S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

WILSON ST.
ANCASTER INC

Functional Servicing Report

392-412 WILSON STREET EAST AND 15 LORNE AVENUE

PROPOSED 8-STOREY MIXED-USE BUILDING

CITY OF HAMILTON

December 2021

SLA File: 20092

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Wilson St. Ancaster Inc. to provide consulting engineering services in support of the re-zoning and official plan amendment for the proposed development located at 392-412 Wilson Street East and 15 Lorne Avenue in the City of Hamilton (see Figure 1.0 for location plan). This report will outline the functional servicing strategy for the proposed development.

The proposed development consists of constructing an 8-storey mixed-use building containing approximately 169 residential units, 1,683m^2 of commercial area and two levels of underground parking. The proposed site will also include concrete curbing/sidewalk, asphalt drive aisle and landscaped areas.

This Functional Servicing Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the preliminary site engineering plans prepared by S. Llewellyn and Associates Limited and the site plan prepared by SRN Architects Inc. for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: City of Hamilton Storm Drainage Policy (2004)

Ref. 3: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 4: City of Hamilton Criteria and Guidelines for Stormwater Management Infrastructure (September 2007)

Ref. 5: Engineering Guidelines for Servicing Land under Development Applications (City of Hamilton, December 2012)

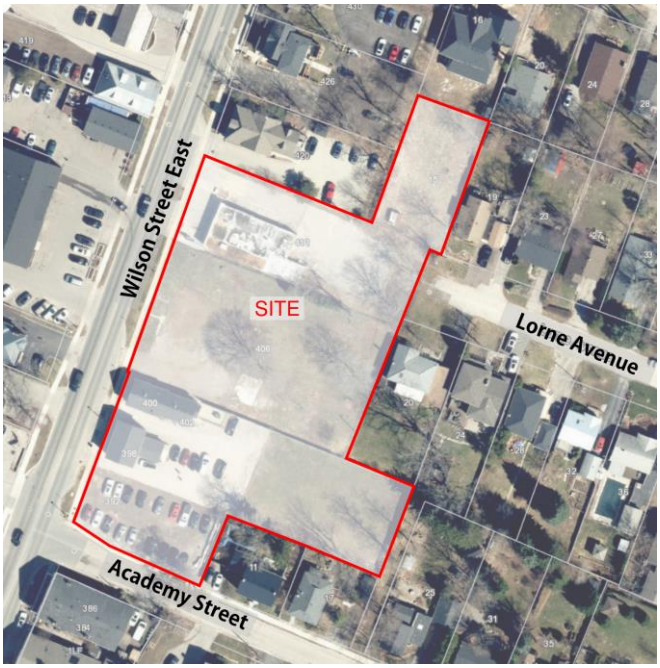


Figure 1.0 - Location Plan

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Hamilton requirements:

Quantity Control

The stormwater discharge rate from the proposed site shall be controlled to the 2-year pre-development flow rate for all storm events (2 to 100-year storm events).

Quality Control

The stormwater runoff from the proposed site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Erosion Control

Erosion and sediment control measures will be implemented in accordance with the standards of the City of Hamilton.

2.1 EXISTING CONDITIONS

In the existing conditions, the approximate 0.78ha land consists of four (4) dwellings with associated driveways and landscaped areas. The site is bound by existing residential lands to the north and east, Academy Street to the south, and Wilson Street East to the west.

The topography of the existing site generally slopes west to east with the majority of the site sheet draining towards the existing residential backyards between Lorne Avenue and Academy Street. The drainage flows overland to Academy Street where it is picked up by roadside ditches and directed north to Rousseaux Street, ultimately discharging to Spencer Creek. The remainder of the site sheet drains to Wilson Street East where is it captured by existing catchbasins within the municipal right-of-way.

An existing 600mmø storm sewer is located adjacent to the property, along Wilson Street East, ultimately discharging to a tributary of Spencer Creek.

Eight (8) catchment areas, Catchments 101, 102, 103, 104, 105, EXT1, EXT2 and EXT3, have been identified in the existing condition. See Table 2.1 and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Catchment 101 represents the existing conditions drainage from the subject site towards Wilson Street East via sheet drainage. All drainage is picked up by the existing 600mmø storm sewer along Wilson Street East, which ultimately outlets to Spencer Creek.

Catchment 102 represents the existing conditions drainage from the subject site towards the existing residential backyards to the east via sheet drainage. All drainage is directed through the existing backyards to Academy Street where it flows north to Rousseaux Street and ultimately Spencer Creek.

Catchment 103 represents the existing conditions drainage from the subject site towards Academy Street via sheet drainage. All drainage is picked up by the existing 300mmø storm sewer along Academy Street, which ultimately outlets to Spencer Creek.

Catchment 104 represents the existing conditions drainage form the subject site towards Lorne Avenue via sheet drainage. All drainage flows overland to Academy Street where it is picked up by roadside ditches flowing north to Rousseaux Street, ultimately outletting to Spencer Creek.

Catchment 105 represents the existing conditions drainage form the subject site towards 16 Brookside Avenue via sheet drainage. All drainage flows overland to Brookside Avenue where it is picked up by roadside ditches flowing north to Rousseaux Street, ultimately outletting to Spencer Creek.

Catchment EXT1 represents the existing conditions drainage from the external residential lots south of the site northeast towards the existing residential backyards via sheet drainage. All drainage is directed through the existing backyards to Academy Street where it flows north to Rousseaux Street and ultimately Spencer Creek.

Catchment EXT2 represents the existing conditions drainage from the external commercial lot north of the site south through the site towards Wilson Street East via sheet drainage. All drainage is directed through the existing backyards to Academy Street where it flows north to Rousseaux Street and ultimately Spencer Creek.

Catchment EXT3 represents the existing conditions drainage from the external commercial lot west of 15 Lorne Avenue northeast through the site towards 16 Brookside Avenue via sheet drainage. All drainage is directed through the existing residential backyard to Brookside Avenue where it flows north to Rousseaux Street and ultimately Spencer Creek. This catchment will be directed around controls in the proposed condition via a cut-off swale and has therefore not been included in allowable flow calculations.

Table 2.1 – Existing Conditions Catchment Areas

Catchment ID	Description	Area (ha)	% Impervious	Runoff Coefficient (C)
101	Drainage to Wilson Street East	0.095	81	0.78
102	Drainage to Residential Backyards	0.561	45	0.54
103	Drainage to Academy Street	0.025	96	0.87
104	Drainage to Lorne Avenue	0.018	17	0.39
105	Drainage to Brookside Avenue	0.078	0	0.25
EXT1	External Drainage Through Site to Residential Backyards	0.033	27	0.43
EXT2	External Drainage Through Site to Wilson Street East	0.003	100	0.90
EXT3	External Drainage Through Site to Brookside Avenue	0.053	72	0.72
	Total	**0.866**	**47**	**0.56**

The allowable discharge from the site was calculated using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates using the 2 to 100-year Mount Hope, City of Hamilton design storms. Table 2.2 summarizes the allowable discharge for all storm events.

Table 2.2 – Allowable Discharge from Site

Storm Event	Discharge to Wilson Street East (m^3/s) [1]	Discharge to Backyard Area (m^3/s) [2]	Discharge to Academy Street (m^3/s)	Discharge to Lorne Avenue (m^3/s)	Discharge to 16 Brookside Avenue (m^3/s) [3]
2-Year	**0.017**	**0.054**	**0.005**	**0.000**	**0.001**
5-Year	0.024	0.078	0.007	0.001	0.004
10-Year	0.028	0.095	0.008	0.001	0.006
25-Year	0.035	0.120	0.010	0.002	0.008
50-Year	0.039	0.141	0.011	0.002	0.010
100-Year	0.044	0.162	0.012	0.003	0.013

[1] Discharge to Wilson Street East = Discharge from Catchment 101 + Discharge from Catchment EXT2
[2] Discharge to Backyard Area = Discharge from Catchment 102 + Discharge from Catchment EXT1
[3] Discharge to 16 Brookside Avenue = Discharge from Catchment 105

2.2 PROPOSED CONDITIONS

It is proposed to develop the site by constructing an 8-storey mixed-use building containing approximately 169 residential units, 1,683m^2 of commercial area and 2 levels of underground parking. The proposed site will also include concrete curbing/sidewalk, asphalt drive aisle and parking lot, and landscaped areas. It is proposed to service the site with a private storm sewer system designed and constructed in accordance with the standards and specifications of the City of Hamilton, directing all captured stormwater runoff to the 600mmø storm sewer located within the Wilson Street East boulevard.

Allocating all stormwater runoff to this location will limit the number of quantity and quality control facilities to one location.

Five (5) catchment areas, Catchments 201, 202, 203, 204 and EXT3, have been identified in the proposed condition. Refer to Table 2.3 below and the Proposed Condition Drainage Area Plan in Appendix A for details.

Catchment 201 represents the drainage area for the portion of the site which will be captured and controlled by the proposed storm sewer system which will discharge to the existing 600mmø storm sewer within Wilson Street East.

Catchment 202 represents the drainage area for the portion of the site which will sheet drain uncontrolled to the residential backyards east of the site. All drainage is directed through the existing backyards to Academy Street where it flows north to Rousseaux Street and ultimately Spencer Creek.

Catchment 203 represents the drainage area for the portion of the site which will sheet drain uncontrolled to Academy Street.

Catchment 204 represents the drainage area for the portion of the site which will sheet drain uncontrolled to Brookside Avenue.

Catchment EXT3 represents the existing conditions drainage from the external commercial lot west of 15 Lorne Avenue northeast through the site towards 16 Brookside Avenue via sheet drainage. All drainage is directed through the existing residential backyard to Brookside Avenue where it flows north to Rousseaux Street and ultimately Spencer Creek. This catchment will be directed around controls in the proposed condition via a cut-off swale and has therefore not been included in flow calculations.

Table 2.3 – Proposed Condition Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
201	Controlled to Wilson Street East	0.759	86	0.81
202	Uncontrolled to Residential Backyards	0.024	0	0.25
203	Uncontrolled to Academy Street	0.010	84	0.80
204	Uncontrolled to Brookside Avenue	0.020	0	0.25
EXT3	External Drainage Through Site to Brookside Avenue	0.053	72	0.72
	Total	**0.866**	**81**	**0.77**

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchment 201 by means of a 75mmø orifice pipe, installed from the SWM tank to MH1, to restrict discharge from the site to the allowable 2-year pre-development discharge rate.

With the installation of on-site quantity control measures for Catchment 201, it will be required to provide stormwater storage during storm events up to and including the 100-year event. To provide the required storage, a cast in place storage vault within the underground parking structure with approximately 509m^3 of storage will be provided. Preliminary sizing details of the proposed storage vault can be found on the Preliminary

Grading and Servicing Plans. See Table 2.4 for the stage-storage-discharge characteristics of the proposed storage tank and Appendix A for additional information.

Table 2.4 – Proposed Condition Stage-Storage-Discharge

Elevation (m)	Storage (m^3)	Discharge (m^3/s)	Comments
226.35	0	0.0000	Bottom of Tank
226.39	0	0.0000	C/L 75mmø Orifice Pipe
226.80	102	0.0080	
227.30	212	0.0115	
227.80	322	0.0142	
228.30	432	0.0164	
228.70	509	0.0179	Top of Tank

The maximum discharge rates and storage volume required for post-development conditions were calculated using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates using the 2 to 100-year Mount Hope, City of Hamilton design storms. The proposed discharge rates and storage volumes can be found in Tables 2.5 and 2.6, with detailed included in Appendix A.

Table 2.5 – Proposed Condition Stormwater Discharge

Catchment Discharge (m^3/s) [1]	Storm Event						Allowable (m^3/s) [2]
	2-Yr.	5-Yr.	10-Yr.	25-Yr.	50-Yr.	100-Yr.	
Wilson St. 201 (controlled)	0.010	0.012	0.013	0.015	0.016	0.017	0.017
Res. Backyard 202 (uncontrolled)	0.000	0.001	0.002	0.003	0.003	0.004	0.054
Academy St. 203 (uncontrolled)	0.002	0.002	0.003	0.0004	0.004	0.005	0.005
Brookside Ave. 204 (uncontrolled)	0.000	0.001	0.001	0.002	0.003	0.003	0.001

[1] Based on SWMHYMO Output. Refer to Appendix A.
[2] From Table 2.2.

Table 2.6 – Proposed Condition Storage Volumes

Storm Event	Storage Volume Required (m^3) [1]	Storage Volume Provided (m^3) [2]
2-Year	156.4	509
5-Year	238.4	
10-Year	295.7	
25-Year	370.5	
50-Year	421.9	
100-Year	480.7	

[1] Based on SWMHYMO Output. Refer to Appendix A.
[2] Refer to Table 2.5.

This analysis determined the following:

- The proposed condition discharge rates will not exceed the allowable 2-year pre-development flow rate from the site with the exception of the 25 to 100-year uncontrolled flows to Brookside Avenue. These flows only exceed the 2-year pre-development allowable flow rate by 2.0 l/s maximum, which is considered negligible.
- Catchment 201 will require 480.7m^3 of stormwater storage during the 100-year event, which can be accommodated within the proposed underground storage vault, having a volume of 509m^3.

Water Quality Control

Water quality control will be achieved through a treatment train approach, designed and constructed as per the standards of the City of Hamilton. See the Preliminary Servicing Plan prepared by S. Llewellyn and Associates Limited for details.

The proposed development is required to achieve an 'Enhanced' (80% TSS removal) level of water quality protection. To achieve this criteria, discharge from Catchment 201 will be subject to a treatment train that consists of ADS FlexStorm Pure Permanent Inlet Filters and a Hydrostorm oil/grit separator (or approved equivalent) before ultimately discharging to the existing 600mmø storm sewer on Wilson Street East.

The Hydroworks sizing software was used to determine the required size of oil/grit separator unit for the site. It was determined that a Hydrostorm HS10 unit will provide 84% TSS removal and 97% average annual runoff treatment. See the Hydrostorm unit sizing procedures in Appendix B for details.

The Hydrostorm unit (HS10) has been certified under the NJDEP for a 50% removal credit. As such, the HS10 has been designed to achieve an 'Enhanced' (80% TSS removal) level of stormwater quality control, but only credited for 50% TSS removal within the treatment train.

Based on similar products, the ADS FlexStorm Pure permanent inlet filters have been assigned a conservative TSS removal efficiency of 35%.

The treatment train mechanisms have been summarized in Table 2.7. In order to calculate the TSS removal from the proposed development, a cumulative weighted average has been taken.

Table 2.7 – Proposed Condition Stormwater Treatment Train

<table>
<tr><th>Surface Type</th><th>Drainage Area (ha)</th><th colspan="3">Treatment Train Mechanism (%TSS Removal)</th><th>Total TSS Removal (%) [4]</th></tr>
<tr><td>Roof</td><td>0.313</td><td rowspan="2">N/A [1] (80%)</td><td></td><td rowspan="3">HydroStorm HS10 (50%) [3]</td><td>90%</td></tr>
<tr><td>Grass</td><td>0.108</td><td rowspan="2">ADS FlexStorm Pure (35%) [2]</td><td>93.5%</td></tr>
<tr><td>Asphalt / Concrete</td><td>0.338</td><td></td><td>67.5%</td></tr>
<tr><td>Total</td><td>0.759</td><td colspan="3"></td><td>80.5%</td></tr>
</table>

[1] Grass and roof surfaces are considered clean runoff which do not require quality treatment and have been assigned a TSS removal of 80%.
[2] The ADS FlexStorm Pure permanent inlet filters have been assigned a conservative TSS removal of 35% based on similar products.
[3] The HydroStorm unit has been designed to achieve 80% TSS removal. As per the standards of the NJDEP, the HydroStorm unit is credited with only 50% TSS removal.
[4] Total TSS removal calculated using the following formula: R=A+B-[(AxB)/100] where R=total TSS removal rate, A=TSS removal rate for first mechanism, B=TSS removal rate for second mechanism

As such, the weighted average TSS removal from the proposed development reveals that the treatment train approach will provide 80.5% TSS removal and meet the 'Enhanced' (80% TSS removal, 90% average annual runoff treatment) level of water quality protection.

Hydrostorm units and ADS FlexStorm Pure filters require regular inspection and maintenance as per the manufacturer's specifications to ensure the unit operates properly. See the Hydrostorm and ADS Flexstorm Pure Maintenance Manuals in Appendix B for details.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks) in the proposed inlet structures as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system; and
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and
- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

For details on the proposed erosion and sediment control for the proposed site, see the Preliminary Grading & Erosion Control Plan included in the engineering drawings.

3.0 SANITARY SEWER SERVICING

3.1 EXSTING CONDITIONS

The site is located on Wilson Street East, north of Academy Street with existing 200mmø sanitary sewers located along Wilson Street East flowing north and along Lorne Avenue and Academy Street flowing east.

3.2 SANITARY DEMAND

The proposed development consists of constructing an 8-storey mixed-use building containing 169 residential units and 1,683m^2 of commercial area. Wastewater generation for the site was calculated based on Table 8.2.1.3.B – Other Occupancies of the 2012 Ontario Building Code for commercial demands and Section E.1.4 – Design Flows of the 2019 City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual for residential demands.

Table 3.1 summarizes the sanitary sewer discharge rates from the proposed site. Sanitary discharge calculations will be confirmed upon completion of the Wastewater Generation Assessment, which will be prepared as part of the Site Plan Approval process.

Table 3.1 – Proposed Sanitary Sewer Discharge

Occupancy Type:	
Residential	360 l/per/day x 2 per/bed x 280 beds **=** 201,600 l/day
Commercial	5 l/m^2 floor area/day x 1,683 m^2 floor area = 8,415 l/day
Waste Generated (l/day):	**210,015**
Total Wastewater Estimate (l/s):	**2.43**

Based on the above, the estimate of sanitary demand for the mixed-use building is:

2.43 l/s

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed mixed-use building will be serviced by a 150mmø sanitary sewer, designed and constructed in accordance with the City of Hamilton standards. Drainage from this sewer will discharge to the existing 200mmø sanitary sewer along Wilson Street East.

The minimum grade of the proposed 150mmø sanitary sewer will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.022 m^3/s (22 l/s). Therefore, the proposed 150mmø sanitary sewer at 2.0% grade is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 200mmø watermain located on Wilson Street East and two 150mmø watermains located on Lorne Avenue and Academy Street. Existing fire hydrants are located at 412 Wilson Street East, adjacent to the west property line, and at the southeast corner of the intersection at Academy Street and Wilson Street East.

4.2 DOMESTIC WATER DEMAND

The following is an estimate of the water usage for the proposed building. Water usage for the site was calculated based on the "Fixture Unit Method" as per Table 7.6.3.2.A. forming part of sentences 7.6.3.1(1) to (3) and 7.6.3.4.(2), (3) and (5) of the 2012 Ontario Building Code. See Table 4.1 for fixture unit (FU) calculations.

Table 4.1 – Domestic Water Demand

Component	No. of Fixtures	FU/ Fixture	Total FU
Lavatory (8.3L/min or less per head) (private)[1,3,4]	251	0.7	175.7
Shower Head (9.5L/min or less per head) (private)[1]	198	1.4	277.2
Water Closet (6 LPF or less with flush tank) (private)[1,3,4]	251	2.2	552.2
Sink (kitchen, domestic, 8.3 L/min or less) (private)[2,4]	170	1.4	238
Dishwasher, domestic (private)[2,4]	170	1.4	238
Clothes Washer (3.5 kg) (private)[3]	169	1.4	236.6
Mop Sink[5]	2	3	6
		Total FU:	**1,723.7**
		Water Usage (l/s):	**18.03**

[1] Each 1-bed unit was assumed to have 1 full bathroom, each 2-bed unit was assumed to have 1.5 bathrooms and each 3-bed unit was assumed to have 2 full bathrooms
[2] Each unit was assumed to have one kitchen, including a dishwasher, and a washing machine
[3] Each commercial space was assumed to have a half bath
[4] The amenity room was assumed to have one half bath and one kitchen with dishwasher
[5] Each parking level was assumed to have one mop sink

Total peak water usage for the site was derived below from the fixture unit count as per Table 7.4.10.5 of the Ontario Building Code.

Total Fixture Unit Count = 1,723.7 FU

Water Usage: 238 IGPM (18.03 l/s)

4.3 FIRE FLOW DEMAND

Fire flow demands for development are governed by a number of guidelines and criteria, such as the Ontario Building Code (OBC), various codes and standards published by the National Fire Protection Association (NFPA) and most recently, the Target Available Fire Flows provided by the City of Hamilton.

The proposed development consists of constructing an 8-storey mixed-use building containing 169 residential units and 1,683m^3 of commercial area. Existing hydrants are located along Wilson Street East and Academy Street, within the required 90m separation to the building face of the proposed building (as per Sentence 3.2.5.7 of the Ontario Building Code).

The fire flow for this building was determined to be the greater of the OBC fire flow calculation (OBC section A-3.2.5.7) or the City of Hamilton Target Available Fire Flow. The result of the OBC fire flow calculation was a maximum flow rate of 9000 l/min (150 l/sec).

This is equal to the City of Hamilton target available fire flow for a Residential Multi (greater than 3 units), which is 150 l/sec. Therefore, the minimum required fire flow for this site is **150 l/sec**. Refer to Appendix C for fire flow calculations.

The following hydrant flow test data for the public fire hydrants in closest proximity to the proposed development have been analyzed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 below summarizes the hydrant flow data made available by the City of Hamilton:

Table 4.2 – Hydrant Flow Test Data

Hydrant ID	AM13H032
Location	Academy Street
Static Pressure	64 psi
Residual Pressure During Test Flow	63 psi
Test Flow Rate	1,030 IGPM (78.0 l/s)
Theoretical Flow @ 20 psi	**7,949 IGPM (602 l/s)**
Hydrant ID	AM13H033
Location	412 Wilson Street East
Static Pressure	88 psi
Residual Pressure During Test Flow	72 psi
Test Flow Rate	1,060 IGPM (80.3 l/s)
Theoretical Flow @ 20 psi	**2,753 IGPM (209 l/s)**

Based on the above hydrant flow test data, the theoretical maximum available flow rate from the hydrant is **209 l/s**, while the maximum required fire flow for the proposed development is only **150 l/s**. Therefore, the water distribution system has adequate pressure and capacity to service the subject site.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

Proposed water servicing for the site consists of connecting a 150mmø water service off of the existing 200mmø watermain adjacent to the site on Wilson Street East. The proposed 150mmø water service will provide domestic and fire water service for the proposed mixed-use building. Water services for the site are to be designed and constructed in accordance with City of Hamilton standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development of 392-412 Wilson Street East and 15 Lorne Avenue can be constructed to meet the requirements of the City of Hamilton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Preliminary Grading & Erosion Control Plan and the Preliminary Site Servicing Plan prepared by S. Llewellyn & Associates Limited;

- A 75mmø orifice pipe be installed as per the Preliminary Site Servicing Plan and this report to provide adequate quantity control;
- An underground storage vault be incorporated into the underground parking garage of the proposed mixed-use building as per the Preliminary Site Servicing Plan and this report to provide effective stormwater storage during storm events;
- A HydroStorm HS10 oil/grit separator and ADS FlexStorm Pure permanent inlet filters be installed as per the Preliminary Site Servicing Plan and this report to provide efficient stormwater quality control;
- Erosion and sediment controls be installed as described in this report to meet City of Hamilton requirements; and
- The proposed sanitary and water servicing system be installed as per the Preliminary Site Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

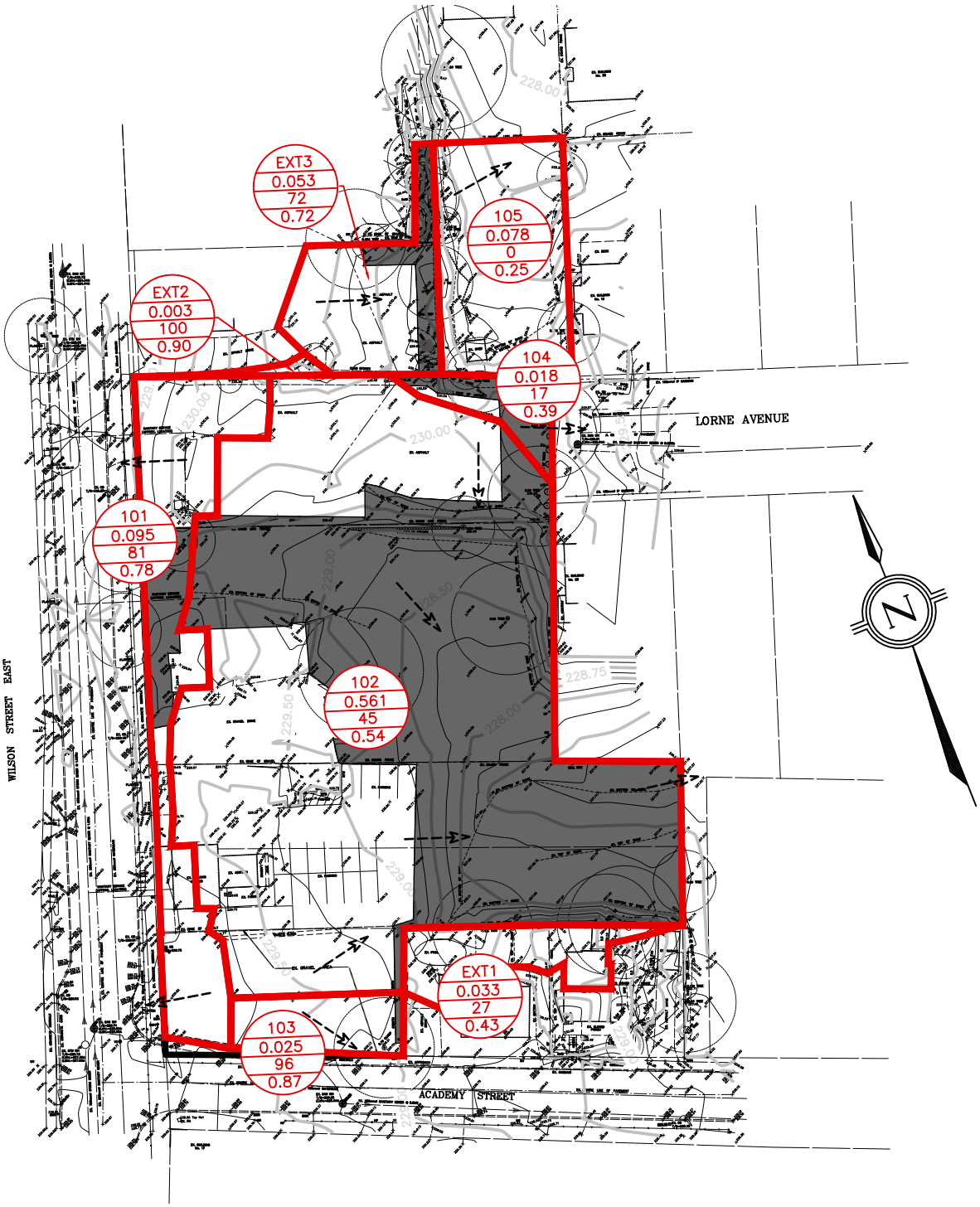
S. LLEWELLYN & ASSOCIATES LIMITED

A. Porco, B.Eng.

S. Frankovich, P.Eng.

APPENDIX A

STORMWATER MANAGEMENT INFORMATION



LEGEND:

- CATCHMENT AREA BOUNDARY
- PERVIOUS AREA
- 203 / 0.10 / 100 / 0.95 — DRAINAGE AREA ID; DRAINAGE AREA (ha); PERCENT IMPERVIOUS; RUNOFF COEFFICIENT
- EXISTING DIRECTION OF DRAINAGE

FIGURE A1
PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:1000

PROJECT: WILSON AT ACADEMY , ANCASTER, ON
PROJECT No.: 20092

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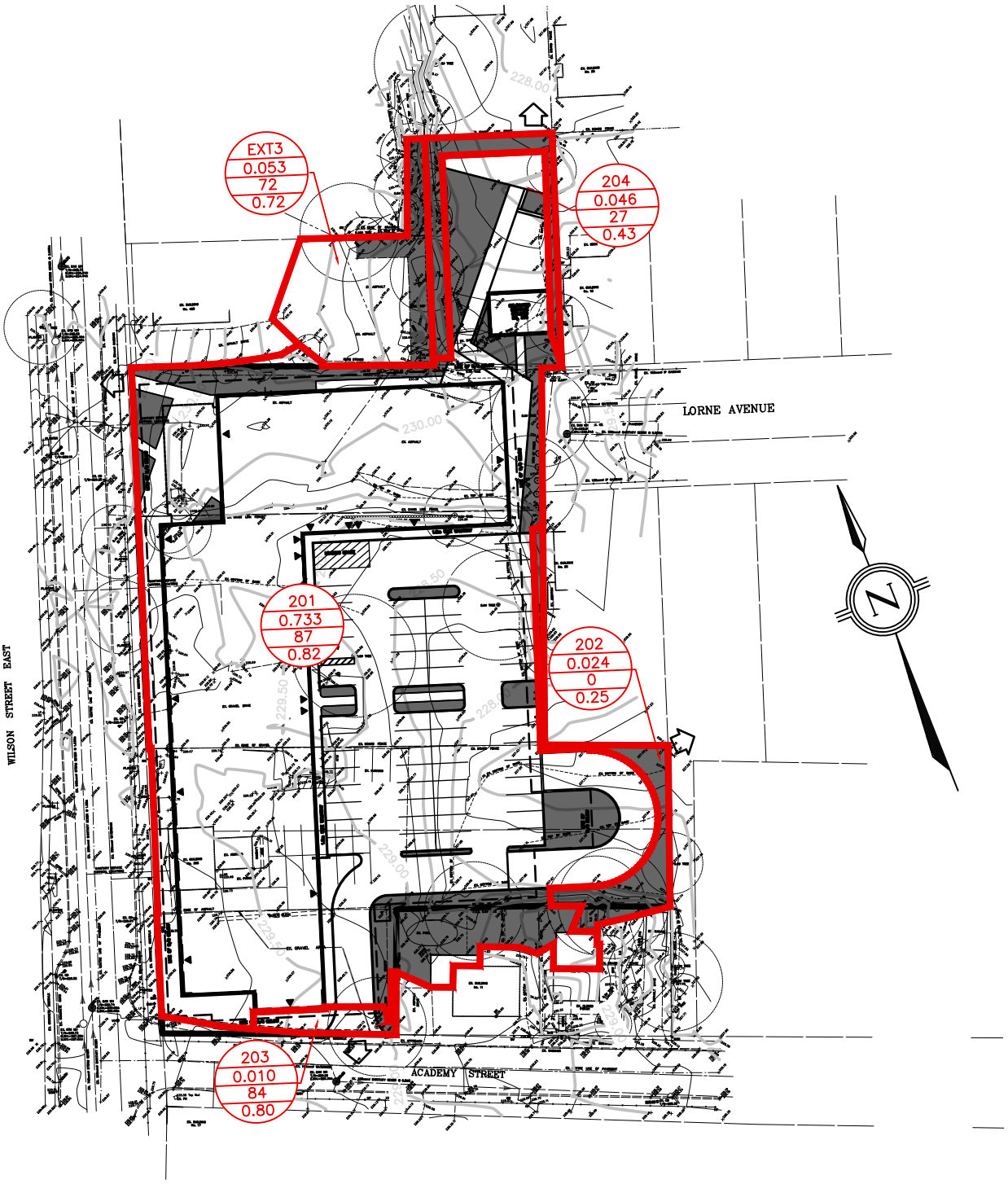

LEGEND:

- CATCHMENT AREA BOUNDARY
- PERVIOUS AREA
- 203 / 0.10 / 100 / 0.95 — DRAINAGE AREA ID; DRAINAGE AREA (ha); PERCENT IMPERVIOUS; RUNOFF COEFFICIENT
- PROPOSED OVERLAND FLOW ROUTE

FIGURE A2
POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:1000

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Ancaster, Ontario

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STAGE-STORAGE-DISCHARGE CALCULATIONS

Outlet Device No. 1 (Quantity)

Type:	Orifice Pipe (Short)
Diameter (mm)	**75**
Area (m^2)	0.00442
Invert Elev. (m)	226.35
C/L Elev. (m)	226.39
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Volumes				Outlet No. 1	
	Elevation m	Area m^2	Tank Incremental Volume	Cumulative Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s
Bottom of Storgae Vault	226.35	220	0	0	0	0	0.0000
C/L of Orifice	226.39	220	0	0	0	0.000	0.0000
0.50m Deep	226.85	220	102	102	102	0.463	0.0080
1.00m Deep	227.35	220	110	212	212	0.963	0.0115
1.50m Deep	227.85	220	110	322	322	1.463	0.0142
2.00m Deep	228.35	220	110	432	432	1.963	0.0164
Top of Storage Vault	228.70	220	77	509	509	2.313	0.0179

```
00001> 2     Metric units
00002> *#*************************************************************************|
00003> *#  Project Name: WILSON AT ACADEMY
00004> *#               HAMILTON, ONTARIO
00005> *#  JOB NUMBER  : 20092
00006> *#       Date   : DECEMBER 2021
00007> *#    Revised   :
00008> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00009> *#       File   : 20092.DAT
00010> *#*************************************************************************|
00011> *
00012> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
00013>                     MTH4002.stm
00014> *
00015> READ STORM          STORM_FILENAME "STORM.001"
00016> *
00017> *#*************************************************************************|
00018> *#
00019> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00020> *#        ============================================
00021> *#
00022> **#************************************************************************|
00023> *# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
00024> CALIB STANDHYD      ID=[1], NHYD=["101"], DT=[1](min), AREA=[0.095](ha),
00025>                     XIMP=[0.81], TIMP=[0.81], DWF=[0](cms), LOSS=[2],
00026>                     SCS curve number CN=[74],
00027>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[2.5](%),
00028>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00029>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[3.5](%),
00030>                                          LGI=[20](m), MNI=[0.013], SCI=[0](min),
00031>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00032> *%-----------------|-------------------------------------------------------|
00033> *# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
00034> CALIB STANDHYD      ID=[2], NHYD=["102"], DT=[1](min), AREA=[0.561](ha),
00035>                     XIMP=[0.45], TIMP=[0.45], DWF=[0](cms), LOSS=[2],
00036>                     SCS curve number CN=[74],
00037>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[5.0](%),
00038>                                          LGP=[65](m), MNP=[0.250], SCP=[0](min),
00039>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00040>                                          LGI=[35](m), MNI=[0.013], SCI=[0](min),
00041>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00042> *%-----------------|-------------------------------------------------------|
00043> *# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
00044> CALIB STANDHYD      ID=[3], NHYD=["103"], DT=[1](min), AREA=[0.025](ha),
00045>                     XIMP=[0.96], TIMP=[0.96], DWF=[0](cms), LOSS=[2],
00046>                     SCS curve number CN=[74],
00047>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[2.0](%),
00048>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00049>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
00050>                                          LGI=[20](m), MNI=[0.013], SCI=[0](min),
00051>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00052> *%-----------------|-------------------------------------------------------|
00053> *# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
00054> CALIB NASHYD        ID=[4], NHYD=["104"], DT=[1]min, AREA=[0.018](ha),
00055>                     DWF=[0](cms),  CN/C=[74], IA=[8.92](mm),
00056>                     N=[3], TP=[0.14]hrs,
00057>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00058> *%-----------------|-------------------------------------------------------|
00059> *# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
00060> CALIB NASHYD        ID=[5], NHYD=["105"], DT=[1]min, AREA=[0.078](ha),
00061>                     DWF=[0](cms),  CN/C=[74], IA=[8.92](mm),
00062>                     N=[3], TP=[0.11]hrs,
00063>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00064> *%-----------------|-------------------------------------------------------|
00065> *# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
00066> CALIB STANDHYD      ID=[6], NHYD=["EXT1"], DT=[1](min), AREA=[0.033](ha),
00067>                     XIMP=[0.27], TIMP=[0.27], DWF=[0](cms), LOSS=[2],
00068>                     SCS curve number CN=[74],
00069>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[2.0](%),
00070>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00071>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
00072>                                          LGI=[15](m), MNI=[0.013], SCI=[0](min),
00073>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00074> *%-----------------|-------------------------------------------------------|
00075> *# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
00076> CALIB STANDHYD      ID=[7], NHYD=["EXT2"], DT=[1](min), AREA=[0.003](ha),
00077>                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
00078>                     SCS curve number CN=[74],
00079>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[2.0](%),
00080>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00081>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[3.0](%),
00082>                                          LGI=[5](m), MNI=[0.013], SCI=[0](min),
00083>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00084> *%-----------------|-------------------------------------------------------|
00085> *# ADD FLOWS TO WILSON
00086> ADD HYD             IDsum=[9], NHYD=["EX.WILSON"], IDs to add=[1,7]
00087> *%-----------------|-------------------------------------------------------|
00088> *# ADD FLOWS TO RES. BACKYARDS
00089> ADD HYD             IDsum=[10], NHYD=["EX.BKYD"], IDs to add=[2,6]
00090> *%-----------------|-------------------------------------------------------|
00091> *# ADD FLOWS FROM EX. SITE
00092> ADD HYD             IDsum=[7], NHYD=["EX.SITE"], IDs to add=[9,10,3,4,5]
00093> *%-----------------|-------------------------------------------------------|
00094> *#*************************************************************************|
00095> *#
00096> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00097> *#        =============================================
00098> *#
00099> **#************************************************************************|
00100> *# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
00101> CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[0.759](ha),
00102>                     XIMP=[0.87], TIMP=[0.87], DWF=[0](cms), LOSS=[2],
00103>                     SCS curve number CN=[74],
00104>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[2.0](%),
00105>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00106>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.5](%),
00107>                                          LGI=[15](m), MNI=[0.013], SCI=[0](min),
00108>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00109> *%-----------------|-------------------------------------------------------|
00110> *# ROUTE FLOWS THROUGH TANK WITH ORIFICE
00111> ROUTE RESERVOIR     IDout=[2],   NHYD=["201_CTL"],  IDin=[1],
00112>                     RDT=[1](min),
00113>                           TABLE of ( OUTFLOW-STORAGE ) values
00114>                                    (cms) - (ha-m)
00115>                                     0.0000  ,  0.0000
00116>                                     0.0080  ,  0.0102
00117>                                     0.0115  ,  0.0212
00118>                                     0.0142  ,  0.0322
00119>                                     0.0164  ,  0.0432
00120>                                     0.0179  ,  0.0509
00121>                                        -1   ,  -1    (max twenty pts)
00122>                           IDovf=[3], NHYDovf=["201_OVF"]
00123> *%-----------------|-------------------------------------------------------|
00124> *# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
00125> CALIB NASHYD        ID=[1], NHYD=["202"], DT=[1]min, AREA=[0.024](ha),
00126>                     DWF=[0](cms),  CN/C=[74], IA=[8.92](mm),
00127>                     N=[3], TP=[0.09]hrs,
00128>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00129> *%-----------------|-------------------------------------------------------|
00130> *# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
00131> CALIB STANDHYD      ID=[4], NHYD=["203"], DT=[1](min), AREA=[0.010](ha),
00132>                     XIMP=[0.84], TIMP=[0.84], DWF=[0](cms), LOSS=[2],
00133>                     SCS curve number CN=[75],
00134>                     Pervious   surfaces: IAper=[8.92](mm), SLPP=[2.0](%),
00135>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00136>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00137>                                          LGI=[10](m), MNI=[0.013], SCI=[0](min),
00138>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00139> *%-----------------|-------------------------------------------------------|
00140> *# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
00141> CALIB NASHYD        ID=[5], NHYD=["204"], DT=[1]min, AREA=[0.020](ha),
00142>                     DWF=[0](cms),  CN/C=[74], IA=[8.92](mm),
00143>                     N=[3], TP=[0.09]hrs,
00144>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00145> *%-----------------|-------------------------------------------------------|
00146> *# ADD PROPOSED FLOWS FROM SITE
00147> ADD HYD             IDsum=[6], NHYD=["PROP.SITE"], IDs to add=[2,3,1,4,5]
00148> *%-----------------|-------------------------------------------------------|
00149> *# AREA CHECK
00150> ADD HYD             IDsum=[1], NHYD=["CHECK"], IDs to add=[7,6]
00151> *%-----------------|-------------------------------------------------------|
00152> * RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
00153> *
00154> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
00155>                     MTH4005.stm
00156> *
00157> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
00158>                     MTH4010.stm
00159> *
00160> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
00161>                     MTH4025.stm
00162> *
00163> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
00164>                     MTH4050.stm
00165> *
00166> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00167>                     MTH4100.stm
00168> *
00169> *%-----------------|-------------------------------------------------------|
00170> FINISH
00171>
00172>
00173>
00174>
00175>
00176>
00177>
00178>
00179>
00180>
```

```
00001> ================================================================================
00002>
00003>   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>       S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>   SSSSS  W W W  M   M  H   H    Y    M   M   OOO           9      9    =========
00008>                                                          9   9  9   9   # 3902680
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: S. Llewellyn & Associates Ltd                +++++++++
00025> +++++++++              Burlington          SERIAL#:3902680           +++++++++
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: 2021-12-14     TIME: 10:43:37     RUN COUNTER: 000429         *
00039> ********************************************************************************
00040> * Input   filename: T:\PROJECTS\20092\SWMHYMO\20092.dat                        *
00041> * Output  filename: T:\PROJECTS\20092\SWMHYMO\20092.out                        *
00042> * Summary filename: T:\PROJECTS\20092\SWMHYMO\20092.sum                        *
00043> * User comments:                                                              *
00044> * 1:_____________________________________________________________________     *
00045> * 2:_____________________________________________________________________     *
00046> * 3:_____________________________________________________________________     *
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001-----------------------------------------------------------------------
00051> *#*****************************************************************************|
00052> *#  Project Name: WILSON AT ACADEMY
00053> *#               HAMILTON, ONTARIO
00054> *#  JOB NUMBER  : 20092
00055> *#       Date   : DECEMBER 2021
00056> *#    Revised   :
00057> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00058> *#       File   : 20092.DAT
00059> *#*****************************************************************************|
00060> *
00061>   ** END OF RUN :   1
00062>
00063> ********************************************************************************
00064>
00065>
00066>
00067>
00068>
00069> --------------------
00070> | START            |  Project  dir.: T:\PROJECTS\20092\SWMHYMO\
00071> --------------------  Rainfall dir.: T:\PROJECTS\20092\SWMHYMO\
00072>     TZERO =   .00 hrs on      0
00073>     METOUT=   2 (output = METRIC)
00074>     NRUN  = 002
00075>     NSTORM=   1
00076>              #  1=MTH4002.stm
00077> --------------------------------------------------------------------------------
00078> 002:0002-----------------------------------------------------------------------
00079> *#*****************************************************************************|
00080> *#  Project Name: WILSON AT ACADEMY
00081> *#               HAMILTON, ONTARIO
00082> *#  JOB NUMBER  : 20092
00083> *#       Date   : DECEMBER 2021
00084> *#    Revised   :
00085> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00086> *#       File   : 20092.DAT
00087> *#*****************************************************************************|
00088> *
00089> --------------------------------------------------------------------------------
00090> 002:0002-----------------------------------------------------------------------
00091> *
00092> --------------------
00093> | READ STORM       |    Filename: 2-YR MT. HOPE (A=646 B=6 C=0.781)
00094> | Ptotal=  35.06 mm|    Comments: 2-YR MT. HOPE (A=646 B=6 C=0.781)
00095> --------------------
00096>                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00097>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00098>                 .17   2.368 |   1.17  18.525 |   2.17   5.648 |   3.17   2.846
00099>                 .33   2.712 |   1.33  74.099 |   2.33   4.806 |   3.33   2.644
00100>                 .50   3.193 |   1.50  24.316 |   2.50   4.199 |   3.50   2.472
00101>                 .67   3.921 |   1.67  12.980 |   2.67   3.739 |   3.67   2.323
00102>                 .83   5.164 |   1.83   8.954 |   2.83   3.378 |   3.83   2.193
00103>                1.00   7.836 |   2.00   6.898 |   3.00   3.087 |   4.00   2.078
00104>
00105> --------------------------------------------------------------------------------
00106> 002:0003-----------------------------------------------------------------------
00107> *
00108> *#*****************************************************************************|
00109> *#
00110> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00111> *#        ==============================================
00112> *#
00113> **#****************************************************************************|
00114> *# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
00115> ----------------------
00116> | CALIB STANDHYD     |   Area    (ha)=     .09
00117> | 01:101    DT= 1.00 |   Total Imp(%)=   81.00   Dir. Conn.(%)=   81.00
00118> ----------------------
00119>                                IMPERVIOUS    PERVIOUS (i)
00120>      Surface Area     (ha)=        .08          .02
00121>      Dep. Storage     (mm)=       1.00         8.92
00122>      Average Slope     (%)=       3.50         2.50
00123>      Length            (m)=      20.00        10.00
00124>      Mannings n             =      .013         .250
00125>
00126>      Max.eff.Inten.(mm/hr)=      74.10         9.00
00127>                 over (min)        1.00         8.00
00128>      Storage Coeff.  (min)=        .75 (ii)    8.28 (ii)
00129>      Unit Hyd. Tpeak (min)=       1.00         8.00
00130>      Unit Hyd. peak  (cms)=       1.25          .14
00131>                                                          *TOTALS*
00132>      PEAK FLOW       (cms)=        .02          .00          .016 (iii)
00133>      TIME TO PEAK    (hrs)=       1.32         1.45         1.333
00134>      RUNOFF VOLUME    (mm)=      34.06         5.92        28.716
00135>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00136>      RUNOFF COEFFICIENT   =        .97          .17          .819
00137>
00138>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00139>            CN* =  74.0    Ia = Dep. Storage  (Above)
00140>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00141>              THAN THE STORAGE COEFFICIENT.
00142>       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00143>
00144> --------------------------------------------------------------------------------
00145> 002:0004-----------------------------------------------------------------------
00146> *# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
00147> ----------------------
00148> | CALIB STANDHYD     |   Area    (ha)=     .56
00149> | 02:102    DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
00150> ----------------------
00151>                                IMPERVIOUS    PERVIOUS (i)
00152>      Surface Area     (ha)=        .25          .31
00153>      Dep. Storage     (mm)=       1.00         8.92
00154>      Average Slope     (%)=       2.00         5.00
00155>      Length            (m)=      35.00        65.00
00156>      Mannings n             =      .013         .250
00157>
00158>      Max.eff.Inten.(mm/hr)=      74.10         6.27
00159>                 over (min)        1.00        23.00
00160>      Storage Coeff.  (min)=       1.25 (ii)   22.96 (ii)
00161>      Unit Hyd. Tpeak (min)=       1.00        23.00
00162>      Unit Hyd. peak  (cms)=        .94          .05
00163>                                                          *TOTALS*
00164>      PEAK FLOW       (cms)=        .05          .00          .052 (iii)
00165>      TIME TO PEAK    (hrs)=       1.33         1.83         1.333
00166>      RUNOFF VOLUME    (mm)=      34.06         5.92        18.586
00167>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00168>      RUNOFF COEFFICIENT   =        .97          .17          .530
00169>
00170>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00171>            CN* =  74.0    Ia = Dep. Storage  (Above)
00172>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00173>              THAN THE STORAGE COEFFICIENT.
00174>       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00175>
00176> --------------------------------------------------------------------------------
00177> 002:0005-----------------------------------------------------------------------
00178> *# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
00179> ----------------------
00180> | CALIB STANDHYD     |   Area    (ha)=     .03
00181> | 03:103    DT= 1.00 |   Total Imp(%)=   96.00   Dir. Conn.(%)=   96.00
00182> ----------------------
00183>                                IMPERVIOUS    PERVIOUS (i)
00184>      Surface Area     (ha)=        .02          .00
00185>      Dep. Storage     (mm)=       1.00         8.92
00186>      Average Slope     (%)=       1.00         2.00
00187>      Length            (m)=      20.00        10.00
00188>      Mannings n             =      .013         .250
00189>
00190>      Max.eff.Inten.(mm/hr)=      74.10         8.59
00191>                 over (min)        1.00         9.00
00192>      Storage Coeff.  (min)=       1.10 (ii)    9.30 (ii)
00193>      Unit Hyd. Tpeak (min)=       1.00         9.00
00194>      Unit Hyd. peak  (cms)=       1.02          .12
00195>                                                          *TOTALS*
00196>      PEAK FLOW       (cms)=        .00          .00          .005 (iii)
00197>      TIME TO PEAK    (hrs)=       1.33         1.52         1.333
00198>      RUNOFF VOLUME    (mm)=      34.06         5.92        32.936
00199>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00200>      RUNOFF COEFFICIENT   =        .97          .17          .939
00201>
00202>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00203>            CN* =  74.0    Ia = Dep. Storage  (Above)
00204>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00205>              THAN THE STORAGE COEFFICIENT.
00206>       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00207>
00208> --------------------------------------------------------------------------------
00209> 002:0006-----------------------------------------------------------------------
00210> *# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
00211> ----------------------
00212> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
00213> | 04:104    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00214> ----------------------  U.H. Tp(hrs)=    .140
00215>
00216>      Unit Hyd Qpeak  (cms)=     .005
00217>
00218>      PEAK FLOW       (cms)=     .000 (i)
00219>      TIME TO PEAK    (hrs)=    1.533
00220>      RUNOFF VOLUME    (mm)=    5.904
00221>      TOTAL RAINFALL   (mm)=   35.063
00222>      RUNOFF COEFFICIENT   =     .168
00223>
00224>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00225>
00226> --------------------------------------------------------------------------------
00227> 002:0007-----------------------------------------------------------------------
00228> *# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
00229> ----------------------
00230> | CALIB NASHYD       |   Area    (ha)=     .08   Curve Number   (CN)=74.00
00231> | 05:105    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00232> ----------------------  U.H. Tp(hrs)=    .110
00233>
00234>      Unit Hyd Qpeak  (cms)=     .027
00235>
00236>      PEAK FLOW       (cms)=     .001 (i)
00237>      TIME TO PEAK    (hrs)=    1.467
00238>      RUNOFF VOLUME    (mm)=    5.920
00239>      TOTAL RAINFALL   (mm)=   35.063
00240>      RUNOFF COEFFICIENT   =     .169
00241>
00242>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00243>
00244> --------------------------------------------------------------------------------
00245> 002:0008-----------------------------------------------------------------------
00246> *# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
00247> ----------------------
00248> | CALIB STANDHYD     |   Area    (ha)=     .03
00249> | 06:EXT1   DT= 1.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
00250> ----------------------
00251>                                IMPERVIOUS    PERVIOUS (i)
00252>      Surface Area     (ha)=        .01          .02
00253>      Dep. Storage     (mm)=       1.00         8.92
00254>      Average Slope     (%)=       1.00         2.00
00255>      Length            (m)=      15.00        10.00
00256>      Mannings n             =      .013         .250
00257>
00258>      Max.eff.Inten.(mm/hr)=      74.10         8.59
00259>                 over (min)        1.00         9.00
00260>      Storage Coeff.  (min)=        .92 (ii)    9.12 (ii)
00261>      Unit Hyd. Tpeak (min)=       1.00         9.00
00262>      Unit Hyd. peak  (cms)=       1.12          .12
00263>                                                          *TOTALS*
00264>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
00265>      TIME TO PEAK    (hrs)=       1.32         1.52         1.333
00266>      RUNOFF VOLUME    (mm)=      34.06         5.92        13.520
00267>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00268>      RUNOFF COEFFICIENT   =        .97          .17          .386
00269>
00270>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
00271>           CN* =  74.0    Ia = Dep. Storage  (Above)
00272>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00273>            THAN THE STORAGE COEFFICIENT.
00274>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00275>
00276> ---------------------------------------------------------------------------
00277> 002:0009-----------------------------------------------------------------
00278> *# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
00279> ----------------------
00280> | CALIB STANDHYD     |   Area    (ha)=     .00
00281> | 07:EXT2    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00282> ----------------------
00283>                              IMPERVIOUS    PERVIOUS (i)
00284>      Surface Area     (ha)=        .00          .00
00285>      Dep. Storage     (mm)=       1.00         8.92
00286>      Average Slope     (%)=       3.00         2.00
00287>      Length            (m)=       5.00        10.00
00288>      Mannings n            =       .013         .250
00289>
00290>      Max.eff.Inten.(mm/hr)=      74.10         9.00
00291>                 over (min)       1.00         8.00
00292>      Storage Coeff.  (min)=        .34 (ii)    8.39 (ii)
00293>      Unit Hyd. Tpeak (min)=       1.00         8.00
00294>      Unit Hyd. peak  (cms)=       1.61          .25
00295>                                                          *TOTALS*
00296>      PEAK FLOW       (cms)=        .00          .00          .001 (iii)
00297>      TIME TO PEAK    (hrs)=       1.23         1.43         1.333
00298>      RUNOFF VOLUME    (mm)=      34.06         5.92        33.781
00299>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00300>      RUNOFF COEFFICIENT   =        .97          .17          .963
00301>
00302>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00303>            CN* =  74.0    Ia = Dep. Storage  (Above)
00304>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00305>            THAN THE STORAGE COEFFICIENT.
00306>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00307>
00308> ---------------------------------------------------------------------------
00309> 002:0010-----------------------------------------------------------------
00310> *# ADD FLOWS TO WILSON
00311> ------------------------
00312> | ADD HYD (EX.WILSON ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00313> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00314>                        ID1 01:101            .09      .016    1.33  28.72    .000
00315>                       +ID2 07:EXT2           .00      .001    1.33  33.78    .000
00316>                        ========================================================
00317>                        SUM 09:EX.WILSON       .10      .017    1.33  28.87    .000
00318>
00319>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00320>
00321> ---------------------------------------------------------------------------
00322> 002:0011-----------------------------------------------------------------
00323> *# ADD FLOWS TO RES. BACKYARDS
00324> ------------------------
00325> | ADD HYD (EX.BKYD   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00326> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00327>                        ID1 02:102            .56      .052    1.33  18.59    .000
00328>                       +ID2 06:EXT1           .03      .002    1.33  13.52    .000
00329>                        ========================================================
00330>                        SUM 10:EX.BKYD         .59      .054    1.33  18.30    .000
00331>
00332>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00333>
00334> ---------------------------------------------------------------------------
00335> 002:0012-----------------------------------------------------------------
00336> *# ADD FLOWS FROM EX. SITE
00337> ------------------------
00338> | ADD HYD (EX.SITE   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00339> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00340>                        ID1 09:EX.WILSON       .10      .017    1.33  28.87    .000
00341>                       +ID2 10:EX.BKYD         .59      .054    1.33  18.30    .000
00342>                       +ID3 03:103             .03      .005    1.33  32.94    .000
00343>                       +ID4 04:104             .02      .000    1.53   5.90    .000
00344>                       +ID5 05:105             .08      .001    1.47   5.92    .000
00345>                        ========================================================
00346>                        SUM 07:EX.SITE         .81      .077    1.33  18.57    .000
00347>
00348>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00349>
00350> ---------------------------------------------------------------------------
00351> 002:0013-----------------------------------------------------------------
00352> *#*************************************************************************|
00353> *#
00354> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00355> *#        ==============================================
00356> *#
00357> **#************************************************************************|
00358> *# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
00359> ----------------------
00360> | CALIB STANDHYD     |   Area    (ha)=     .76
00361> | 01:201     DT= 1.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
00362> ----------------------
00363>                              IMPERVIOUS    PERVIOUS (i)
00364>      Surface Area     (ha)=        .66          .10
00365>      Dep. Storage     (mm)=       1.00         8.92
00366>      Average Slope     (%)=       1.50         2.00
00367>      Length            (m)=      15.00        10.00
00368>      Mannings n            =       .013         .250
00369>
00370>      Max.eff.Inten.(mm/hr)=      74.10         8.59
00371>                 over (min)       1.00         9.00
00372>      Storage Coeff.  (min)=        .82 (ii)    9.02 (ii)
00373>      Unit Hyd. Tpeak (min)=       1.00         9.00
00374>      Unit Hyd. peak  (cms)=       1.20          .13
00375>                                                          *TOTALS*
00376>      PEAK FLOW       (cms)=        .14          .00          .136 (iii)
00377>      TIME TO PEAK    (hrs)=       1.33         1.52         1.333
00378>      RUNOFF VOLUME    (mm)=      34.06         5.92        30.405
00379>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00380>      RUNOFF COEFFICIENT   =        .97          .17          .867
00381>
00382>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00383>            CN* =  74.0    Ia = Dep. Storage  (Above)
00384>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00385>            THAN THE STORAGE COEFFICIENT.
00386>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00387>
00388> ---------------------------------------------------------------------------
00389> 002:0014-----------------------------------------------------------------
00390> *# ROUTE FLOWS THROUGH TANK WITH ORIFICE
00391> ---------------------
00392> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00393> |  IN>01:(201   )   |
00394> | OUT<02:(201_CT)   |    =========  OUTLFOW STORAGE TABLE  =========
00395> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00396>                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
00397>                             .000  .0000E+00    |     .014  .3220E-01
00398>                             .008  .1020E-01    |     .016  .4320E-01
00399>                             .012  .2120E-01    |     .018  .5090E-01
00400>
00401>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00402>      ---------------            (ha)     (cms)     (hrs)       (mm)
00403>      INFLOW >01: (201   )        .76      .136     1.333     30.405
00404>      OUTFLOW<02: (201_CT)        .76      .010     2.183     30.405
00405>     OVERFLOW<03: (201_OV)        .00      .000      .000       .000
00406>
00407>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00408>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00409>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00410>
00411>
00412>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    7.131
00413>                    TIME SHIFT OF PEAK FLOW          (min)=    51.00
00414>                    MAXIMUM  STORAGE   USED        (ha.m.)=.1564E-01
00415>
00416> ---------------------------------------------------------------------------
00417> 002:0015-----------------------------------------------------------------
00418> *# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
00419> ----------------------
00420> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
00421> | 01:202     DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00422> ----------------------   U.H. Tp(hrs)=    .090
00423>
00424>      Unit Hyd Qpeak  (cms)=     .010
00425>
00426>      PEAK FLOW       (cms)=     .000 (i)
00427>      TIME TO PEAK    (hrs)=    1.417
00428>      RUNOFF VOLUME    (mm)=    5.914
00429>      TOTAL RAINFALL   (mm)=   35.063
00430>      RUNOFF COEFFICIENT   =     .169
00431>
00432>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00433>
00434> ---------------------------------------------------------------------------
00435> 002:0016-----------------------------------------------------------------
00436> *# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
00437> ----------------------
00438> | CALIB STANDHYD     |   Area    (ha)=     .01
00439> | 04:203     DT= 1.00 |   Total Imp(%)=   84.00   Dir. Conn.(%)=   84.00
00440> ----------------------
00441>                              IMPERVIOUS    PERVIOUS (i)
00442>      Surface Area     (ha)=        .01          .00
00443>      Dep. Storage     (mm)=       1.00         8.92
00444>      Average Slope     (%)=       2.00         2.00
00445>      Length            (m)=      10.00        10.00
00446>      Mannings n            =       .013         .250
00447>
00448>      Max.eff.Inten.(mm/hr)=      74.10         9.00
00449>                 over (min)       1.00         9.00
00450>      Storage Coeff.  (min)=        .59 (ii)    8.64 (ii)
00451>      Unit Hyd. Tpeak (min)=       1.00         9.00
00452>      Unit Hyd. peak  (cms)=       1.39          .13
00453>                                                          *TOTALS*
00454>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
00455>      TIME TO PEAK    (hrs)=       1.27         1.47         1.333
00456>      RUNOFF VOLUME    (mm)=      34.06         6.17        29.599
00457>      TOTAL RAINFALL   (mm)=      35.06        35.06        35.063
00458>      RUNOFF COEFFICIENT   =        .97          .18          .844
00459>
00460>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00461>            CN* =  75.0    Ia = Dep. Storage  (Above)
00462>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00463>            THAN THE STORAGE COEFFICIENT.
00464>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00465>
00466> ---------------------------------------------------------------------------
00467> 002:0017-----------------------------------------------------------------
00468> *# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
00469> ----------------------
00470> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
00471> | 05:204     DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00472> ----------------------   U.H. Tp(hrs)=    .090
00473>
00474>      Unit Hyd Qpeak  (cms)=     .008
00475>
00476>      PEAK FLOW       (cms)=     .000 (i)
00477>      TIME TO PEAK    (hrs)=    1.417
00478>      RUNOFF VOLUME    (mm)=    5.911
00479>      TOTAL RAINFALL   (mm)=   35.063
00480>      RUNOFF COEFFICIENT   =     .169
00481>
00482>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00483>
00484> ---------------------------------------------------------------------------
00485> 002:0018-----------------------------------------------------------------
00486> *# ADD PROPOSED FLOWS FROM SITE
00487> ------------------------
00488> | ADD HYD (PROP.SITE ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00489> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00490>                        ID1 02:201_CTL         .76      .010    2.18  30.40    .000
00491>                       +ID2 03:201_OVF         .00      .000     .00    .00    .000
00492>                       +ID3 01:202             .02      .000    1.42   5.91    .000
00493>                       +ID4 04:203             .01      .002    1.33  29.60    .000
00494>                       +ID5 05:204             .02      .000    1.42   5.91    .000
00495>                        ========================================================
00496>                        SUM 06:PROP.SITE       .81      .011    1.33  29.07    .000
00497>
00498>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00499>
00500> ---------------------------------------------------------------------------
00501> 002:0019-----------------------------------------------------------------
00502> *# AREA CHECK
00503> ------------------------
00504> | ADD HYD (CHECK     ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00505> ------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00506>                        ID1 07:EX.SITE         .81      .077    1.33  18.57    .000
00507>                       +ID2 06:PROP.SITE       .81      .011    1.33  29.07    .000
00508>                        ========================================================
00509>                        SUM 01:CHECK          1.63      .087    1.33  23.82    .000
00510>
00511>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00512>
00513> ---------------------------------------------------------------------------
00514> 002:0020-----------------------------------------------------------------
00515> * RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
00516> *
00517>   ** END OF RUN :   4
00518>
00519> ***************************************************************************
00520>
00521>
00522>
00523>
00524>
00525> --------------------
00526> | START            |  Project  dir.: T:\PROJECTS\20092\SWMHYMO\
00527> --------------------  Rainfall dir.: T:\PROJECTS\20092\SWMHYMO\
00528>     TZERO =   .00 hrs on        0
00529>     METOUT=   2 (output = METRIC)
00530>     NRUN  = 005
00531>     NSTORM=   1
00532>               #  1=MTH4005.stm
00533> ---------------------------------------------------------------------------
00534> 005:0002-----------------------------------------------------------------
00535> *#*************************************************************************|
00536> *#  Project Name: WILSON AT ACADEMY
00537> *#               HAMILTON, ONTARIO
00538> *#  JOB NUMBER  : 20092
00539> *#       Date   : DECEMBER 2021
00540> *#    Revised   :
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00541> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00542> *#       File   : 20092.DAT
00543> *#**************************************************************************|
00544> *
00545> ------------------------------------------------------------------------------
00546> 005:0002-----------------------------------------------------------------------
00547> *
00548> ---------------------
00549> | READ STORM        |    Filename: 5-YR MT. HOPE (A=1049.5 B=8 C=0.803)
00550> | Ptotal=  50.14 mm|    Comments: 5-YR MT. HOPE (A=1049.5 B=8 C=0.803)
00551> ---------------------
00552>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00553>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00554>                .17   3.196 |   1.17  28.027 |   2.17   8.084 |   3.17   3.885
00555>                .33   3.691 |   1.33 103.038 |   2.33   6.801 |   3.33   3.593
00556>                .50   4.393 |   1.50  36.919 |   2.50   5.885 |   3.50   3.344
00557>                .67   5.470 |   1.67  19.516 |   2.67   5.198 |   3.67   3.130
00558>                .83   7.347 |   1.83  13.211 |   2.83   4.664 |   3.83   2.945
00559>               1.00  11.470 |   2.00  10.009 |   3.00   4.236 |   4.00   2.782
00560>
00561> ------------------------------------------------------------------------------
00562> 005:0003-----------------------------------------------------------------------
00563> *
00564> *#**************************************************************************|
00565> *#
00566> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00567> *#        ==============================================
00568> *#
00569> **#*************************************************************************|
00570> *# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
00571> ----------------------
00572> | CALIB STANDHYD     |   Area    (ha)=     .09
00573> | 01:101    DT= 1.00 |   Total Imp(%)=   81.00   Dir. Conn.(%)=   81.00
00574> ----------------------
00575>                              IMPERVIOUS    PERVIOUS (i)
00576>      Surface Area     (ha)=        .08          .02
00577>      Dep. Storage     (mm)=       1.00         8.92
00578>      Average Slope     (%)=       3.50         2.50
00579>      Length            (m)=      20.00        10.00
00580>      Mannings n             =      .013         .250
00581>
00582>      Max.eff.Inten.(mm/hr)=     103.04        25.41
00583>                    over (min)        1.00         6.00
00584>      Storage Coeff.  (min)=        .66 (ii)    5.63 (ii)
00585>      Unit Hyd. Tpeak (min)=       1.00         6.00
00586>      Unit Hyd. peak  (cms)=       1.33          .20
00587>                                                          *TOTALS*
00588>      PEAK FLOW       (cms)=        .02          .00          .023 (iii)
00589>      TIME TO PEAK    (hrs)=       1.32         1.40         1.333
00590>      RUNOFF VOLUME    (mm)=      49.14        13.02        42.277
00591>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00592>      RUNOFF COEFFICIENT   =        .98          .26          .843
00593>
00594>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00595>            CN* =  74.0    Ia = Dep. Storage  (Above)
00596>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00597>            THAN THE STORAGE COEFFICIENT.
00598>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00599>
00600> ------------------------------------------------------------------------------
00601> 005:0004-----------------------------------------------------------------------
00602> *# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
00603> ----------------------
00604> | CALIB STANDHYD     |   Area    (ha)=     .56
00605> | 02:102    DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
00606> ----------------------
00607>                              IMPERVIOUS    PERVIOUS (i)
00608>      Surface Area     (ha)=        .25          .31
00609>      Dep. Storage     (mm)=       1.00         8.92
00610>      Average Slope     (%)=       2.00         5.00
00611>      Length            (m)=      35.00        65.00
00612>      Mannings n             =      .013         .250
00613>
00614>      Max.eff.Inten.(mm/hr)=     103.04        18.06
00615>                    over (min)        1.00        15.00
00616>      Storage Coeff.  (min)=       1.09 (ii)   15.32 (ii)
00617>      Unit Hyd. Tpeak (min)=       1.00        15.00
00618>      Unit Hyd. peak  (cms)=       1.02          .07
00619>                                                          *TOTALS*
00620>      PEAK FLOW       (cms)=        .07          .01          .074 (iii)
00621>      TIME TO PEAK    (hrs)=       1.33         1.62         1.333
00622>      RUNOFF VOLUME    (mm)=      49.14        13.02        29.275
00623>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00624>      RUNOFF COEFFICIENT   =        .98          .26          .584
00625>
00626>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00627>            CN* =  74.0    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> 005:0005-----------------------------------------------------------------------
00634> *# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
00635> ----------------------
00636> | CALIB STANDHYD     |   Area    (ha)=     .03
00637> | 03:103    DT= 1.00 |   Total Imp(%)=   96.00   Dir. Conn.(%)=   96.00
00638> ----------------------
00639>                              IMPERVIOUS    PERVIOUS (i)
00640>      Surface Area     (ha)=        .02          .00
00641>      Dep. Storage     (mm)=       1.00         8.92
00642>      Average Slope     (%)=       1.00         2.00
00643>      Length            (m)=      20.00        10.00
00644>      Mannings n             =      .013         .250
00645>
00646>      Max.eff.Inten.(mm/hr)=     103.04        25.41
00647>                    over (min)        1.00         6.00
00648>      Storage Coeff.  (min)=        .96 (ii)    6.28 (ii)
00649>      Unit Hyd. Tpeak (min)=       1.00         6.00
00650>      Unit Hyd. peak  (cms)=       1.10          .18
00651>                                                          *TOTALS*
00652>      PEAK FLOW       (cms)=        .01          .00          .007 (iii)
00653>      TIME TO PEAK    (hrs)=       1.33         1.40         1.333
00654>      RUNOFF VOLUME    (mm)=      49.14        13.02        47.694
00655>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00656>      RUNOFF COEFFICIENT   =        .98          .26          .951
00657>
00658>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00659>            CN* =  74.0    Ia = Dep. Storage  (Above)
00660>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00661>            THAN THE STORAGE COEFFICIENT.
00662>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00663>
00664> ------------------------------------------------------------------------------
00665> 005:0006-----------------------------------------------------------------------
00666> *# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
00667> ----------------------
00668> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
00669> | 04:104    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00670> ----------------------   U.H. Tp(hrs)=    .140
00671>
00672>      Unit Hyd Qpeak  (cms)=     .005
00673>
00674>      PEAK FLOW       (cms)=     .001 (i)
00675>      TIME TO PEAK    (hrs)=    1.500
00676>      RUNOFF VOLUME    (mm)=   13.006
00677>      TOTAL RAINFALL   (mm)=   50.139
00678>      RUNOFF COEFFICIENT   =     .259
00679>
00680>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00681>
00682> ------------------------------------------------------------------------------
00683> 005:0007-----------------------------------------------------------------------
00684> *# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
00685> ----------------------
00686> | CALIB NASHYD       |   Area    (ha)=     .08   Curve Number   (CN)=74.00
00687> | 05:105    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00688> ----------------------   U.H. Tp(hrs)=    .110
00689>
00690>      Unit Hyd Qpeak  (cms)=     .027
00691>
00692>      PEAK FLOW       (cms)=     .004 (i)
00693>      TIME TO PEAK    (hrs)=    1.433
00694>      RUNOFF VOLUME    (mm)=   13.020
00695>      TOTAL RAINFALL   (mm)=   50.139
00696>      RUNOFF COEFFICIENT   =     .260
00697>
00698>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00699>
00700> ------------------------------------------------------------------------------
00701> 005:0008-----------------------------------------------------------------------
00702> *# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
00703> ----------------------
00704> | CALIB STANDHYD     |   Area    (ha)=     .03
00705> | 06:EXT1   DT= 1.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
00706> ----------------------
00707>                              IMPERVIOUS    PERVIOUS (i)
00708>      Surface Area     (ha)=        .01          .02
00709>      Dep. Storage     (mm)=       1.00         8.92
00710>      Average Slope     (%)=       1.00         2.00
00711>      Length            (m)=      15.00        10.00
00712>      Mannings n             =      .013         .250
00713>
00714>      Max.eff.Inten.(mm/hr)=     103.04        25.41
00715>                    over (min)        1.00         6.00
00716>      Storage Coeff.  (min)=        .81 (ii)    6.12 (ii)
00717>      Unit Hyd. Tpeak (min)=       1.00         6.00
00718>      Unit Hyd. peak  (cms)=       1.21          .19
00719>                                                          *TOTALS*
00720>      PEAK FLOW       (cms)=        .00          .00          .003 (iii)
00721>      TIME TO PEAK    (hrs)=       1.30         1.40         1.333
00722>      RUNOFF VOLUME    (mm)=      49.14        13.02        22.774
00723>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00724>      RUNOFF COEFFICIENT   =        .98          .26          .454
00725>
00726>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00727>            CN* =  74.0    Ia = Dep. Storage  (Above)
00728>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00729>            THAN THE STORAGE COEFFICIENT.
00730>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00731>
00732> ------------------------------------------------------------------------------
00733> 005:0009-----------------------------------------------------------------------
00734> *# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
00735> ----------------------
00736> | CALIB STANDHYD     |   Area    (ha)=     .00
00737> | 07:EXT2   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00738> ----------------------
00739>                              IMPERVIOUS    PERVIOUS (i)
00740>      Surface Area     (ha)=        .00          .00
00741>      Dep. Storage     (mm)=       1.00         8.92
00742>      Average Slope     (%)=       3.00         2.00
00743>      Length            (m)=      5.00        10.00
00744>      Mannings n             =      .013         .250
00745>
00746>      Max.eff.Inten.(mm/hr)=     103.04        25.41
00747>                    over (min)        1.00         6.00
00748>      Storage Coeff.  (min)=        .30 (ii)    5.62 (ii)
00749>      Unit Hyd. Tpeak (min)=       1.00         6.00
00750>      Unit Hyd. peak  (cms)=       1.64          .25
00751>                                                          *TOTALS*
00752>      PEAK FLOW       (cms)=        .00          .00          .001 (iii)
00753>      TIME TO PEAK    (hrs)=       1.23         1.40         1.333
00754>      RUNOFF VOLUME    (mm)=      49.14        13.02        48.778
00755>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00756>      RUNOFF COEFFICIENT   =        .98          .26          .973
00757>
00758>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00759>            CN* =  74.0    Ia = Dep. Storage  (Above)
00760>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00761>            THAN THE STORAGE COEFFICIENT.
00762>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00763>
00764> ------------------------------------------------------------------------------
00765> 005:0010-----------------------------------------------------------------------
00766> *# ADD FLOWS TO WILSON
00767> ------------------------
00768> | ADD HYD (EX.WILSON ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00769> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00770>                        ID1 01:101          .09      .023    1.33  42.28    .000
00771>                       +ID2 07:EXT2         .00      .001    1.33  48.78    .000
00772>                        ========================================================
00773>                        SUM 09:EX.WILSON     .10      .024    1.33  42.48    .000
00774>
00775>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00776>
00777> ------------------------------------------------------------------------------
00778> 005:0011-----------------------------------------------------------------------
00779> *# ADD FLOWS TO RES. BACKYARDS
00780> ------------------------
00781> | ADD HYD (EX.BKYD   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00782> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00783>                        ID1 02:102          .56      .074    1.33  29.28    .000
00784>                       +ID2 06:EXT1         .03      .003    1.33  22.77    .000
00785>                        ========================================================
00786>                        SUM 10:EX.BKYD       .59      .078    1.33  28.91    .000
00787>
00788>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00789>
00790> ------------------------------------------------------------------------------
00791> 005:0012-----------------------------------------------------------------------
00792> *# ADD FLOWS FROM EX. SITE
00793> ------------------------
00794> | ADD HYD (EX.SITE   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00795> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00796>                        ID1 09:EX.WILSON     .10      .024    1.33  42.48    .000
00797>                       +ID2 10:EX.BKYD       .59      .078    1.33  28.91    .000
00798>                       +ID3 03:103           .03      .007    1.33  47.69    .000
00799>                       +ID4 04:104           .02      .001    1.50  13.01    .000
00800>                       +ID5 05:105           .08      .004    1.43  13.02    .000
00801>                        ========================================================
00802>                        SUM 07:EX.SITE       .81      .111    1.33  29.25    .000
00803>
00804>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00805>
00806> ------------------------------------------------------------------------------
00807> 005:0013-----------------------------------------------------------------------
00808> *#**************************************************************************|
00809> *#
00810> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
```

```
00811> *#        ================================================
00812> *#
00813> **#*************************************************************************|
00814> *# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
00815> ----------------------
00816> | CALIB STANDHYD     |   Area    (ha)=     .76
00817> | 01:201    DT= 1.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
00818> ----------------------
00819>                              IMPERVIOUS    PERVIOUS (i)
00820>      Surface Area     (ha)=        .66          .10
00821>      Dep. Storage     (mm)=       1.00         8.92
00822>      Average Slope     (%)=       1.50         2.00
00823>      Length            (m)=      15.00        10.00
00824>      Mannings n            =       .013         .250
00825>
00826>      Max.eff.Inten.(mm/hr)=     103.04        25.41
00827>                    over (min)       1.00         6.00
00828>      Storage Coeff.  (min)=        .72 (ii)    6.03 (ii)
00829>      Unit Hyd. Tpeak (min)=       1.00         6.00
00830>      Unit Hyd. peak  (cms)=       1.28          .19
00831>                                                          *TOTALS*
00832>      PEAK FLOW       (cms)=        .19          .00          .192 (iii)
00833>      TIME TO PEAK    (hrs)=       1.33         1.40         1.333
00834>      RUNOFF VOLUME    (mm)=      49.14        13.02        44.444
00835>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00836>      RUNOFF COEFFICIENT   =        .98          .26          .886
00837>
00838>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00839>            CN* =  74.0    Ia = Dep. Storage  (Above)
00840>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00841>            THAN THE STORAGE COEFFICIENT.
00842>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00843>
00844> -------------------------------------------------------------------------------
00845> 005:0014-------------------------------------------------------------------------
00846> *# ROUTE FLOWS THROUGH TANK WITH ORIFICE
00847> ----------------------
00848> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00849> |  IN>01:(201   )    |
00850> | OUT<02:(201_CT)    |    =========  OUTFLOW STORAGE TABLE  =========
00851> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00852>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
00853>                              .000  .0000E+00    |     .014  .3220E-01
00854>                              .008  .1020E-01    |     .016  .4320E-01
00855>                              .012  .2120E-01    |     .018  .5090E-01
00856>
00857>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00858>      --------------------       (ha)     (cms)     (hrs)       (mm)
00859>      INFLOW >01: (201   )        .76      .192     1.333     44.444
00860>      OUTFLOW<02: (201_CT)        .76      .012     2.350     44.444
00861>     OVERFLOW<03: (201_OV)        .00      .000      .000      .000
00862>
00863>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00864>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00865>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00866>
00867>
00868>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    6.313
00869>                    TIME SHIFT OF PEAK FLOW       (min)=    61.00
00870>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2384E-01
00871>
00872> -------------------------------------------------------------------------------
00873> 005:0015-------------------------------------------------------------------------
00874> *# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
00875> ----------------------
00876> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
00877> | 01:202    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00878> ----------------------   U.H. Tp(hrs)=    .090
00879>
00880>      Unit Hyd Qpeak  (cms)=     .010
00881>
00882>      PEAK FLOW       (cms)=     .001 (i)
00883>      TIME TO PEAK    (hrs)=    1.400
00884>      RUNOFF VOLUME    (mm)=   13.013
00885>      TOTAL RAINFALL   (mm)=   50.139
00886>      RUNOFF COEFFICIENT   =     .260
00887>
00888>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00889>
00890> -------------------------------------------------------------------------------
00891> 005:0016-------------------------------------------------------------------------
00892> *# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
00893> ----------------------
00894> | CALIB STANDHYD     |   Area    (ha)=     .01
00895> | 04:203    DT= 1.00 |   Total Imp(%)=   84.00   Dir. Conn.(%)=   84.00
00896> ----------------------
00897>                              IMPERVIOUS    PERVIOUS (i)
00898>      Surface Area     (ha)=        .01          .00
00899>      Dep. Storage     (mm)=       1.00         8.92
00900>      Average Slope     (%)=       2.00         2.00
00901>      Length            (m)=      10.00        10.00
00902>      Mannings n            =       .013         .250
00903>
00904>      Max.eff.Inten.(mm/hr)=     103.04        26.49
00905>                    over (min)       1.00         6.00
00906>      Storage Coeff.  (min)=        .52 (ii)    5.74 (ii)
00907>      Unit Hyd. Tpeak (min)=       1.00         6.00
00908>      Unit Hyd. peak  (cms)=       1.46          .19
00909>                                                          *TOTALS*
00910>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
00911>      TIME TO PEAK    (hrs)=       1.27         1.40         1.333
00912>      RUNOFF VOLUME    (mm)=      49.14        13.50        43.436
00913>      TOTAL RAINFALL   (mm)=      50.14        50.14        50.139
00914>      RUNOFF COEFFICIENT   =        .98          .27          .866
00915>
00916>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00917>            CN* =  75.0    Ia = Dep. Storage  (Above)
00918>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00919>            THAN THE STORAGE COEFFICIENT.
00920>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00921>
00922> -------------------------------------------------------------------------------
00923> 005:0017-------------------------------------------------------------------------
00924> *# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
00925> ----------------------
00926> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
00927> | 05:204    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
00928> ----------------------   U.H. Tp(hrs)=    .090
00929>
00930>      Unit Hyd Qpeak  (cms)=     .008
00931>
00932>      PEAK FLOW       (cms)=     .001 (i)
00933>      TIME TO PEAK    (hrs)=    1.400
00934>      RUNOFF VOLUME    (mm)=   13.013
00935>      TOTAL RAINFALL   (mm)=   50.139
00936>      RUNOFF COEFFICIENT   =     .260
00937>
00938>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00939>
00940> -------------------------------------------------------------------------------
00941> 005:0018-------------------------------------------------------------------------
00942> *# ADD PROPOSED FLOWS FROM SITE
00943> ------------------------
00944> | ADD HYD (PROP.SITE ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00945> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00946>                        ID1 02:201_CTL        .76     .012    2.35  44.44    .000
00947>                       +ID2 03:201_OVF        .00     .000     .00    .00    .000
00948>                       +ID3 01:202            .02     .001    1.40  13.01    .000
00949>                       +ID4 04:203            .01     .002    1.33  43.44    .000
00950>                       +ID5 05:204            .02     .001    1.40  13.01    .000
00951>                        ========================================================
00952>                        SUM 06:PROP.SITE       .81     .014    1.50  42.73    .000
00953>
00954>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00955>
00956> -------------------------------------------------------------------------------
00957> 005:0019-------------------------------------------------------------------------
00958> *# AREA CHECK
00959> ------------------------
00960> | ADD HYD (CHECK     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00961> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00962>                        ID1 07:EX.SITE        .81     .111    1.33  29.25    .000
00963>                       +ID2 06:PROP.SITE      .81     .014    1.50  42.73    .000
00964>                        ========================================================
00965>                        SUM 01:CHECK          1.63     .125    1.33  35.99    .000
00966>
00967>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00968>
00969> -------------------------------------------------------------------------------
00970> 005:0020-------------------------------------------------------------------------
00971> * RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
00972> *
00973> -------------------------------------------------------------------------------
00974> 005:0002-------------------------------------------------------------------------
00975> *
00976>   ** END OF RUN :   9
00977>
00978> ***************************************************************************
00979>
00980>
00981>
00982>
00983>
00984> --------------------
00985> | START            |  Project  dir.: T:\PROJECTS\20092\SWMHYMO\
00986> --------------------  Rainfall dir.: T:\PROJECTS\20092\SWMHYMO\
00987>     TZERO =   .00 hrs on        0
00988>     METOUT=   2 (output = METRIC)
00989>     NRUN  = 010
00990>     NSTORM=   1
00991>               #  1=MTH4010.stm
00992> -------------------------------------------------------------------------------
00993> 010:0002-------------------------------------------------------------------------
00994> *#************************************************************************|
00995> *#  Project Name: WILSON AT ACADEMY
00996> *#               HAMILTON, ONTARIO
00997> *#  JOB NUMBER  : 20092
00998> *#       Date   : DECEMBER 2021
00999> *#    Revised   :
01000> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01001> *#       File   : 20092.DAT
01002> *#************************************************************************|
01003> *
01004> -------------------------------------------------------------------------------
01005> 010:0002-------------------------------------------------------------------------
01006> *
01007> --------------------
01008> | READ STORM       |    Filename: 10-YR MT. HOPE (A=1343.7 B=9 C=0.814)
01009> | Ptotal=  60.22 mm|    Comments: 10-YR MT. HOPE (A=1343.7 B=9 C=0.814)
01010> --------------------
01011>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01012>              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01013>              .17   3.725 |   1.17  34.487 |   2.17   9.714 |   3.17   4.557
01014>              .33   4.322 |   1.33 122.292 |   2.33   8.126 |   3.33   4.203
01015>              .50   5.173 |   1.50  45.465 |   2.50   6.998 |   3.50   3.903
01016>              .67   6.489 |   1.67  23.981 |   2.67   6.156 |   3.67   3.646
01017>              .83   8.802 |   1.83  16.104 |   2.83   5.503 |   3.83   3.423
01018>             1.00  13.931 |   2.00  12.108 |   3.00   4.982 |   4.00   3.228
01019>
01020> -------------------------------------------------------------------------------
01021> 010:0003-------------------------------------------------------------------------
01022> *
01023> *#************************************************************************|
01024> *#
01025> *#         PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01026> *#         ==============================================
01027> *#
01028> **#*********************************************************************|
01029> *# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
01030> ----------------------
01031> | CALIB STANDHYD     |   Area    (ha)=     .09
01032> | 01:101    DT= 1.00 |   Total Imp(%)=   81.00   Dir. Conn.(%)=   81.00
01033> ----------------------
01034>                              IMPERVIOUS    PERVIOUS (i)
01035>      Surface Area     (ha)=        .08          .02
01036>      Dep. Storage     (mm)=       1.00         8.92
01037>      Average Slope     (%)=       3.50         2.50
01038>      Length            (m)=      20.00        10.00
01039>      Mannings n            =       .013         .250
01040>
01041>      Max.eff.Inten.(mm/hr)=     122.29        39.27
01042>                    over (min)       1.00         5.00
01043>      Storage Coeff.  (min)=        .62 (ii)    4.79 (ii)
01044>      Unit Hyd. Tpeak (min)=       1.00         5.00
01045>      Unit Hyd. peak  (cms)=       1.36          .23
01046>                                                          *TOTALS*
01047>      PEAK FLOW       (cms)=        .03          .00          .027 (iii)
01048>      TIME TO PEAK    (hrs)=       1.32         1.38         1.333
01049>      RUNOFF VOLUME    (mm)=      59.22        18.72        51.525
01050>      TOTAL RAINFALL   (mm)=      60.22        60.22        60.219
01051>      RUNOFF COEFFICIENT   =        .98          .31          .856
01052>
01053>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01054>            CN* =  74.0    Ia = Dep. Storage  (Above)
01055>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01056>            THAN THE STORAGE COEFFICIENT.
01057>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01058>
01059> -------------------------------------------------------------------------------
01060> 010:0004-------------------------------------------------------------------------
01061> *# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
01062> ----------------------
01063> | CALIB STANDHYD     |   Area    (ha)=     .56
01064> | 02:102    DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
01065> ----------------------
01066>                              IMPERVIOUS    PERVIOUS (i)
01067>      Surface Area     (ha)=        .25          .31
01068>      Dep. Storage     (mm)=       1.00         8.92
01069>      Average Slope     (%)=       2.00         5.00
01070>      Length            (m)=      35.00        65.00
01071>      Mannings n            =       .013         .250
01072>
01073>      Max.eff.Inten.(mm/hr)=     122.29        27.98
01074>                    over (min)       1.00        13.00
01075>      Storage Coeff.  (min)=       1.02 (ii)   12.96 (ii)
01076>      Unit Hyd. Tpeak (min)=       1.00        13.00
01077>      Unit Hyd. peak  (cms)=       1.06          .09
01078>                                                          *TOTALS*
01079>      PEAK FLOW       (cms)=        .09          .02          .091 (iii)
01080>      TIME TO PEAK    (hrs)=       1.33         1.53         1.333
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```
      RUNOFF VOLUME    (mm)=      59.22        18.72         36.947
      TOTAL RAINFALL   (mm)=      60.22        60.22         60.219
      RUNOFF COEFFICIENT   =        .98          .31           .614

        (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.

010:0005----------------------------------------------------------------------------
*# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 03:103    DT= 1.00 |   Total Imp(%)=   96.00   Dir. Conn.(%)=   96.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .02          .00
      Dep. Storage     (mm)=       1.00         8.92
      Average Slope     (%)=       1.00         2.00
      Length            (m)=      20.00        10.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=     122.29        39.27
                  over (min)        1.00         5.00
      Storage Coeff.  (min)=        .90 (ii)    5.36 (ii)
      Unit Hyd. Tpeak (min)=       1.00         5.00
      Unit Hyd. peak  (cms)=       1.14          .22
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .01           .00          .008 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.38         1.333
      RUNOFF VOLUME    (mm)=      59.22        18.72        57.599
      TOTAL RAINFALL   (mm)=      60.22        60.22        60.219
      RUNOFF COEFFICIENT   =        .98          .31          .956

        (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.

010:0006----------------------------------------------------------------------------
*# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
----------------------
| CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
| 04:104    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .140

      Unit Hyd Qpeak  (cms)=     .005

      PEAK FLOW       (cms)=     .001 (i)
      TIME TO PEAK    (hrs)=    1.500
      RUNOFF VOLUME    (mm)=   18.706
      TOTAL RAINFALL   (mm)=   60.219
      RUNOFF COEFFICIENT   =     .311

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

010:0007----------------------------------------------------------------------------
*# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
----------------------
| CALIB NASHYD       |   Area    (ha)=     .08   Curve Number   (CN)=74.00
| 05:105    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .110

      Unit Hyd Qpeak  (cms)=     .027

      PEAK FLOW       (cms)=     .005 (i)
      TIME TO PEAK    (hrs)=    1.433
      RUNOFF VOLUME    (mm)=   18.722
      TOTAL RAINFALL   (mm)=   60.219
      RUNOFF COEFFICIENT   =     .311

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

010:0008----------------------------------------------------------------------------
*# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 06:EXT1   DT= 1.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .01          .02
      Dep. Storage     (mm)=       1.00         8.92
      Average Slope     (%)=       1.00         2.00
      Length            (m)=      15.00        10.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=     122.29        39.27
                  over (min)        1.00         5.00
      Storage Coeff.  (min)=        .76 (ii)    5.22 (ii)
      Unit Hyd. Tpeak (min)=       1.00         5.00
      Unit Hyd. peak  (cms)=       1.25          .22
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .00           .00          .005 (iii)
      TIME TO PEAK    (hrs)=       1.30         1.38         1.333
      RUNOFF VOLUME    (mm)=      59.22        18.72        29.658
      TOTAL RAINFALL   (mm)=      60.22        60.22        60.219
      RUNOFF COEFFICIENT   =        .98          .31          .492

        (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.

010:0009----------------------------------------------------------------------------
*# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .00
| 07:EXT2   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .00          .00
      Dep. Storage     (mm)=       1.00         8.92
      Average Slope     (%)=       3.00         2.00
      Length            (m)=       5.00        10.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=     122.29        39.27
                  over (min)        1.00         5.00
      Storage Coeff.  (min)=        .28 (ii)    4.75 (ii)
      Unit Hyd. Tpeak (min)=       1.00         5.00
      Unit Hyd. peak  (cms)=       1.65          .27
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .00           .00          .001 (iii)
      TIME TO PEAK    (hrs)=       1.28         1.38         1.333
      RUNOFF VOLUME    (mm)=      59.22        18.72        58.814
      TOTAL RAINFALL   (mm)=      60.22        60.22        60.219
      RUNOFF COEFFICIENT   =        .98          .31          .977

        (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.

010:0010----------------------------------------------------------------------------
*# ADD FLOWS TO WILSON
------------------------
| ADD HYD (EX.WILSON ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:101            .09      .027    1.33  51.53    .000
                    +ID2 07:EXT2            .00      .001    1.33  58.81    .000
                      ============================================================
                      SUM 09:EX.WILSON      .10      .028    1.33  51.75    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

010:0011----------------------------------------------------------------------------
*# ADD FLOWS TO RES. BACKYARDS
------------------------
| ADD HYD (EX.BKYD   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 02:102            .56      .091    1.33  36.95    .000
                    +ID2 06:EXT1            .03      .005    1.33  29.66    .000
                      ============================================================
                      SUM 10:EX.BKYD        .59      .095    1.33  36.54    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

010:0012----------------------------------------------------------------------------
*# ADD FLOWS FROM EX. SITE
------------------------
| ADD HYD (EX.SITE   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 09:EX.WILSON      .10      .028    1.33  51.75    .000
                    +ID2 10:EX.BKYD         .59      .095    1.33  36.54    .000
                    +ID3 03:103             .03      .008    1.33  57.60    .000
                    +ID4 04:104             .02      .001    1.50  18.71    .000
                    +ID5 05:105             .08      .005    1.43  18.72    .000
                      ============================================================
                      SUM 07:EX.SITE        .81      .136    1.33  36.92    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

010:0013----------------------------------------------------------------------------
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .76
| 01:201    DT= 1.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .66          .10
      Dep. Storage     (mm)=       1.00         8.92
      Average Slope     (%)=       1.50         2.00
      Length            (m)=      15.00        10.00
      Mannings n           =       .013         .250

      Max.eff.Inten.(mm/hr)=     122.29        39.27
                  over (min)        1.00         5.00
      Storage Coeff.  (min)=        .67 (ii)    5.13 (ii)
      Unit Hyd. Tpeak (min)=       1.00         5.00
      Unit Hyd. peak  (cms)=       1.32          .22
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .22           .01          .231 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.38         1.333
      RUNOFF VOLUME    (mm)=      59.22        18.72        53.955
      TOTAL RAINFALL   (mm)=      60.22        60.22        60.219
      RUNOFF COEFFICIENT   =        .98          .31          .896

        (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.

010:0014----------------------------------------------------------------------------
*# ROUTE FLOWS THROUGH TANK WITH ORIFICE
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>01:(201    )   |
| OUT<02:(201_CT)   |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .014  .3220E-01
                            .008  .1020E-01   |     .016  .4320E-01
                            .012  .2120E-01   |     .018  .5090E-01

      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
      ---------------           (ha)     (cms)     (hrs)       (mm)
      INFLOW >01: (201   )        .76      .231     1.333     53.955
      OUTFLOW<02: (201_CT)        .76      .014     2.500     53.955
     OVERFLOW<03: (201_OV)        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=       .00

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=     5.874
                    TIME SHIFT OF PEAK FLOW          (min)=     70.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.2957E-01

010:0015----------------------------------------------------------------------------
*# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
----------------------
| CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
| 01:202    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .090

      Unit Hyd Qpeak  (cms)=     .010

      PEAK FLOW       (cms)=     .002 (i)
      TIME TO PEAK    (hrs)=    1.400
      RUNOFF VOLUME    (mm)=   18.715
      TOTAL RAINFALL   (mm)=   60.219
      RUNOFF COEFFICIENT   =     .311

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

010:0016----------------------------------------------------------------------------
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# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
----------
| CALIB STANDHYD     |   Area    (ha)=     .01
| 04:203    DT= 1.00 |   Total Imp(%)=   84.00   Dir. Conn.(%)=   84.00
----------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .00
     Dep. Storage     (mm)=       1.00         8.92
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      10.00        10.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     122.29        40.82
                  over (min)        1.00         5.00
     Storage Coeff.  (min)=        .48 (ii)    4.88 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.49          .23
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .003 (iii)
     TIME TO PEAK    (hrs)=       1.30         1.38         1.333
     RUNOFF VOLUME    (mm)=      59.22        19.35        52.841
     TOTAL RAINFALL   (mm)=      60.22        60.22        60.219
     RUNOFF COEFFICIENT   =        .98          .32          .877

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0017--------------------------------------------------------------------------
*# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
----------
| CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
| 05:204    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
----------  U.H. Tp(hrs)=    .090

     Unit Hyd Qpeak  (cms)=     .008

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.400
     RUNOFF VOLUME    (mm)=   18.715
     TOTAL RAINFALL   (mm)=   60.219
     RUNOFF COEFFICIENT   =     .311

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

--------------------------------------------------------------------------------
010:0018--------------------------------------------------------------------------
*# ADD PROPOSED FLOWS FROM SITE
------------------------
| ADD HYD (PROP.SITE ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 02:201_CTL        .76     .014    2.50  53.95    .000
                     +ID2 03:201_OVF        .00     .000     .00    .00    .000
                     +ID3 01:202            .02     .002    1.40  18.72    .000
                     +ID4 04:203            .01     .003    1.33  52.84    .000
                     +ID5 05:204            .02     .002    1.40  18.72    .000
                      ========================================================
                      SUM 06:PROP.SITE      .81     .017    1.33  52.03    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0019--------------------------------------------------------------------------
*# AREA CHECK
------------------------
| ADD HYD (CHECK     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 07:EX.SITE        .81     .136    1.33  36.92    .000
                     +ID2 06:PROP.SITE      .81     .017    1.33  52.03    .000
                      ========================================================
                      SUM 01:CHECK          1.63     .153    1.33  44.48    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0020--------------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
*
--------------------------------------------------------------------------------
010:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
010:0002--------------------------------------------------------------------------
*
  ** END OF RUN :  24

********************************************************************************
--------------------
| START            |  Project  dir.: T:\PROJECTS\20092\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\20092\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
             #  1=MTH4025.stm
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
*#*******************************************************************************|
*#  Project Name: WILSON AT ACADEMY
*#               HAMILTON, ONTARIO
*#  JOB NUMBER  : 20092
*#       Date   : DECEMBER 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20092.DAT
*#*******************************************************************************|
*
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 25-YR MT. HOPE (A=1719.5 B=10 C=0.823)
| Ptotal=  73.09 mm|    Comments: 25-YR MT. HOPE (A=1719.5 B=10 C=0.823)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.422 |   1.17  42.745 |   2.17  11.847 |   3.17   5.440
               .33   5.152 |   1.33 146.101 |   2.33   9.863 |   3.33   5.006
               .50   6.198 |   1.50  56.322 |   2.50   8.458 |   3.50   4.639
               .67   7.827 |   1.67  29.752 |   2.67   7.413 |   3.67   4.326
               .83  10.708 |   1.83  19.870 |   2.83   6.605 |   3.83   4.055
              1.00  17.140 |   2.00  14.849 |   3.00   5.963 |   4.00   3.818

--------------------------------------------------------------------------------
025:0003--------------------------------------------------------------------------
*
*#*******************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
----------
| CALIB STANDHYD     |   Area    (ha)=     .09
| 01:101    DT= 1.00 |   Total Imp(%)=   81.00   Dir. Conn.(%)=   81.00
----------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .08          .02
     Dep. Storage     (mm)=       1.00         8.92
     Average Slope     (%)=       3.50         2.50
     Length            (m)=      20.00        10.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     146.10        58.72
                  over (min)        1.00         4.00
     Storage Coeff.  (min)=        .57 (ii)    4.13 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.40          .28
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .033 (iii)
     TIME TO PEAK    (hrs)=       1.30         1.37         1.333
     RUNOFF VOLUME    (mm)=      72.09        26.84        63.489
     TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
     RUNOFF COEFFICIENT   =        .99          .37          .869

       (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.

--------------------------------------------------------------------------------
025:0004--------------------------------------------------------------------------
*# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
----------
| CALIB STANDHYD     |   Area    (ha)=     .56
| 02:102    DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
----------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .25          .31
     Dep. Storage     (mm)=       1.00         8.92
     Average Slope     (%)=       2.00         5.00
     Length            (m)=      35.00        65.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     146.10        43.90
                  over (min)        1.00        11.00
     Storage Coeff.  (min)=        .95 (ii)   10.92 (ii)
     Unit Hyd. Tpeak (min)=       1.00        11.00
     Unit Hyd. peak  (cms)=       1.11          .10
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .10          .02          .114 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      72.09        26.84        47.200
     TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
     RUNOFF COEFFICIENT   =        .99          .37          .646

       (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.

--------------------------------------------------------------------------------
025:0005--------------------------------------------------------------------------
*# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
----------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 03:103    DT= 1.00 |   Total Imp(%)=   96.00   Dir. Conn.(%)=   96.00
----------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=       1.00         8.92
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.00        10.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     146.10        56.76
                  over (min)        1.00         5.00
     Storage Coeff.  (min)=        .84 (ii)    4.69 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.19          .24
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .010 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.38         1.333
     RUNOFF VOLUME    (mm)=      72.09        26.84        70.276
     TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
     RUNOFF COEFFICIENT   =        .99          .37          .962

       (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.

--------------------------------------------------------------------------------
025:0006--------------------------------------------------------------------------
*# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
----------
| CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
| 04:104    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
----------  U.H. Tp(hrs)=    .140

     Unit Hyd Qpeak  (cms)=     .005

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.483
     RUNOFF VOLUME    (mm)=   26.822
     TOTAL RAINFALL   (mm)=   73.086
     RUNOFF COEFFICIENT   =     .367

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

--------------------------------------------------------------------------------
025:0007--------------------------------------------------------------------------
*# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
----------
| CALIB NASHYD       |   Area    (ha)=     .08   Curve Number   (CN)=74.00
| 05:105    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
----------  U.H. Tp(hrs)=    .110

     Unit Hyd Qpeak  (cms)=     .027

     PEAK FLOW       (cms)=     .008 (i)
     TIME TO PEAK    (hrs)=    1.417
     RUNOFF VOLUME    (mm)=   26.836
     TOTAL RAINFALL   (mm)=   73.086
     RUNOFF COEFFICIENT   =     .367

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

```
01621> ------------------------------------------------------------------------------
01622> 025:0008------------------------------------------------------------------------
01623> *# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
01624> ----------------------
01625> | CALIB STANDHYD     |   Area    (ha)=     .03
01626> | 06:EXT1   DT= 1.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
01627> ----------------------
01628>                              IMPERVIOUS    PERVIOUS (i)
01629>      Surface Area     (ha)=        .01          .02
01630>      Dep. Storage     (mm)=       1.00         8.92
01631>      Average Slope     (%)=       1.00         2.00
01632>      Length            (m)=      15.00        10.00
01633>      Mannings n             =      .013         .250
01634>
01635>      Max.eff.Inten.(mm/hr)=     146.10        56.76
01636>                   over (min)        1.00         5.00
01637>      Storage Coeff.  (min)=        .70 (ii)    4.56 (ii)
01638>      Unit Hyd. Tpeak (min)=       1.00         5.00
01639>      Unit Hyd. peak  (cms)=       1.29          .24
01640>                                                          *TOTALS*
01641>      PEAK FLOW       (cms)=        .00          .00          .006 (iii)
01642>      TIME TO PEAK    (hrs)=       1.30         1.38         1.333
01643>      RUNOFF VOLUME    (mm)=      72.09        26.84        39.055
01644>      TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
01645>      RUNOFF COEFFICIENT   =        .99          .37          .534
01646>
01647>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01648>            CN* =  74.0    Ia = Dep. Storage  (Above)
01649>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01650>            THAN THE STORAGE COEFFICIENT.
01651>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01652>
01653> ------------------------------------------------------------------------------
01654> 025:0009------------------------------------------------------------------------
01655> *# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
01656> ----------------------
01657> | CALIB STANDHYD     |   Area    (ha)=     .00
01658> | 07:EXT2   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
01659> ----------------------
01660>                              IMPERVIOUS    PERVIOUS (i)
01661>      Surface Area     (ha)=        .00          .00
01662>      Dep. Storage     (mm)=       1.00         8.92
01663>      Average Slope     (%)=       3.00         2.00
01664>      Length            (m)=       5.00        10.00
01665>      Mannings n             =      .013         .250
01666>
01667>      Max.eff.Inten.(mm/hr)=     146.10        58.72
01668>                   over (min)        1.00         4.00
01669>      Storage Coeff.  (min)=        .26 (ii)    4.06 (ii)
01670>      Unit Hyd. Tpeak (min)=       1.00         4.00
01671>      Unit Hyd. peak  (cms)=       1.66          .30
01672>                                                          *TOTALS*
01673>      PEAK FLOW       (cms)=        .00          .00          .001 (iii)
01674>      TIME TO PEAK    (hrs)=       1.23         1.37         1.333
01675>      RUNOFF VOLUME    (mm)=      72.09        26.84        71.634
01676>      TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
01677>      RUNOFF COEFFICIENT   =        .99          .37          .980
01678>
01679>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01680>            CN* =  74.0    Ia = Dep. Storage  (Above)
01681>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01682>            THAN THE STORAGE COEFFICIENT.
01683>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01684>
01685> ------------------------------------------------------------------------------
01686> 025:0010------------------------------------------------------------------------
01687> *# ADD FLOWS TO WILSON
01688> ------------------------
01689> | ADD HYD (EX.WILSON ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01690> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
01691>                       ID1 01:101             .09      .033    1.33  63.49    .000
01692>                      +ID2 07:EXT2            .00      .001    1.33  71.63    .000
01693>                       ========================================================
01694>                       SUM 09:EX.WILSON       .10      .035    1.33  63.74    .000
01695>
01696>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01697>
01698> ------------------------------------------------------------------------------
01699> 025:0011------------------------------------------------------------------------
01700> *# ADD FLOWS TO RES. BACKYARDS
01701> ------------------------
01702> | ADD HYD (EX.BKYD   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01703> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
01704>                       ID1 02:102             .56      .114    1.33  47.20    .000
01705>                      +ID2 06:EXT1            .03      .006    1.33  39.06    .000
01706>                       ========================================================
01707>                       SUM 10:EX.BKYD         .59      .120    1.33  46.75    .000
01708>
01709>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01710>
01711> ------------------------------------------------------------------------------
01712> 025:0012------------------------------------------------------------------------
01713> *# ADD FLOWS FROM EX. SITE
01714> ------------------------
01715> | ADD HYD (EX.SITE   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01716> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
01717>                       ID1 09:EX.WILSON       .10      .035    1.33  63.74    .000
01718>                      +ID2 10:EX.BKYD         .59      .120    1.33  46.75    .000
01719>                      +ID3 03:103             .03      .010    1.33  70.28    .000
01720>                      +ID4 04:104             .02      .002    1.48  26.82    .000
01721>                      +ID5 05:105             .08      .008    1.42  26.84    .000
01722>                       ========================================================
01723>                       SUM 07:EX.SITE         .81      .171    1.33  47.17    .000
01724>
01725>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01726>
01727> ------------------------------------------------------------------------------
01728> 025:0013------------------------------------------------------------------------
01729> *#*****************************************************************************|
01730> *#
01731> *#         POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01732> *#         ==============================================
01733> *#
01734> **#*****************************************************************************|
01735> *# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
01736> ----------------------
01737> | CALIB STANDHYD     |   Area    (ha)=     .76
01738> | 01:201    DT= 1.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
01739> ----------------------
01740>                              IMPERVIOUS    PERVIOUS (i)
01741>      Surface Area     (ha)=        .66          .10
01742>      Dep. Storage     (mm)=       1.00         8.92
01743>      Average Slope     (%)=       1.50         2.00
01744>      Length            (m)=      15.00        10.00
01745>      Mannings n             =      .013         .250
01746>
01747>      Max.eff.Inten.(mm/hr)=     146.10        58.72
01748>                   over (min)        1.00         4.00
01749>      Storage Coeff.  (min)=        .62 (ii)    4.42 (ii)
01750>      Unit Hyd. Tpeak (min)=       1.00         4.00
01751>      Unit Hyd. peak  (cms)=       1.36          .26
01752>                                                          *TOTALS*
01753>      PEAK FLOW       (cms)=        .27          .01          .279 (iii)
01754>      TIME TO PEAK    (hrs)=       1.33         1.37         1.333
01755>      RUNOFF VOLUME    (mm)=      72.09        26.84        66.204
01756>      TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
01757>      RUNOFF COEFFICIENT   =        .99          .37          .906
01758>
01759>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01760>            CN* =  74.0    Ia = Dep. Storage  (Above)
01761>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01762>            THAN THE STORAGE COEFFICIENT.
01763>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01764>
01765> ------------------------------------------------------------------------------
01766> 025:0014------------------------------------------------------------------------
01767> *# ROUTE FLOWS THROUGH TANK WITH ORIFICE
01768> ----------------------
01769> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
01770> |  IN>01:(201   )   |
01771> | OUT<02:(201_CT)   |    =========  OUTFLOW STORAGE TABLE  =========
01772> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01773>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
01774>                              .000  .0000E+00    |     .014  .3220E-01
01775>                              .008  .1020E-01    |     .016  .4320E-01
01776>                              .012  .2120E-01    |     .018  .5090E-01
01777>
01778>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01779>      ---------------            (ha)     (cms)     (hrs)       (mm)
01780>      INFLOW >01: (201   )        .76      .279     1.333      66.204
01781>      OUTFLOW<02: (201_CT)        .76      .015     2.533      66.204
01782>     OVERFLOW<03: (201_OV)        .00      .000      .000       .000
01783>
01784>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01785>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
01786>                    PERCENTAGE OF TIME OVERFLOWING    (%)=       .00
01787>
01788>
01789>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=     5.434
01790>                    TIME SHIFT OF PEAK FLOW         (min)=     72.00
01791>                    MAXIMUM  STORAGE   USED       (ha.m.)=.3705E-01
01792>
01793> ------------------------------------------------------------------------------
01794> 025:0015------------------------------------------------------------------------
01795> *# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
01796> ----------------------
01797> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
01798> | 01:202    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
01799> ----------------------   U.H. Tp(hrs)=    .090
01800>
01801>      Unit Hyd Qpeak  (cms)=     .010
01802>
01803>      PEAK FLOW       (cms)=     .003 (i)
01804>      TIME TO PEAK    (hrs)=    1.383
01805>      RUNOFF VOLUME    (mm)=   26.830
01806>      TOTAL RAINFALL   (mm)=   73.086
01807>      RUNOFF COEFFICIENT   =     .367
01808>
01809>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01810>
01811> ------------------------------------------------------------------------------
01812> 025:0016------------------------------------------------------------------------
01813> *# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
01814> ----------------------
01815> | CALIB STANDHYD     |   Area    (ha)=     .01
01816> | 04:203    DT= 1.00 |   Total Imp(%)=   84.00   Dir. Conn.(%)=   84.00
01817> ----------------------
01818>                              IMPERVIOUS    PERVIOUS (i)
01819>      Surface Area     (ha)=        .01          .00
01820>      Dep. Storage     (mm)=       1.00         8.92
01821>      Average Slope     (%)=       2.00         2.00
01822>      Length            (m)=      10.00        10.00
01823>      Mannings n             =      .013         .250
01824>
01825>      Max.eff.Inten.(mm/hr)=     146.10        60.82
01826>                   over (min)        1.00         4.00
01827>      Storage Coeff.  (min)=        .45 (ii)    4.20 (ii)
01828>      Unit Hyd. Tpeak (min)=       1.00         4.00
01829>      Unit Hyd. peak  (cms)=       1.52          .27
01830>                                                          *TOTALS*
01831>      PEAK FLOW       (cms)=        .00          .00          .004 (iii)
01832>      TIME TO PEAK    (hrs)=       1.27         1.37         1.333
01833>      RUNOFF VOLUME    (mm)=      72.09        27.66        64.979
01834>      TOTAL RAINFALL   (mm)=      73.09        73.09        73.086
01835>      RUNOFF COEFFICIENT   =        .99          .38          .889
01836>
01837>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01838>            CN* =  75.0    Ia = Dep. Storage  (Above)
01839>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01840>            THAN THE STORAGE COEFFICIENT.
01841>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01842>
01843> ------------------------------------------------------------------------------
01844> 025:0017------------------------------------------------------------------------
01845> *# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
01846> ----------------------
01847> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
01848> | 05:204    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
01849> ----------------------   U.H. Tp(hrs)=    .090
01850>
01851>      Unit Hyd Qpeak  (cms)=     .008
01852>
01853>      PEAK FLOW       (cms)=     .002 (i)
01854>      TIME TO PEAK    (hrs)=    1.383
01855>      RUNOFF VOLUME    (mm)=   26.830
01856>      TOTAL RAINFALL   (mm)=   73.086
01857>      RUNOFF COEFFICIENT   =     .367
01858>
01859>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01860>
01861> ------------------------------------------------------------------------------
01862> 025:0018------------------------------------------------------------------------
01863> *# ADD PROPOSED FLOWS FROM SITE
01864> ------------------------
01865> | ADD HYD (PROP.SITE ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01866> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
01867>                       ID1 02:201_CTL         .76      .015    2.53  66.20    .000
01868>                      +ID2 03:201_OVF         .00      .000     .00    .00    .000
01869>                      +ID3 01:202             .02      .003    1.38  26.83    .000
01870>                      +ID4 04:203             .01      .004    1.33  64.98    .000
01871>                      +ID5 05:204             .02      .002    1.38  26.83    .000
01872>                       ========================================================
01873>                       SUM 06:PROP.SITE       .81      .020    1.33  64.06    .000
01874>
01875>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01876>
01877> ------------------------------------------------------------------------------
01878> 025:0019------------------------------------------------------------------------
01879> *# AREA CHECK
01880> ----------------------
01881> | ADD HYD (CHECK     ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01882> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
01883>                       ID1 07:EX.SITE         .81      .171    1.33  47.17    .000
01884>                      +ID2 06:PROP.SITE       .81      .020    1.33  64.06    .000
01885>                       ========================================================
01886>                       SUM 01:CHECK          1.63      .191    1.33  55.61    .000
01887>
01888>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01889>
01890> ------------------------------------------------------------------------------
```

```
01891> 025:0020-------------------------------------------------------------------------------
01892> * RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
01893> *
01894> -------------------------------------------------------------------------------
01895> 025:0002-------------------------------------------------------------------------------
01896> *
01897> -------------------------------------------------------------------------------
01898> 025:0002-------------------------------------------------------------------------------
01899> *
01900> -------------------------------------------------------------------------------
01901> 025:0002-------------------------------------------------------------------------------
01902> *
01903>   ** END OF RUN :  49
01904>
01905> ********************************************************************************
01906>
01907>
01908>
01909>
01910>
01911> --------------------
01912> | START            |  Project  dir.: T:\PROJECTS\20092\SWMHYMO\
01913> --------------------  Rainfall dir.: T:\PROJECTS\20092\SWMHYMO\
01914>     TZERO =   .00 hrs on       0
01915>     METOUT=   2 (output = METRIC)
01916>     NRUN  = 050
01917>     NSTORM=   1
01918>              #  1=MTH4050.stm
01919> -------------------------------------------------------------------------------
01920> 050:0002-------------------------------------------------------------------------------
01921> *#*****************************************************************************|
01922> *#  Project Name: WILSON AT ACADEMY
01923> *#               HAMILTON, ONTARIO
01924> *#  JOB NUMBER   : 20092
01925> *#       Date    : DECEMBER 2021
01926> *#    Revised    :
01927> *#    Company    : S. LLEWELLYN AND ASSOCIATES LTD.
01928> *#       File    : 20092.DAT
01929> *#*****************************************************************************|
01930> *
01931> -------------------------------------------------------------------------------
01932> 050:0002-------------------------------------------------------------------------------
01933> *
01934> --------------------
01935> | READ STORM       |    Filename: 50-YR MT. HOPE (A=1954.8 B=10 C=0.826)
01936> | Ptotal=  81.72 mm|    Comments: 50-YR MT. HOPE (A=1954.8 B=10 C=0.826)
01937> --------------------
01938>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01939>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01940>                .17   4.881 |   1.17  47.876 |   2.17  13.160 |   3.17   6.012
01941>                .33   5.692 |   1.33 164.608 |   2.33  10.942 |   3.33   5.529
01942>                .50   6.856 |   1.50  63.166 |   2.50   9.374 |   3.50   5.122
01943>                .67   8.670 |   1.67  33.244 |   2.67   8.209 |   3.67   4.774
01944>                .83  11.887 |   1.83  22.146 |   2.83   7.309 |   3.83   4.473
01945>               1.00  19.086 |   2.00  16.518 |   3.00   6.594 |   4.00   4.210
01946>
01947> -------------------------------------------------------------------------------
01948> 050:0003-------------------------------------------------------------------------------
01949> *
01950> *#*****************************************************************************|
01951> *#
01952> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01953> *#        ==============================================
01954> *#
01955> **#*****************************************************************************|
01956> *# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
01957> ----------------------
01958> | CALIB STANDHYD     |   Area    (ha)=     .09
01959> | 01:101    DT= 1.00 |   Total Imp(%)=   81.00   Dir. Conn.(%)=   81.00
01960> ----------------------
01961>                              IMPERVIOUS    PERVIOUS (i)
01962>      Surface Area     (ha)=        .08          .02
01963>      Dep. Storage     (mm)=       1.00         8.92
01964>      Average Slope     (%)=       3.50         2.50
01965>      Length            (m)=      20.00        10.00
01966>      Mannings n            =       .013         .250
01967>
01968>      Max.eff.Inten.(mm/hr)=     164.61        73.01
01969>                   over (min)        1.00         4.00
01970>      Storage Coeff.  (min)=        .55 (ii)    3.81 (ii)
01971>      Unit Hyd. Tpeak (min)=       1.00         4.00
01972>      Unit Hyd. peak  (cms)=       1.43          .29
01973>                                                          *TOTALS*
01974>      PEAK FLOW       (cms)=        .04          .00          .038 (iii)
01975>      TIME TO PEAK    (hrs)=       1.30         1.37         1.333
01976>      RUNOFF VOLUME    (mm)=      80.72        32.71        71.600
01977>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
01978>      RUNOFF COEFFICIENT   =        .99          .40          .876
01979>
01980>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01981>            CN* =  74.0    Ia = Dep. Storage  (Above)
01982>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01983>            THAN THE STORAGE COEFFICIENT.
01984>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01985>
01986> -------------------------------------------------------------------------------
01987> 050:0004-------------------------------------------------------------------------------
01988> *# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
01989> ----------------------
01990> | CALIB STANDHYD     |   Area    (ha)=     .56
01991> | 02:102    DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
01992> ----------------------
01993>                              IMPERVIOUS    PERVIOUS (i)
01994>      Surface Area     (ha)=        .25          .31
01995>      Dep. Storage     (mm)=       1.00         8.92
01996>      Average Slope     (%)=       2.00         5.00
01997>      Length            (m)=      35.00        65.00
01998>      Mannings n            =       .013         .250
01999>
02000>      Max.eff.Inten.(mm/hr)=     164.61        57.60
02001>                   over (min)        1.00        10.00
02002>      Storage Coeff.  (min)=        .91 (ii)    9.85 (ii)
02003>      Unit Hyd. Tpeak (min)=       1.00        10.00
02004>      Unit Hyd. peak  (cms)=       1.14          .11
02005>                                                          *TOTALS*
02006>      PEAK FLOW       (cms)=        .12          .03          .133 (iii)
02007>      TIME TO PEAK    (hrs)=       1.33         1.48         1.333
02008>      RUNOFF VOLUME    (mm)=      80.72        32.71        54.315
02009>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
02010>      RUNOFF COEFFICIENT   =        .99          .40          .665
02011>
02012>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02013>            CN* =  74.0    Ia = Dep. Storage  (Above)
02014>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02015>            THAN THE STORAGE COEFFICIENT.
02016>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02017>
02018> -------------------------------------------------------------------------------
02019> 050:0005-------------------------------------------------------------------------------
02020> *# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
02021> ----------------------
02022> | CALIB STANDHYD     |   Area    (ha)=     .03
02023> | 03:103    DT= 1.00 |   Total Imp(%)=   96.00   Dir. Conn.(%)=   96.00
02024> ----------------------
02025>                              IMPERVIOUS    PERVIOUS (i)
02026>      Surface Area     (ha)=        .02          .00
02027>      Dep. Storage     (mm)=       1.00         8.92
02028>      Average Slope     (%)=       1.00         2.00
02029>      Length            (m)=      20.00        10.00
02030>      Mannings n            =       .013         .250
02031>
02032>      Max.eff.Inten.(mm/hr)=     164.61        73.01
02033>                   over (min)        1.00         4.00
02034>      Storage Coeff.  (min)=        .80 (ii)    4.28 (ii)
02035>      Unit Hyd. Tpeak (min)=       1.00         4.00
02036>      Unit Hyd. peak  (cms)=       1.21          .27
02037>                                                          *TOTALS*
02038>      PEAK FLOW       (cms)=        .01          .00          .011 (iii)
02039>      TIME TO PEAK    (hrs)=       1.33         1.37         1.333
02040>      RUNOFF VOLUME    (mm)=      80.72        32.71        78.802
02041>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
02042>      RUNOFF COEFFICIENT   =        .99          .40          .964
02043>
02044>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02045>            CN* =  74.0    Ia = Dep. Storage  (Above)
02046>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02047>            THAN THE STORAGE COEFFICIENT.
02048>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02049>
02050> -------------------------------------------------------------------------------
02051> 050:0006-------------------------------------------------------------------------------
02052> *# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
02053> ----------------------
02054> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
02055> | 04:104    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02056> ----------------------  U.H. Tp(hrs)=    .140
02057>
02058>      Unit Hyd Qpeak  (cms)=     .005
02059>
02060>      PEAK FLOW       (cms)=     .002 (i)
02061>      TIME TO PEAK    (hrs)=    1.467
02062>      RUNOFF VOLUME    (mm)=   32.692
02063>      TOTAL RAINFALL   (mm)=   81.723
02064>      RUNOFF COEFFICIENT   =     .400
02065>
02066>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02067>
02068> -------------------------------------------------------------------------------
02069> 050:0007-------------------------------------------------------------------------------
02070> *# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
02071> ----------------------
02072> | CALIB NASHYD       |   Area    (ha)=     .08   Curve Number   (CN)=74.00
02073> | 05:105    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02074> ----------------------  U.H. Tp(hrs)=    .110
02075>
02076>      Unit Hyd Qpeak  (cms)=     .027
02077>
02078>      PEAK FLOW       (cms)=     .010 (i)
02079>      TIME TO PEAK    (hrs)=    1.417
02080>      RUNOFF VOLUME    (mm)=   32.706
02081>      TOTAL RAINFALL   (mm)=   81.723
02082>      RUNOFF COEFFICIENT   =     .400
02083>
02084>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02085>
02086> -------------------------------------------------------------------------------
02087> 050:0008-------------------------------------------------------------------------------
02088> *# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
02089> ----------------------
02090> | CALIB STANDHYD     |   Area    (ha)=     .03
02091> | 06:EXT1   DT= 1.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
02092> ----------------------
02093>                              IMPERVIOUS    PERVIOUS (i)
02094>      Surface Area     (ha)=        .01          .02
02095>      Dep. Storage     (mm)=       1.00         8.92
02096>      Average Slope     (%)=       1.00         2.00
02097>      Length            (m)=      15.00        10.00
02098>      Mannings n            =       .013         .250
02099>
02100>      Max.eff.Inten.(mm/hr)=     164.61        73.01
02101>                   over (min)        1.00         4.00
02102>      Storage Coeff.  (min)=        .67 (ii)    4.15 (ii)
02103>      Unit Hyd. Tpeak (min)=       1.00         4.00
02104>      Unit Hyd. peak  (cms)=       1.32          .28
02105>                                                          *TOTALS*
02106>      PEAK FLOW       (cms)=        .00          .00          .008 (iii)
02107>      TIME TO PEAK    (hrs)=       1.30         1.37         1.333
02108>      RUNOFF VOLUME    (mm)=      80.72        32.71        45.672
02109>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
02110>      RUNOFF COEFFICIENT   =        .99          .40          .559
02111>
02112>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02113>            CN* =  74.0    Ia = Dep. Storage  (Above)
02114>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02115>            THAN THE STORAGE COEFFICIENT.
02116>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02117>
02118> -------------------------------------------------------------------------------
02119> 050:0009-------------------------------------------------------------------------------
02120> *# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
02121> ----------------------
02122> | CALIB STANDHYD     |   Area    (ha)=     .00
02123> | 07:EXT2   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
02124> ----------------------
02125>                              IMPERVIOUS    PERVIOUS (i)
02126>      Surface Area     (ha)=        .00          .00
02127>      Dep. Storage     (mm)=       1.00         8.92
02128>      Average Slope     (%)=       3.00         2.00
02129>      Length            (m)=       5.00        10.00
02130>      Mannings n            =       .013         .250
02131>
02132>      Max.eff.Inten.(mm/hr)=     164.61        73.01
02133>                   over (min)        1.00         4.00
02134>      Storage Coeff.  (min)=        .25 (ii)    3.73 (ii)
02135>      Unit Hyd. Tpeak (min)=       1.00         4.00
02136>      Unit Hyd. peak  (cms)=       1.67          .32
02137>                                                          *TOTALS*
02138>      PEAK FLOW       (cms)=        .00          .00          .001 (iii)
02139>      TIME TO PEAK    (hrs)=       1.25         1.37         1.333
02140>      RUNOFF VOLUME    (mm)=      80.72        32.71        80.243
02141>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
02142>      RUNOFF COEFFICIENT   =        .99          .40          .982
02143>
02144>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02145>            CN* =  74.0    Ia = Dep. Storage  (Above)
02146>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02147>            THAN THE STORAGE COEFFICIENT.
02148>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02149>
02150> -------------------------------------------------------------------------------
02151> 050:0010-------------------------------------------------------------------------------
02152> *# ADD FLOWS TO WILSON
02153> ----------------------
02154> | ADD HYD (EX.WILSON ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02155> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
02156>                      ID1 01:101            .09      .038    1.33  71.60    .000
02157>                     +ID2 07:EXT2           .00      .001    1.33  80.24    .000
02158>                      ================================================================
02159>                      SUM 09:EX.WILSON      .10      .039    1.33  71.86    .000
02160>
```

```
02161>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02162>
02163> ---------------------------------------------------------------------------
02164> 050:0011-----------------------------------------------------------------
02165> *# ADD FLOWS TO RES. BACKYARDS
02166> ------------------------
02167> | ADD HYD (EX.BKYD   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02168> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
02169>                       ID1 02:102           .56     .133    1.33  54.31    .000
02170>                      +ID2 06:EXT1          .03     .008    1.33  45.67    .000
02171>                       ========================================================
02172>                       SUM 10:EX.BKYD        .59     .141    1.33  53.83    .000
02173>
02174>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02175>
02176> ---------------------------------------------------------------------------
02177> 050:0012-----------------------------------------------------------------
02178> *# ADD FLOWS FROM EX. SITE
02179> ------------------------
02180> | ADD HYD (EX.SITE   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02181> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
02182>                       ID1 09:EX.WILSON      .10     .039    1.33  71.86    .000
02183>                      +ID2 10:EX.BKYD        .59     .141    1.33  53.83    .000
02184>                      +ID3 03:103            .03     .011    1.33  78.80    .000
02185>                      +ID4 04:104            .02     .002    1.47  32.69    .000
02186>                      +ID5 05:105            .08     .010    1.42  32.71    .000
02187>                       ========================================================
02188>                       SUM 07:EX.SITE        .81     .200    1.33  54.28    .000
02189>
02190>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02191>
02192> ---------------------------------------------------------------------------
02193> 050:0013-----------------------------------------------------------------
02194> *#*************************************************************************|
02195> *#
02196> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
02197> *#        ==============================================
02198> *#
02199> **#*************************************************************************|
02200> *# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
02201> ----------------------
02202> | CALIB STANDHYD     |   Area    (ha)=     .76
02203> | 01:201    DT= 1.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
02204> ----------------------
02205>                              IMPERVIOUS    PERVIOUS (i)
02206>      Surface Area     (ha)=        .66          .10
02207>      Dep. Storage     (mm)=       1.00         8.92
02208>      Average Slope     (%)=       1.50         2.00
02209>      Length            (m)=      15.00        10.00
02210>      Mannings n             =       .013         .250
02211>
02212>      Max.eff.Inten.(mm/hr)=     164.61        73.01
02213>                   over (min)        1.00         4.00
02214>      Storage Coeff.  (min)=        .59 (ii)    4.08 (ii)
02215>      Unit Hyd. Tpeak (min)=       1.00         4.00
02216>      Unit Hyd. peak  (cms)=       1.38          .28
02217>                                                          *TOTALS*
02218>      PEAK FLOW       (cms)=        .30          .02          .317 (iii)
02219>      TIME TO PEAK    (hrs)=       1.33         1.37         1.333
02220>      RUNOFF VOLUME    (mm)=      80.72        32.71        74.481
02221>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
02222>      RUNOFF COEFFICIENT   =        .99          .40          .911
02223>
02224>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02225>            CN* =  74.0    Ia = Dep. Storage  (Above)
02226>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02227>            THAN THE STORAGE COEFFICIENT.
02228>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02229>
02230> ---------------------------------------------------------------------------
02231> 050:0014-----------------------------------------------------------------
02232> *# ROUTE FLOWS THROUGH TANK WITH ORIFICE
02233> --------------------
02234> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
02235> |  IN>01:(201   )   |
02236> | OUT<02:(201_CT)   |    =========  OUTLFOW STORAGE TABLE  =========
02237> --------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
02238>                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
02239>                           .000  .0000E+00     |     .014  .3220E-01
02240>                           .008  .1020E-01     |     .016  .4320E-01
02241>                           .012  .2120E-01     |     .018  .5090E-01
02242>
02243>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
02244>      --------------------       (ha)     (cms)     (hrs)       (mm)
02245>      INFLOW >01: (201   )         .76      .317     1.333     74.481
02246>      OUTFLOW<02: (201_CT)         .76      .016     2.667     74.480
02247>     OVERFLOW<03: (201_OV)         .00      .000      .000       .000
02248>
02249>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
02250>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
02251>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
02252>
02253>
02254>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.117
02255>                     TIME SHIFT OF PEAK FLOW          (min)=    80.00
02256>                     MAXIMUM  STORAGE   USED       (ha.m.)=.4219E-01
02257>
02258> ---------------------------------------------------------------------------
02259> 050:0015-----------------------------------------------------------------
02260> *# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
02261> ----------------------
02262> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
02263> | 01:202    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02264> ----------------------   U.H. Tp(hrs)=    .090
02265>
02266>      Unit Hyd Qpeak  (cms)=     .010
02267>
02268>      PEAK FLOW       (cms)=     .003 (i)
02269>      TIME TO PEAK    (hrs)=    1.383
02270>      RUNOFF VOLUME    (mm)=   32.700
02271>      TOTAL RAINFALL   (mm)=   81.723
02272>      RUNOFF COEFFICIENT   =     .400
02273>
02274>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02275>
02276> ---------------------------------------------------------------------------
02277> 050:0016-----------------------------------------------------------------
02278> *# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
02279> ----------------------
02280> | CALIB STANDHYD     |   Area    (ha)=     .01
02281> | 04:203    DT= 1.00 |   Total Imp(%)=   84.00   Dir. Conn.(%)=   84.00
02282> ----------------------
02283>                              IMPERVIOUS    PERVIOUS (i)
02284>      Surface Area     (ha)=        .01          .00
02285>      Dep. Storage     (mm)=       1.00         8.92
02286>      Average Slope     (%)=       2.00         2.00
02287>      Length            (m)=      10.00        10.00
02288>      Mannings n             =       .013         .250
02289>
02290>      Max.eff.Inten.(mm/hr)=     164.61        75.47
02291>                   over (min)        1.00         4.00
02292>      Storage Coeff.  (min)=        .43 (ii)    3.87 (ii)
02293>      Unit Hyd. Tpeak (min)=       1.00         4.00
02294>      Unit Hyd. peak  (cms)=       1.54          .29
02295>                                                          *TOTALS*
02296>      PEAK FLOW       (cms)=        .00          .00          .004 (iii)
02297>      TIME TO PEAK    (hrs)=       1.25         1.37         1.333
02298>      RUNOFF VOLUME    (mm)=      80.72        33.66        73.192
02299>      TOTAL RAINFALL   (mm)=      81.72        81.72        81.723
02300>      RUNOFF COEFFICIENT   =        .99          .41          .896
02301>
02302>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02303>            CN* =  75.0    Ia = Dep. Storage  (Above)
02304>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02305>            THAN THE STORAGE COEFFICIENT.
02306>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02307>
02308> ---------------------------------------------------------------------------
02309> 050:0017-----------------------------------------------------------------
02310> *# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
02311> ----------------------
02312> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number   (CN)=74.00
02313> | 05:204    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02314> ----------------------   U.H. Tp(hrs)=    .090
02315>
02316>      Unit Hyd Qpeak  (cms)=     .008
02317>
02318>      PEAK FLOW       (cms)=     .003 (i)
02319>      TIME TO PEAK    (hrs)=    1.383
02320>      RUNOFF VOLUME    (mm)=   32.698
02321>      TOTAL RAINFALL   (mm)=   81.723
02322>      RUNOFF COEFFICIENT   =     .400
02323>
02324>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02325>
02326> ---------------------------------------------------------------------------
02327> 050:0018-----------------------------------------------------------------
02328> *# ADD PROPOSED FLOWS FROM SITE
02329> ------------------------
02330> | ADD HYD (PROP.SITE ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02331> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
02332>                       ID1 02:201_CTL        .76     .016    2.67  74.48    .000
02333>                      +ID2 03:201_OVF        .00     .000     .00    .00    .000
02334>                      +ID3 01:202            .02     .003    1.38  32.70    .000
02335>                      +ID4 04:203            .01     .004    1.33  73.19    .000
02336>                      +ID5 05:204            .02     .003    1.38  32.70    .000
02337>                       ========================================================
02338>                       SUM 06:PROP.SITE      .81     .022    1.33  72.20    .000
02339>
02340>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02341>
02342> ---------------------------------------------------------------------------
02343> 050:0019-----------------------------------------------------------------
02344> *# AREA CHECK
02345> ------------------------
02346> | ADD HYD (CHECK     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02347> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
02348>                       ID1 07:EX.SITE        .81     .200    1.33  54.28    .000
02349>                      +ID2 06:PROP.SITE      .81     .022    1.33  72.20    .000
02350>                       ========================================================
02351>                       SUM 01:CHECK          1.63     .222    1.33  63.24    .000
02352>
02353>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02354>
02355> ---------------------------------------------------------------------------
02356> 050:0020-----------------------------------------------------------------
02357> * RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
02358> *
02359> ---------------------------------------------------------------------------
02360> 050:0002-----------------------------------------------------------------
02361> *
02362> ---------------------------------------------------------------------------
02363> 050:0002-----------------------------------------------------------------
02364> *
02365> ---------------------------------------------------------------------------
02366> 050:0002-----------------------------------------------------------------
02367> *
02368> ---------------------------------------------------------------------------
02369> 050:0002-----------------------------------------------------------------
02370> *
02371>   ** END OF RUN :  99
02372>
02373> ***************************************************************************
02374>
02375>
02376>
02377>
02378>
02379> --------------------
02380> | START            |  Project  dir.: T:\PROJECTS\20092\SWMHYMO\
02381> --------------------  Rainfall dir.: T:\PROJECTS\20092\SWMHYMO\
02382>     TZERO =   .00 hrs on        0
02383>     METOUT=   2 (output = METRIC)
02384>     NRUN  = 100
02385>     NSTORM=   1
02386>               #  1=MTH4100.stm
02387> ---------------------------------------------------------------------------
02388> 100:0002-----------------------------------------------------------------
02389> *#*************************************************************************|
02390> *#  Project Name: WILSON AT ACADEMY
02391> *#               HAMILTON, ONTARIO
02392> *#  JOB NUMBER  : 20092
02393> *#       Date   : DECEMBER 2021
02394> *#    Revised   :
02395> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
02396> *#       File   : 20092.DAT
02397> *#*************************************************************************|
02398> *
02399> ---------------------------------------------------------------------------
02400> 100:0002-----------------------------------------------------------------
02401> *
02402> --------------------
02403> | READ STORM       |    Filename: 100-YR MT. HOPE (A=2317.4 B=11 C=0.836)
02404> | Ptotal=  91.37 mm|    Comments: 100-YR MT. HOPE (A=2317.4 B=11 C=0.836)
02405> --------------------
02406>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
02407>               hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
02408>               .17   5.311 |   1.17  54.599 |   2.17  14.754 |   3.17   6.584
02409>               .33   6.222 |   1.33 181.813 |   2.33  12.204 |   3.33   6.040
02410>               .50   7.538 |   1.50  72.007 |   2.50  10.407 |   3.50   5.582
02411>               .67   9.603 |   1.67  37.943 |   2.67   9.076 |   3.67   5.191
02412>               .83  13.290 |   1.83  25.134 |   2.83   8.053 |   3.83   4.855
02413>              1.00  21.597 |   2.00  18.629 |   3.00   7.242 |   4.00   4.561
02414>
02415> ---------------------------------------------------------------------------
02416> 100:0003-----------------------------------------------------------------
02417> *
02418> *#*************************************************************************|
02419> *#
02420> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
02421> *#        ==============================================
02422> *#
02423> **#*************************************************************************|
02424> *# CATCHMENT 101 - EXISTING CONDITIONS (TO WILSON)
02425> ----------------------
02426> | CALIB STANDHYD     |   Area    (ha)=     .09
02427> | 01:101    DT= 1.00 |   Total Imp(%)=   81.00   Dir. Conn.(%)=   81.00
02428> ----------------------
02429>                              IMPERVIOUS    PERVIOUS (i)
02430>      Surface Area     (ha)=        .08          .02
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02431>      Dep. Storage     (mm)=       1.00         8.92
02432>      Average Slope     (%)=       3.50         2.50
02433>      Length            (m)=      20.00        10.00
02434>      Mannings n            =       .013         .250
02435>
02436>      Max.eff.Inten.(mm/hr)=     181.81        87.81
02437>                  over (min)        1.00         4.00
02438>      Storage Coeff.  (min)=        .53 (ii)    3.55 (ii)
02439>      Unit Hyd. Tpeak (min)=       1.00         4.00
02440>      Unit Hyd. peak  (cms)=       1.45          .30
02441>                                                          *TOTALS*
02442>      PEAK FLOW       (cms)=        .04          .00          .042 (iii)
02443>      TIME TO PEAK    (hrs)=       1.30         1.35         1.333
02444>      RUNOFF VOLUME    (mm)=      90.37        39.60        80.725
02445>      TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02446>      RUNOFF COEFFICIENT   =        .99          .43          .883
02447>
02448>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02449>            CN* =  74.0    Ia = Dep. Storage  (Above)
02450>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02451>            THAN THE STORAGE COEFFICIENT.
02452>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02453>
02454> ----------------------------------------------------------------------------
02455> 100:0004----------------------------------------------------------------------
02456> *# CATCHMENT 102 - EXISTING CONDITIONS (TO RES. BACKYARDS)
02457> ----------------------
02458> | CALIB STANDHYD     |   Area    (ha)=     .56
02459> | 02:102    DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
02460> ----------------------
02461>                                IMPERVIOUS    PERVIOUS (i)
02462>      Surface Area     (ha)=        .25          .31
02463>      Dep. Storage     (mm)=       1.00         8.92
02464>      Average Slope     (%)=       2.00         5.00
02465>      Length            (m)=      35.00        65.00
02466>      Mannings n            =       .013         .250
02467>
02468>      Max.eff.Inten.(mm/hr)=     181.81        73.98
02469>                  over (min)        1.00         9.00
02470>      Storage Coeff.  (min)=        .87 (ii)    8.96 (ii)
02471>      Unit Hyd. Tpeak (min)=       1.00         9.00
02472>      Unit Hyd. peak  (cms)=       1.16          .13
02473>                                                          *TOTALS*
02474>      PEAK FLOW       (cms)=        .13          .04          .153 (iii)
02475>      TIME TO PEAK    (hrs)=       1.33         1.45         1.333
02476>      RUNOFF VOLUME    (mm)=      90.37        39.59        62.445
02477>      TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02478>      RUNOFF COEFFICIENT   =        .99          .43          .683
02479>
02480>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02481>            CN* =  74.0    Ia = Dep. Storage  (Above)
02482>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02483>            THAN THE STORAGE COEFFICIENT.
02484>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02485>
02486> ----------------------------------------------------------------------------
02487> 100:0005----------------------------------------------------------------------
02488> *# CATCHMENT 103 - EXISTING CONDITIONS (TO ACADEMY)
02489> ----------------------
02490> | CALIB STANDHYD     |   Area    (ha)=     .03
02491> | 03:103    DT= 1.00 |   Total Imp(%)=   96.00   Dir. Conn.(%)=   96.00
02492> ----------------------
02493>                                IMPERVIOUS    PERVIOUS (i)
02494>      Surface Area     (ha)=        .02          .00
02495>      Dep. Storage     (mm)=       1.00         8.92
02496>      Average Slope     (%)=       1.00         2.00
02497>      Length            (m)=      20.00        10.00
02498>      Mannings n            =       .013         .250
02499>
02500>      Max.eff.Inten.(mm/hr)=     181.81        87.81
02501>                  over (min)        1.00         4.00
02502>      Storage Coeff.  (min)=        .77 (ii)    4.00 (ii)
02503>      Unit Hyd. Tpeak (min)=       1.00         4.00
02504>      Unit Hyd. peak  (cms)=       1.24          .28
02505>                                                          *TOTALS*
02506>      PEAK FLOW       (cms)=        .01          .00          .012 (iii)
02507>      TIME TO PEAK    (hrs)=       1.32         1.37         1.333
02508>      RUNOFF VOLUME    (mm)=      90.37        39.60        88.341
02509>      TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02510>      RUNOFF COEFFICIENT   =        .99          .43          .967
02511>
02512>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02513>            CN* =  74.0    Ia = Dep. Storage  (Above)
02514>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02515>            THAN THE STORAGE COEFFICIENT.
02516>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02517>
02518> ----------------------------------------------------------------------------
02519> 100:0006----------------------------------------------------------------------
02520> *# CATCHMENT 104 - EXISTING CONDITIONS (TO LORNE)
02521> ----------------------
02522> | CALIB NASHYD       |   Area    (ha)=     .02   Curve Number    (CN)=74.00
02523> | 04:104    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02524> ----------------------   U.H. Tp(hrs)=    .140
02525>
02526>      Unit Hyd Qpeak  (cms)=     .005
02527>
02528>      PEAK FLOW       (cms)=     .003 (i)
02529>      TIME TO PEAK    (hrs)=    1.467
02530>      RUNOFF VOLUME    (mm)=   39.577
02531>      TOTAL RAINFALL   (mm)=   91.372
02532>      RUNOFF COEFFICIENT   =     .433
02533>
02534>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02535>
02536> ----------------------------------------------------------------------------
02537> 100:0007----------------------------------------------------------------------
02538> *# CATCHMENT 105 - EXISTING CONDITIONS (TO BROOKSIDE)
02539> ----------------------
02540> | CALIB NASHYD       |   Area    (ha)=     .08   Curve Number    (CN)=74.00
02541> | 05:105    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02542> ----------------------   U.H. Tp(hrs)=    .110
02543>
02544>      Unit Hyd Qpeak  (cms)=     .027
02545>
02546>      PEAK FLOW       (cms)=     .012 (i)
02547>      TIME TO PEAK    (hrs)=    1.417
02548>      RUNOFF VOLUME    (mm)=   39.593
02549>      TOTAL RAINFALL   (mm)=   91.372
02550>      RUNOFF COEFFICIENT   =     .433
02551>
02552>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02553>
02554> ----------------------------------------------------------------------------
02555> 100:0008----------------------------------------------------------------------
02556> *# CATCHMENT EXT1 - EXTERNAL DRAINAGE THROUGH SITE (TO RES. BACKYARDS)
02557> ----------------------
02558> | CALIB STANDHYD     |   Area    (ha)=     .03
02559> | 06:EXT1   DT= 1.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
02560> ----------------------
02561>                                IMPERVIOUS    PERVIOUS (i)
02562>      Surface Area     (ha)=        .01          .02
02563>      Dep. Storage     (mm)=       1.00         8.92
02564>      Average Slope     (%)=       1.00         2.00
02565>      Length            (m)=      15.00        10.00
02566>      Mannings n            =       .013         .250
02567>
02568>      Max.eff.Inten.(mm/hr)=     181.81        87.81
02569>                  over (min)        1.00         4.00
02570>      Storage Coeff.  (min)=        .64 (ii)    3.88 (ii)
02571>      Unit Hyd. Tpeak (min)=       1.00         4.00
02572>      Unit Hyd. peak  (cms)=       1.34          .29
02573>                                                          *TOTALS*
02574>      PEAK FLOW       (cms)=        .00          .00          .009 (iii)
02575>      TIME TO PEAK    (hrs)=       1.28         1.37         1.333
02576>      RUNOFF VOLUME    (mm)=      90.37        39.60        53.305
02577>      TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02578>      RUNOFF COEFFICIENT   =        .99          .43          .583
02579>
02580>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02581>            CN* =  74.0    Ia = Dep. Storage  (Above)
02582>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02583>            THAN THE STORAGE COEFFICIENT.
02584>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02585>
02586> ----------------------------------------------------------------------------
02587> 100:0009----------------------------------------------------------------------
02588> *# CATCHMENT EXT2 - EXTERNAL DRAINAGE THROUGH SITE (TO WILSON)
02589> ----------------------
02590> | CALIB STANDHYD     |   Area    (ha)=     .00
02591> | 07:EXT2   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
02592> ----------------------
02593>                                IMPERVIOUS    PERVIOUS (i)
02594>      Surface Area     (ha)=        .00          .00
02595>      Dep. Storage     (mm)=       1.00         8.92
02596>      Average Slope     (%)=       3.00         2.00
02597>      Length            (m)=       5.00        10.00
02598>      Mannings n            =       .013         .250
02599>
02600>      Max.eff.Inten.(mm/hr)=     181.81        90.16
02601>                  over (min)        1.00         3.00
02602>      Storage Coeff.  (min)=        .24 (ii)    3.44 (ii)
02603>      Unit Hyd. Tpeak (min)=       1.00         3.00
02604>      Unit Hyd. peak  (cms)=       1.67          .36
02605>                                                          *TOTALS*
02606>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
02607>      TIME TO PEAK    (hrs)=       1.23         1.35         1.333
02608>      RUNOFF VOLUME    (mm)=      90.37        39.60        89.865
02609>      TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02610>      RUNOFF COEFFICIENT   =        .99          .43          .983
02611>
02612>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02613>            CN* =  74.0    Ia = Dep. Storage  (Above)
02614>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02615>            THAN THE STORAGE COEFFICIENT.
02616>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02617>
02618> ----------------------------------------------------------------------------
02619> 100:0010----------------------------------------------------------------------
02620> *# ADD FLOWS TO WILSON
02621> ------------------------
02622> | ADD HYD (EX.WILSON ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02623> ------------------------ ID1 01:101          (ha)     (cms)   (hrs)   (mm)   (cms)
02624>                          ID1 01:101          .09      .042    1.33  80.72    .000
02625>                        +ID2 07:EXT2          .00      .002    1.33  89.86    .000
02626>                         ========================================================
02627>                         SUM 09:EX.WILSON     .10      .044    1.33  81.00    .000
02628>
02629>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02630>
02631> ----------------------------------------------------------------------------
02632> 100:0011----------------------------------------------------------------------
02633> *# ADD FLOWS TO RES. BACKYARDS
02634> ------------------------
02635> | ADD HYD (EX.BKYD   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02636> ------------------------ ID1 02:102          (ha)     (cms)   (hrs)   (mm)   (cms)
02637>                          ID1 02:102          .56      .153    1.33  62.45    .000
02638>                        +ID2 06:EXT1          .03      .009    1.33  53.30    .000
02639>                         ========================================================
02640>                         SUM 10:EX.BKYD       .59      .162    1.33  61.94    .000
02641>
02642>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02643>
02644> ----------------------------------------------------------------------------
02645> 100:0012----------------------------------------------------------------------
02646> *# ADD FLOWS FROM EX. SITE
02647> ------------------------
02648> | ADD HYD (EX.SITE   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02649> ------------------------ ID1 09:EX.WILSON    (ha)     (cms)   (hrs)   (mm)   (cms)
02650>                          ID1 09:EX.WILSON    .10      .044    1.33  81.00    .000
02651>                        +ID2 10:EX.BKYD       .59      .162    1.33  61.94    .000
02652>                        +ID3 03:103           .03      .012    1.33  88.34    .000
02653>                        +ID4 04:104           .02      .003    1.47  39.58    .000
02654>                        +ID5 05:105           .08      .012    1.42  39.59    .000
02655>                         ========================================================
02656>                         SUM 07:EX.SITE       .81      .230    1.33  62.41    .000
02657>
02658>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02659>
02660> ----------------------------------------------------------------------------
02661> 100:0013----------------------------------------------------------------------
02662> *#############################################################################|
02663> *#
02664> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
02665> *#        ==============================================
02666> *#
02667> **#############################################################################|
02668> *# CATCHMENT 201 - PROPOSED CONDITIONS (CONTROLLED TO WILSON)
02669> ----------------------
02670> | CALIB STANDHYD     |   Area    (ha)=     .76
02671> | 01:201    DT= 1.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
02672> ----------------------
02673>                                IMPERVIOUS    PERVIOUS (i)
02674>      Surface Area     (ha)=        .66          .10
02675>      Dep. Storage     (mm)=       1.00         8.92
02676>      Average Slope     (%)=       1.50         2.00
02677>      Length            (m)=      15.00        10.00
02678>      Mannings n            =       .013         .250
02679>
02680>      Max.eff.Inten.(mm/hr)=     181.81        87.81
02681>                  over (min)        1.00         4.00
02682>      Storage Coeff.  (min)=        .57 (ii)    3.81 (ii)
02683>      Unit Hyd. Tpeak (min)=       1.00         4.00
02684>      Unit Hyd. peak  (cms)=       1.40          .29
02685>                                                          *TOTALS*
02686>      PEAK FLOW       (cms)=        .33          .02          .352 (iii)
02687>      TIME TO PEAK    (hrs)=       1.32         1.37         1.333
02688>      RUNOFF VOLUME    (mm)=      90.37        39.60        83.771
02689>      TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02690>      RUNOFF COEFFICIENT   =        .99          .43          .917
02691>
02692>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02693>            CN* =  74.0    Ia = Dep. Storage  (Above)
02694>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02695>            THAN THE STORAGE COEFFICIENT.
02696>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02697>
02698> ----------------------------------------------------------------------------
02699> 100:0014----------------------------------------------------------------------
02700> *# ROUTE FLOWS THROUGH TANK WITH ORIFICE
```

```
02701> ----------------------
02702> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
02703> |  IN>01:(201   )   |
02704> | OUT<02:(201_CT)   |    =========  OUTLFOW STORAGE TABLE  =========
02705> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
02706>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
02707>                              .000  .0000E+00   |     .014  .3220E-01
02708>                              .008  .1020E-01   |     .016  .4320E-01
02709>                              .012  .2120E-01   |     .018  .5090E-01
02710>
02711>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
02712>     ---------------------       (ha)     (cms)     (hrs)       (mm)
02713>     INFLOW >01: (201   )         .76      .352     1.333     83.771
02714>     OUTFLOW<02: (201_CT)         .76      .017     2.683     83.771
02715>    OVERFLOW<03: (201_OV)         .00      .000      .000       .000
02716>
02717>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
02718>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
02719>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
02720>
02721>
02722>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.931
02723>                    TIME SHIFT OF PEAK FLOW         (min)=    81.00
02724>                    MAXIMUM  STORAGE   USED       (ha.m.)=.4807E-01
02725>
02726> --------------------------------------------------------------------------------
02727> 100:0015--------------------------------------------------------------------------
02728> *# CATCHMENT 202 - PROPOSED CONDITIONS (UNCONTROLLED TO RES. BACKYARDS)
02729> ----------------------
02730> | CALIB NASHYD      |   Area    (ha)=     .02   Curve Number   (CN)=74.00
02731> | 01:202    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02732> ----------------------   U.H. Tp(hrs)=    .090
02733>
02734>     Unit Hyd Qpeak  (cms)=     .010
02735>
02736>     PEAK FLOW       (cms)=     .004 (i)
02737>     TIME TO PEAK    (hrs)=    1.383
02738>     RUNOFF VOLUME    (mm)=   39.587
02739>     TOTAL RAINFALL   (mm)=   91.372
02740>     RUNOFF COEFFICIENT   =     .433
02741>
02742>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02743>
02744> --------------------------------------------------------------------------------
02745> 100:0016--------------------------------------------------------------------------
02746> *# CATCHMENT 203 - PROPOSED CONDITIONS (UNCONTROLLED TO ACADEMY)
02747> ----------------------
02748> | CALIB STANDHYD    |   Area    (ha)=     .01
02749> | 04:203    DT= 1.00 |   Total Imp(%)=   84.00   Dir. Conn.(%)=   84.00
02750> ----------------------
02751>                              IMPERVIOUS    PERVIOUS (i)
02752>     Surface Area     (ha)=        .01          .00
02753>     Dep. Storage     (mm)=       1.00         8.92
02754>     Average Slope     (%)=       2.00         2.00
02755>     Length            (m)=      10.00        10.00
02756>     Mannings n           =       .013         .250
02757>
02758>     Max.eff.Inten.(mm/hr)=     181.81        90.59
02759>               over (min)          1.00         4.00
02760>     Storage Coeff.  (min)=        .41 (ii)    3.61 (ii)
02761>     Unit Hyd. Tpeak (min)=       1.00         4.00
02762>     Unit Hyd. peak  (cms)=       1.55          .30
02763>                                                        *TOTALS*
02764>     PEAK FLOW       (cms)=        .00          .00          .005 (iii)
02765>     TIME TO PEAK    (hrs)=       1.25         1.35         1.333
02766>     RUNOFF VOLUME    (mm)=      90.37        40.68        82.421
02767>     TOTAL RAINFALL   (mm)=      91.37        91.37        91.372
02768>     RUNOFF COEFFICIENT   =        .99          .45          .902
02769>
02770>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
02771>           CN* =  75.0    Ia = Dep. Storage  (Above)
02772>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
02773>           THAN THE STORAGE COEFFICIENT.
02774>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02775>
02776> --------------------------------------------------------------------------------
02777> 100:0017--------------------------------------------------------------------------
02778> *# CATCHMENT 204 - PROPOSED CONDITIONS (UNCONTROLLED TO BROOKSIDE)
02779> ----------------------
02780> | CALIB NASHYD      |   Area    (ha)=     .02   Curve Number   (CN)=74.00
02781> | 05:204    DT= 1.00 |   Ia      (mm)=   8.920   # of Linear Res.(N)= 3.00
02782> ----------------------   U.H. Tp(hrs)=    .090
02783>
02784>     Unit Hyd Qpeak  (cms)=     .008
02785>
02786>     PEAK FLOW       (cms)=     .003 (i)
02787>     TIME TO PEAK    (hrs)=    1.383
02788>     RUNOFF VOLUME    (mm)=   39.587
02789>     TOTAL RAINFALL   (mm)=   91.372
02790>     RUNOFF COEFFICIENT   =     .433
02791>
02792>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
02793>
02794> --------------------------------------------------------------------------------
02795> 100:0018--------------------------------------------------------------------------
02796> *# ADD PROPOSED FLOWS FROM SITE
02797> ------------------------
02798> | ADD HYD (PROP.SITE ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02799> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
02800>                       ID1 02:201_CTL        .76     .017    2.68  83.77    .000
02801>                      +ID2 03:201_OVF        .00     .000     .00    .00    .000
02802>                      +ID3 01:202            .02     .004    1.38  39.59    .000
02803>                      +ID4 04:203            .01     .005    1.33  82.42    .000
02804>                      +ID5 05:204            .02     .003    1.38  39.59    .000
02805>                       ========================================================
02806>                       SUM 06:PROP.SITE      .81     .025    1.33  81.36    .000
02807>
02808>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02809>
02810> --------------------------------------------------------------------------------
02811> 100:0019--------------------------------------------------------------------------
02812> *# AREA CHECK
02813> ------------------------
02814> | ADD HYD (CHECK     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
02815> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
02816>                       ID1 07:EX.SITE        .81     .230    1.33  62.41    .000
02817>                      +ID2 06:PROP.SITE      .81     .025    1.33  81.36    .000
02818>                       ========================================================
02819>                       SUM 01:CHECK         1.63     .254    1.33  71.89    .000
02820>
02821>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
02822>
02823> --------------------------------------------------------------------------------
02824> 100:0020--------------------------------------------------------------------------
02825> * RUN REMAINING DESIGN STORMS (HAMILTON MOUNT HOPE 5 TO 100-YR)
02826> *
02827> --------------------------------------------------------------------------------
02828> 100:0002--------------------------------------------------------------------------
02829> *
02830> --------------------------------------------------------------------------------
02831> 100:0002--------------------------------------------------------------------------
02832> *
02833> --------------------------------------------------------------------------------
02834> 100:0002--------------------------------------------------------------------------
02835> *
02836> --------------------------------------------------------------------------------
02837> 100:0002--------------------------------------------------------------------------
02838> *
02839> --------------------------------------------------------------------------------
02840> 100:0002--------------------------------------------------------------------------
02841> *
02842>       FINISH
02843> --------------------------------------------------------------------------------
02844> ********************************************************************************
02845>      WARNINGS / ERRORS / NOTES
02846>      -------------------------
02847>    Simulation ended on 2021-12-14     at 10:43:42
02848> ================================================================================
02849>
```

APPENDIX B

QUALITY CONTROL INFORMATION

Hydroworks Sizing Summary

20092 - 392-412 Wilson Street East & 15 Lorne Avenue Ancaster, ON

12-14-2021

Recommended Size: HS 10

A HydroStorm HS 10 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.759 (ha) with an imperviousness of 86 % and Hamilton RBG, Ontario rainfall for the ETV Canada particle size distribution.

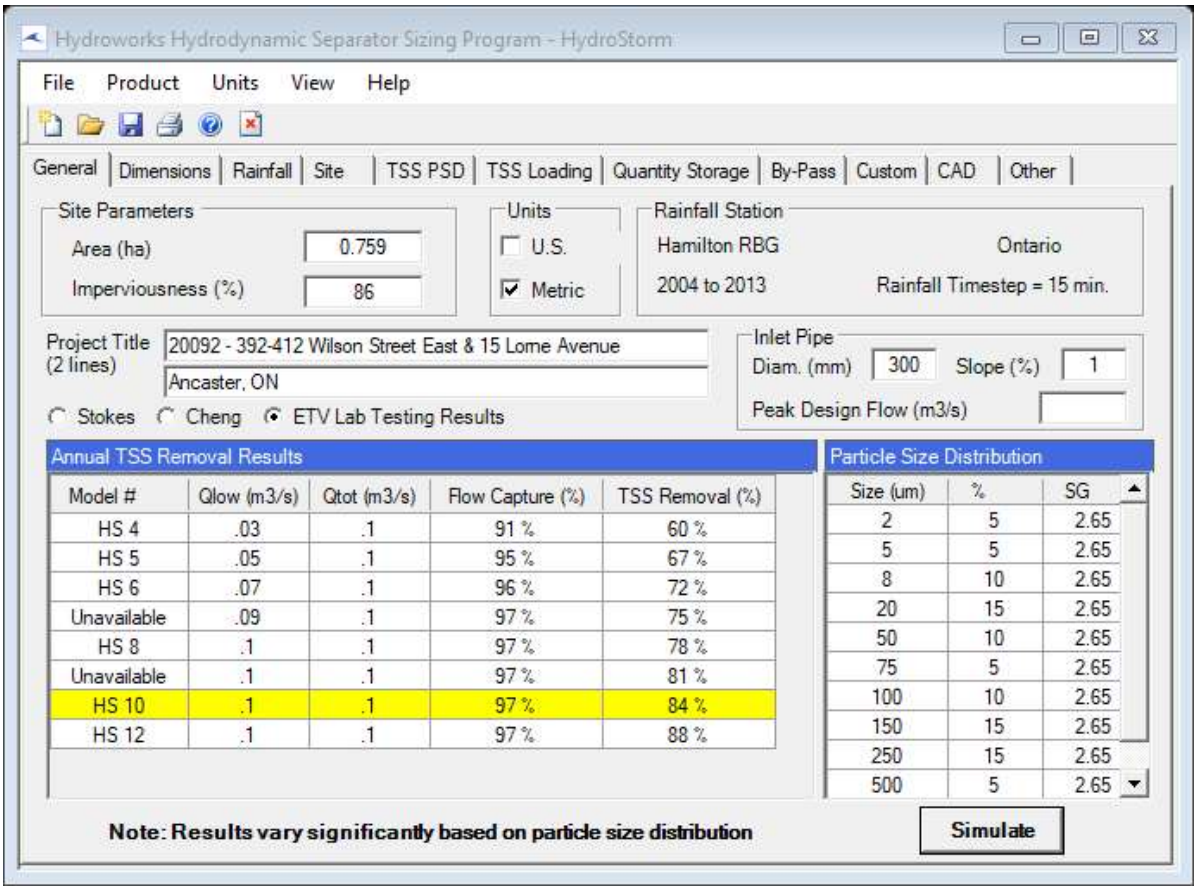
The recommended HydroStorm HS 10 treats 97 % of the annual runoff and provides 84 % annual TSS removal for the Hamilton RBG rainfall records and ETV Canada particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .1 (m3/s) for the given 300 (mm) pipe diameter at 1% slope. The headloss was calculated to be 99 (mm) based on a flow depth of 300 (mm) (full pipe flow).

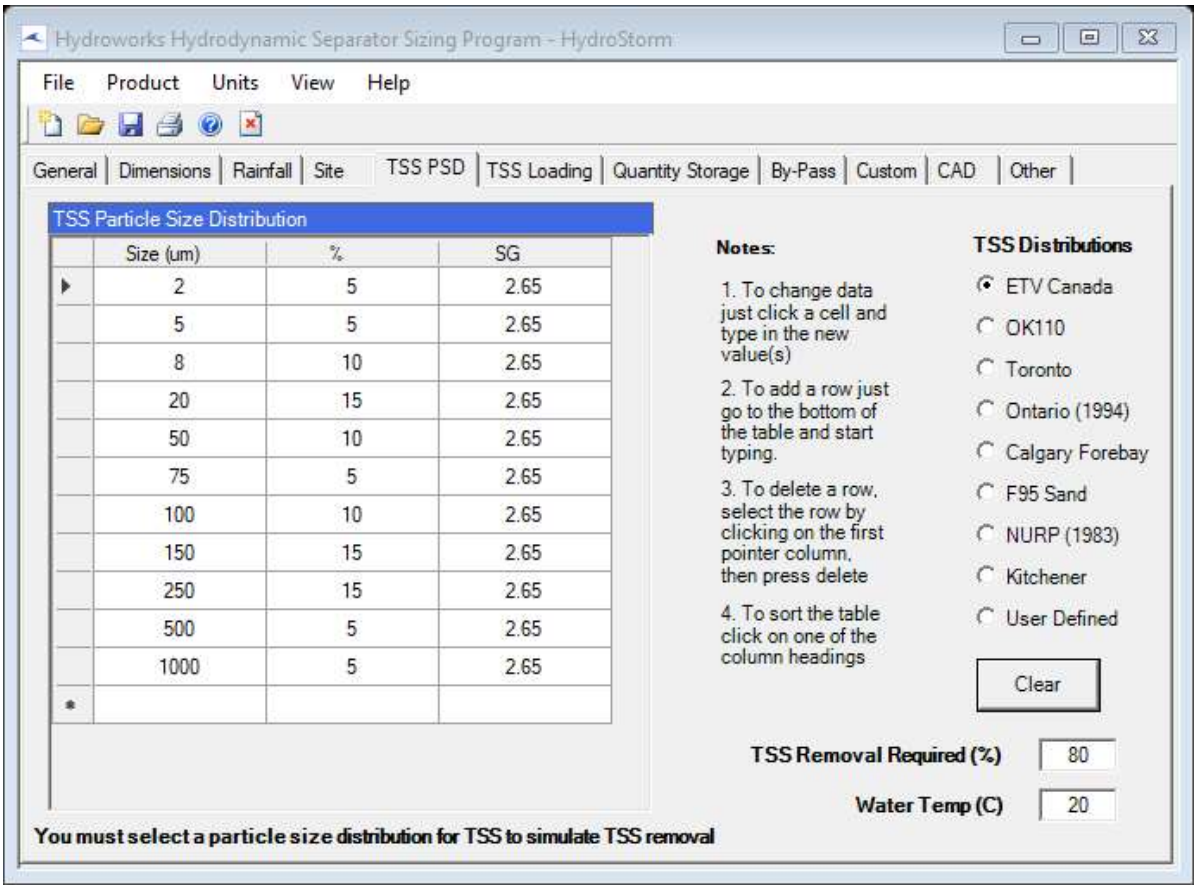
This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

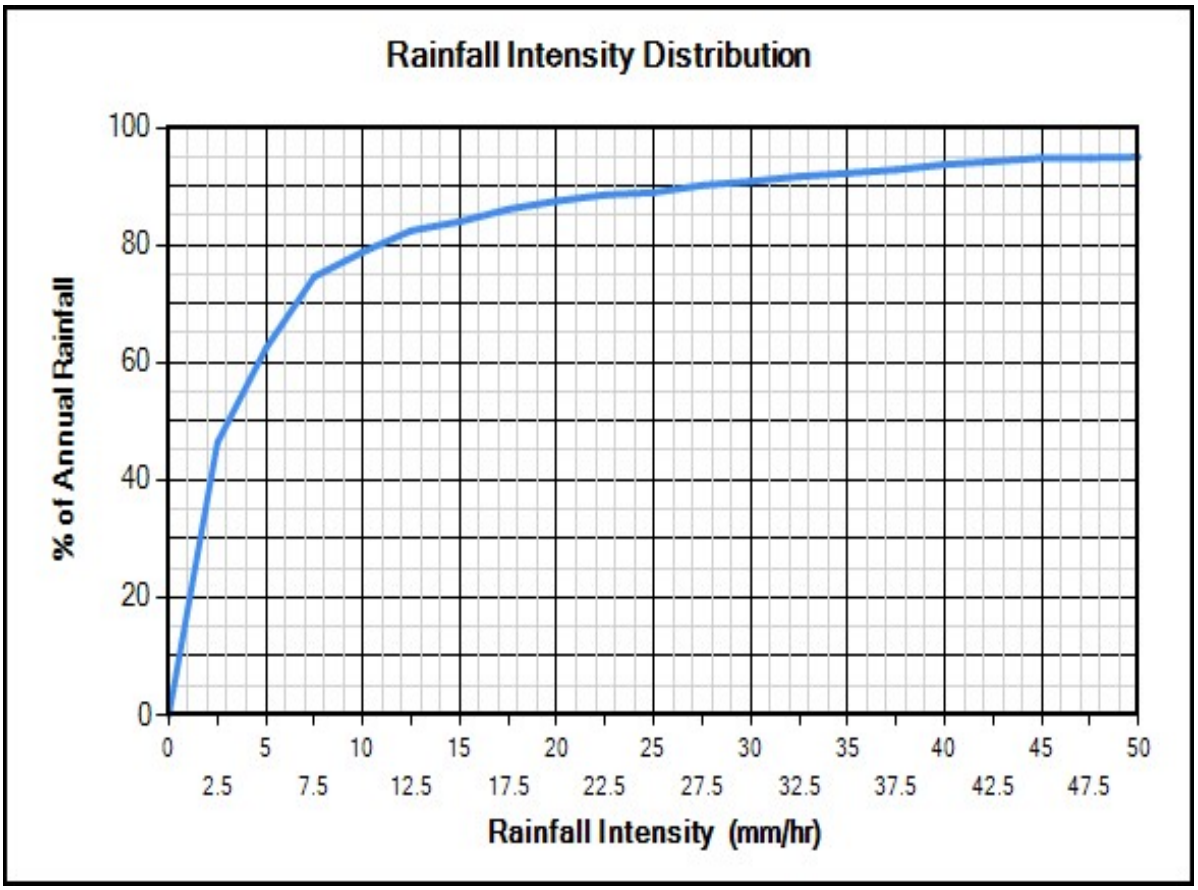
TSS Removal Sizing Summary



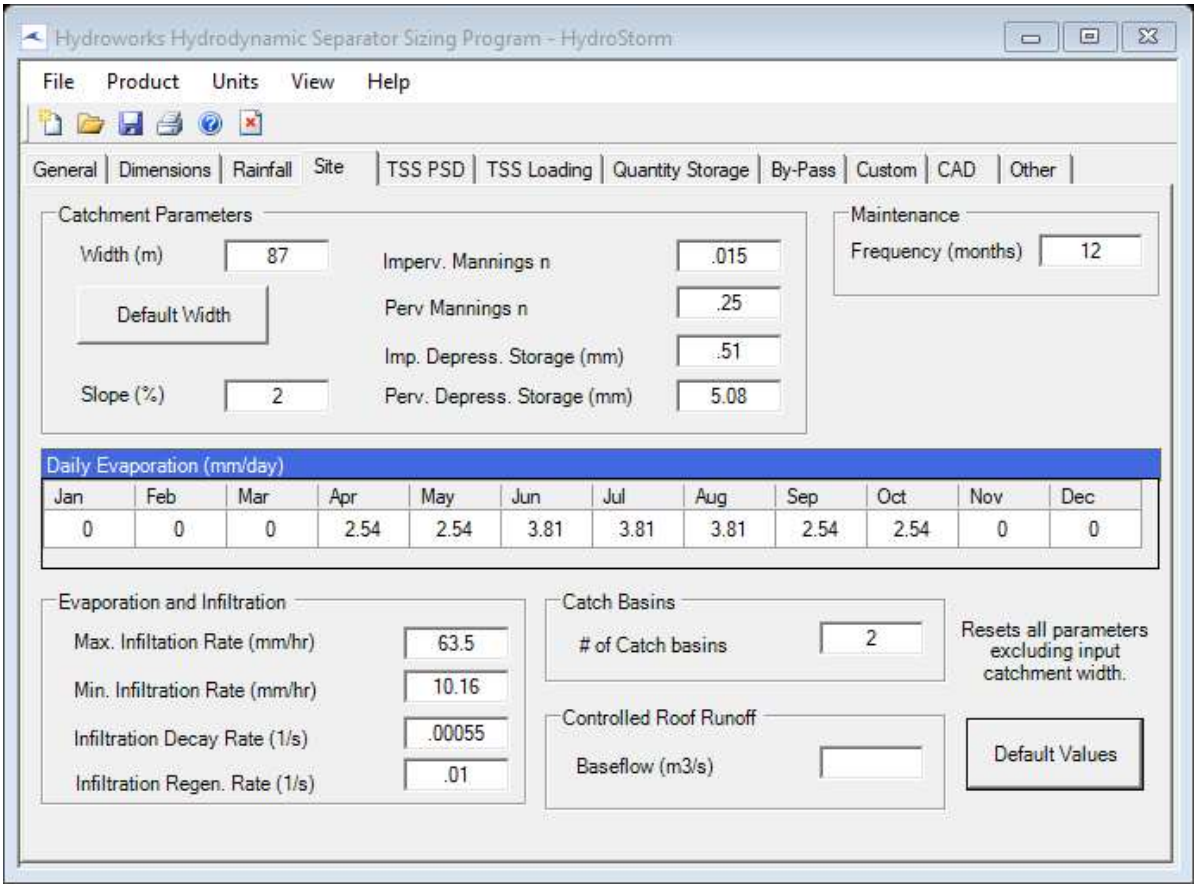
TSS Particle Size Distribution



Rainfall Station - Hamilton RBG, Ontario(2004 to 2013)



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units View Help

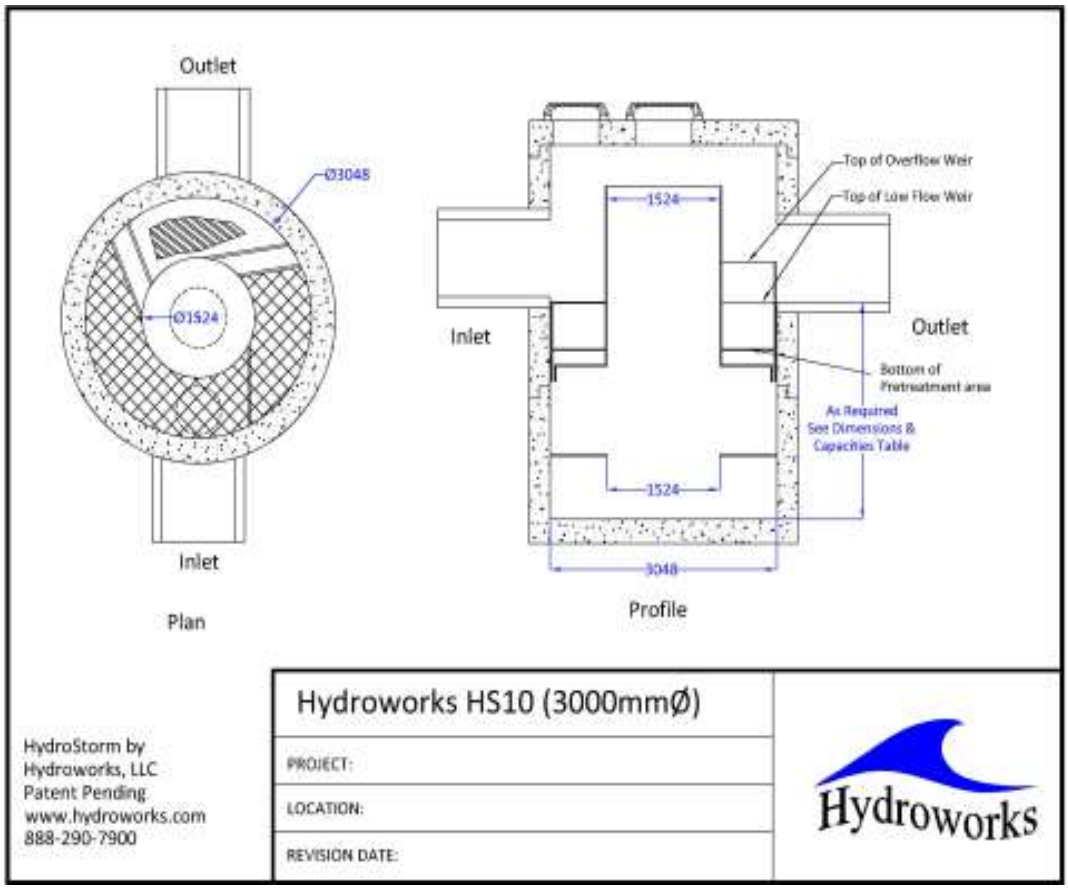
General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Other

Dimensions and Capacities

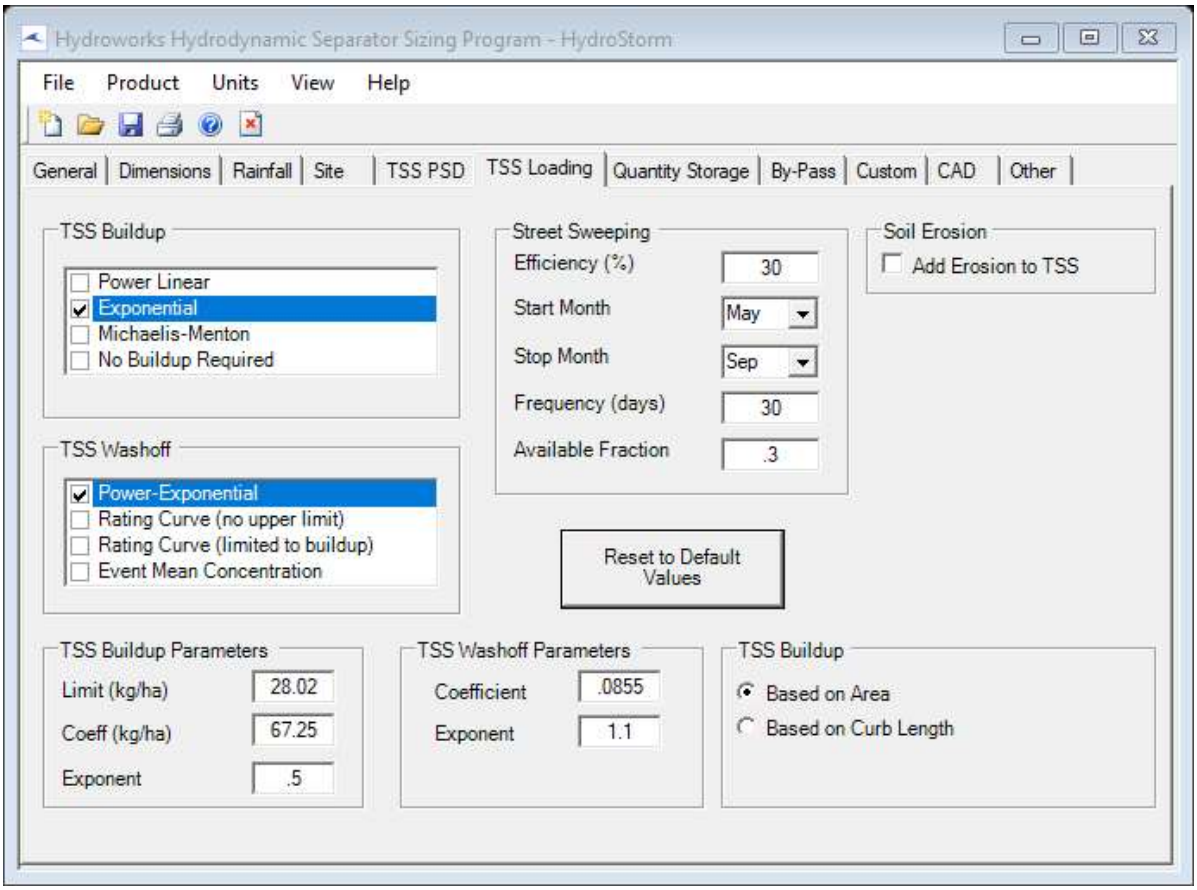
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 9	2.74	2.44	3242	9.3	14.4
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

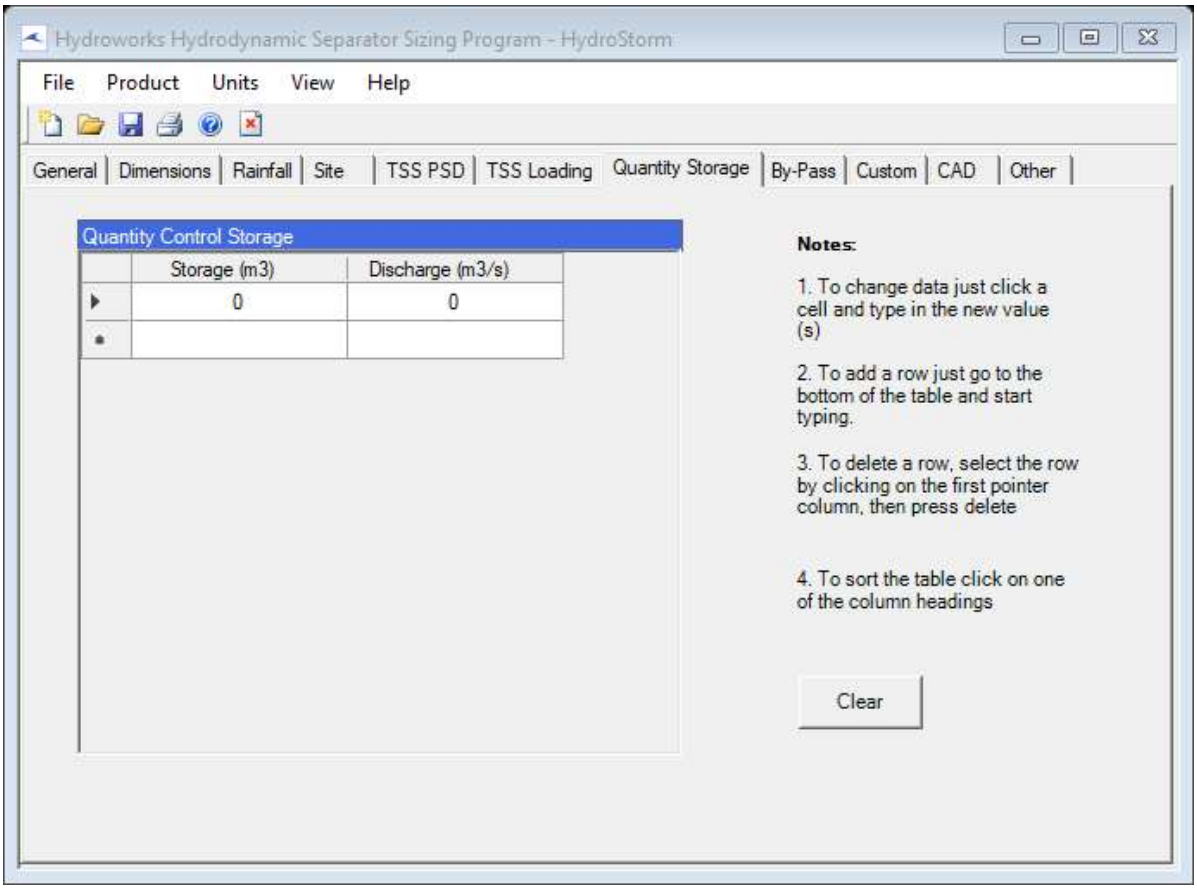
Generic HS 10 CAD Drawing



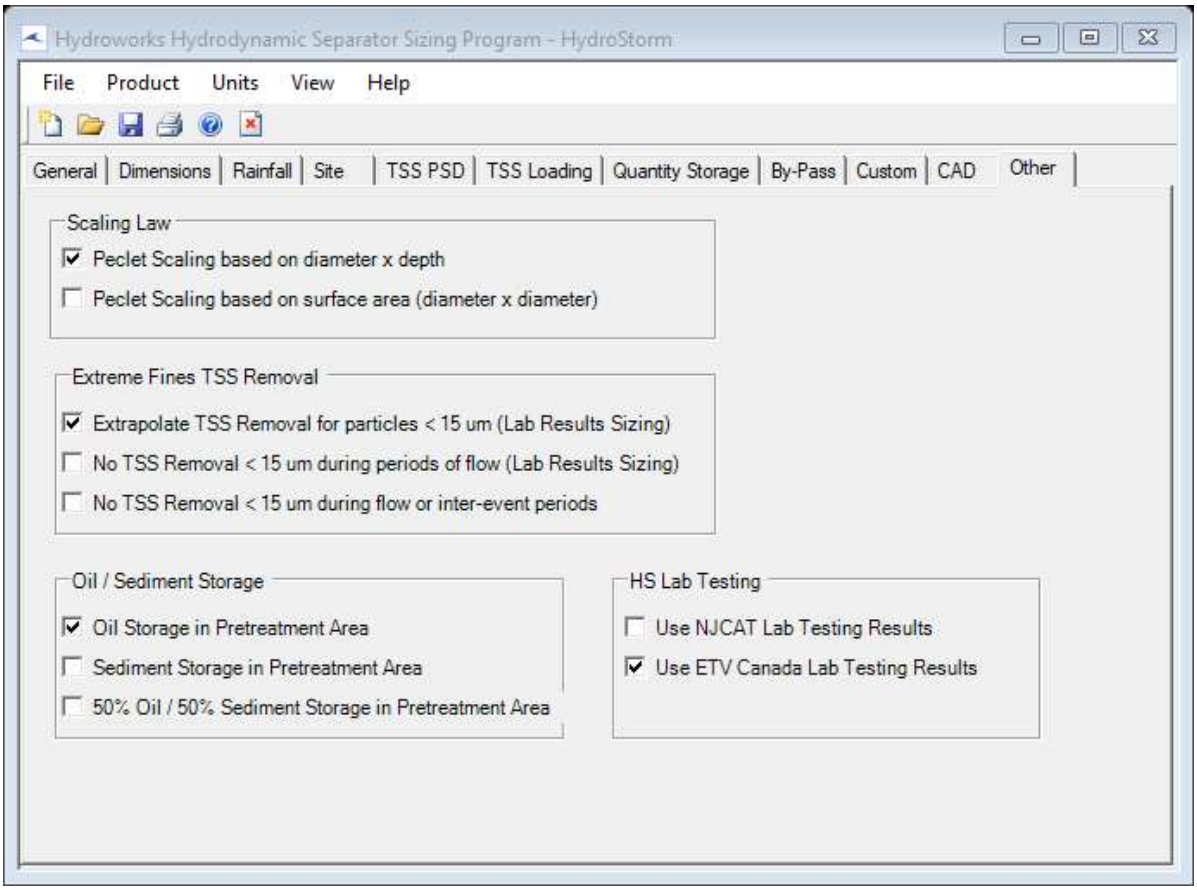
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Hydroworks® HydroStorm

Operations & Maintenance Manual

Version 1.0

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Introduction

The HydroStorm is a state of the art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroStorm is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroStorm.

Hydroworks® HydroStorm Operation

The Hydroworks HydroStorm (HS) separator is a unique hydrodynamic by-pass separator. It incorporates a protected submerged pretreatment zone to collect larger solids, a treatment tank to remove finer solids, and a dual set of weirs to create a high flow bypass. High flows are conveyed directly to the outlet and do not enter the treatment area, however, the submerged pretreatment area still allows removal of coarse solids during high flows.

Under normal or low flows, water enters an inlet area with a horizontal grate. The area underneath the grate is submerged with openings to the main treatment area of the separator. Coarse solids fall through the grate and are either trapped in the pretreatment area or conveyed into the main treatment area depending on the flow rate. Fines are transported into the main treatment area. Openings and weirs in the pretreatment area allow entry of water and solids into the main treatment area and cause water to rotate in the main treatment area creating a vortex motion. Water in the main treatment area is forced to rise along the walls of the separator to discharge from the treatment area to the downstream pipe.

The vortex motion forces solids and floatables to the middle of the inner chamber. Floatables are trapped since the inlet to the treatment area is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while water must flow up the walls of the separator to discharge into the downstream pipe.

A set of high flow weirs near the outlet pipe create a high flow bypass over both the pretreatment area and main treatment chamber. The rate of flow into the treatment area is regulated by the number and size of openings into the treatment chamber and the height of by-pass weirs. High flows flow over the weirs directly to the outlet pipe preventing the scour and resuspension of any fines collected in the treatment chamber.

A central access tube is located in the structure to provide access for cleaning. The arrangement of the inlet area and bypass weirs near the outlet pipe facilitate the use of multiple inlet pipes.

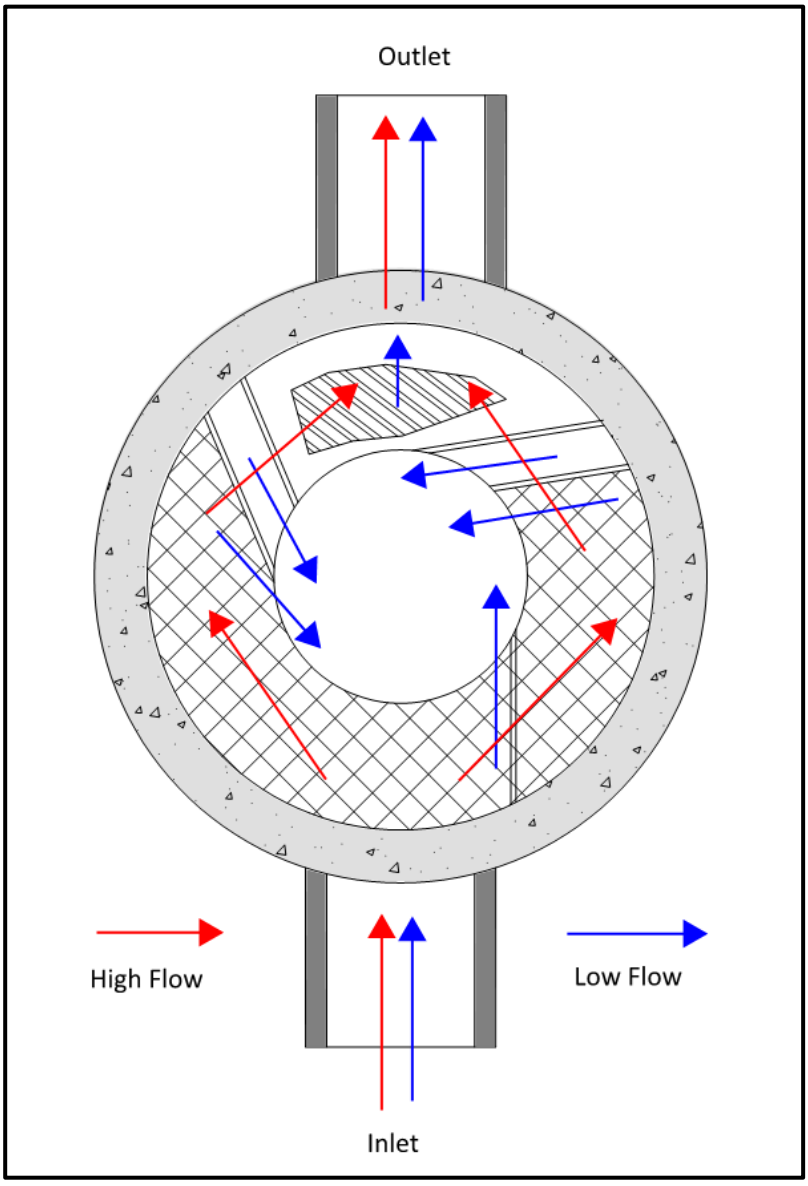


Figure 1. Hydroworks HydroStorm Operation – Plan View

Figure 2 is a profile view of the HydroStorm separator showing the flow patterns for low and high flows.

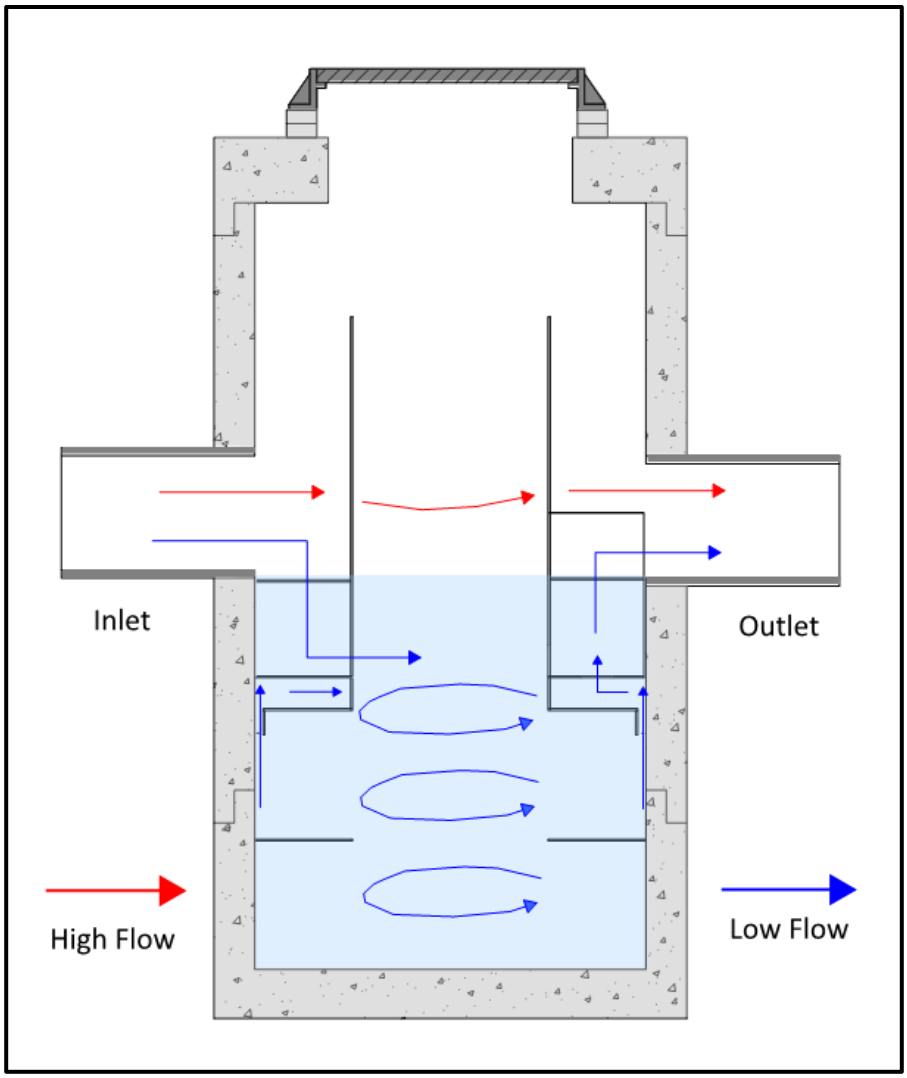


Figure 2. Hydroworks HydroStorm Operation – Profile View

The HS 4i is an inlet version of the HS 4 separator. There is a catch-basin grate on top of the HS 4i. A funnel sits sits underneath the grate on the frame and directs the water to the inlet side of the separator to ensure all lows flows are properly treated. The whole funnel is removed for inspection and cleaning.

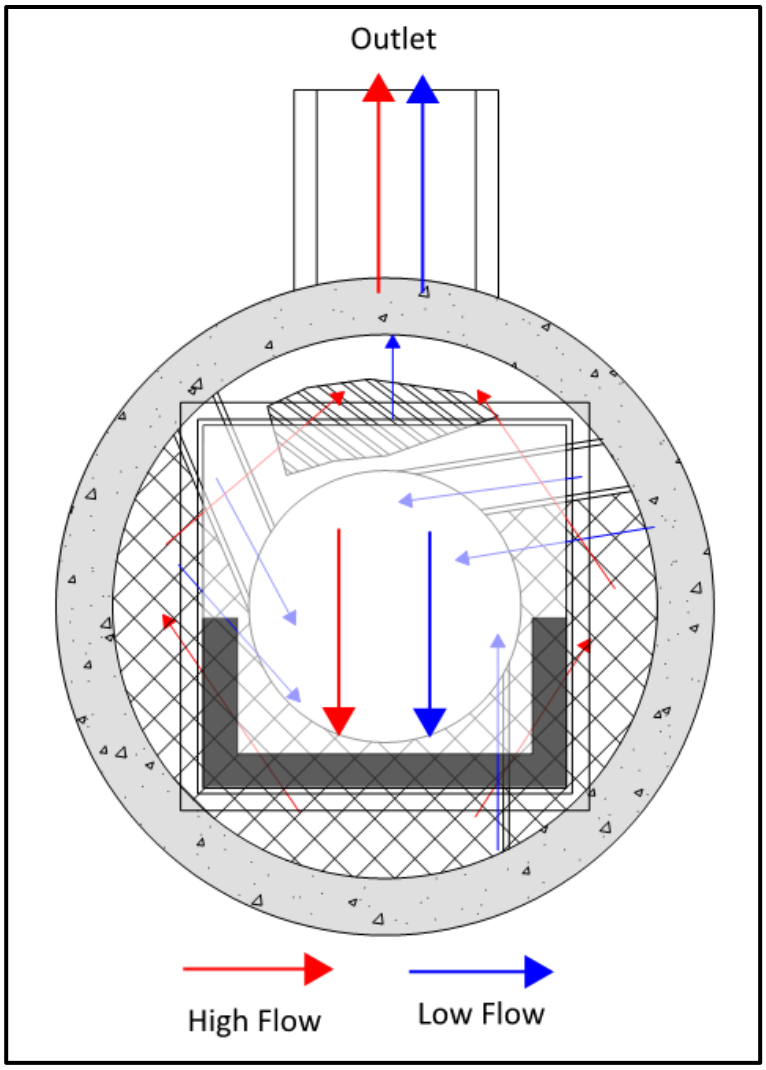


Figure 3. Hydroworks HS 4i Funnel

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the center access tube of the separator. Separators with an inlet grate (HS 4i or custom separator) will have a plastic funnel located under the grate that must be removed from the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

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TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HydroStorm separator should be inspected every four weeks and after every large storm (over 0.5" (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroStorm separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HydroStorm separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroStorm unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroStorm separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

A central access opening (24” or greater) is provided to the gain access to the lower treatment tank of the unit. This is the primary location to maintain by vacuum truck. The pretreatment area can also be vacuumed and/or flushed into the lower treatment tank of the separator for cleaning via the central access once the water level is lowered below the pretreatment floor.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature. Disposal of the water will depend on local requirements. Disposal options for the decanted water may include:

1. Discharge into a nearby sanitary sewer manhole
2. Discharge into a nearby LID practice (grassed swale, bioretention)
3. Discharge through a filter bag into a downstream storm drain connection

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HydroStorm unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

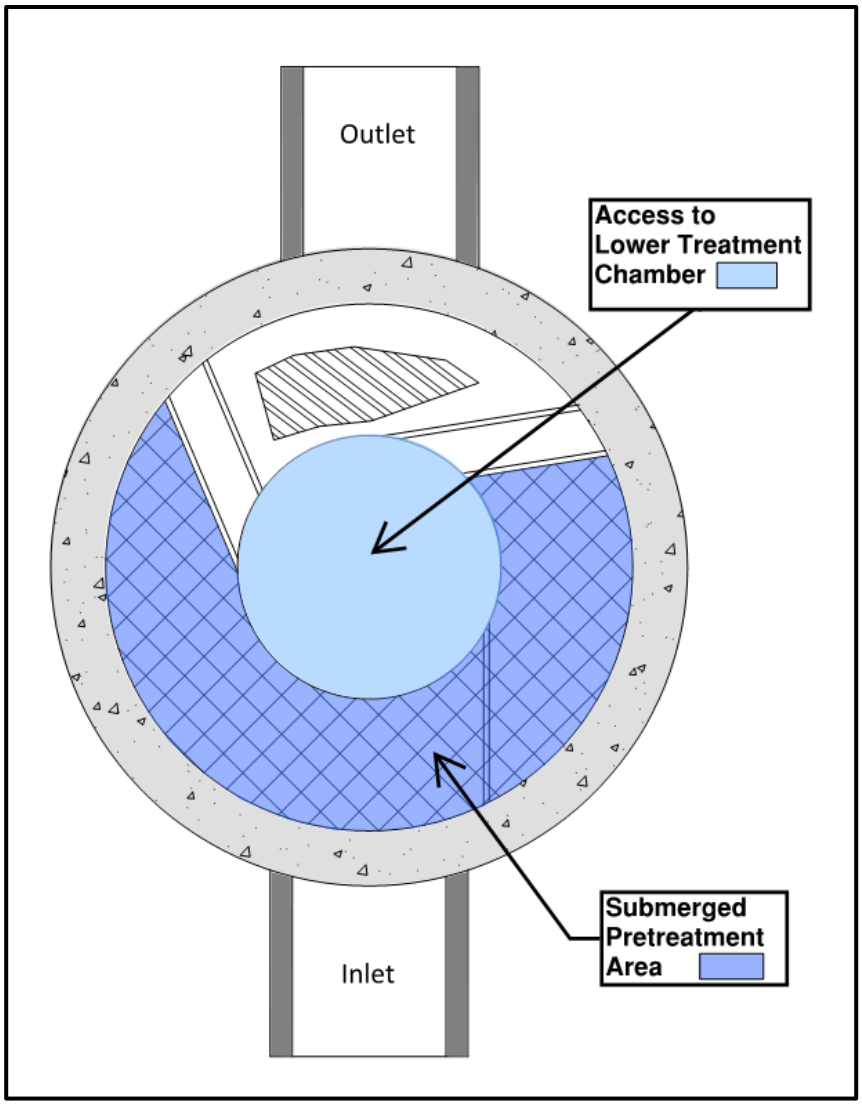


Figure 3. Maintenance Access

Frequency

Construction Period

A HydroStorm separator can fill with construction sediment quickly during the construction period. The HydroStorm must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroStorm separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The HydroStorm was independently tested by Alden Research Laboratory in 2017. A HydroStorm HS 4 was tested for scour with a 50% sediment depth of 0.5 ft. Therefore, maintenance for sediment accumulation is required if the depth of sediment is 1 ft or greater in separators with standard water (sump) depths (Table 1).

There will be designs with increased sediment storage based on specifications or site-specific criteria. A measurement of the total water depth in the separator through the central access tube should be taken and compared to water depth given in Table 1. The standard water depth from Table 1 should be subtracted from the measured water depth and the resulting extra depth should be added to the 1 ft to determine the site-specific sediment maintenance depth for that separator.

For example, if the measured water depth in the HS-7 is 7 feet, then the sediment maintenance depth for that HS-7 is 2 ft (= 1 + 7 – 6) and the separator does not need to be cleaned for sediment accumulation until the measure sediment depth is 2 ft.

The HydroStorm separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the water surface of the separator.

Table 1 Standard Dimensions for Hydroworks HydroStorm Models

Model	Diameter (ft)	Total Water Depth (ft)	Sediment Maintenance Depth for Table 1 Total Water Depth(ft)
HS-3	3	3	1
HS-4	4	4	1
HS-5	5	4	1
HS-6	6	4	1
HS-7	7	6	1
HS-8	8	7	1
HS-9	9	7.5	1
HS-10	10	8	1
HS-11	11	9	1
HS-12	12	9.5	1

HYDROSTORM INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroStorm	**Yes**	**No**
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____“

Routine Measurements

Floating debris depth	**< 0.5” (13mm)**	☐	**>0.5” 13mm)**	☐ *
Floating debris coverage	**< 50% of surface area**	☐	**> 50% surface area**	☐ *
Sludge depth	**< 12” (300mm)**	☐	**> 12” (300mm)**	☐ ****

* Maintenance required
** Repairs required
*** Further investigation is required

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroStorm

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroStorm to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroStorm are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroStorm, or the cost of other goods or services related to the purchase and installation of the HydroStorm. For this Limited Warranty to apply, the HydroStorm must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroStorm arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroStorm, whether the claim is based upon contract, tort, or other legal basis.

APPENDIX C

WATER ANALYSIS INFORMATION

OBC FIRE FLOW WATER SUPPLY

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Project: **Wilson Street East at Academy**
Project Number: 20113
Date: May-21

Type of Development: **Multi-Residential**

Required Fire Water Supply (Q) per OBC: **$Q = K\ V\ S_{tot}$** *(OBC Tables and Figures attached)*

Where:
Q = Minimim supply of water in litres
K = Water suppy coefficient from Table 1
V = total building volume in cubic meters
S_{tot} = total of spatial coefficient values from property line exposures on all sides
$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + ...]$ from Figure 1. Max. 2.0

Water Supply Coefficient (K)

Building Group/Division Classification: **C (Residential Occupancies)**

From Table 1, **K =** **16**

Building Volume (V)

8-Storey
Building Footprint Area: **2762** m^2

Building Height: **30.1** m

Building Volume (V): ***83136.2*** **m^3**

Spatial Coefficient (S)

See Figure 1 for Spatial Coefficients

Side	Dist (m)	S_{coeff}
North	**2+/-**	**0.5**
South	**7+/-**	**0.3**
East	**6+/-**	**0.4**
West	**14+/-**	**0**
	Total	1.2

Therefore, S_{tot} = **2.2**

Required Water Supply

$Q = K\ V\ S_{tot}$ = 2926394 m^3

From Table 2, the minimum required water supply flow rate = ***9000*** ***l/min*** ***or*** 150 l/s

City of Hamilton Target flow for Multi Residential (3 or more units) = **150** **l/s <-- governs**

OBC Tables and Figures

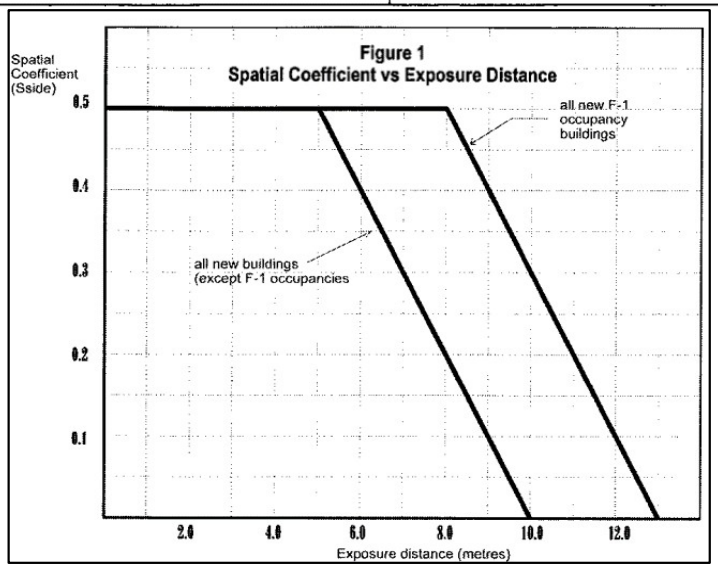
Table 1

Water Supply Coefficient - K

Type of Construction	Classification by Group or Division in Accordance with Table 3.1.2.1. of the Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

Table 2

Part 3 Buildings under the Building Code	Required Minimum Water Supply Flow Rate, L/min
One-storey building with building area not exceeding 600 m²	1 800
All other buildings	2 700 (if Q ≤ 108 000 L)(1) 3 600 (if Q > 108 000 L and ≤ 135 000 L)(1) 4 500 (if Q > 135 000 L and ≤ 162 000 L)(1) 5 400 (if Q > 162 000 L and ≤ 190 000 L)(1) 6 300 (if Q > 190 000 L and ≤ 270 000 L)(1) 9 000 (if Q > 270 000 L)(1)



City of Hamilton Target Flows (Policy PW19096)

Table 1: Target Available Fire Flow

Land Use	Target AFF (L/s)
Commercial	150
Small ICI (<1,800 m^3)[1]	100
Industrial	250
Institutional	150
Residential Multi (greater than 3 units)	150
Residential Medium (3 or less units)	125
Residential Single	75
Residential Single (Dead End)	50