORAGE COEFFICIENT.
00289>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00290>
00291> ---------------------------------------------------------------------------
00292> 001:0010-----------------------------------------------------------------
00293> * Total to east side of forebay
00294> ----------------------
00295> | ADD HYD (EastForeba) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00296> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00297>                      ID1 05:       203     4.39     .759    1.17  57.45    .000
00298>                     +ID2 07:       205     2.50     .475    1.02  46.76    .000
00299>                     +ID3 09:       206      .43     .124    1.12  52.89    .000
00300>                     +ID4 01:       207     9.42    1.714    1.03  46.38    .000
00301>                      ============================================================
00302>                      SUM 08:EastForeba    16.74    2.859    1.05  49.51    .000
00303>
00304>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00305>
00306> ---------------------------------------------------------------------------
00307> 001:0011-----------------------------------------------------------------
00308> * TO WEST FOREBAY
00309> * Catchment 201 - Block 278 - lands that will be developed as site plan
00310> * Release rate controlled to 5-year post-dev flow
00311> * Discharges to west forebay
00312> ----------------------
00313> | DESIGN STANDHYD    |   Area     (ha)=    2.37
00314> | 01:000201 DT= 1.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   60.00
00315> ----------------------
00316>                              IMPERVIOUS    PERVIOUS (i)
00317>      Surface Area     (ha)=       1.90         .47
00318>      Dep. Storage     (mm)=        .80         1.50
00319>      Average Slope     (%)=        .50          .50
00320>      Length            (m)=     125.70        40.00
00321>      Mannings n          =        .013         .250
00322>
00323>      Max.eff.Inten.(mm/hr)=     173.34       139.59
00324>                 over (min)        3.00        12.00
00325>      Storage Coeff.  (min)=       2.90 (ii)   12.26 (ii)
00326>      Unit Hyd. Tpeak (min)=       3.00        12.00
00327>      Unit Hyd. peak  (cms)=        .38          .09
00328>                                                        *TOTALS*
00329>      PEAK FLOW       (cms)=        .57          .11          .618 (iii)
00330>      TIME TO PEAK    (hrs)=       1.02         1.20         1.017
00331>      RUNOFF VOLUME    (mm)=      62.66        36.63         52.248
00332>      TOTAL RAINFALL   (mm)=      63.46        63.46         63.456
00333>      RUNOFF COEFFICIENT   =         .99          .58           .823
00334>
00335>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00336>            CN* =  74.0    Ia = Dep. Storage  (Above)
00337>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00338>            THAN THE STORAGE COEFFICIENT.
00339>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00340>
00341> ---------------------------------------------------------------------------
00342> 001:0012-----------------------------------------------------------------
00343> * Roof Drain Collection ByPass for Environmental Compensation (Uncontrolled)
00344> * 2-year flow from 1 block of Townhouses (556 m2) - Rational Method
00345> ----------------------
00346> | COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .009  (cms)
00347> | TotalHyd 01:000201 |   Number of inlets in system [NINLET] =       1
00348> ----------------------   Total minor system capacity          =    .009  (cms)
00349>                          Total major system storage [TMJSTO] =       0.(cu.m.)
00350>
00351>                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
00352>                                   (ha)     (cms)     (hrs)     (mm)     (cms)
00353>      TOTAL HYD.   01:000201       2.37      .618     1.017   52.248     .000
00354>      ================================================================
00355>      MAJOR SYST   02:pond         2.17      .609     1.017   52.248     .000
00356>      MINOR SYST   04:envunc        .20      .009      .183   52.248     .000
00357>
00358>      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00359>
00360> ---------------------------------------------------------------------------
00361> 001:0013-----------------------------------------------------------------
00362> *  Release rate controlled to 5-year post-dev flow
00363> * 5-year flow from Rational Method, storage is arbitrary to be confirmed at deta
00364> ----------------------
00365> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00366> |  IN>02:(pond  )    |
00367> | OUT<03:(000201)    |    =========  OUTLFOW STORAGE TABLE  =========
00368> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00369>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00370>                              .000  .0000E+00    |     .420  .2900E-01
00371>
00372>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00373>      ---------------------       (ha)     (cms)     (hrs)       (mm)
00374>      INFLOW >02: (pond  )       2.17      .609     1.017     52.248
00375>      OUTFLOW<03: (000201)       2.17      .359     1.167     52.248
00376>
00377>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   58.930
00378>                    TIME SHIFT OF PEAK FLOW          (min)=     9.00
00379>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2480E-01
00380>
00381> ---------------------------------------------------------------------------
00382> 001:0014-----------------------------------------------------------------
00383> * Catchment 202 - lands that will be developed
00384> * Discharges to west forebay
00385> ----------------------
00386> | DESIGN STANDHYD    |   Area     (ha)=    8.99
00387> | 01:000202 DT= 1.00 |   Total Imp(%)=   57.00   Dir. Conn.(%)=   48.00
00388> ----------------------
00389>                              IMPERVIOUS    PERVIOUS (i)
00390>      Surface Area     (ha)=       5.12         3.87
00391>      Dep. Storage     (mm)=        .80         1.50
00392>      Average Slope     (%)=        .50          .50
00393>      Length            (m)=     244.81        40.00
00394>      Mannings n          =        .013         .250
00395>
00396>      Max.eff.Inten.(mm/hr)=     173.34        65.16
00397>                 over (min)        4.00        17.00
00398>      Storage Coeff.  (min)=       4.32 (ii)   17.02 (ii)
00399>      Unit Hyd. Tpeak (min)=       4.00        17.00
00400>      Unit Hyd. peak  (cms)=        .27          .07
00401>                                                        *TOTALS*
00402>      PEAK FLOW       (cms)=       1.52          .43          1.657 (iii)
00403>      TIME TO PEAK    (hrs)=       1.03         1.32          1.033
00404>      RUNOFF VOLUME    (mm)=      62.65        33.74         47.619
00405>      TOTAL RAINFALL   (mm)=      63.46        63.46         63.456
00406>      RUNOFF COEFFICIENT   =         .99          .53           .750
00407>
00408>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00409>            CN* =  80.0    Ia = Dep. Storage  (Above)
00410>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00411>            THAN THE STORAGE COEFFICIENT.
00412>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00413>
00414> ---------------------------------------------------------------------------
00415> 001:0015-----------------------------------------------------------------
00416> * Total to pond (east and west forebays)
00417> ----------------------
00418> | ADD HYD (toPond    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00419> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00420>                       ID1 08:EastForeba    16.74    2.859    1.05  49.51    .000
00421>                      +ID2 03:       201     2.17     .359    1.17  52.25    .000
00422>                      +ID3 01:       202     8.99    1.657    1.03  47.62    .000
00423>                       ============================================================
00424>                       SUM 09:toPond        27.90    4.799    1.05  49.11    .000
00425>
00426>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00427>
00428> ---------------------------------------------------------------------------
00429> 001:0016-----------------------------------------------------------------
00430> * Includes Extended Detention  (ED outflow accounts for 25mm flow from
00431> * external areas that discharge through the pond)
00432> ----------------------
00433> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00434> |  IN>09:(toPond)    |
00435> | OUT<08:(Pond  )    |    =========  OUTLFOW STORAGE TABLE  =========
00436> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00437>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00438>                              .000  .0000E+00    |     .700  .1600E+01
00439>                              .011  .4404E+00    |     .000  .0000E+00
00440>
00441>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00442>      ---------------------       (ha)     (cms)     (hrs)       (mm)
00443>      INFLOW >09: (toPond)       27.90     4.799     1.050     49.114
00444>      OUTFLOW<08: (Pond  )       27.90      .410     3.000     49.107
00445>
00446>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    8.544
00447>                    TIME SHIFT OF PEAK FLOW          (min)=   117.00
00448>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1112E+01
00449>
00450> ---------------------------------------------------------------------------
00451> 001:0017-----------------------------------------------------------------
00452> * AREAS THAT WILL DISCHARGE UNCONTROLLED
00453> * UNC1 - lands that will be developed
00454> * Discharge to environmental channel (rear of single lots)
00455> ----------------------
00456> | DESIGN STANDHYD    |   Area     (ha)=    2.11
00457> | 01:000001 DT= 1.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   13.00
00458> ----------------------
00459>                              IMPERVIOUS    PERVIOUS (i)
00460>      Surface Area     (ha)=        .42         1.69
00461>      Dep. Storage     (mm)=        .80         1.50
00462>      Average Slope     (%)=        .50          .50
00463>      Length            (m)=     118.60        40.00
00464>      Mannings n          =        .013         .250
00465>
00466>      Max.eff.Inten.(mm/hr)=     173.34        48.26
00467>                 over (min)        3.00        17.00
00468>      Storage Coeff.  (min)=       2.80 (ii)   17.11 (ii)
00469>      Unit Hyd. Tpeak (min)=       3.00        17.00
00470>      Unit Hyd. peak  (cms)=        .39          .07
00471>                                                        *TOTALS*
00472>      PEAK FLOW       (cms)=        .11          .14          .165 (iii)
00473>      TIME TO PEAK    (hrs)=       1.02         1.32         1.267
00474>      RUNOFF VOLUME    (mm)=      62.66        28.37        32.826
00475>      TOTAL RAINFALL   (mm)=      63.46        63.46        63.456
00476>      RUNOFF COEFFICIENT   =         .99          .45           .517
00477>
00478>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00479>            CN* =  76.0    Ia = Dep. Storage  (Above)
00480>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00481>            THAN THE STORAGE COEFFICIENT.
00482>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00483>
00484> ---------------------------------------------------------------------------
00485> 001:0018-----------------------------------------------------------------
00486> * UNC2 - lands that will be developed
00487> * Discharge to railway (rear of single lots)
00488> ----------------------
00489> | DESIGN STANDHYD    |   Area     (ha)=     .36
00490> | 02:000002 DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00491> ----------------------
00492>                              IMPERVIOUS    PERVIOUS (i)
00493>      Surface Area     (ha)=        .15          .21
00494>      Dep. Storage     (mm)=        .80         1.50
00495>      Average Slope     (%)=        .50          .50
00496>      Length            (m)=      48.99        40.00
00497>      Mannings n          =        .013         .250
00498>
00499>      Max.eff.Inten.(mm/hr)=     173.34        72.67
00500>                 over (min)        2.00        14.00
00501>      Storage Coeff.  (min)=       1.64 (ii)   13.80 (ii)
00502>      Unit Hyd. Tpeak (min)=       2.00        14.00
00503>      Unit Hyd. peak  (cms)=        .63          .08
00504>                                                        *TOTALS*
00505>      PEAK FLOW       (cms)=        .05          .03          .060 (iii)
00506>      TIME TO PEAK    (hrs)=       1.00         1.25         1.000
00507>      RUNOFF VOLUME    (mm)=      62.66        34.50        43.509
00508>      TOTAL RAINFALL   (mm)=      63.46        63.46        63.456
00509>      RUNOFF COEFFICIENT   =         .99          .54           .686
00510>
00511>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00512>            CN* =  81.0    Ia = Dep. Storage  (Above)
00513>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00514>            THAN THE STORAGE COEFFICIENT.
00515>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00516>
00517> ---------------------------------------------------------------------------
00518> 001:0019-----------------------------------------------------------------
00519> * UNC8 - lands that will remain undeveloped
00520> * Discharge to existing wetland
00521> ----------------------
00522> | DESIGN NASHYD      |   Area     (ha)=     .49   Curve Number   (CN)=74.00
00523> | 03:000008 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00524> ----------------------   U.H. Tp(hrs)=    .100
00525>
00526>      Unit Hyd Qpeak  (cms)=     .187
00527>
00528>      PEAK FLOW       (cms)=     .055 (i)
00529>      TIME TO PEAK    (hrs)=    1.117
00530>      RUNOFF VOLUME    (mm)=   25.387
00531>      TOTAL RAINFALL   (mm)=   63.456
00532>      RUNOFF COEFFICIENT   =     .400
00533>
00534>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00535>
00536> ---------------------------------------------------------------------------
00537> 001:0020-----------------------------------------------------------------
00538> * AREA TO RAMSEY
00539> * Catchment 208 - lands that will be developed
00540> * Includes ROW and multi-use trail
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00541> * This area is to be controlled using LIDs
00542> ----------------------
00543> | DESIGN STANDHYD    |   Area    (ha)=     .62
00544> | 01:000208 DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   80.00
00545> ----------------------
00546>                             IMPERVIOUS    PERVIOUS (i)
00547>      Surface Area     (ha)=        .56         .06
00548>      Dep. Storage     (mm)=        .80        1.50
00549>      Average Slope     (%)=        .50         .50
00550>      Length            (m)=      64.29       40.00
00551>      Mannings n            =       .013        .250
00552>
00553>      Max.eff.Inten.(mm/hr)=     173.34      153.25
00554>                 over (min)        2.00       11.00
00555>      Storage Coeff.  (min)=       1.94 (ii)   10.95 (ii)
00556>      Unit Hyd. Tpeak (min)=       2.00       11.00
00557>      Unit Hyd. peak  (cms)=        .57         .10
00558>                                                          *TOTALS*
00559>      PEAK FLOW       (cms)=        .22         .02          .229 (iii)
00560>      TIME TO PEAK    (hrs)=       1.00        1.18         1.000
00561>      RUNOFF VOLUME    (mm)=      62.66       38.25        57.774
00562>      TOTAL RAINFALL   (mm)=      63.46       63.46        63.456
00563>      RUNOFF COEFFICIENT   =        .99         .60          .910
00564>
00565>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00566>            CN* =  76.0    Ia = Dep. Storage  (Above)
00567>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00568>            THAN THE STORAGE COEFFICIENT.
00569>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00570>
00571> --------------------------------------------------------------------------------
00572> 001:0021--------------------------------------------------------------------------
00573> * AREA TO EXISTING WOODLOT
00574> * UNC7 - sloping to match development grade
00575> * Discharge to woodlot
00576> ----------------------
00577> | DESIGN NASHYD      |   Area    (ha)=     .40   Curve Number   (CN)=74.00
00578> | 07:000007 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00579> ----------------------   U.H. Tp(hrs)=    .100
00580>
00581>      Unit Hyd Qpeak  (cms)=     .153
00582>
00583>      PEAK FLOW       (cms)=     .045 (i)
00584>      TIME TO PEAK    (hrs)=    1.117
00585>      RUNOFF VOLUME    (mm)=   25.387
00586>      TOTAL RAINFALL   (mm)=   63.456
00587>      RUNOFF COEFFICIENT   =     .400
00588>
00589>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00590>
00591> --------------------------------------------------------------------------------
00592> 001:0022--------------------------------------------------------------------------
00593> * EPA1 - (lands are owned by applicant by will not be developed
00594> * as part of this application)
00595> * Flow to Point A
00596> ----------------------
00597> | DESIGN NASHYD      |   Area    (ha)=    4.93   Curve Number   (CN)=75.00
00598> | 01:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00599> ----------------------   U.H. Tp(hrs)=    .430
00600>
00601>      Unit Hyd Qpeak  (cms)=     .438
00602>
00603>      PEAK FLOW       (cms)=     .261 (i)
00604>      TIME TO PEAK    (hrs)=    1.567
00605>      RUNOFF VOLUME    (mm)=   26.180
00606>      TOTAL RAINFALL   (mm)=   63.456
00607>      RUNOFF COEFFICIENT   =     .413
00608>
00609>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00610>
00611> --------------------------------------------------------------------------------
00612> 001:0023--------------------------------------------------------------------------
00613> * EXT1 - External Flow to Point A
00614> ----------------------
00615> | DESIGN NASHYD      |   Area    (ha)=     .20   Curve Number   (CN)=77.00
00616> | 02:000001 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00617> ----------------------   U.H. Tp(hrs)=    .430
00618>
00619>      Unit Hyd Qpeak  (cms)=     .018
00620>
00621>      PEAK FLOW       (cms)=     .011 (i)
00622>      TIME TO PEAK    (hrs)=    1.567
00623>      RUNOFF VOLUME    (mm)=   27.848
00624>      TOTAL RAINFALL   (mm)=   63.456
00625>      RUNOFF COEFFICIENT   =     .439
00626>
00627>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00628>
00629> --------------------------------------------------------------------------------
00630> 001:0024--------------------------------------------------------------------------
00631> * EPA2 - (lands are owned by applicant by will not be developed
00632> * as part of this application)
00633> * Flow to Point B
00634> ----------------------
00635> | DESIGN NASHYD      |   Area    (ha)=    5.91   Curve Number   (CN)=75.00
00636> | 03:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00637> ----------------------   U.H. Tp(hrs)=    .790
00638>
00639>      Unit Hyd Qpeak  (cms)=     .286
00640>
00641>      PEAK FLOW       (cms)=     .209 (i)
00642>      TIME TO PEAK    (hrs)=    2.050
00643>      RUNOFF VOLUME    (mm)=   26.180
00644>      TOTAL RAINFALL   (mm)=   63.456
00645>      RUNOFF COEFFICIENT   =     .413
00646>
00647>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00648>
00649> --------------------------------------------------------------------------------
00650> 001:0025--------------------------------------------------------------------------
00651> * EXT2 - External Flow to Point B
00652> ----------------------
00653> | DESIGN NASHYD      |   Area    (ha)=     .65   Curve Number   (CN)=77.00
00654> | 04:000002 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00655> ----------------------   U.H. Tp(hrs)=    .790
00656>
00657>      Unit Hyd Qpeak  (cms)=     .031
00658>
00659>      PEAK FLOW       (cms)=     .025 (i)
00660>      TIME TO PEAK    (hrs)=    2.050
00661>      RUNOFF VOLUME    (mm)=   27.850
00662>      TOTAL RAINFALL   (mm)=   63.456
00663>      RUNOFF COEFFICIENT   =     .439
00664>
00665>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00666>
00667> --------------------------------------------------------------------------------
00668> 001:0026--------------------------------------------------------------------------
00669> * Total to existing woodlot (for water balance)
00670> ----------------------
00671> | ADD HYD (WOOD      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00672> ----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00673>                      ID1 07:         7      .40     .045    1.12  25.39    .000
00674>                     +ID2 01:         1     4.93     .261    1.57  26.18    .000
00675>                     +ID3 02:         1      .20     .011    1.57  27.85    .000
00676>                     +ID4 03:WOOD           5.91     .209    2.05  26.18    .000
00677>                     +ID5 04:         2      .65     .025    2.05  27.85    .000
00678>                      ==========================================================
00679>                      SUM 03:WOOD           11.71     .588    1.57  26.28    .000
00680>
00681>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00682>
00683> --------------------------------------------------------------------------------
00684> 001:0027--------------------------------------------------------------------------
00685>       FINISH
00686> --------------------------------------------------------------------------------
00687> ********************************************************************************
00688>      WARNINGS / ERRORS / NOTES
00689>      -------------------------
00690>    Simulation ended on 2021-07-14     at 11:06:45
00691> ================================================================================
00692>
00693>
```

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

Stormwater Management Calculations – North

Project: Niagara Village - NORTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS

Catchment 209 Drainage Area = **85375** **m2** **or** **8.54** **ha**

Right of Ways (m2)

19991	

Total Area= 2.00 ha

		Area
TIMP	90%	1.80 ha
XIMP	80%	1.60 ha

Parkland Areas (m2)

2490	Block 283
6460	Block 285
1970	Block 282

Total Area= 1.092 ha

		Area
TIMP	10%	0.11 ha
XIMP	5%	0.05 ha

SWM Block (m2)

9730	

Total Area = 0.97 ha

		Area
TIMP	50%	0.49 ha
XIMP	50%	0.49 ha

Medium Density (m2)

Total Area = 0.00 ha

		Area
TIMP	80%	0.78 ha
XIMP	60%	0.58 ha

Low-Density Residential Areas (m2)

3566	Single Detached
20332	
6982	

Total Area 3.09 ha

		Area
TIMP	43%	1.33 ha
XIMP	32%	0.99 ha

Townhouses (m2)

5365	
8490	

Total Area 1.39 ha

		Area
TIMP	64%	0.77 ha
XIMP	48%	0.58 ha

IMPERVIOUSNESS			
TOTAL Modelled Area=	**8.54 ha**	**TOTAL Pervious Area=**	**3.93 ha**
OVERALL TIMP	**0.540**		
OVERALL XIMP	**0.451**		

Project: Niagara Village - NORTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

IMPERVIOUS CALCULATIONS

Catchment UNC3 Drainage Area = **14590** **m2** **or** **1.46** **ha**

Right of Ways (m2)

11534	

Total Area= 1.15 ha

		Area
TIMP	90%	1.04 ha
XIMP	80%	0.92 ha

Parkland Areas (m2)

3056	Block 282

Total Area= 0.30559 ha

		Area
TIMP	10%	0.03 ha
XIMP	5%	0.02 ha

SWM Block (m2)

Total Area = 0.00 ha

		Area
TIMP	50%	0.00 ha
XIMP	50%	0.00 ha

Medium Density (m2)

Total Area = 0.00 ha

		Area
TIMP	80%	0.00 ha
XIMP	60%	0.00 ha

Low-Density Residential Areas (m2)

Total Area 0.00 ha

		Area
TIMP	43%	0.00 ha
XIMP	32%	0.00 ha

Townhouses (m2)

Total Area 0.00 ha

		Area
TIMP	64%	0.00 ha
XIMP	48%	0.00 ha

IMPERVIOUSNESS

TOTAL Modelled Area=	**1.46 ha**	**TOTAL Pervious Area=**	**0.39 ha**
OVERALL TIMP	**0.732**		
OVERALL XIMP	**0.653**		

Project: Niagara Village - NORTH
File: 300041230.0000
Designed by: L.Garner
Date: 31-May-21

BURNSIDE

Wet Pond Permament Pool Requirement

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

TOTAL DRAINAGE AREA TO POND	8.79	ha
IMPERVIOUSNESS	52.74	%
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	52.74	144.35	1268.81
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	52.74	67.74	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	52.74	33.30	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-May-21

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 = 0.083 cms *see below
Vs = 0.0003 m/s

therefore:
Dist = 23.5 metres
Width= 11.8 metres

*Peak quality flowrate (Qp) from pond based on 2-year post-development flow from pond 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 = 0.826 cms *see below
d = 1.2 m
Vf = 0.5 m/s
Forebay S

therefore:
Dist = 11.0 metres
Width= 5.5 metres
Min Bottom Width= 1.4 metres *MOE equation 4.6
Pond Side Slopes: 5
Calc. Top Width= 13.377 metres
Calc. Top Length= 26.753 meters

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

Minimum Forebay Dimension:

Length= 26.8 meters
Width= 13.4 meters

Actual Forebay Design:

Length= 35.0 meters
Width= 17.5 meters

Check Average velocity in forebay <= 0.15 m/s
Pond Side Slopes: 5 H : 1 V
Q = V x A Q = 0.826 A = 14 sq.metres

therefore: V = 0.0599 m/s
Design: **OK**

Project: Niagara Village - NORTH
File: 300041230.0000
Designed by: L.Garner
Date: 5/31/2021

BURNSIDE

North SWM Pond Storage Calculations

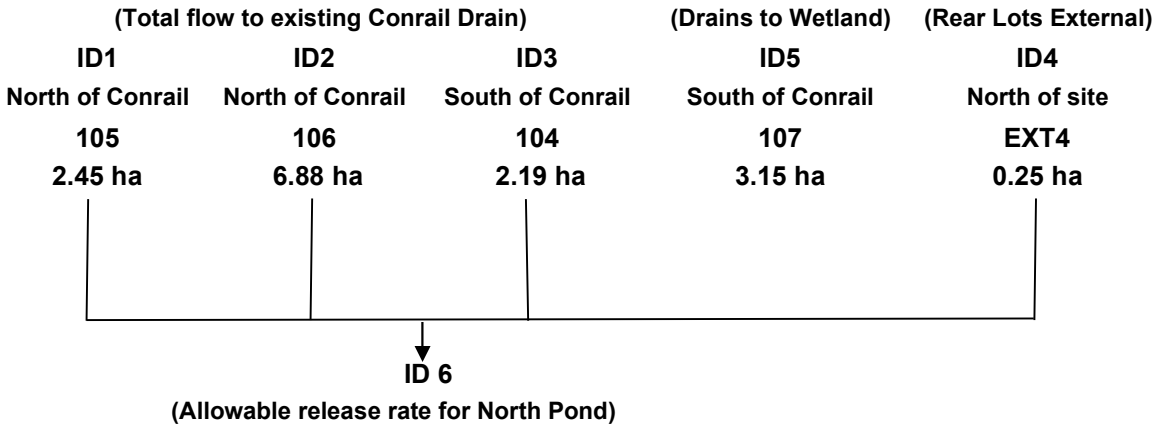
INPUT AREA

Base of Pond:	176.90	
N.W.L.:	178.20	masl
Required Permanent Pool Volume:	1269	m^3
Permanent Pool Volume Provided:	2567	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)
	177.00	-1.20		116.34	
	177.70	-0.50		1288.58	
NWL	178.20	0.00	0.00	2567.26	0.00
	178.70	0.50	0.50	4292.24	1724.98
	179.20	1.00	1.00	6436.55	3869.29
	179.70	1.50	1.50	9006.20	6438.94
Freeboard	180.40	2.20	2.20	13358.84	10791.58
Top of Pond	180.80	2.60	2.60	15882.15	13314.89

North Pond – SWMHYMO Model Schematic – EXISTING



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

(C:\...Pre1.dat)

```
00001> 2     Metric units
00002> *#*****************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00004> *#  Date        : 11-29-2019 updated 05-31-2021
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=[80], 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=[75], 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=[2.19](ha),
00044>                    DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
00045>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00046> *%-----------------|-------------------------------------------------------------|
00047> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00048> *%-----------------|-------------------------------------------------------------|
00049> DESIGN NASHYD       ID=[5], NHYD=["107"], DT=[1]min, AREA=[3.15](ha),
00050>                    DWF=[0](cms), CN/C=[81], TP=[0.55]hrs,
00051>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00052> *%-----------------|-------------------------------------------------------------|
00053> * Catchment EXT4 - Rear Lots - North Side of Site
00054> *%-----------------|-------------------------------------------------------------|
00055> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00056>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00057>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00058> *%-----------------|-------------------------------------------------------------|
00059> ADD HYD             IDsum=[6], NHYD=["TOTCONRAIL"], IDs to add=[1,2,3,4]
00060> *%-----------------|-------------------------------------------------------------|
00061> ADD HYD             IDsum=[7], NHYD=["TOTNORTH"], IDs to add=[1,2,3,4,5]
00062> *%-----------------|-------------------------------------------------------------|
00063> *%-----------------|-------------------------------------------------------------|
00064> *#  100yr - 12 hr AES (NPCA)
00065> MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
00066>                    CURVE_FILENAME=["AES-12HR.mst"]
00067> *%-----------------|-------------------------------------------------------------|
00068> * Catchment 105 - North of Conrail - Pre-Development
00069> *%-----------------|-------------------------------------------------------------|
00070> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00071>                    DWF=[0](cms), CN/C=[80], TP=[0.33]hrs,
00072>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00073> *%-----------------|-------------------------------------------------------------|
00074> * Catchment 106 - North of Conrail - Pre-Development
00075> *%-----------------|-------------------------------------------------------------|
00076> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00077>                    DWF=[0](cms), CN/C=[75], TP=[0.45]hrs,
00078>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00079> *%-----------------|-------------------------------------------------------------|
00080> * Catchment 104 - South of Conrail - Pre-Development
00081> *%-----------------|-------------------------------------------------------------|
00082> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.19](ha),
00083>                    DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
00084>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00085> *%-----------------|-------------------------------------------------------------|
00086> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00087> *%-----------------|-------------------------------------------------------------|
00088> DESIGN NASHYD       ID=[5], NHYD=["107"], DT=[1]min, AREA=[3.15](ha),
00089>                    DWF=[0](cms), CN/C=[81], TP=[0.55]hrs,
00090>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00091> *%-----------------|-------------------------------------------------------------|
00092> * Catchment EXT4 - Rear Lots - North Side of Site
00093> *%-----------------|-------------------------------------------------------------|
00094> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00095>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00096>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00097> *%-----------------|-------------------------------------------------------------|
00098> ADD HYD             IDsum=[6], NHYD=["TOTCONRAIL"], IDs to add=[1,2,3,4]
00099> *%-----------------|-------------------------------------------------------------|
00100> ADD HYD             IDsum=[7], NHYD=["TOTNORTH"], IDs to add=[1,2,3,4,5]
00101> *%-----------------|-------------------------------------------------------------|
00102> *%-----------------|-------------------------------------------------------------|
00103> *#  100yr - 24 hr SCS (NPCA)
00104> READ STORM          STORM_FILENAME=["100Y24.STM"]
00105> *%-----------------|-------------------------------------------------------------|
00106> * Catchment 105 - North of Conrail - Pre-Development
00107> *%-----------------|-------------------------------------------------------------|
00108> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00109>                    DWF=[0](cms), CN/C=[80], TP=[0.33]hrs,
00110>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00111> *%-----------------|-------------------------------------------------------------|
00112> * Catchment 106 - North of Conrail - Pre-Development
00113> *%-----------------|-------------------------------------------------------------|
00114> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00115>                    DWF=[0](cms), CN/C=[75], TP=[0.45]hrs,
00116>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00117> *%-----------------|-------------------------------------------------------------|
00118> * Catchment 104 - South of Conrail - Pre-Development
00119> *%-----------------|-------------------------------------------------------------|
00120> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.19](ha),
00121>                    DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
00122>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00123> *%-----------------|-------------------------------------------------------------|
00124> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00125> *%-----------------|-------------------------------------------------------------|
00126> DESIGN NASHYD       ID=[5], NHYD=["107"], DT=[1]min, AREA=[3.15](ha),
00127>                    DWF=[0](cms), CN/C=[81], TP=[0.55]hrs,
00128>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00129> *%-----------------|-------------------------------------------------------------|
00130> * Catchment EXT4 - Rear Lots - North Side of Site
00131> *%-----------------|-------------------------------------------------------------|
00132> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00133>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00134>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00135> *%-----------------|-------------------------------------------------------------|
00136> ADD HYD             IDsum=[6], NHYD=["TOTCONRAIL"], IDs to add=[1,2,3,4]
00137> *%-----------------|-------------------------------------------------------------|
00138> ADD HYD             IDsum=[7], NHYD=["TOTNORTH"], IDs to add=[1,2,3,4,5]
00139> *%-----------------|-------------------------------------------------------------|
00140> *#  2yr - 3 hr Chicago
00141> CHICAGO STORM       IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00142>                    ICASEcs=[1],
00143>                     A=[521.97],  B=[5.28], and C=[0.7588],
00144> *%-----------------|-------------------------------------------------------------|
00145> * Catchment 105 - North of Conrail - Pre-Development
00146> *%-----------------|-------------------------------------------------------------|
00147> DESIGN NASHYD       ID=[1], NHYD=["105"], DT=[1]min, AREA=[2.45](ha),
00148>                    DWF=[0](cms), CN/C=[80], TP=[0.33]hrs,
00149>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00150> *%-----------------|-------------------------------------------------------------|
00151> * Catchment 106 - North of Conrail - Pre-Development
00152> *%-----------------|-------------------------------------------------------------|
00153> DESIGN NASHYD       ID=[2], NHYD=["106"], DT=[1]min, AREA=[6.88](ha),
00154>                    DWF=[0](cms), CN/C=[75], TP=[0.45]hrs,
00155>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00156> *%-----------------|-------------------------------------------------------------|
00157> * Catchment 104 - South of Conrail - Pre-Development
00158> *%-----------------|-------------------------------------------------------------|
00159> DESIGN NASHYD       ID=[3], NHYD=["104"], DT=[1]min, AREA=[2.19](ha),
00160>                    DWF=[0](cms), CN/C=[80], TP=[0.23]hrs,
00161>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00162> *%-----------------|-------------------------------------------------------------|
00163> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00164> *%-----------------|-------------------------------------------------------------|
00165> DESIGN NASHYD       ID=[5], NHYD=["107"], DT=[1]min, AREA=[3.15](ha),
00166>                    DWF=[0](cms), CN/C=[81], TP=[0.55]hrs,
00167>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00168> *%-----------------|-------------------------------------------------------------|
00169> * Catchment EXT4 - Rear Lots - North Side of Site
00170> *%-----------------|-------------------------------------------------------------|
00171> DESIGN NASHYD       ID=[4], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00172>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00173>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00174> *%-----------------|-------------------------------------------------------------|
00175> ADD HYD             IDsum=[6], NHYD=["TOTCONRAIL"], IDs to add=[1,2,3,4]
00176> *%-----------------|-------------------------------------------------------------|
00177> ADD HYD             IDsum=[7], NHYD=["TOTNORTH"], IDs to add=[1,2,3,4,5]
00178> *%-----------------|-------------------------------------------------------------|
00179> *%-----------------|-------------------------------------------------------------|
00180> FINISH
00181>
00182>
00183>
00184>
00185>
00186>
00187>
00188>
00189>
00190>
00191>
00192>
00193>
```

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

(C:\...Pre1.out)

```
================================================================================
                                                                    999    999    =========
   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: 2021-06-07     TIME: 16:04:53     RUN COUNTER: 002409          *
 ********************************************************************************
 * 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 updated 05-31-2021
*#  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)=80.00
| 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)=     .176 (i)
     TIME TO PEAK    (hrs)=    1.350
     RUNOFF VOLUME    (mm)=   30.600
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .482

     (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)=75.00
| 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)=     .344 (i)
     TIME TO PEAK    (hrs)=    1.533
     RUNOFF VOLUME    (mm)=   26.182
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .413

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

--------------------------------------------------------------------------------
001:0005--------------------------------------------------------------------------
* Catchment 104 - South of Conrail - Pre-Development
---------------------
| DESIGN NASHYD      |   Area     (ha)=    2.19   Curve Number   (CN)=80.00
| 03:104    DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
---------------------  U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .364

     PEAK FLOW       (cms)=     .195 (i)
     TIME TO PEAK    (hrs)=    1.217
     RUNOFF VOLUME    (mm)=   30.600
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .482

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

--------------------------------------------------------------------------------
001:0006--------------------------------------------------------------------------
* Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
---------------------
| DESIGN NASHYD      |   Area     (ha)=    3.15   Curve Number   (CN)=81.00
| 05:107    DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
---------------------  U.H. Tp(hrs)=    .550

     Unit Hyd Qpeak  (cms)=     .219

     PEAK FLOW       (cms)=     .170 (i)
     TIME TO PEAK    (hrs)=    1.650
     RUNOFF VOLUME    (mm)=   31.586
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .498

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

--------------------------------------------------------------------------------
001:0007--------------------------------------------------------------------------
* 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.

--------------------------------------------------------------------------------
001:0008--------------------------------------------------------------------------
------------------------
| ADD HYD (TOTCONRAIL) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                       ID1 01:105          2.45     .176    1.35  30.60     .000
                      +ID2 02:106          6.88     .344    1.53  26.18     .000
                      +ID3 03:104          2.19     .195    1.22  30.60     .000
                      +ID4 04:EXT4          .25     .028    1.02  25.39     .000
                       ==========================================================
                       SUM 06:TOTCONRAIL   11.77     .677    1.38  27.91     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009--------------------------------------------------------------------------
------------------------
| ADD HYD (TOTNORTH  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                       ID1 01:105          2.45     .176    1.35  30.60     .000
                      +ID2 02:106          6.88     .344    1.53  26.18     .000
                      +ID3 03:104          2.19     .195    1.22  30.60     .000
                      +ID4 04:EXT4          .25     .028    1.02  25.39     .000
                      +ID5 05:107          3.15     .170    1.65  31.59     .000
                       ==========================================================
                       SUM 07:TOTNORTH    14.92     .825    1.42  28.68     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0010--------------------------------------------------------------------------
*#  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

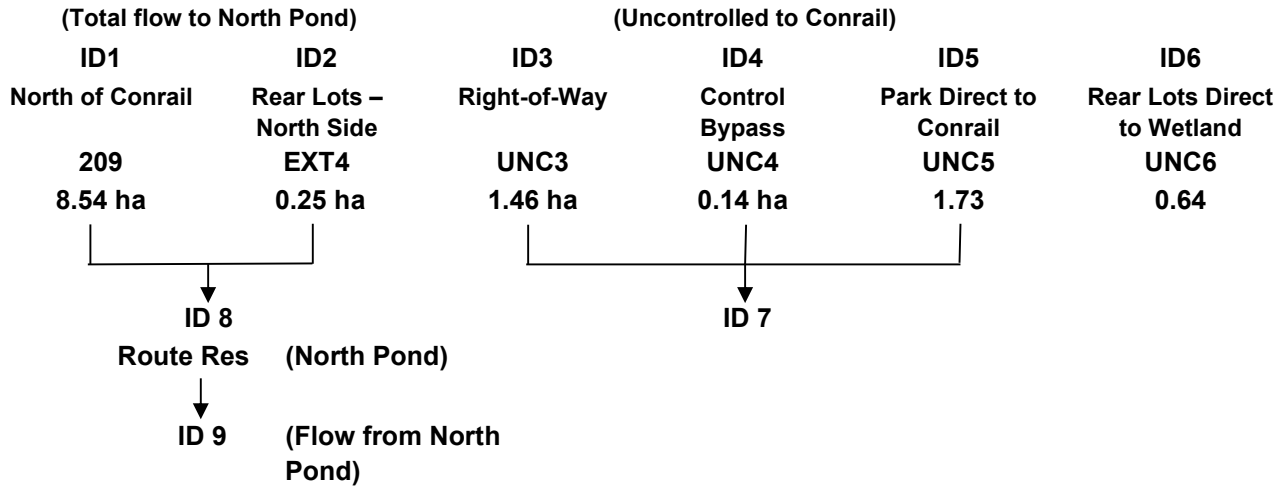
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   4.403 |   3.08   9.687 |   6.08   7.925 |   9.08   5.284
               .17   4.403 |   3.17   9.687 |   6.17   7.925 |   9.17   5.284
               .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

--------------------------------------------------------------------------------
001:0011--------------------------------------------------------------------------
* Catchment 105 - North of Conrail - Pre-Development
```

```
00271> ----------------------
00272> | DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=80.00
00273> | 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00274> ----------------------   U.H. Tp(hrs)=    .330
00275>
00276>      Unit Hyd Qpeak  (cms)=     .284
00277>
00278>      PEAK FLOW       (cms)=     .059 (i)
00279>      TIME TO PEAK    (hrs)=    6.050
00280>      RUNOFF VOLUME    (mm)=   49.931
00281>      TOTAL RAINFALL   (mm)=   88.060
00282>      RUNOFF COEFFICIENT   =     .567
00283>
00284>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00285>
00286> ------------------------------------------------------------------------------
00287> 001:0012-------------------------------------------------------------------------
00288> * Catchment 106 - North of Conrail - Pre-Development
00289> ----------------------
00290> | DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=75.00
00291> | 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00292> ----------------------   U.H. Tp(hrs)=    .450
00293>
00294>      Unit Hyd Qpeak  (cms)=     .584
00295>
00296>      PEAK FLOW       (cms)=     .143 (i)
00297>      TIME TO PEAK    (hrs)=    6.083
00298>      RUNOFF VOLUME    (mm)=   43.758
00299>      TOTAL RAINFALL   (mm)=   88.060
00300>      RUNOFF COEFFICIENT   =     .497
00301>
00302>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00303>
00304> ------------------------------------------------------------------------------
00305> 001:0013-------------------------------------------------------------------------
00306> * Catchment 104 - South of Conrail - Pre-Development
00307> ----------------------
00308> | DESIGN NASHYD      |   Area    (ha)=    2.19   Curve Number   (CN)=80.00
00309> | 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00310> ----------------------   U.H. Tp(hrs)=    .230
00311>
00312>      Unit Hyd Qpeak  (cms)=     .364
00313>
00314>      PEAK FLOW       (cms)=     .053 (i)
00315>      TIME TO PEAK    (hrs)=    6.017
00316>      RUNOFF VOLUME    (mm)=   49.931
00317>      TOTAL RAINFALL   (mm)=   88.060
00318>      RUNOFF COEFFICIENT   =     .567
00319>
00320>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00321>
00322> ------------------------------------------------------------------------------
00323> 001:0014-------------------------------------------------------------------------
00324> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00325> ----------------------
00326> | DESIGN NASHYD      |   Area    (ha)=    3.15   Curve Number   (CN)=81.00
00327> | 05:107    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00328> ----------------------   U.H. Tp(hrs)=    .550
00329>
00330>      Unit Hyd Qpeak  (cms)=     .219
00331>
00332>      PEAK FLOW       (cms)=     .076 (i)
00333>      TIME TO PEAK    (hrs)=    6.100
00334>      RUNOFF VOLUME    (mm)=   51.270
00335>      TOTAL RAINFALL   (mm)=   88.060
00336>      RUNOFF COEFFICIENT   =     .582
00337>
00338>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00339>
00340> ------------------------------------------------------------------------------
00341> 001:0015-------------------------------------------------------------------------
00342> * Catchment EXT4 - Rear Lots - North Side of Site
00343> ----------------------
00344> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00345> | 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00346> ----------------------   U.H. Tp(hrs)=    .090
00347>
00348>      Unit Hyd Qpeak  (cms)=     .106
00349>
00350>      PEAK FLOW       (cms)=     .005 (i)
00351>      TIME TO PEAK    (hrs)=    6.000
00352>      RUNOFF VOLUME    (mm)=   42.619
00353>      TOTAL RAINFALL   (mm)=   88.060
00354>      RUNOFF COEFFICIENT   =     .484
00355>
00356>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00357>
00358> ------------------------------------------------------------------------------
00359> 001:0016-------------------------------------------------------------------------
00360> ------------------------
00361> | ADD HYD (TOTCONRAIL) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00362> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00363>                       ID1 01:105           2.45     .059    6.05   49.93    .000
00364>                      +ID2 02:106           6.88     .143    6.08   43.76    .000
00365>                      +ID3 03:104           2.19     .053    6.02   49.93    .000
00366>                      +ID4 04:EXT4           .25     .005    6.00   42.62    .000
00367>                       ========================================================
00368>                       SUM 06:TOTCONRAIL    11.77     .260    6.03   46.17    .000
00369>
00370>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00371>
00372> ------------------------------------------------------------------------------
00373> 001:0017-------------------------------------------------------------------------
00374> ------------------------
00375> | ADD HYD (TOTNORTH  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00376> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00377>                       ID1 01:105           2.45     .059    6.05   49.93    .000
00378>                      +ID2 02:106           6.88     .143    6.08   43.76    .000
00379>                      +ID3 03:104           2.19     .053    6.02   49.93    .000
00380>                      +ID4 04:EXT4           .25     .005    6.00   42.62    .000
00381>                      +ID5 05:107           3.15     .076    6.10   51.27    .000
00382>                       ========================================================
00383>                       SUM 07:TOTNORTH      14.92     .335    6.03   47.24    .000
00384>
00385>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00386>
00387> ------------------------------------------------------------------------------
00388> 001:0018-------------------------------------------------------------------------
00389> *#  100yr - 24 hr SCS (NPCA)
00390> --------------------
00391> | READ STORM       |    Filename: 100yr/24hr
00392> | Ptotal= 102.88 mm|    Comments: 100yr/24hr
00393> --------------------
00394>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00395>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00396>                .25    .000 |   6.50   2.060 |  12.75  14.820 |  19.00   1.850
00397>                .50   1.130 |   6.75   2.060 |  13.00   7.610 |  19.25   1.850
00398>                .75   1.130 |   7.00   2.060 |  13.25   7.610 |  19.50   1.850
00399>               1.00   1.130 |   7.25   2.060 |  13.50   1.440 |  19.75   1.850
00400>               1.25   1.130 |   7.50   2.060 |  13.75   1.440 |  20.00   1.850
00401>               1.50   1.130 |   7.75   2.060 |  14.00   8.440 |  20.25   1.850
00402>               1.75   1.130 |   8.00   2.060 |  14.25   8.440 |  20.50   1.230
00403>               2.00   1.130 |   8.25   2.060 |  14.50   3.090 |  20.75   1.230
00404>               2.25   1.130 |   8.50   2.780 |  14.75   3.090 |  21.00   1.230
00405>               2.50   1.340 |   8.75   2.780 |  15.00   3.090 |  21.25   1.230
00406>               2.75   1.340 |   9.00   2.780 |  15.25   3.090 |  21.50   1.230
00407>               3.00   1.340 |   9.25   2.780 |  15.50   3.090 |  21.75   1.230
00408>               3.25   1.340 |   9.50   3.290 |  15.75   3.090 |  22.00   1.230
00409>               3.50   1.340 |   9.75   3.290 |  16.00   3.090 |  22.25   1.230
00410>               3.75   1.340 |  10.00   3.700 |  16.25   3.090 |  22.50   1.230
00411>               4.00   1.340 |  10.25   3.700 |  16.50   1.850 |  22.75   1.230
00412>               4.25   1.340 |  10.50   4.730 |  16.75   1.850 |  23.00   1.230
00413>               4.50   1.650 |  10.75   4.730 |  17.00   1.850 |  23.25   1.230
00414>               4.75   1.650 |  11.00   6.380 |  17.25   1.850 |  23.50   1.230
00415>               5.00   1.650 |  11.25   6.380 |  17.50   1.850 |  23.75   1.230
00416>               5.25   1.650 |  11.50   9.880 |  17.75   1.850 |  24.00   1.230
00417>               5.50   1.650 |  11.75   9.880 |  18.00   1.850 |  24.25   1.230
00418>               5.75   1.650 |  12.00  42.800 |  18.25   1.850 |
00419>               6.00   1.650 |  12.25 113.590 |  18.50   1.850 |
00420>               6.25   1.650 |  12.50  14.820 |  18.75   1.850 |
00421>
00422> ------------------------------------------------------------------------------
00423> 001:0019-------------------------------------------------------------------------
00424> * Catchment 105 - North of Conrail - Pre-Development
00425> ----------------------
00426> | DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=80.00
00427> | 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00428> ----------------------   U.H. Tp(hrs)=    .330
00429>
00430>      Unit Hyd Qpeak  (cms)=     .284
00431>
00432>      PEAK FLOW       (cms)=     .273 (i)
00433>      TIME TO PEAK    (hrs)=   12.467
00434>      RUNOFF VOLUME    (mm)=   62.338
00435>      TOTAL RAINFALL   (mm)=  102.883
00436>      RUNOFF COEFFICIENT   =     .606
00437>
00438>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00439>
00440> ------------------------------------------------------------------------------
00441> 001:0020-------------------------------------------------------------------------
00442> * Catchment 106 - North of Conrail - Pre-Development
00443> ----------------------
00444> | DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=75.00
00445> | 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00446> ----------------------   U.H. Tp(hrs)=    .450
00447>
00448>      Unit Hyd Qpeak  (cms)=     .584
00449>
00450>      PEAK FLOW       (cms)=     .542 (i)
00451>      TIME TO PEAK    (hrs)=   12.583
00452>      RUNOFF VOLUME    (mm)=   55.246
00453>      TOTAL RAINFALL   (mm)=  102.883
00454>      RUNOFF COEFFICIENT   =     .537
00455>
00456>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00457>
00458> ------------------------------------------------------------------------------
00459> 001:0021-------------------------------------------------------------------------
00460> * Catchment 104 - South of Conrail - Pre-Development
00461> ----------------------
00462> | DESIGN NASHYD      |   Area    (ha)=    2.19   Curve Number   (CN)=80.00
00463> | 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00464> ----------------------   U.H. Tp(hrs)=    .230
00465>
00466>      Unit Hyd Qpeak  (cms)=     .364
00467>
00468>      PEAK FLOW       (cms)=     .309 (i)
00469>      TIME TO PEAK    (hrs)=   12.367
00470>      RUNOFF VOLUME    (mm)=   62.338
00471>      TOTAL RAINFALL   (mm)=  102.883
00472>      RUNOFF COEFFICIENT   =     .606
00473>
00474>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00475>
00476> ------------------------------------------------------------------------------
00477> 001:0022-------------------------------------------------------------------------
00478> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00479> ----------------------
00480> | DESIGN NASHYD      |   Area    (ha)=    3.15   Curve Number   (CN)=81.00
00481> | 05:107    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00482> ----------------------   U.H. Tp(hrs)=    .550
00483>
00484>      Unit Hyd Qpeak  (cms)=     .219
00485>
00486>      PEAK FLOW       (cms)=     .252 (i)
00487>      TIME TO PEAK    (hrs)=   12.700
00488>      RUNOFF VOLUME    (mm)=   63.856
00489>      TOTAL RAINFALL   (mm)=  102.883
00490>      RUNOFF COEFFICIENT   =     .621
00491>
00492>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00493>
00494> ------------------------------------------------------------------------------
00495> 001:0023-------------------------------------------------------------------------
00496> * Catchment EXT4 - Rear Lots - North Side of Site
00497> ----------------------
00498> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00499> | 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00500> ----------------------   U.H. Tp(hrs)=    .090
00501>
00502>      Unit Hyd Qpeak  (cms)=     .106
00503>
00504>      PEAK FLOW       (cms)=     .046 (i)
00505>      TIME TO PEAK    (hrs)=   12.267
00506>      RUNOFF VOLUME    (mm)=   53.919
00507>      TOTAL RAINFALL   (mm)=  102.883
00508>      RUNOFF COEFFICIENT   =     .524
00509>
00510>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00511>
00512> ------------------------------------------------------------------------------
00513> 001:0024-------------------------------------------------------------------------
00514> ------------------------
00515> | ADD HYD (TOTCONRAIL) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00516> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00517>                       ID1 01:105           2.45     .273   12.47   62.34    .000
00518>                      +ID2 02:106           6.88     .542   12.58   55.25    .000
00519>                      +ID3 03:104           2.19     .309   12.37   62.34    .000
00520>                      +ID4 04:EXT4           .25     .046   12.27   53.92    .000
00521>                       ========================================================
00522>                       SUM 06:TOTCONRAIL    11.77    1.074   12.45   58.01    .000
00523>
00524>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00525>
00526> ------------------------------------------------------------------------------
00527> 001:0025-------------------------------------------------------------------------
00528> ------------------------
00529> | ADD HYD (TOTNORTH  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00530> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00531>                       ID1 01:105           2.45     .273   12.47   62.34    .000
00532>                      +ID2 02:106           6.88     .542   12.58   55.25    .000
00533>                      +ID3 03:104           2.19     .309   12.37   62.34    .000
00534>                      +ID4 04:EXT4           .25     .046   12.27   53.92    .000
00535>                      +ID5 05:107           3.15     .252   12.70   63.86    .000
00536>                       ========================================================
00537>                       SUM 07:TOTNORTH      14.92    1.293   12.48   59.25    .000
00538>
00539>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00540>
```

```
00541> ------------------------------------------------------------------------------
00542> 001:0026------------------------------------------------------------------------
00543> *#  2yr - 3 hr Chicago
00544> --------------------
00545> | CHICAGO STORM    |    IDF curve parameters: A= 521.970
00546> | Ptotal= 29.78 mm |                          B=   5.280
00547> --------------------                          C=    .759
00548>                          used in:   INTENSITY =  A / (t + B)^C
00549>
00550>                          Duration of storm  =  3.00 hrs
00551>                          Storm time step    =  5.00 min
00552>                          Time to peak ratio =   .30
00553>
00554>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00555>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00556>                .08   2.827 |    .83  29.012 |   1.58   6.779 |   2.33   3.579
00557>                .17   3.090 |    .92  89.073 |   1.67   6.123 |   2.42   3.414
00558>                .25   3.417 |   1.00  39.118 |   1.75   5.594 |   2.50   3.265
00559>                .33   3.835 |   1.08  22.704 |   1.83   5.157 |   2.58   3.130
00560>                .42   4.390 |   1.17  16.029 |   1.92   4.790 |   2.67   3.007
00561>                .50   5.170 |   1.25  12.450 |   2.00   4.477 |   2.75   2.895
00562>                .58   6.352 |   1.33  10.226 |   2.08   4.207 |   2.83   2.792
00563>                .67   8.373 |   1.42   8.711 |   2.17   3.971 |   2.92   2.697
00564>                .75  12.693 |   1.50   7.613 |   2.25   3.764 |   3.00   2.609
00565>
00566> ------------------------------------------------------------------------------
00567> 001:0027------------------------------------------------------------------------
00568> * Catchment 105 - North of Conrail - Pre-Development
00569> ----------------------
00570> | DESIGN NASHYD      |   Area    (ha)=    2.45   Curve Number   (CN)=80.00
00571> | 01:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00572> ----------------------   U.H. Tp(hrs)=    .330
00573>
00574>      Unit Hyd Qpeak  (cms)=     .284
00575>
00576>      PEAK FLOW       (cms)=     .047 (i)
00577>      TIME TO PEAK    (hrs)=    1.367
00578>      RUNOFF VOLUME    (mm)=    8.713
00579>      TOTAL RAINFALL   (mm)=   29.778
00580>      RUNOFF COEFFICIENT   =     .293
00581>
00582>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00583>
00584> ------------------------------------------------------------------------------
00585> 001:0028------------------------------------------------------------------------
00586> * Catchment 106 - North of Conrail - Pre-Development
00587> ----------------------
00588> | DESIGN NASHYD      |   Area    (ha)=    6.88   Curve Number   (CN)=75.00
00589> | 02:106    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00590> ----------------------   U.H. Tp(hrs)=    .450
00591>
00592>      Unit Hyd Qpeak  (cms)=     .584
00593>
00594>      PEAK FLOW       (cms)=     .088 (i)
00595>      TIME TO PEAK    (hrs)=    1.550
00596>      RUNOFF VOLUME    (mm)=    7.080
00597>      TOTAL RAINFALL   (mm)=   29.778
00598>      RUNOFF COEFFICIENT   =     .238
00599>
00600>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00601>
00602> ------------------------------------------------------------------------------
00603> 001:0029------------------------------------------------------------------------
00604> * Catchment 104 - South of Conrail - Pre-Development
00605> ----------------------
00606> | DESIGN NASHYD      |   Area    (ha)=    2.19   Curve Number   (CN)=80.00
00607> | 03:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00608> ----------------------   U.H. Tp(hrs)=    .230
00609>
00610>      Unit Hyd Qpeak  (cms)=     .364
00611>
00612>      PEAK FLOW       (cms)=     .052 (i)
00613>      TIME TO PEAK    (hrs)=    1.233
00614>      RUNOFF VOLUME    (mm)=    8.713
00615>      TOTAL RAINFALL   (mm)=   29.778
00616>      RUNOFF COEFFICIENT   =     .293
00617>
00618>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00619>
00620> ------------------------------------------------------------------------------
00621> 001:0030------------------------------------------------------------------------
00622> * Catchment 107 - South of Conrail - Drains to Wetland - Pre-Development
00623> ----------------------
00624> | DESIGN NASHYD      |   Area    (ha)=    3.15   Curve Number   (CN)=81.00
00625> | 05:107    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00626> ----------------------   U.H. Tp(hrs)=    .550
00627>
00628>      Unit Hyd Qpeak  (cms)=     .219
00629>
00630>      PEAK FLOW       (cms)=     .047 (i)
00631>      TIME TO PEAK    (hrs)=    1.683
00632>      RUNOFF VOLUME    (mm)=    9.101
00633>      TOTAL RAINFALL   (mm)=   29.778
00634>      RUNOFF COEFFICIENT   =     .306
00635>
00636>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00637>
00638> ------------------------------------------------------------------------------
00639> 001:0031------------------------------------------------------------------------
00640> * Catchment EXT4 - Rear Lots - North Side of Site
00641> ----------------------
00642> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00643> | 04:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00644> ----------------------   U.H. Tp(hrs)=    .090
00645>
00646>      Unit Hyd Qpeak  (cms)=     .106
00647>
00648>      PEAK FLOW       (cms)=     .007 (i)
00649>      TIME TO PEAK    (hrs)=    1.017
00650>      RUNOFF VOLUME    (mm)=    6.804
00651>      TOTAL RAINFALL   (mm)=   29.778
00652>      RUNOFF COEFFICIENT   =     .228
00653>
00654>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00655>
00656> ------------------------------------------------------------------------------
00657> 001:0032------------------------------------------------------------------------
00658> ------------------------
00659> | ADD HYD (TOTCONRAIL) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00660> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
00661>                       ID1 01:105           2.45     .047    1.37   8.71    .000
00662>                      +ID2 02:106           6.88     .088    1.55   7.08    .000
00663>                      +ID3 03:104           2.19     .052    1.23   8.71    .000
00664>                      +ID4 04:EXT4           .25     .007    1.02   6.80    .000
00665>                       ============================================================
00666>                       SUM 06:TOTCONRAIL    11.77     .178    1.38   7.72    .000
00667>
00668>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00669>
00670> ------------------------------------------------------------------------------
00671> 001:0033------------------------------------------------------------------------
00672> ------------------------
00673> | ADD HYD (TOTNORTH  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00674> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
00675>                       ID1 01:105           2.45     .047    1.37   8.71    .000
00676>                      +ID2 02:106           6.88     .088    1.55   7.08    .000
00677>                      +ID3 03:104           2.19     .052    1.23   8.71    .000
00678>                      +ID4 04:EXT4           .25     .007    1.02   6.80    .000
00679>                      +ID5 05:107           3.15     .047    1.68   9.10    .000
00680>                       ============================================================
00681>                       SUM 07:TOTNORTH      14.92     .218    1.45   8.01    .000
00682>
00683>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00684>
00685> ------------------------------------------------------------------------------
00686> 001:0034------------------------------------------------------------------------
00687>      FINISH
00688> ------------------------------------------------------------------------------
00689> ********************************************************************************
00690>      WARNINGS / ERRORS / NOTES
00691>      -------------------------
00692>    Simulation ended on 2021-06-07     at 16:04:54
00693> ================================================================================
00694>
00695>
```

North Pond – SWMHYMO Model Schematic – PROPOSED



Project Name	Niagara Village Development
Project No.	300041230.0000
Date	May 28, 2021

BURNSIDE
[The Difference is our People]

INPUT FILE: North Side, Post- Development, 5 & 100-Year Storm

(C:\...Post1.dat)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Niagara Village]    Project Number: [300041230]
00004> *#  Date        : 01-31-2020 updated 05-31-2021
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> *#  5yr - 3 hr Chicago
00024> CHICAGO STORM      IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00025>                    ICASEcs=[1],
00026>                     A=[719.5],  B=[6.34], and C=[0.769],
00027> *%-----------------|---------------------------------------------------------|
00028> * Catchment 209 - North Side Post-Development Controlled
00029> *%-----------------|---------------------------------------------------------|
00030> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.54](ha),
00031>                    XIMP=[0.45], TIMP=[0.54], DWF=[0](cms), LOSS=[2], CN=[76],
00032>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00033> *%-----------------|---------------------------------------------------------|
00034> * Catchment EXT4 - Rear Lots - North Side of Site
00035> *%-----------------|---------------------------------------------------------|
00036> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00037>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00038>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00039> *%-----------------|---------------------------------------------------------|
00040> * Catchment UNC3 - ROW Post-Development Uncontrolled
00041> *%-----------------|---------------------------------------------------------|
00042> DESIGN STANDHYD     ID=[3], NHYD=["UNC3"], DT=[1]min, AREA=[1.46](ha),
00043>                    XIMP=[0.65], TIMP=[0.73], DWF=[0](cms), LOSS=[2], CN=[80],
00044>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00045> *%-----------------|---------------------------------------------------------|
00046> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00047> *%-----------------|---------------------------------------------------------|
00048> DESIGN NASHYD       ID=[4], NHYD=["UNC4"], DT=[1]min, AREA=[0.14](ha),
00049>                    DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00050>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00051> *%-----------------|---------------------------------------------------------|
00052> * Catchment UNC5 - Park Direct to Conrail
00053> *%-----------------|---------------------------------------------------------|
00054> DESIGN NASHYD       ID=[5], NHYD=["UNC5"], DT=[1]min, AREA=[1.73](ha),
00055>                    DWF=[0](cms), CN/C=[80], TP=[0.19]hrs,
00056>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00057> *%-----------------|---------------------------------------------------------|
00058> * Catchment UNC6 - Rear Lots Direct to Wetland
00059> *%-----------------|---------------------------------------------------------|
00060> DESIGN STANDHYD     ID=[6], NHYD=["UNC6"], DT=[1]min, AREA=[0.64](ha),
00061>                    XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2], CN=[80],
00062>                    SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00063> *%-----------------|---------------------------------------------------------|
00064> * Total Post-Dev Flow North Side
00065> *%-----------------|---------------------------------------------------------|
00066> ADD HYD            IDsum=[8], NHYD=["TotNorth"], IDs to add=[1,2,3,4,5,6]
00067> *%-----------------|---------------------------------------------------------|
00068> * Total Uncontrolled Flow to Conrail
00069> *%-----------------|---------------------------------------------------------|
00070> ADD HYD            IDsum=[7], NHYD=["TotUnc"], IDs to add=[3,4,5]
00071> *%-----------------|---------------------------------------------------------|
00072> * Total Flow to Pond
00073> *%-----------------|---------------------------------------------------------|
00074> ADD HYD            IDsum=[8], NHYD=["TotPond"], IDs to add=[1,2]
00075> *%-----------------|---------------------------------------------------------|
00076> ROUTE RESERVOIR     IDout=[9],   NHYD=["NorthPond"],  IDin=[8],
00077>                    RDT=[1](min),
00078>                         TABLE of ( OUTFLOW-STORAGE ) values
00079>                                    (cms) - (ha-m)
00080>                                  [   0.0  ,  0.0 ]
00081>                                  [   0.2,  0.43 ]
00082>                                  [   -1   ,  -1  ]  (max twenty pts)
00083>                         IDovf=[   ], NHYDovf=[   ]
00084> *%-----------------|---------------------------------------------------------|
00085> *%-----------------|---------------------------------------------------------|
00086> *#  100yr - 3 hr Chicago
00087> CHICAGO STORM      IUNITS=[2],  TD=[3.0](hrs), TPRAT=[0.3],  CSDT=[5](min),
00088>                    ICASEcs=[1],
00089>                     A=[1264.57],  B=[7.72], and C=[0.7814],
00090> *%-----------------|---------------------------------------------------------|
00091> * Catchment 209 - North Side Post-Development Controlled
00092> *%-----------------|---------------------------------------------------------|
00093> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.54](ha),
00094>                    XIMP=[0.45], TIMP=[0.54], DWF=[0](cms), LOSS=[2], CN=[76],
00095>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00096> *%-----------------|---------------------------------------------------------|
00097> * Catchment EXT4 - Rear Lots - North Side of Site
00098> *%-----------------|---------------------------------------------------------|
00099> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00100>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00101>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00102> *%-----------------|---------------------------------------------------------|
00103> * Catchment UNC3 - ROW Post-Development Uncontrolled
00104> *%-----------------|---------------------------------------------------------|
00105> DESIGN STANDHYD     ID=[3], NHYD=["UNC3"], DT=[1]min, AREA=[1.46](ha),
00106>                    XIMP=[0.65], TIMP=[0.73], DWF=[0](cms), LOSS=[2], CN=[80],
00107>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00108> *%-----------------|---------------------------------------------------------|
00109> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00110> *%-----------------|---------------------------------------------------------|
00111> DESIGN NASHYD       ID=[4], NHYD=["UNC4"], DT=[1]min, AREA=[0.14](ha),
00112>                    DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00113>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00114> *%-----------------|---------------------------------------------------------|
00115> * Catchment UNC5 - Park Direct to Conrail
00116> *%-----------------|---------------------------------------------------------|
00117> DESIGN NASHYD       ID=[5], NHYD=["UNC5"], DT=[1]min, AREA=[1.73](ha),
00118>                    DWF=[0](cms), CN/C=[80], TP=[0.19]hrs,
00119>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00120> *%-----------------|---------------------------------------------------------|
00121> * Catchment UNC6 - Rear Lots Direct to Wetland
00122> *%-----------------|---------------------------------------------------------|
00123> DESIGN STANDHYD     ID=[6], NHYD=["UNC6"], DT=[1]min, AREA=[0.64](ha),
00124>                    XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2], CN=[80],
00125>                    SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00126> *%-----------------|---------------------------------------------------------|
00127> * Total Post-Dev Flow North Side
00128> *%-----------------|---------------------------------------------------------|
00129> ADD HYD            IDsum=[8], NHYD=["TotNorth"], IDs to add=[1,2,3,4,5,6]
00130> *%-----------------|---------------------------------------------------------|
00131> * Total Uncontrolled Flow to Conrail
00132> *%-----------------|---------------------------------------------------------|
00133> ADD HYD            IDsum=[7], NHYD=["TotUnc"], IDs to add=[3,4,5]
00134> *%-----------------|---------------------------------------------------------|
00135> * Total Flow to Pond
00136> *%-----------------|---------------------------------------------------------|
00137> ADD HYD            IDsum=[8], NHYD=["TotPond"], IDs to add=[1,2]
00138> *%-----------------|---------------------------------------------------------|
00139> ROUTE RESERVOIR     IDout=[9],   NHYD=["NorthPond"],  IDin=[8],
00140>                    RDT=[1](min),
00141>                         TABLE of ( OUTFLOW-STORAGE ) values
00142>                                    (cms) - (ha-m)
00143>                                  [   0.0  ,  0.0 ]
00144>                                  [   0.2,  0.43 ]
00145>                                  [   -1   ,  -1  ]  (max twenty pts)
00146>                         IDovf=[   ], NHYDovf=[   ]
00147> *%-----------------|---------------------------------------------------------|
00148> *#  100yr - 12 hr AES (NPCA)
00149> MASS STORM          PTOTAL=[88.06](mm), CSDT=[5](min),
00150>                    CURVE_FILENAME=["AES-12HR.mst"]
00151> *%-----------------|---------------------------------------------------------|
00152> * Catchment 209 - North Side Post-Development Controlled
00153> *%-----------------|---------------------------------------------------------|
00154> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.54](ha),
00155>                    XIMP=[0.45], TIMP=[0.54], DWF=[0](cms), LOSS=[2], CN=[76],
00156>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00157> *%-----------------|---------------------------------------------------------|
00158> * Catchment EXT4 - Rear Lots - North Side of Site
00159> *%-----------------|---------------------------------------------------------|
00160> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00161>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00162>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00163> *%-----------------|---------------------------------------------------------|
00164> * Catchment UNC3 - ROW Post-Development Uncontrolled
00165> *%-----------------|---------------------------------------------------------|
00166> DESIGN STANDHYD     ID=[3], NHYD=["UNC3"], DT=[1]min, AREA=[1.46](ha),
00167>                    XIMP=[0.65], TIMP=[0.73], DWF=[0](cms), LOSS=[2], CN=[80],
00168>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00169> *%-----------------|---------------------------------------------------------|
00170> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00171> *%-----------------|---------------------------------------------------------|
00172> DESIGN NASHYD       ID=[4], NHYD=["UNC4"], DT=[1]min, AREA=[0.14](ha),
00173>                    DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00174>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00175> *%-----------------|---------------------------------------------------------|
00176> * Catchment UNC5 - Park Direct to Conrail
00177> *%-----------------|---------------------------------------------------------|
00178> DESIGN NASHYD       ID=[5], NHYD=["UNC5"], DT=[1]min, AREA=[1.73](ha),
00179>                    DWF=[0](cms), CN/C=[80], TP=[0.19]hrs,
00180>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00181> *%-----------------|---------------------------------------------------------|
00182> * Catchment UNC6 - Rear Lots Direct to Wetland
00183> *%-----------------|---------------------------------------------------------|
00184> DESIGN STANDHYD     ID=[6], NHYD=["UNC6"], DT=[1]min, AREA=[0.64](ha),
00185>                    XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2], CN=[80],
00186>                    SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00187> *%-----------------|---------------------------------------------------------|
00188> * Total Post-Dev Flow North Side
00189> *%-----------------|---------------------------------------------------------|
00190> ADD HYD            IDsum=[8], NHYD=["TotNorth"], IDs to add=[1,2,3,4,5,6]
00191> *%-----------------|---------------------------------------------------------|
00192> * Total Uncontrolled Flow to Conrail
00193> *%-----------------|---------------------------------------------------------|
00194> ADD HYD            IDsum=[7], NHYD=["TotUnc"], IDs to add=[3,4,5]
00195> *%-----------------|---------------------------------------------------------|
00196> * Total Flow to Pond
00197> *%-----------------|---------------------------------------------------------|
00198> ADD HYD            IDsum=[8], NHYD=["TotPond"], IDs to add=[1,2]
00199> *%-----------------|---------------------------------------------------------|
00200> *#  100yr - 24 hr SCS (NPCA)
00201> READ STORM          STORM_FILENAME=["100Y24.STM"]
00202> *%-----------------|---------------------------------------------------------|
00203> * Catchment 209 - North Side Post-Development Controlled
00204> *%-----------------|---------------------------------------------------------|
00205> DESIGN STANDHYD     ID=[1], NHYD=["209"], DT=[1]min, AREA=[8.54](ha),
00206>                    XIMP=[0.45], TIMP=[0.54], DWF=[0](cms), LOSS=[2], CN=[76],
00207>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00208> *%-----------------|---------------------------------------------------------|
00209> * Catchment EXT4 - Rear Lots - North Side of Site
00210> *%-----------------|---------------------------------------------------------|
00211> DESIGN NASHYD       ID=[2], NHYD=["EXT4"], DT=[1]min, AREA=[0.25](ha),
00212>                    DWF=[0](cms), CN/C=[74], TP=[0.09]hrs,
00213>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00214> *%-----------------|---------------------------------------------------------|
00215> * Catchment UNC3 - ROW Post-Development Uncontrolled
00216> *%-----------------|---------------------------------------------------------|
00217> DESIGN STANDHYD     ID=[3], NHYD=["UNC3"], DT=[1]min, AREA=[1.46](ha),
00218>                    XIMP=[0.65], TIMP=[0.73], DWF=[0](cms), LOSS=[2], CN=[80],
00219>                    SLOPE=[0.5](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00220> *%-----------------|---------------------------------------------------------|
00221> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00222> *%-----------------|---------------------------------------------------------|
00223> DESIGN NASHYD       ID=[4], NHYD=["UNC4"], DT=[1]min, AREA=[0.14](ha),
00224>                    DWF=[0](cms), CN/C=[74], TP=[0.11]hrs,
00225>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00226> *%-----------------|---------------------------------------------------------|
00227> * Catchment UNC5 - Park Direct to Conrail
00228> *%-----------------|---------------------------------------------------------|
00229> DESIGN NASHYD       ID=[5], NHYD=["UNC5"], DT=[1]min, AREA=[1.73](ha),
00230>                    DWF=[0](cms), CN/C=[80], TP=[0.19]hrs,
00231>                    RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00232> *%-----------------|---------------------------------------------------------|
00233> * Catchment UNC6 - Rear Lots Direct to Wetland
00234> *%-----------------|---------------------------------------------------------|
00235> DESIGN STANDHYD     ID=[6], NHYD=["UNC6"], DT=[1]min, AREA=[0.64](ha),
00236>                    XIMP=[0.32], TIMP=[0.43], DWF=[0](cms), LOSS=[2], CN=[80],
00237>                    SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00238> *%-----------------|---------------------------------------------------------|
00239> * Total Post-Dev Flow North Side
00240> *%-----------------|---------------------------------------------------------|
00241> ADD HYD            IDsum=[8], NHYD=["TotNorth"], IDs to add=[1,2,3,4,5,6]
00242> *%-----------------|---------------------------------------------------------|
00243> * Total Uncontrolled Flow to Conrail
00244> *%-----------------|---------------------------------------------------------|
00245> ADD HYD            IDsum=[7], NHYD=["TotUnc"], IDs to add=[3,4,5]
00246> *%-----------------|---------------------------------------------------------|
00247> * Total Flow to Pond
00248> *%-----------------|---------------------------------------------------------|
00249> ADD HYD            IDsum=[8], NHYD=["TotPond"], IDs to add=[1,2]
00250> *%-----------------|---------------------------------------------------------|
00251> FINISH
00252>
00253>
00254>
00255>
00256>
00257>
00258>
00259>
00260>
00261>
00262>
00263>
00264>
00265>
00266>
00267>
00268>
00269>
00270>
```

OUTPUT FILE: North Side, Post- Development, 5 &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: 2021-06-07     TIME: 16:14:00     RUN COUNTER: 002411          *
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 updated 05-31-2021
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> *#  5yr - 3 hr Chicago
00076> --------------------
00077> | CHICAGO STORM    |    IDF curve parameters: A= 719.500
00078> | Ptotal= 38.75 mm |                          B=   6.340
00079> --------------------                          C=    .769
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   3.608 |    .83  38.761 |   1.58   8.907 |   2.33   4.602
00089>               .17   3.955 |    .92 111.182 |   1.67   8.018 |   2.42   4.382
00090>               .25   4.387 |   1.00  51.991 |   1.75   7.302 |   2.50   4.185
00091>               .33   4.942 |   1.08  30.552 |   1.83   6.713 |   2.58   4.007
00092>               .42   5.684 |   1.17  21.536 |   1.92   6.220 |   2.67   3.846
00093>               .50   6.731 |   1.25  16.651 |   2.00   5.800 |   2.75   3.698
00094>               .58   8.328 |   1.33  13.610 |   2.08   5.439 |   2.83   3.562
00095>               .67  11.079 |   1.42  11.540 |   2.17   5.124 |   2.92   3.437
00096>               .75  16.983 |   1.50  10.041 |   2.25   4.847 |   3.00   3.322
00097>
00098> --------------------------------------------------------------------------------
00099> 001:0003--------------------------------------------------------------------------
00100> * Catchment 209 - North Side Post-Development Controlled
00101> ----------------------
00102> | DESIGN STANDHYD    |   Area     (ha)=    8.54
00103> | 01:209    DT= 1.00 |   Total Imp(%)=   54.00   Dir. Conn.(%)=   45.00
00104> ----------------------
00105>                              IMPERVIOUS    PERVIOUS (i)
00106>      Surface Area     (ha)=       4.61         3.93
00107>      Dep. Storage     (mm)=        .80         1.50
00108>      Average Slope     (%)=        .50          .50
00109>      Length            (m)=     238.61        40.00
00110>      Mannings n            =       .013         .250
00111>
00112>      Max.eff.Inten.(mm/hr)=     111.18        19.35
00113>                  over (min)        5.00        26.00
00114>      Storage Coeff.  (min)=       5.08 (ii)   25.72 (ii)
00115>      Unit Hyd. Tpeak (min)=       5.00        26.00
00116>      Unit Hyd. peak  (cms)=        .22          .04
00117>                                                          *TOTALS*
00118>      PEAK FLOW       (cms)=        .80          .12          .816 (iii)
00119>      TIME TO PEAK    (hrs)=        .97         1.42          .967
00120>      RUNOFF VOLUME    (mm)=      37.95        13.44        24.469
00121>      TOTAL RAINFALL   (mm)=      38.75        38.75        38.747
00122>      RUNOFF COEFFICIENT   =        .98          .35          .632
00123>
00124>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00125>            CN* =  76.0    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 EXT4 - Rear Lots - North Side of Site
00133> ----------------------
00134> | DESIGN NASHYD      |   Area     (ha)=     .25   Curve Number    (CN)=74.00
00135> | 02:EXT4   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00136> ----------------------   U.H. Tp(hrs)=    .090
00137>
00138>      Unit Hyd Qpeak  (cms)=     .106
00139>
00140>      PEAK FLOW       (cms)=     .012 (i)
00141>      TIME TO PEAK    (hrs)=    1.017
00142>      RUNOFF VOLUME    (mm)=   10.968
00143>      TOTAL RAINFALL   (mm)=   38.747
00144>      RUNOFF COEFFICIENT   =     .283
00145>
00146>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00147>
00148> --------------------------------------------------------------------------------
00149> 001:0005--------------------------------------------------------------------------
00150> * Catchment UNC3 - ROW Post-Development Uncontrolled
00151> ----------------------
00152> | DESIGN STANDHYD    |   Area     (ha)=    1.46
00153> | 03:UNC3   DT= 1.00 |   Total Imp(%)=   73.00   Dir. Conn.(%)=   65.00
00154> ----------------------
00155>                              IMPERVIOUS    PERVIOUS (i)
00156>      Surface Area     (ha)=       1.07          .39
00157>      Dep. Storage     (mm)=        .80         1.50
00158>      Average Slope     (%)=        .50          .50
00159>      Length            (m)=      98.66        40.00
00160>      Mannings n            =       .013         .250
00161>
00162>      Max.eff.Inten.(mm/hr)=     111.18        30.00
00163>                  over (min)        3.00        20.00
00164>      Storage Coeff.  (min)=       2.99 (ii)   20.31 (ii)
00165>      Unit Hyd. Tpeak (min)=       3.00        20.00
00166>      Unit Hyd. peak  (cms)=        .38          .06
00167>                                                          *TOTALS*
00168>      PEAK FLOW       (cms)=        .24          .02          .244 (iii)
00169>      TIME TO PEAK    (hrs)=        .93         1.30          .933
00170>      RUNOFF VOLUME    (mm)=      37.95        16.32        30.378
00171>      TOTAL RAINFALL   (mm)=      38.75        38.75        38.747
00172>      RUNOFF COEFFICIENT   =        .98          .42          .784
00173>
00174>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00175>            CN* =  80.0    Ia = Dep. Storage  (Above)
00176>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00177>            THAN THE STORAGE COEFFICIENT.
00178>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00179>
00180> --------------------------------------------------------------------------------
00181> 001:0006--------------------------------------------------------------------------
00182> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00183> ----------------------
00184> | DESIGN NASHYD      |   Area     (ha)=     .14   Curve Number    (CN)=74.00
00185> | 04:UNC4   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00186> ----------------------   U.H. Tp(hrs)=    .110
00187>
00188>      Unit Hyd Qpeak  (cms)=     .049
00189>
00190>      PEAK FLOW       (cms)=     .006 (i)
00191>      TIME TO PEAK    (hrs)=    1.050
00192>      RUNOFF VOLUME    (mm)=   10.967
00193>      TOTAL RAINFALL   (mm)=   38.747
00194>      RUNOFF COEFFICIENT   =     .283
00195>
00196>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00197>
00198> --------------------------------------------------------------------------------
00199> 001:0007--------------------------------------------------------------------------
00200> * Catchment UNC5 - Park Direct to Conrail
00201> ----------------------
00202> | DESIGN NASHYD      |   Area     (ha)=    1.73   Curve Number    (CN)=80.00
00203> | 05:UNC5   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00204> ----------------------   U.H. Tp(hrs)=    .190
00205>
00206>      Unit Hyd Qpeak  (cms)=     .348
00207>
00208>      PEAK FLOW       (cms)=     .074 (i)
00209>      TIME TO PEAK    (hrs)=    1.167
00210>      RUNOFF VOLUME    (mm)=   13.771
00211>      TOTAL RAINFALL   (mm)=   38.747
00212>      RUNOFF COEFFICIENT   =     .355
00213>
00214>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00215>
00216> --------------------------------------------------------------------------------
00217> 001:0008--------------------------------------------------------------------------
00218> * Catchment UNC6 - Rear Lots Direct to Wetland
00219> ----------------------
00220> | DESIGN STANDHYD    |   Area     (ha)=     .64
00221> | 06:UNC6   DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00222> ----------------------
00223>                              IMPERVIOUS    PERVIOUS (i)
00224>      Surface Area     (ha)=        .28          .36
00225>      Dep. Storage     (mm)=        .80         1.50
00226>      Average Slope     (%)=       2.00         2.00
00227>      Length            (m)=      65.32        40.00
00228>      Mannings n            =       .013         .250
00229>
00230>      Max.eff.Inten.(mm/hr)=     111.18        31.98
00231>                  over (min)        2.00        13.00
00232>      Storage Coeff.  (min)=       1.54 (ii)   12.68 (ii)
00233>      Unit Hyd. Tpeak (min)=       2.00        13.00
00234>      Unit Hyd. peak  (cms)=        .65          .09
00235>                                                          *TOTALS*
00236>      PEAK FLOW       (cms)=        .06          .02          .065 (iii)
00237>      TIME TO PEAK    (hrs)=        .92         1.17          .917
00238>      RUNOFF VOLUME    (mm)=      37.95        15.49        22.678
00239>      TOTAL RAINFALL   (mm)=      38.75        38.75        38.747
00240>      RUNOFF COEFFICIENT   =        .98          .40          .585
00241>
00242>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00243>            CN* =  80.0    Ia = Dep. Storage  (Above)
00244>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00245>            THAN THE STORAGE COEFFICIENT.
00246>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00247>
00248> --------------------------------------------------------------------------------
00249> 001:0009--------------------------------------------------------------------------
00250> * Total Post-Dev Flow North Side
00251> ------------------------
00252> | ADD HYD (TotNorth  ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00253> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
00254>                        ID1 01:209          8.54     .816     .97  24.47    .000
00255>                      +ID2 02:EXT4          .25     .012    1.02  10.97    .000
00256>                      +ID3 03:UNC3         1.46     .244     .93  30.38    .000
00257>                      +ID4 04:UNC4          .14     .006    1.05  10.97    .000
00258>                      +ID5 05:UNC5         1.73     .074    1.17  13.77    .000
00259>                      +ID6 06:UNC6          .64     .065     .92  22.68    .000
00260>                       ============================================================
00261>                       SUM 08:TotNorth     12.76    1.126     .95  23.19    .000
00262>
00263>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00264>
00265> --------------------------------------------------------------------------------
00266> 001:0010--------------------------------------------------------------------------
00267> * Total Uncontrolled Flow to Conrail
00268> ------------------------
00269> | ADD HYD (TotUnc    ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00270> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
```

```
                      ID1 03:UNC3          1.46     .244     .93  30.38    .000
                     +ID2 04:UNC4           .14     .006    1.05  10.97    .000
                     +ID3 05:UNC5          1.73     .074    1.17  13.77    .000
                      ============================================================
                      SUM 07:TotUnc         3.33     .271     .93  20.93    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0011--------------------------------------------------------------------------
* Total Flow to Pond
----------------------
| ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:209           8.54     .816     .97  24.47    .000
                     +ID2 02:EXT4           .25     .012    1.02  10.97    .000
                      ============================================================
                      SUM 08:TotPond        8.79     .826     .97  24.09    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0012--------------------------------------------------------------------------
----------------------
| 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   |     .200  .4300E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (TotPon)       8.79      .826      .967     24.085
     OUTFLOW<09: (NorthP)       8.79      .073     3.017     24.085

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    8.787
                    TIME SHIFT OF PEAK FLOW          (min)=   123.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1561E+00

--------------------------------------------------------------------------------
001:0013--------------------------------------------------------------------------
*#  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

--------------------------------------------------------------------------------
001:0014--------------------------------------------------------------------------
* Catchment 209 - North Side Post-Development Controlled
---------------------
| DESIGN STANDHYD    |   Area    (ha)=    8.54
| 01:209    DT= 1.00 |   Total Imp(%)=   54.00   Dir. Conn.(%)=   45.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       4.61         3.93
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=     238.61        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34        53.41
                 over (min)=       4.00        18.00
     Storage Coeff.  (min)=       4.25 (ii)   18.00 (ii)
     Unit Hyd. Tpeak (min)=       4.00        18.00
     Unit Hyd. peak  (cms)=        .27          .06
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.36          .35         1.447 (iii)
     TIME TO PEAK    (hrs)=        .95         1.27          .950
     RUNOFF VOLUME    (mm)=      62.66        29.93        44.658
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.460
     RUNOFF COEFFICIENT   =        .99          .47          .704

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  76.0    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 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)=     .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.

--------------------------------------------------------------------------------
001:0016--------------------------------------------------------------------------
* Catchment UNC3 - ROW Post-Development Uncontrolled
----------------------
| DESIGN STANDHYD    |   Area    (ha)=    1.46
| 03:UNC3   DT= 1.00 |   Total Imp(%)=   73.00   Dir. Conn.(%)=   65.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.07          .39
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=        .50          .50
     Length            (m)=      98.66        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34        78.11
                 over (min)=       3.00        14.00
     Storage Coeff.  (min)=       2.50 (ii)   14.31 (ii)
     Unit Hyd. Tpeak (min)=       3.00        14.00
     Unit Hyd. peak  (cms)=        .42          .08
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .39          .05          .408 (iii)
     TIME TO PEAK    (hrs)=        .93         1.18          .933
     RUNOFF VOLUME    (mm)=      62.66        34.88        52.936
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.460
     RUNOFF COEFFICIENT   =        .99          .55          .834

       (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.

--------------------------------------------------------------------------------
001:0017--------------------------------------------------------------------------
* Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .14   Curve Number   (CN)=74.00
| 04:UNC4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .110

     Unit Hyd Qpeak  (cms)=     .049

     PEAK FLOW       (cms)=     .014 (i)
     TIME TO PEAK    (hrs)=    1.050
     RUNOFF VOLUME    (mm)=   25.389
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .400

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

--------------------------------------------------------------------------------
001:0018--------------------------------------------------------------------------
* Catchment UNC5 - Park Direct to Conrail
----------------------
| DESIGN NASHYD      |   Area    (ha)=    1.73   Curve Number   (CN)=80.00
| 05:UNC5   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .190

     Unit Hyd Qpeak  (cms)=     .348

     PEAK FLOW       (cms)=     .171 (i)
     TIME TO PEAK    (hrs)=    1.167
     RUNOFF VOLUME    (mm)=   30.599
     TOTAL RAINFALL   (mm)=   63.460
     RUNOFF COEFFICIENT   =     .482

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

--------------------------------------------------------------------------------
001:0019--------------------------------------------------------------------------
* Catchment UNC6 - Rear Lots Direct to Wetland
----------------------
| DESIGN STANDHYD    |   Area    (ha)=     .64
| 06:UNC6   DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .28          .36
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      65.32        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     173.34        81.72
                 over (min)=       1.00         9.00
     Storage Coeff.  (min)=       1.29 (ii)    8.94 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=        .92          .13
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .10          .05          .119 (iii)
     TIME TO PEAK    (hrs)=        .92         1.07          .917
     RUNOFF VOLUME    (mm)=      62.66        33.52        42.844
     TOTAL RAINFALL   (mm)=      63.46        63.46        63.460
     RUNOFF COEFFICIENT   =        .99          .53          .675

       (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--------------------------------------------------------------------------
* Total Post-Dev Flow North Side
----------------------
| ADD HYD (TotNorth  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:209           8.54    1.447     .95  44.66    .000
                     +ID2 02:EXT4           .25     .028    1.02  25.39    .000
                     +ID3 03:UNC3          1.46     .408     .93  52.94    .000
                     +ID4 04:UNC4           .14     .014    1.05  25.39    .000
                     +ID5 05:UNC5          1.73     .171    1.17  30.60    .000
                     +ID6 06:UNC6           .64     .119     .92  42.84    .000
                      ============================================================
                      SUM 08:TotNorth     12.76    2.033     .95  43.02    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0021--------------------------------------------------------------------------
* Total Uncontrolled Flow to Conrail
----------------------
| ADD HYD (TotUnc    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 03:UNC3          1.46     .408     .93  52.94    .000
                     +ID2 04:UNC4           .14     .014    1.05  25.39    .000
                     +ID3 05:UNC5          1.73     .171    1.17  30.60    .000
                      ============================================================
                      SUM 07:TotUnc         3.33     .478     .93  40.17    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0022--------------------------------------------------------------------------
* Total Flow to Pond
----------------------
| ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:209           8.54    1.447     .95  44.66    .000
                     +ID2 02:EXT4           .25     .028    1.02  25.39    .000
                      ============================================================
                      SUM 08:TotPond        8.79    1.470     .95  44.11    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0023--------------------------------------------------------------------------
----------------------
| 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   |     .200  .4300E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
```

```
00541>      --------------------       (ha)      (cms)      (hrs)       (mm)
00542>      INFLOW >08: (TotPon)       8.79     1.470      .950      44.110
00543>      OUTFLOW<09: (NorthP)       8.79      .134     2.850      44.109
00544>
00545>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.150
00546>                    TIME SHIFT OF PEAK FLOW          (min)=   114.00
00547>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2892E+00
00548>
00549> ------------------------------------------------------------------------------
00550> 001:0024------------------------------------------------------------------------
00551> *#  100yr - 12 hr AES (NPCA)
00552> ---------------------
00553> | MASS STORM       |    Filename: C:\SWMHYM~1\NIAGARA\AES-12HR.mst
00554> | Ptotal= 88.06 mm |    Comments: MASS CURVE: 12 HR AES 50% (NORTHERN ONTA
00555> ---------------------
00556>                         Duration of storm        =   12.00 hrs
00557>                         Mass curve time step     =   60.00 min
00558>                         Selected storm time step =    5.00 min
00559>                         Volume of derived storm  =   88.06 mm
00560>
00561>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00562>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00563>                .08   4.403 |   3.08   9.687 |   6.08   7.925 |   9.08   5.284
00564>                .17   4.403 |   3.17   9.687 |   6.17   7.925 |   9.17   5.284
00565>                .25   4.403 |   3.25   9.687 |   6.25   7.925 |   9.25   5.284
00566>                .33   4.403 |   3.33   9.687 |   6.33   7.925 |   9.33   5.284
00567>                .42   4.403 |   3.42   9.687 |   6.42   7.925 |   9.42   5.284
00568>                .50   4.403 |   3.50   9.687 |   6.50   7.925 |   9.50   5.284
00569>                .58   4.403 |   3.58   9.687 |   6.58   7.925 |   9.58   5.284
00570>                .67   4.403 |   3.67   9.687 |   6.67   7.925 |   9.67   5.284
00571>                .75   4.403 |   3.75   9.687 |   6.75   7.925 |   9.75   5.284
00572>                .83   4.403 |   3.83   9.687 |   6.83   7.925 |   9.83   5.284
00573>                .92   4.403 |   3.92   9.687 |   6.92   7.925 |   9.92   5.284
00574>               1.00   4.403 |   4.00   9.687 |   7.00   7.925 |  10.00   5.284
00575>               1.08   8.806 |   4.08  13.209 |   7.08   7.925 |  10.08   1.761
00576>               1.17   8.806 |   4.17  13.209 |   7.17   7.925 |  10.17   1.761
00577>               1.25   8.806 |   4.25  13.209 |   7.25   7.925 |  10.25   1.761
00578>               1.33   8.806 |   4.33  13.209 |   7.33   7.925 |  10.33   1.761
00579>               1.42   8.806 |   4.42  13.209 |   7.42   7.925 |  10.42   1.761
00580>               1.50   8.806 |   4.50  13.209 |   7.50   7.925 |  10.50   1.761
00581>               1.58   8.806 |   4.58  13.209 |   7.58   7.925 |  10.58   1.761
00582>               1.67   8.806 |   4.67  13.209 |   7.67   7.925 |  10.67   1.761
00583>               1.75   8.806 |   4.75  13.209 |   7.75   7.925 |  10.75   1.761
00584>               1.83   8.806 |   4.83  13.209 |   7.83   7.925 |  10.83   1.761
00585>               1.92   8.806 |   4.92  13.209 |   7.92   7.925 |  10.92   1.761
00586>               2.00   8.806 |   5.00  13.209 |   8.00   7.925 |  11.00   1.761
00587>               2.08  10.567 |   5.08  12.328 |   8.08   5.284 |  11.08    .881
00588>               2.17  10.567 |   5.17  12.328 |   8.17   5.284 |  11.17    .881
00589>               2.25  10.567 |   5.25  12.328 |   8.25   5.284 |  11.25    .881
00590>               2.33  10.567 |   5.33  12.328 |   8.33   5.284 |  11.33    .881
00591>               2.42  10.567 |   5.42  12.328 |   8.42   5.284 |  11.42    .881
00592>               2.50  10.567 |   5.50  12.328 |   8.50   5.284 |  11.50    .881
00593>               2.58  10.567 |   5.58  12.328 |   8.58   5.284 |  11.58    .881
00594>               2.67  10.567 |   5.67  12.328 |   8.67   5.284 |  11.67    .881
00595>               2.75  10.567 |   5.75  12.328 |   8.75   5.284 |  11.75    .881
00596>               2.83  10.567 |   5.83  12.328 |   8.83   5.284 |  11.83    .881
00597>               2.92  10.567 |   5.92  12.328 |   8.92   5.284 |  11.92    .881
00598>               3.00  10.567 |   6.00  12.328 |   9.00   5.284 |  12.00    .881
00599>
00600> ------------------------------------------------------------------------------
00601> 001:0025------------------------------------------------------------------------
00602> * Catchment 209 - North Side Post-Development Controlled
00603> ----------------------
00604> | DESIGN STANDHYD    |   Area     (ha)=    8.54
00605> | 01:209    DT= 1.00 |   Total Imp(%)=   54.00   Dir. Conn.(%)=   45.00
00606> ----------------------
00607>                              IMPERVIOUS    PERVIOUS (i)
00608>      Surface Area     (ha)=       4.61         3.93
00609>      Dep. Storage     (mm)=        .80         1.50
00610>      Average Slope     (%)=        .50          .50
00611>      Length            (m)=     238.61        40.00
00612>      Mannings n             =      .013         .250
00613>
00614>      Max.eff.Inten.(mm/hr)=      13.21        10.19
00615>                    over (min)       12.00        39.00
00616>      Storage Coeff.  (min)=      11.91 (ii)   38.58 (ii)
00617>      Unit Hyd. Tpeak (min)=      12.00        39.00
00618>      Unit Hyd. peak  (cms)=        .09          .03
00619>                                                          *TOTALS*
00620>      PEAK FLOW       (cms)=        .14          .10          .235 (iii)
00621>      TIME TO PEAK    (hrs)=       5.00         6.17         6.000
00622>      RUNOFF VOLUME    (mm)=      87.25        48.94        66.197
00623>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00624>      RUNOFF COEFFICIENT   =        .99          .56          .752
00625>
00626>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00627>            CN* =  76.0    Ia = Dep. Storage  (Above)
00628>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00629>            THAN THE STORAGE COEFFICIENT.
00630>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00631>
00632> ------------------------------------------------------------------------------
00633> 001:0026------------------------------------------------------------------------
00634> * Catchment EXT4 - Rear Lots - North Side of Site
00635> ----------------------
00636> | DESIGN NASHYD      |   Area     (ha)=     .25   Curve Number   (CN)=74.00
00637> | 02:EXT4   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00638> ----------------------   U.H. Tp(hrs)=    .090
00639>
00640>      Unit Hyd Qpeak  (cms)=     .106
00641>
00642>      PEAK FLOW       (cms)=     .005 (i)
00643>      TIME TO PEAK    (hrs)=    6.000
00644>      RUNOFF VOLUME    (mm)=   42.619
00645>      TOTAL RAINFALL   (mm)=   88.060
00646>      RUNOFF COEFFICIENT   =     .484
00647>
00648>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00649>
00650> ------------------------------------------------------------------------------
00651> 001:0027------------------------------------------------------------------------
00652> * Catchment UNC3 - ROW Post-Development Uncontrolled
00653> ----------------------
00654> | DESIGN STANDHYD    |   Area     (ha)=    1.46
00655> | 03:UNC3   DT= 1.00 |   Total Imp(%)=   73.00   Dir. Conn.(%)=   65.00
00656> ----------------------
00657>                              IMPERVIOUS    PERVIOUS (i)
00658>      Surface Area     (ha)=       1.07          .39
00659>      Dep. Storage     (mm)=        .80         1.50
00660>      Average Slope     (%)=        .50          .50
00661>      Length            (m)=      98.66        40.00
00662>      Mannings n             =      .013         .250
00663>
00664>      Max.eff.Inten.(mm/hr)=      13.21        12.40
00665>                    over (min)        7.00        32.00
00666>      Storage Coeff.  (min)=       7.01 (ii)   31.67 (ii)
00667>      Unit Hyd. Tpeak (min)=       7.00        32.00
00668>      Unit Hyd. peak  (cms)=        .16          .04
00669>                                                          *TOTALS*
00670>      PEAK FLOW       (cms)=        .03          .01          .046 (iii)
00671>      TIME TO PEAK    (hrs)=       5.00         6.07         5.017
00672>      RUNOFF VOLUME    (mm)=      87.25        55.56        76.171
00673>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00674>      RUNOFF COEFFICIENT   =        .99          .63          .865
00675>
00676>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00677>            CN* =  80.0    Ia = Dep. Storage  (Above)
00678>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00679>            THAN THE STORAGE COEFFICIENT.
00680>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00681>
00682> ------------------------------------------------------------------------------
00683> 001:0028------------------------------------------------------------------------
00684> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00685> ----------------------
00686> | DESIGN NASHYD      |   Area     (ha)=     .14   Curve Number   (CN)=74.00
00687> | 04:UNC4   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00688> ----------------------   U.H. Tp(hrs)=    .110
00689>
00690>      Unit Hyd Qpeak  (cms)=     .049
00691>
00692>      PEAK FLOW       (cms)=     .003 (i)
00693>      TIME TO PEAK    (hrs)=    6.000
00694>      RUNOFF VOLUME    (mm)=   42.618
00695>      TOTAL RAINFALL   (mm)=   88.060
00696>      RUNOFF COEFFICIENT   =     .484
00697>
00698>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00699>
00700> ------------------------------------------------------------------------------
00701> 001:0029------------------------------------------------------------------------
00702> * Catchment UNC5 - Park Direct to Conrail
00703> ----------------------
00704> | DESIGN NASHYD      |   Area     (ha)=    1.73   Curve Number   (CN)=80.00
00705> | 05:UNC5   DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
00706> ----------------------   U.H. Tp(hrs)=    .190
00707>
00708>      Unit Hyd Qpeak  (cms)=     .348
00709>
00710>      PEAK FLOW       (cms)=     .042 (i)
00711>      TIME TO PEAK    (hrs)=    6.017
00712>      RUNOFF VOLUME    (mm)=   49.931
00713>      TOTAL RAINFALL   (mm)=   88.060
00714>      RUNOFF COEFFICIENT   =     .567
00715>
00716>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00717>
00718> ------------------------------------------------------------------------------
00719> 001:0030------------------------------------------------------------------------
00720> * Catchment UNC6 - Rear Lots Direct to Wetland
00721> ----------------------
00722> | DESIGN STANDHYD    |   Area     (ha)=     .64
00723> | 06:UNC6   DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00724> ----------------------
00725>                              IMPERVIOUS    PERVIOUS (i)
00726>      Surface Area     (ha)=        .28          .36
00727>      Dep. Storage     (mm)=        .80         1.50
00728>      Average Slope     (%)=       2.00         2.00
00729>      Length            (m)=      65.32        40.00
00730>      Mannings n             =      .013         .250
00731>
00732>      Max.eff.Inten.(mm/hr)=      13.21        11.19
00733>                    over (min)        4.00        21.00
00734>      Storage Coeff.  (min)=       3.61 (ii)   20.56 (ii)
00735>      Unit Hyd. Tpeak (min)=       4.00        21.00
00736>      Unit Hyd. peak  (cms)=        .30          .05
00737>                                                          *TOTALS*
00738>      PEAK FLOW       (cms)=        .01          .01          .018 (iii)
00739>      TIME TO PEAK    (hrs)=       4.73         6.03         6.000
00740>      RUNOFF VOLUME    (mm)=      87.26        53.80        64.513
00741>      TOTAL RAINFALL   (mm)=      88.06        88.06        88.060
00742>      RUNOFF COEFFICIENT   =        .99          .61          .733
00743>
00744>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00745>            CN* =  80.0    Ia = Dep. Storage  (Above)
00746>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00747>            THAN THE STORAGE COEFFICIENT.
00748>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00749>
00750> ------------------------------------------------------------------------------
00751> 001:0031------------------------------------------------------------------------
00752> * Total Post-Dev Flow North Side
00753> ------------------------
00754> | ADD HYD (TotNorth  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00755> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00756>                        ID1 01:209          8.54      .235    6.00  66.20     .000
00757>                       +ID2 02:EXT4          .25      .005    6.00  42.62     .000
00758>                       +ID3 03:UNC3         1.46      .046    5.02  76.17     .000
00759>                       +ID4 04:UNC4          .14      .003    6.00  42.62     .000
00760>                       +ID5 05:UNC5         1.73      .042    6.02  49.93     .000
00761>                       +ID6 06:UNC6          .64      .018    6.00  64.51     .000
00762>                        ==========================================================
00763>                        SUM 08:TotNorth     12.76      .349    6.00  64.33     .000
00764>
00765>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00766>
00767> ------------------------------------------------------------------------------
00768> 001:0032------------------------------------------------------------------------
00769> * Total Uncontrolled Flow to Conrail
00770> ------------------------
00771> | ADD HYD (TotUnc    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00772> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00773>                        ID1 03:UNC3          1.46      .046    5.02  76.17     .000
00774>                       +ID2 04:UNC4          .14      .003    6.00  42.62     .000
00775>                       +ID3 05:UNC5         1.73      .042    6.02  49.93     .000
00776>                        ==========================================================
00777>                        SUM 07:TotUnc        3.33      .090    6.00  61.13     .000
00778>
00779>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00780>
00781> ------------------------------------------------------------------------------
00782> 001:0033------------------------------------------------------------------------
00783> * Total Flow to Pond
00784> ------------------------
00785> | ADD HYD (TotPond   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00786> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00787>                        ID1 01:209          8.54      .235    6.00  66.20     .000
00788>                       +ID2 02:EXT4          .25      .005    6.00  42.62     .000
00789>                        ==========================================================
00790>                        SUM 08:TotPond       8.79      .240    6.00  65.53     .000
00791>
00792>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00793>
00794> ------------------------------------------------------------------------------
00795> 001:0034------------------------------------------------------------------------
00796> *#  100yr - 24 hr SCS (NPCA)
00797> ---------------------
00798> | READ STORM       |    Filename: 100yr/24hr
00799> | Ptotal= 102.88 mm|    Comments: 100yr/24hr
00800> ---------------------
00801>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00802>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00803>                .25    .000 |   6.50   2.060 |  12.75  14.820 |  19.00   1.850
00804>                .50   1.130 |   6.75   2.060 |  13.00   7.610 |  19.25   1.850
00805>                .75   1.130 |   7.00   2.060 |  13.25   7.610 |  19.50   1.850
00806>               1.00   1.130 |   7.25   2.060 |  13.50   1.440 |  19.75   1.850
00807>               1.25   1.130 |   7.50   2.060 |  13.75   1.440 |  20.00   1.850
00808>               1.50   1.130 |   7.75   2.060 |  14.00   8.440 |  20.25   1.850
00809>               1.75   1.130 |   8.00   2.060 |  14.25   8.440 |  20.50   1.230
00810>               2.00   1.130 |   8.25   2.060 |  14.50   3.090 |  20.75   1.230
```

```
00811>               2.25   1.130 |   8.50   2.780 |  14.75   3.090 |  21.00   1.230
00812>               2.50   1.340 |   8.75   2.780 |  15.00   3.090 |  21.25   1.230
00813>               2.75   1.340 |   9.00   2.780 |  15.25   3.090 |  21.50   1.230
00814>               3.00   1.340 |   9.25   2.780 |  15.50   3.090 |  21.75   1.230
00815>               3.25   1.340 |   9.50   3.290 |  15.75   3.090 |  22.00   1.230
00816>               3.50   1.340 |   9.75   3.290 |  16.00   3.090 |  22.25   1.230
00817>               3.75   1.340 |  10.00   3.700 |  16.25   3.090 |  22.50   1.230
00818>               4.00   1.340 |  10.25   3.700 |  16.50   1.850 |  22.75   1.230
00819>               4.25   1.340 |  10.50   4.730 |  16.75   1.850 |  23.00   1.230
00820>               4.50   1.650 |  10.75   4.730 |  17.00   1.850 |  23.25   1.230
00821>               4.75   1.650 |  11.00   6.380 |  17.25   1.850 |  23.50   1.230
00822>               5.00   1.650 |  11.25   6.380 |  17.50   1.850 |  23.75   1.230
00823>               5.25   1.650 |  11.50   9.880 |  17.75   1.850 |  24.00   1.230
00824>               5.50   1.650 |  11.75   9.880 |  18.00   1.850 |  24.25   1.230
00825>               5.75   1.650 |  12.00  42.800 |  18.25   1.850 |
00826>               6.00   1.650 |  12.25 113.590 |  18.50   1.850 |
00827>               6.25   1.650 |  12.50  14.820 |  18.75   1.850 |
00828>
00829> --------------------------------------------------------------------------------
00830> 001:0035--------------------------------------------------------------------------
00831> * Catchment 209 - North Side Post-Development Controlled
00832> ----------------------
00833> | DESIGN STANDHYD     |   Area    (ha)=    8.54
00834> | 01:209     DT= 1.00 |   Total Imp(%)=   54.00   Dir. Conn.(%)=   45.00
00835> ----------------------
00836>                              IMPERVIOUS    PERVIOUS (i)
00837>      Surface Area     (ha)=       4.61         3.93
00838>      Dep. Storage     (mm)=        .80         1.50
00839>      Average Slope     (%)=        .50          .50
00840>      Length            (m)=     238.61        40.00
00841>      Mannings n             =       .013         .250
00842>
00843>      Max.eff.Inten.(mm/hr)=     113.59        88.77
00844>                  over (min)        5.00        16.00
00845>      Storage Coeff.  (min)=       5.04 (ii)   16.26 (ii)
00846>      Unit Hyd. Tpeak (min)=       5.00        16.00
00847>      Unit Hyd. peak  (cms)=        .22          .07
00848>                                                            *TOTALS*
00849>      PEAK FLOW       (cms)=       1.15          .59          1.610 (iii)
00850>      TIME TO PEAK    (hrs)=      12.25        12.40         12.267
00851>      RUNOFF VOLUME    (mm)=     102.07        61.20         79.608
00852>      TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
00853>      RUNOFF COEFFICIENT   =        .99          .59           .774
00854>
00855>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00856>            CN* =  76.0    Ia = Dep. Storage  (Above)
00857>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00858>            THAN THE STORAGE COEFFICIENT.
00859>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00860>
00861> --------------------------------------------------------------------------------
00862> 001:0036--------------------------------------------------------------------------
00863> * Catchment EXT4 - Rear Lots - North Side of Site
00864> ----------------------
00865> | DESIGN NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=74.00
00866> | 02:EXT4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00867> ----------------------   U.H. Tp(hrs)=    .090
00868>
00869>      Unit Hyd Qpeak  (cms)=     .106
00870>
00871>      PEAK FLOW       (cms)=     .046 (i)
00872>      TIME TO PEAK    (hrs)=   12.267
00873>      RUNOFF VOLUME    (mm)=   53.919
00874>      TOTAL RAINFALL   (mm)=  102.883
00875>      RUNOFF COEFFICIENT   =     .524
00876>
00877>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00878>
00879> --------------------------------------------------------------------------------
00880> 001:0037--------------------------------------------------------------------------
00881> * Catchment UNC3 - ROW Post-Development Uncontrolled
00882> ----------------------
00883> | DESIGN STANDHYD     |   Area    (ha)=    1.46
00884> | 03:UNC3    DT= 1.00 |   Total Imp(%)=   73.00   Dir. Conn.(%)=   65.00
00885> ----------------------
00886>                              IMPERVIOUS    PERVIOUS (i)
00887>      Surface Area     (ha)=       1.07          .39
00888>      Dep. Storage     (mm)=        .80         1.50
00889>      Average Slope     (%)=        .50          .50
00890>      Length            (m)=      98.66        40.00
00891>      Mannings n             =       .013         .250
00892>
00893>      Max.eff.Inten.(mm/hr)=     113.59       113.95
00894>                  over (min)        3.00        13.00
00895>      Storage Coeff.  (min)=       2.96 (ii)   13.12 (ii)
00896>      Unit Hyd. Tpeak (min)=       3.00        13.00
00897>      Unit Hyd. peak  (cms)=        .38          .09
00898>                                                            *TOTALS*
00899>      PEAK FLOW       (cms)=        .30          .08           .368 (iii)
00900>      TIME TO PEAK    (hrs)=      12.25        12.35         12.250
00901>      RUNOFF VOLUME    (mm)=     102.07        68.65         90.385
00902>      TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
00903>      RUNOFF COEFFICIENT   =        .99          .67           .879
00904>
00905>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00906>            CN* =  80.0    Ia = Dep. Storage  (Above)
00907>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00908>            THAN THE STORAGE COEFFICIENT.
00909>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00910>
00911> --------------------------------------------------------------------------------
00912> 001:0038--------------------------------------------------------------------------
00913> * Catchment UNC4 - Uncontrolled Flows to Conrail Bypass
00914> ----------------------
00915> | DESIGN NASHYD      |   Area    (ha)=     .14   Curve Number   (CN)=74.00
00916> | 04:UNC4   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00917> ----------------------   U.H. Tp(hrs)=    .110
00918>
00919>      Unit Hyd Qpeak  (cms)=     .049
00920>
00921>      PEAK FLOW       (cms)=     .024 (i)
00922>      TIME TO PEAK    (hrs)=   12.267
00923>      RUNOFF VOLUME    (mm)=   53.918
00924>      TOTAL RAINFALL   (mm)=  102.883
00925>      RUNOFF COEFFICIENT   =     .524
00926>
00927>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00928>
00929> --------------------------------------------------------------------------------
00930> 001:0039--------------------------------------------------------------------------
00931> * Catchment UNC5 - Park Direct to Conrail
00932> ----------------------
00933> | DESIGN NASHYD      |   Area    (ha)=    1.73   Curve Number   (CN)=80.00
00934> | 05:UNC5   DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00935> ----------------------   U.H. Tp(hrs)=    .190
00936>
00937>      Unit Hyd Qpeak  (cms)=     .348
00938>
00939>      PEAK FLOW       (cms)=     .273 (i)
00940>      TIME TO PEAK    (hrs)=   12.333
00941>      RUNOFF VOLUME    (mm)=   62.338
00942>      TOTAL RAINFALL   (mm)=  102.883
00943>      RUNOFF COEFFICIENT   =     .606
00944>
00945>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00946>
00947> --------------------------------------------------------------------------------
00948> 001:0040--------------------------------------------------------------------------
00949> * Catchment UNC6 - Rear Lots Direct to Wetland
00950> ----------------------
00951> | DESIGN STANDHYD     |   Area    (ha)=     .64
00952> | 06:UNC6   DT= 1.00 |   Total Imp(%)=   43.00   Dir. Conn.(%)=   32.00
00953> ----------------------
00954>                              IMPERVIOUS    PERVIOUS (i)
00955>      Surface Area     (ha)=        .28          .36
00956>      Dep. Storage     (mm)=        .80         1.50
00957>      Average Slope     (%)=       2.00         2.00
00958>      Length            (m)=      65.32        40.00
00959>      Mannings n             =       .013         .250
00960>
00961>      Max.eff.Inten.(mm/hr)=     113.59       105.11
00962>                  over (min)        2.00         8.00
00963>      Storage Coeff.  (min)=       1.53 (ii)    8.45 (ii)
00964>      Unit Hyd. Tpeak (min)=       2.00         8.00
00965>      Unit Hyd. peak  (cms)=        .66          .14
00966>                                                            *TOTALS*
00967>      PEAK FLOW       (cms)=        .06          .08           .146 (iii)
00968>      TIME TO PEAK    (hrs)=      12.25        12.28         12.250
00969>      RUNOFF VOLUME    (mm)=     102.08        66.68         78.018
00970>      TOTAL RAINFALL   (mm)=     102.88       102.88        102.883
00971>      RUNOFF COEFFICIENT   =        .99          .65           .758
00972>
00973>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00974>            CN* =  80.0    Ia = Dep. Storage  (Above)
00975>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00976>            THAN THE STORAGE COEFFICIENT.
00977>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00978>
00979> --------------------------------------------------------------------------------
00980> 001:0041--------------------------------------------------------------------------
00981> * Total Post-Dev Flow North Side
00982> ----------------------
00983> | ADD HYD (TotNorth  ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00984> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00985>                        ID1 01:209          8.54    1.610   12.27  79.61    .000
00986>                      +ID2 02:EXT4           .25     .046   12.27  53.92    .000
00987>                      +ID3 03:UNC3          1.46     .368   12.25  90.39    .000
00988>                      +ID4 04:UNC4           .14     .024   12.27  53.92    .000
00989>                      +ID5 05:UNC5          1.73     .273   12.33  62.34    .000
00990>                      +ID6 06:UNC6           .64     .146   12.25  78.02    .000
00991>                       ========================================================
00992>                       SUM 08:TotNorth     12.76    2.421   12.27  77.63    .000
00993>
00994>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00995>
00996> --------------------------------------------------------------------------------
00997> 001:0042--------------------------------------------------------------------------
00998> * Total Uncontrolled Flow to Conrail
00999> ----------------------
01000> | ADD HYD (TotUnc    ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01001> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
01002>                        ID1 03:UNC3          1.46     .368   12.25  90.39    .000
01003>                      +ID2 04:UNC4           .14     .024   12.27  53.92    .000
01004>                      +ID3 05:UNC5          1.73     .273   12.33  62.34    .000
01005>                       ========================================================
01006>                       SUM 07:TotUnc         3.33     .630   12.25  74.28    .000
01007>
01008>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01009>
01010> --------------------------------------------------------------------------------
01011> 001:0043--------------------------------------------------------------------------
01012> * Total Flow to Pond
01013> ----------------------
01014> | ADD HYD (TotPond   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01015> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
01016>                        ID1 01:209          8.54    1.610   12.27  79.61    .000
01017>                      +ID2 02:EXT4           .25     .046   12.27  53.92    .000
01018>                       ========================================================
01019>                       SUM 08:TotPond        8.79    1.656   12.27  78.88    .000
01020>
01021>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01022>
01023> --------------------------------------------------------------------------------
01024> 001:0044--------------------------------------------------------------------------
01025>      FINISH
01026> --------------------------------------------------------------------------------
01027> ********************************************************************************
01028>      WARNINGS / ERRORS / NOTES
01029>      -------------------------
01030>    Simulation ended on 2021-06-07     at 16:14:01
01031> ================================================================================
01032>
01033>
```

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

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

Operations & Maintenance Manuals

North Pond - Operations and Maintenance Manual
Niagara Village Development

2592693 Ontario Inc.
c/o 4308 Village Centre Court,
Mississauga ON L4Z 1S2

R.J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga ON L5N 8R9 CANADA

June 2021
300041230.0000

Record of Revisions

Revision	Date	Description
0	June 4, 2021	Initial Submission to Client and Planner

R.J. Burnside & Associates Limited

Report Prepared By:

Laura Garner, P.Eng.
Project Engineer
LG:bs

Report Reviewed By:

Steven Roorda, P.Eng.
Vice President, Land Development
SR:bs

Table of Contents

Tables

Appendices

Disclaimer

1.0 Introduction and Background

This Operation and Maintenance (O&M) Report has been prepared for 2592693 Ontario Inc. to provide a comprehensive maintenance program for the North Pond stormwater management facility on the Niagara Village development lands.

The Niagara Village development 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. The North Pond is located on the north side of the Conrail Drain, generally in the centre of the north portion of the development, adjacent the Drummond Road Extension. Full details of the Stormwater Management Design are described in the June 2021 Stormwater Management Report (SWM) prepared by R.J. Burnside & Associates Limited (Burnside), and associated Plans.

This report outlines the maintenance responsibilities and inspection procedures in accordance with the March 2003 Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual and the Niagara Peninsula Conservation Authority (NPCA) Policies.

The purpose of the SWM facility is:

- To provide stormwater management controls such that the combined pond discharge and uncontrolled flow to the Conrail Drain are controlled below the pre-development rates for all storms up to and including the 100-year design storm.
- To provide Enhanced (Level 1) water quality control.

The SWM facility parameters and operating characteristics are described in the Stormwater Management Report prepared by Burnside.

2.0 Siltation Control Measures

All maintenance activities during construction of the pond and development will be the responsibility of the Developer.

Erosion and sediment control for the construction of the ponds and development shall be in accordance with the detailed erosion and sediment control engineering drawings that will be prepared at the Detailed Design stage.

3.0 Inspection and Monitoring Program

3.1 Frequency of Inspection

The SWM facility will require careful monitoring, particularly in the initial years of operation. Inspections are an important part of this monitoring program. Regular visual inspections should be conducted:

- After every significant rainfall (>10 mm) for the first two years of operation.
- Annually after the initial 2-year period.

3.2 Checklist

An inspection checklist for the SWM facility is located in Appendix A. This checklist shall be completed following each site visit and a record of the completed checklists may be kept by the City to provide an ongoing record of maintenance activities.

Annual inspection checklists shall be maintained for the life of the facility and provided to the City, Conservation Authority and Ontario Ministry of the Environment, Conservation and Parks upon request. The annual inspection and maintenance activities should include reporting of the following items:

- Condition of vegetation in and around the SWM facility and grassed swale.
- Hydraulic operation of the SWM facility (detention time, evidence of occurrence of overflows).
- Evidence of spills and oil/grease contamination.
- Occurrence of obstructions at the inlet and outlet.
- Frequency of trash build up.
- Measured sediment depths (where appropriate).
- Maintenance and operation activities.
- Recommendations for inspection and maintenance program for the following year.

4.0 Maintenance Tasks

4.1 Grass Cutting

Grass cutting within the SWM facility is not recommended in order to maintain a natural environment and increased water quality benefits associated with vegetative buffers.

Should grass cutting be required to enhance the perceived aesthetics of the facility, the following practices should be considered:

- Minimize frequency of cutting.
- Do not cut grass up to edge of SWM facility (to maintain shading and nutrient uptake).
- Do not blow grass clippings into SWM facility (to minimize organic loading).

4.2 Weed Control

Weed control is not an anticipated or recommended practice for the SWM facility. Should weed control be required, the following items should be considered:

- Weeding should generally be done by hand to protect the surrounding vegetation.
- Prohibit the use of herbicides and insecticides for potential water quality concerns associated with downstream uses.
- Limit the use of fertilizer with weed control (to prevent potential nutrient loading to the downstream areas)

4.3 Plantings

Any replacement plantings required due to disturbance or die-out (upland, shoreline fringe, aquatic), are to be in accordance with the Landscape Plans, or as otherwise deemed appropriate by the City. Native species should be utilized where possible for all plantings.

4.4 Litter/Debris Removal

Accumulated litter and debris within the facility can be removed by hand during the regular inspection periods.

4.5 Outlet Structure

The outlet structure and associated flow control device shall be inspected for blockage and cleared of debris (if required) on a regular basis (at the same time as the pond inspections). In addition, any sediment build-up within the structure shall be pumped out by vacuum truck and disposed of accordingly.

4.6 Sediment Removal

In order to maintain the removal efficiency of the sediment forebay portion of the facility, the accumulated sediment will need to be removed periodically.

4.6.1 Cleanout Frequency

The accumulated sediment within the SWM facility should be cleaned out when the removal efficiency has been reduced by 5% or when the capacity of the permanent pool within the sediment forebays have been reduced by 50%. Based on the calculation provided in Appendix B, sediment removal will be required every 107 years, when the efficiency for removal of sediment drops below 75%. The proposed cleanout frequency is every 10 years. Refer to Appendix B for sediment cleanout frequency calculations.

4.6.2 Sediment Removal Procedure

The following is a suggested method of sediment removal for the SWM facility:

1. Drain the pond via gravity and pump out any remaining water to the outlet structure. Use a silt bag at the end of the pumped effluent and place intake on a hard surface such as a patio stone.

2. Excavated accumulated sediments using an excavator (equipped with long boom) from the wet pond forebay areas. Excavated sediment shall be placed immediately in a truck for disposal to minimize disturbance of existing aquatic and upland vegetation.

3. Restore vegetation as per the Landscape Plan or as otherwise deemed appropriate by the City.

4.6.3 Sediment Disposal

1. Sediments are to be tested in accordance with MECP sediment disposal guidelines.

2. Sediment is to be removed off-site to either a sanitary landfill or to a drying area and then a fill area (as deemed appropriate by sediment testing and the Municipality).

4.7 Winter Operation

There are no special requirements for winter operation.

5.0 Unscheduled/Emergency Maintenance

Failure of any feature impacting the operation of the SWM facility should be rectified immediately to minimize impacts on the receiving watercourse. In case of pond failure, personnel should be notified immediately. Table 1 identifies the contact personnel.

Table 1: Contact Personnel

Personnel	Phone Number
TO BE CONFIRMED BY CITY OF NIAGARA FALLS	

6.0 Safety

6.1 Vegetation

The Landscape Plans utilize strategic planting locations and species to discourage direct access to the pond wherever possible. Any re-vegetation should be completed in accordance with these Plans.

6.2 Signage

Warning signs are specified at key locations around the pond to inform the public that rapid water level changes could occur within the pond. In addition, safety signing should be installed in conjunction with any walkway system to notify the public of the potential safety concerns associated with flooding that may occur in the overland flow routes during rainfall events.

6.3 Infrastructure

Safety grates are required on all large, exposed orifices. Handrails will be placed on the pond headwalls for pedestrian safety.

7.0 Conclusion

This report has clearly identified the maintenance responsibilities and procedures required to efficiently maintain the Niagara Village Subdivision North stormwater management facility.

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Appendix A

Inspection and Monitoring Checklist

Niagara Village Subdivision North Stormwater Management Pond
SWM Inspection / Maintenance Checklist

Inspection Date:

		Maintenance Required Y/N	Comments / Recommended Maintenance
Stormwater Management Pond			
Outlet	Outlet Blockage - If the pond has not drained 48 hours after a rainfall, check and remove any blockages around the ditch inlet catch basin.		
	Is there trash or sediment buildup or blockage at the outlet or in the ditch inlet catch basin?		
Inlet	If there is sediment backing up into the pond inlet pipe it is time to clean out the pond.		
	Is there a blockage at the inlet?		
Sediment Depth	If the forebay of the pond becomes 50% full of sediment, it will need to be cleaned out. The anticipated cleanout frequency is every 10 years.		
Shoreline Vegetation	If the vegetation is dead or dying, remove and replace the vegetation.		
Upland Vegetation	If the vegetation is dead or dying, remove and replace the vegetation.		
Berm Stability	If there are any signs of cracking or slumping, call the engineer.		
Erosion	Are there any signs of erosion within the SWM facility?		
Maintenance Access	Check to ensure the road is in fair condition and restore road as necessary.		

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Appendix B

Sediment Cleanout Frequency Calculations

Sediment Cleanout Frequency
Wet Pond

BURNSIDE

Project: Niagara Village - NORTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

Imperviousness	52.74	%
Enhanced Quality Volume Required:	1620	cum/ha
which includes:	1269	cum for Perm. Pool
	40	cum/ha for Ext. Det.
Site Contributing Drainage Area	8.8	ha
Permanent Pool Details:		
Permanent Pool Required (per MC	1269	cum
Permanent Pool Provided	2567	cum
Annual loading:	1.75	cum/ha/year
(Drainage Area)(loading rate) =	15.4	cum/year

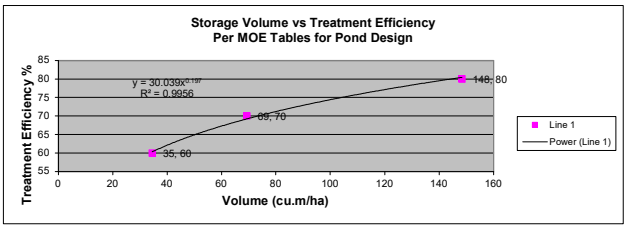
For "ENHANCED PROTECTION" the Design Efficiency of the facility is 80%. The Target Efficiency is 75%.
The pond requires cleanout when the efficiency for removal of sediment drops below Target Efficiency (75%).

Wet PondDesign Parameters	Volume (cum/ha)	Treatment Efficiency (%)
Enhanced Permanent Pool Volume	148	80
Normal Permanent Pool Volume	69	70
Basic Permanent Pool Volume	35	60

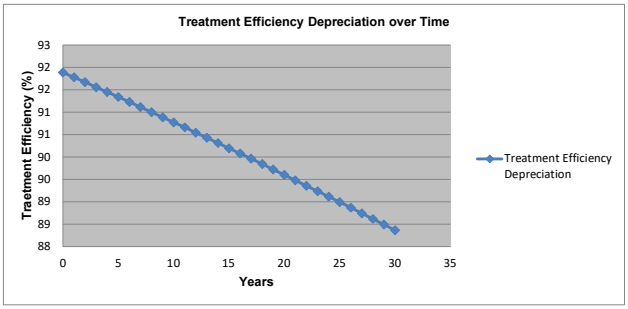
Efficiency at Cleanout	75	%
Cleanout Frequency	107	years

SEDIMENT RESULT CHART

Years	Sediment Accumulation (cu.m)	Available P.P. (cu.m)	PP (cu.m/ha)	Treatment Efficiency (%)
0	0.0	2567.3	292.1	91.89
1	15.4	2551.9	290.3	91.78
2	30.8	2536.4	288.6	91.67
3	46.2	2521.0	286.8	91.56
4	61.6	2505.6	285.1	91.45
5	77.0	2490.2	283.3	91.34
6	92.5	2474.8	281.5	91.23
7	107.9	2459.4	279.8	91.11
8	123.3	2444.0	278.0	91.00
9	138.7	2428.6	276.3	90.89
10	154.1	2413.2	274.5	90.77
11	169.5	2397.8	272.8	90.66
12	184.9	2382.4	271.0	90.55
13	200.3	2366.9	269.3	90.43
14	215.7	2351.5	267.5	90.31
15	231.1	2336.1	265.8	90.20
16	246.5	2320.7	264.0	90.08
17	262.0	2305.3	262.3	89.96
18	277.4	2289.9	260.5	89.84
19	292.8	2274.5	258.8	89.72
20	308.2	2259.1	257.0	89.60
21	323.6	2243.7	255.3	89.48
22	339.0	2228.3	253.5	89.36
23	354.4	2212.8	251.7	89.24
24	369.8	2197.4	250.0	89.12
25	385.2	2182.0	248.2	88.99
26	400.6	2166.6	246.5	88.87
27	416.0	2151.2	244.7	88.74
28	431.5	2135.8	243.0	88.62
29	446.9	2120.4	241.2	88.49
30	462.3	2105.0	239.5	88.36
107	1648.8	918.5	104.5	75.05
108	1664.2	903.1	102.7	74.80
109	1679.6	887.7	101.0	74.55
110	1695.0	872.3	99.2	74.29
111	1710.4	856.8	97.5	74.03
112	1725.8	841.4	95.7	73.76
113	1741.2	826.0	94.0	73.50
114	1756.6	810.6	92.2	73.22
115	1772.1	795.2	90.5	72.95
116	1787.5	779.8	88.7	72.67
117	1802.9	764.4	87.0	72.38
118	1818.3	749.0	85.2	72.09
119	1833.7	733.6	83.5	71.80
120	1849.1	718.2	81.7	71.50
121	1864.5	702.8	79.9	71.19
122	1879.9	687.3	78.2	70.88



The following power trendline best describes the relationship between available permanent pool and overall treatment efficiency **y= c * x ^ b**	c=	30.04
	b=	0.20



South Pond - Operations and Maintenance Manual
Niagara Village Development

2592693 Ontario Inc.
c/o 4308 Village Centre Court,
Mississauga ON L4Z 1S2

R.J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga ON L5N 8R9 CANADA

June 2021
300041230.0000

Record of Revisions

Revision	Date	Description
0	June 9, 2021	Initial Submission to Client and Planner

R.J. Burnside & Associates Limited

Report Prepared By:

Laura Garner, P.Eng.
Project Engineer
LG:bs

Report Reviewed By:

Steven Roorda, P.Eng.
Vice President, Land Development
SR:bs

Table of Contents

Tables

Appendices

Disclaimer

1.0 Introduction and Background

This Operation and Maintenance (O&M) Report has been prepared for 2592693 Ontario Inc. to provide a comprehensive maintenance program for the South Pond stormwater management facility on the Niagara Village development lands.

The Niagara Village development 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. The South Pond is located on the south side of the site, adjacent to the existing southern watercourse and the Ramsey Road Extension. Full details of the Stormwater Management Design are described in the June 2021 Stormwater Management Report (SWM) prepared by R.J. Burnside & Associates Limited (Burnside), and associated Plans.

This report outlines the maintenance responsibilities and inspection procedures in accordance with the March 2003 Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual and the Niagara Peninsula Conservation Authority (NPCA) Policies.

The purpose of the SWM facility is:

- To provide stormwater management controls such that the combined pond discharge and uncontrolled flow to the southern watercourse are controlled below the pre-development rates for all storms up to and including the 100-year design storm.
- To provide Enhanced (Level 1) water quality control.
- To provide a 24-hour extended detention of the 25 mm storm event.

The SWM facility parameters and operating characteristics are described in the Stormwater Management Report prepared by Burnside.

2.0 Siltation Control Measures

All maintenance activities during construction of the pond and development will be the responsibility of the Developer.

Erosion and sediment control for the construction of the ponds and development shall be in accordance with the detailed erosion and sediment control engineering drawings that will be prepared at the Detailed Design stage.

3.0 Inspection and Monitoring Program

3.1 Frequency of Inspection

The SWM facility will require careful monitoring, particularly in the initial years of operation. Inspections are an important part of this monitoring program. Regular visual inspections should be conducted:

- After every significant rainfall (>10 mm) for the first two years of operation.
- Annually after the initial 2-year period.

3.2 Checklist

An inspection checklist for the SWM facility is located in Appendix A. This checklist shall be completed following each site visit and a record of the completed checklists may be kept by the City to provide an ongoing record of maintenance activities.

Annual inspection checklists shall be maintained for the life of the facility and provided to the City, Conservation Authority and Ontario Ministry of the Environment, Conservation and Parks upon request. The annual inspection and maintenance activities should include reporting of the following items:

- Condition of vegetation in and around the SWM facility and grassed swale.
- Hydraulic operation of the SWM facility (detention time, evidence of occurrence of overflows).
- Evidence of spills and oil/grease contamination.
- Occurrence of obstructions at the inlet and outlet.
- Frequency of trash build up.
- Measured sediment depths (where appropriate).
- Maintenance and operation activities.
- Recommendations for inspection and maintenance program for the following year.

4.0 Maintenance Tasks

4.1 Grass Cutting

Grass cutting within the SWM facility is not recommended in order to maintain a natural environment and increased water quality benefits associated with vegetative buffers.

Should grass cutting be required to enhance the perceived aesthetics of the facility, the following practices should be considered:

- Minimize frequency of cutting.
- Do not cut grass up to edge of SWM facility (to maintain shading and nutrient uptake).
- Do not blow grass clippings into SWM facility (to minimize organic loading).

4.2 Weed Control

Weed control is not an anticipated or recommended practice for the SWM facility. Should weed control be required, the following items should be considered:

- Weeding should generally be done by hand to protect the surrounding vegetation.
- Prohibit the use of herbicides and insecticides for potential water quality concerns associated with downstream uses.
- Limit the use of fertilizer with weed control (to prevent potential nutrient loading to the downstream areas).

4.3 Plantings

Any replacement plantings required due to disturbance or die-out (upland, shoreline fringe, aquatic), are to be in accordance with the Landscape Plans, or as otherwise deemed appropriate by the City. Native species should be utilized where possible for all plantings.

4.4 Litter/Debris Removal

Accumulated litter and debris within the facility can be removed by hand during the regular inspection periods.

4.5 Outlet Structure/Extended Detention Outlet

The outlet structure and associated flow control device shall be inspected for blockage and cleared of debris (if required) on a regular basis (at the same time as the pond inspections). In addition, any sediment build-up within the structure shall be pumped out by vacuum truck and disposed of accordingly.

4.6 Sediment Removal

In order to maintain the removal efficiency of the sediment forebay portion of the facility, the accumulated sediment will need to be removed periodically.

4.6.1 Cleanout Frequency

The accumulated sediment within the SWM facility should be cleaned out when the removal efficiency has been reduced by 5% or when the capacity of the permanent pool within the sediment forebays have been reduced by 50%. Based on the calculation provided in Appendix B, sediment removal will be required every 100 years, when the efficiency for removal of sediment drops below 75%. The proposed cleanout frequency is every 10 years. Refer to Appendix B for sediment cleanout frequency calculations.

4.6.2 Sediment Removal Procedure

The following is a suggested method of sediment removal for the SWM facility:

1. Drain the pond via gravity and pump out any remaining water to the outlet structure. Use a silt bag at the end of the pumped effluent and place intake on a hard surface such as a patio stone.

2. Excavated accumulated sediments using an excavator (equipped with long boom) from the wet pond forebay areas. Excavated sediment shall be placed immediately in a truck for disposal to minimize disturbance of existing aquatic and upland vegetation.

3. Restore vegetation as per the Landscape Plan or as otherwise deemed appropriate by the City.

4.6.3 Sediment Disposal

1. Sediments are to be tested in accordance with MECP sediment disposal guidelines.

2. Sediment is to be removed off-site to either a sanitary landfill or to a drying area and then a fill area (as deemed appropriate by sediment testing and the Municipality).

4.7 Winter Operation

There are no special requirements for winter operation.

5.0 Unscheduled/Emergency Maintenance

Failure of any feature impacting the operation of the SWM facility should be rectified immediately to minimize impacts on the receiving watercourse. In case of pond failure, personnel should be notified immediately. Table 1 identifies the contact personnel.

Table 1: Contact Personnel

Personnel	Phone Number
TO BE CONFIRMED BY CITY OF NIAGARA FALLS	

6.0 Safety

6.1 Vegetation

The Landscape Plans utilize strategic planting locations and species to discourage direct access to the pond wherever possible. Any re-vegetation should be completed in accordance with these Plans.

6.2 Signage

Warning signs are specified at key locations around the pond to inform the public that rapid water level changes could occur within the pond. In addition, safety signing should be installed in conjunction with any walkway system to notify the public of the potential safety concerns associated with flooding that may occur in the overland flow routes during rainfall events.

6.3 Infrastructure

Safety grates are required on all large, exposed orifices. Handrails will be placed on the pond headwalls for pedestrian safety.

7.0 Conclusion

This report has clearly identified the maintenance responsibilities and procedures required to efficiently maintain the Niagara Village Subdivision North stormwater management facility.

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Appendix A

Inspection and Monitoring Checklist

Niagara Village Subdivision South Stormwater Management Pond
SWM Inspection / Maintenance Checklist

Inspection Date:

		Maintenance Required Y/N	Comments / Recommended Maintenance
Stormwater Management Pond			
Outlet	Outlet Blockage - If the pond has not drained 48 hours after a rainfall, check and remove any blockages around the ditch inlet catch basin.		
	Is there trash or sediment buildup or blockage at the outlet or in the ditch inlet catch basin?		
Inlet	If there is sediment backing up into the pond inlet pipe it is time to clean out the pond.		
	Is there a blockage at the inlet?		
Sediment Depth	If the forebay of the pond becomes 50% full of sediment, it will need to be cleaned out. The anticipated cleanout frequency is every 10 years.		
Shoreline Vegetation	If the vegetation is dead or dying, remove and replace the vegetation.		
Upland Vegetation	If the vegetation is dead or dying, remove and replace the vegetation.		
Berm Stability	If there are any signs of cracking or slumping, call the engineer.		
Erosion	Are there any signs of erosion within the SWM facility?		
Maintenance Access	Check to ensure the road is in fair condition and restore road as necessary.		

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Appendix B

Sediment Cleanout Frequency Calculations

Sediment Cleanout Frequency
Wet Pond

BURNSIDE

Project: Niagara Village - SOUTH
File: 300041230
Designed by: L.Garner
Date: 31-May-21

Imperviousness	64.62	%
Enhanced Quality Volume Required:	6063	cum/ha
which includes:	4922	cum for Perm. Pool
	40	cum/ha for Ext. Det.
Site Contributing Drainage Area	28.5	ha
Permanent Pool Details:		
Permanent Pool Required (per MC	4922	cum
Permanent Pool Provided	10081	cum
Annual loading:	2.48	cum/ha/year
(Drainage Area)(loading rate) =	70.7	cum/year

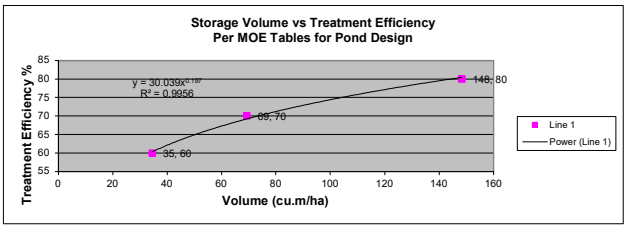
For "ENHANCED PROTECTION" the Design Efficiency of the facility is 80%. The Target Efficiency is 75%.
The pond requires cleanout when the efficiency for removal of sediment drops below Target Efficiency (75%).

Wet PondDesign Parameters	Volume (cum/ha)	Treatment Efficiency (%)
Enhanced Permanent Pool Volume	148	80
Normal Permanent Pool Volume	69	70
Basic Permanent Pool Volume	35	60

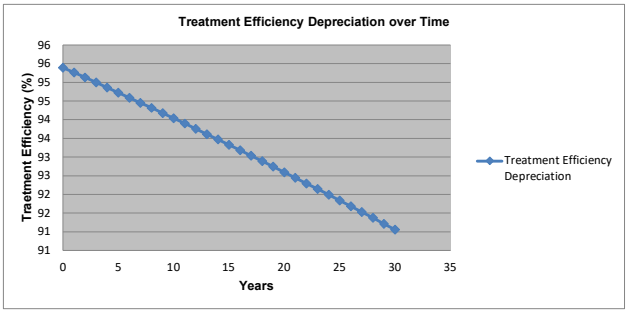
Efficiency at Cleanout	75	%
Cleanout Frequency	100	years

SEDIMENT RESULT CHART

Years	Sediment Accumulation (cu.m)	Available P.P. (cu.m)	PP (cu.m/ha)	Treatment Efficiency (%)
0	0.0	10080.9	353.2	95.39
1	70.7	10010.2	350.7	95.26
2	141.4	9939.5	348.3	95.13
3	212.1	9868.8	345.8	95.00
4	282.8	9798.1	343.3	94.86
5	353.5	9727.4	340.8	94.73
6	424.2	9656.7	338.4	94.59
7	494.9	9586.0	335.9	94.45
8	565.6	9515.3	333.4	94.31
9	636.3	9444.5	330.9	94.18
10	707.0	9373.8	328.4	94.04
11	777.8	9303.1	326.0	93.90
12	848.5	9232.4	323.5	93.76
13	919.2	9161.7	321.0	93.61
14	989.9	9091.0	318.5	93.47
15	1060.6	9020.3	316.1	93.33
16	1131.3	8949.6	313.6	93.18
17	1202.0	8878.9	311.1	93.04
18	1272.7	8808.2	308.6	92.89
19	1343.4	8737.5	306.1	92.74
20	1414.1	8666.8	303.7	92.60
21	1484.8	8596.1	301.2	92.45
22	1555.5	8525.4	298.7	92.30
23	1626.2	8454.7	296.2	92.15
24	1696.9	8384.0	293.8	91.99
25	1767.6	8313.3	291.3	91.84
26	1838.3	8242.6	288.8	91.69
27	1909.0	8171.9	286.3	91.53
28	1979.7	8101.2	283.9	91.37
29	2050.4	8030.5	281.4	91.22
30	2121.1	7959.7	278.9	91.06
31	2191.8	7889.0	276.4	90.90
32	2262.6	7818.3	273.9	90.74
33	2333.3	7747.6	271.5	90.57
34	2404.0	7676.9	269.0	90.41
35	2474.7	7606.2	266.5	90.25
96	6787.7	3293.2	115.4	76.53
97	6858.4	3222.5	112.9	76.20
98	6929.1	3151.8	110.4	75.87
99	6999.8	3081.1	108.0	75.53
100	7070.5	3010.4	105.5	75.19
101	7141.2	2939.7	103.0	74.84
102	7211.9	2869.0	100.5	74.48
103	7282.6	2798.3	98.0	74.11
104	7353.3	2727.6	95.6	73.74
105	7424.0	2656.9	93.1	73.36
106	7494.7	2586.2	90.6	72.97
107	7565.4	2515.5	88.1	72.57
108	7636.1	2444.8	85.7	72.17
109	7706.8	2374.1	83.2	71.75
110	7777.5	2303.4	80.7	71.33
111	7848.2	2232.7	78.2	70.89
112	7918.9	2162.0	75.8	70.44
113	7989.6	2091.3	73.3	69.98
114	8060.3	2020.6	70.8	69.51
115	8131.0	1949.8	68.3	69.02
116	8201.7	1879.1	65.8	68.52
117	8272.4	1808.4	63.4	68.01
118	8343.2	1737.7	60.9	67.48
119	8413.9	1667.0	58.4	66.93
120	8484.6	1596.3	55.9	66.36
121	8555.3	1525.6	53.5	65.77
122	8626.0	1454.9	51.0	65.16



The following power trendline best describes the relationship between available permanent pool and overall treatment efficiency **y= c * x ^ b**	c=	30.04
	b=	0.20



BURNSIDE

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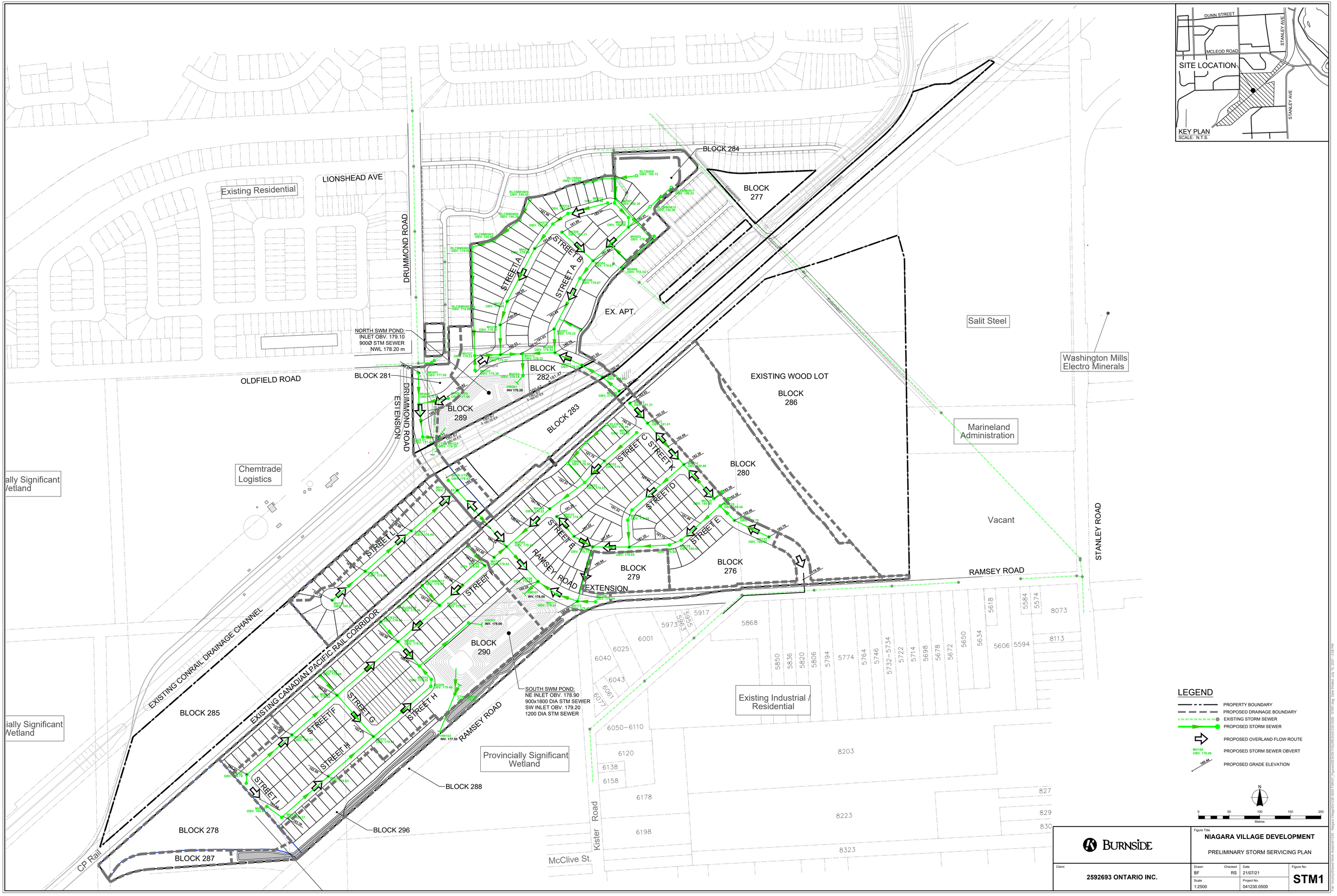
Drawings



BURNSIDE

Figure Title
NIAGARA VILLAGE DEVELOPMENT
PRELIMINARY STORM SERVICING PLAN

Client
2592693 ONTARIO INC.

Drawn	Checked	Date
BF	RS	21/07/21

Scale	Project No.
1:2500	041230.0500

Figure No.
STM1

LIONSHEAD AVENUE

DRUMMOND ROAD

DRUMMOND ROAD EXTENSION

OLDFIELD ROAD

EAGLEWOOD DRIVE

CLUBVIEW LANE

JOHN DALY WAY

GREEN VISTA GATE

STREET A

STREET B

STREET K

STREET C

BLOCK 277

BLOCK 280

BLOCK 281

BLOCK 282

BLOCK 283

BLOCK 284

BLOCK 286

BLOCK 289

EX. APT.

WOODLOT

Easement

EXISTING CONRAIL DRAINAGE CHANNEL

EXISTING CANADIAN PACIFIC RAIL CORRIDOR

EXISTING CULVERT

EXISTING CATCHBASIN WITH OUTLET TO CONRAIL DRAIN

DUNN STREET

MCLEOD ROAD

STANLEY AVE

SITE LOCATION

KEY PLAN
SCALE: N.T.S.

LEGEND

LOT TYPE:

- SPLIT DRAINAGE (S)
- FRONT DRAINAGE (F)
- BACK SPLIT (BS)
- WALK OUT (WO)
- LOOK OUT (LO)

PROPERTY BOUNDARY

EXISTING GRADE ×179.36

PROPOSED GRADE ×190.20

PROPOSED SLOPE 0.55%

OVERLAND FLOW ROUTE

0 20 40 60 80
Metres

BURNSIDE

Figure Title
NIAGARA VILLAGE DEVELOPMENT
PRELIMINARY GRADING PLAN - NORTH

Client
2592693 ONTARIO INC.

Drawn	Checked	Date
BF	DN	21/07/21

Scale: 1:1000
Project No.: 041230.0500
Figure No.: **GRD1**

EXISTING CONRAIL DRAINAGE CHANNEL

EXISTING CANADIAN PACIFIC RAIL CORRIDOR

EX. APT.

STREET A

BLOCK 282

BLOCK 289

BLOCK 283

BLOCK 280

BLOCK 286

BLOCK 276

BLOCK 279

BLOCK 290

STREET C

STREET D

STREET E

STREET F

STREET K

RAMSEY RD EXTENSION

DRUMMOND RD. EXT.

RAMSEY ROAD

KISTER ROAD

WOODLOT

Easement

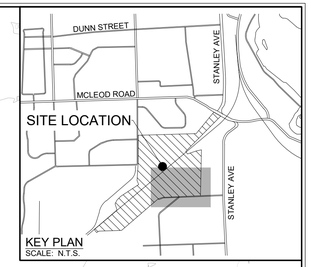
EXISTING CHANNEL TO BE REGRADED SURROUNDING THE WOODLOT IN ACCORDANCE WITH EIS REPORT (JULY 2021). DETAILED GRADING WILL BE COMPLETED AS PART OF DETAILED DESIGN

30m BUFFER FROM WOODLOT

EXISTING CHANNEL TO BE REGRADED SURROUNDING THE WOODLOT IN ACCORDANCE WITH EIS REPORT (JULY 2021). DETAILED GRADING WILL BE COMPLETED AS PART OF DETAILED DESIGN

EXISTING CULVERT

EXISTING CATCHBASIN WITH OUTLET TO CONRAIL DRAIN



LEGEND

LOT TYPE:

- SPLIT DRAINAGE — S
- FRONT DRAINAGE — F
- BACK SPLIT — BS
- WALK OUT — WO
- LOOK OUT — LO
- PROPERTY BOUNDARY
- EXISTING GRADE ×179.36
- PROPOSED GRADE ×190.20
- PROPOSED SLOPE 0.55%
- MAX. 3:1 SLOPE
- OVERLAND FLOW ROUTE

N

0 20 40 60 80
Metres

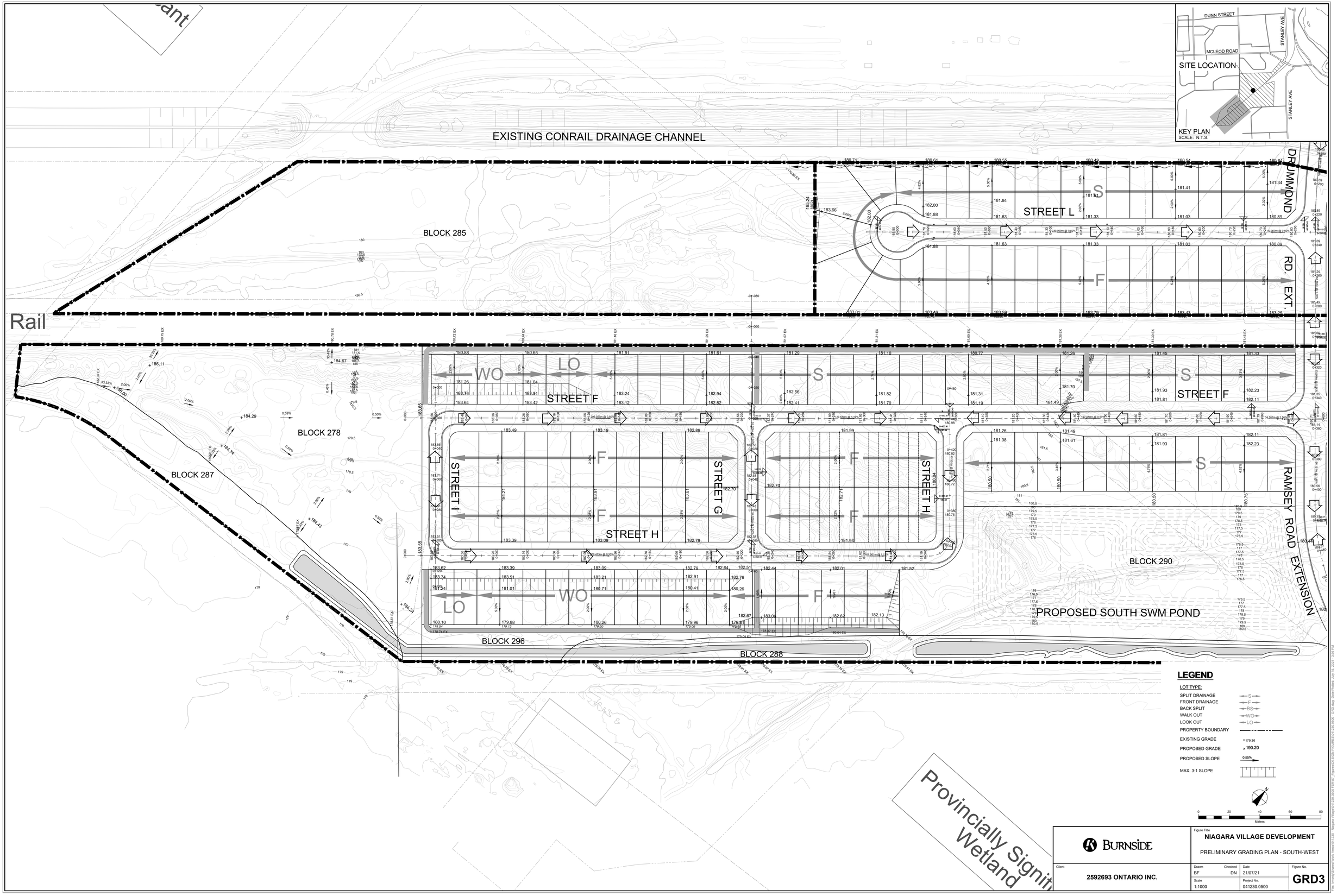
BURNSIDE

Figure Title: **NIAGARA VILLAGE DEVELOPMENT**

PRELIMINARY GRADING PLAN - SOUTH-EAST

Client: **2592693 ONTARIO INC.**

Drawn	Checked	Date	Figure No.
BF	DN	21/07/21	**GRD2**
Scale: 1:1000		Project No.: 041230.0500	



LEGEND

LOT TYPE:

- SPLIT DRAINAGE — S
- FRONT DRAINAGE — F
- BACK SPLIT — BS
- WALK OUT — WO
- LOOK OUT — LO
- PROPERTY BOUNDARY
- EXISTING GRADE ×179.36
- PROPOSED GRADE ×190.20
- PROPOSED SLOPE 0.55%
- MAX. 3:1 SLOPE

0 20 40 60 80
Metres

BURNSIDE

Figure Title
NIAGARA VILLAGE DEVELOPMENT
PRELIMINARY GRADING PLAN - SOUTH-WEST

Client
2592693 ONTARIO INC.

Drawn	Checked	Date	Figure No.
BF	DN	21/07/21	**GRD3**
Scale		Project No.	
1:1000		041230.0500	

KEY PLAN
SCALE: N.T.S.
SITE LOCATION
DUNN STREET
MCLEOD ROAD
STANLEY AVE
Existing Residential
DRUMMOND ROAD
LIONSHEAD AVE
EXISTING CONRAIL DRAINAGE CHANNEL
STREET A
STREET B
OLDFIELD ROAD
SEDIMENT BASIN No. 1
OLDFIELD RD. EXT.
DRUMMOND ROAD EXTENSION
EX. CONRAIL DRAINAGE CHANNEL
EXISTING CANADIAN PACIFIC RAIL CORRIDOR
OLDFIELD ROAD EXTENSION
Salit Steel
Washington Mills Electro Minerals
Marineland Administration
Chemtrade Logistics
ally Significant Wetland
SEDIMENT BASIN No.3
STREET C
STREET D
STREET E
STREET L
Vacant
STANLEY ROAD
RAMSEY ROAD
RAMSEY ROAD EXT.
STREET F
STREET H
STREET G
STREET I
SEDIMENT BASIN No.2
Kister Road
Existing Industrial / Residential
Provincially Significant Wetland
ially Significant Wetland
CP Rail
McClive St.
LEGEND
PROPERTY BOUNDARY
EXISTING SANITARY SEWER
EXISTING STORM SEWER
EXISTING WATERMAIN
EXISTING RURAL WATERMAIN
EXISTING OVER LAND FLOW DIRECTION
LIMIT OF DEVELOPMENT
SWALE
PROPOSED SEDIMENT CONTROL FENCE
PROPOSED DOUBLE RUN SEDIMENT CONTROL FENCE WITH STRAW BALES
N
0 50 100 150 200
Metres
BURNSIDE
Figure Title
NIAGARA VILLAGE DEVELOPMENT
INTERIM CONCEPTUAL EROSION AND SEDIMENT CONTROL PLAN
Client
2592693 ONTARIO INC.
Drawn RS
Checked LG
Date 21/07/21
Scale 1:2500
Project No. 041230.0500
Figure No.
ESC1
File: \\monty\Shared Work Areas\041230 - Niagara Village\041230.0500 FSR\07_Figures\DESIGN FIGURES\041230.0500 - ESC.dwg Date Plotted: July 15, 2021 - 11:38 AM

R.J. Burnside & Associates Limited