S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing & Stormwater Management Report

1989 APPLEBY LINE

CITY OF BURLINGTON

LATCH DEVELOPMENTS LTD.

May 2022

SLA File: 22004

3228 South Service Road, Suite 105, East Wing Burlington, Ontario L7N 3H8
Tel. (905) 631-6978 www.sla.on.ca

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Latch Developments Limited to provide consulting engineering services for the proposed development at 1989 Appleby Line in the City of Burlington (see Figure 1.0 for location plan). This report will outline the functional servicing and stormwater management strategy for the proposed development.

The proposed development consists of demolishing an existing gas station and associated buildings and constructing a 20-storey mixed-use condominium building. The 20-storey mixed-used building will contain approximately 475 residential units and approximately 871m^2 of retail space. The proposed development will also include underground and surface parking.

This Functional Servicing & Stormwater Management Report will provide detailed information of the proposed servicing and stormwater management 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 Raw Design Incorporated 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 Burlington Standard Drawings (City of Burlington, March 2004)

Ref. 3: Halton Region Water and Wastewater Linear Design Manual (Halton Region, May 2014)

Ref. 4: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 5: Stormwater Management Design Guidelines (City of Burlington, May 2020)

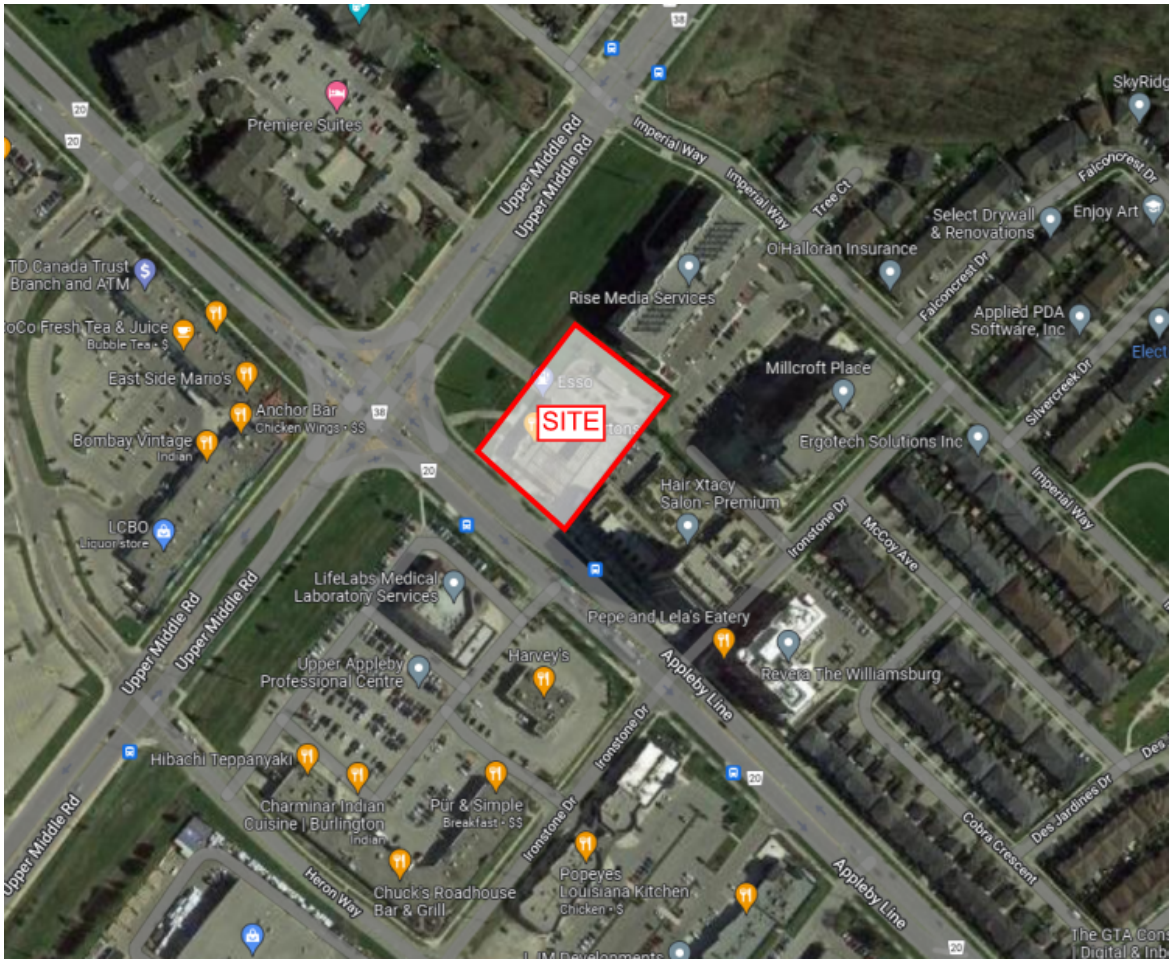


Figure 1.0 – Location Plan

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the Preconsultation Meeting Notes dated February 2, 2022, prepared by the City of Burlington:

Quantity Control

The stormwater discharge rates in the post-development condition shall be controlled to the pre-development discharge rates for all storm events up to and including the 100-year event with a maximum pre-development imperviousness of 36% (C=0.5).

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 Burlington.

2.1 PRE-DEVELOPMENT CONDITIONS

In the pre-development condition, the 0.60 ha site contains an existing gas station with associated buildings/stores, asphalt laneways and landscaped areas. The site is bound by Upper Middle Road to the north, existing condominium buildings to the east and south and Appleby Line to the west.

Catchbasins within the gas station development capture stormwater runoff, which is conveyed via a private storm sewer system to the existing 375mmø storm sewer on Appleby Line.

Two catchment areas, Catchment 101 and 102, have been identified in the pre-development condition. Catchment 101 represents the drainage area for the gas station development which is captured and conveyed to the existing 375mmø storm sewer on Appleby Line. Catchment 102 represents the drainage area for the external lands north of the subject lands along Upper Middle Road, which sheet drains south into the site. These lands are also captured by the existing private storm sewer system and conveyed to Appleby Line. See Table 2.1 below and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.1- Pre-Development Catchment Areas

Catchment ID	Description	Area (ha)	% Imp.	Runoff Coefficient
101	Subject Lands	0.60	36*	0.50*
102	External Lands	0.25	17	0.36

* Maximum imperviousness and runoff coefficient per City of Burlington standards

An analysis was performed on Catchment 101 and 102 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington Design Storms. A summary of the results can be found in Table 2.2 below and the detailed SWMHYMO input/output information in Appendix B.

Table 2.2 - Pre-Development Condition Discharge

Storm Event	Catchment 101 Discharge (m^3/s)	Catchment 102 Discharge (m^3/s)	Total Discharge[1] (m^3/s)
2-Yr Event	0.053	0.011	0.061
5-Yr Event	0.078	0.018	0.093
10-Yr Event	0.096	0.024	0.117
25-Yr Event	0.123	0.032	0.150
50-Yr Event	0.141	0.039	0.174
100-Yr Event	0.164	0.045	0.203

[1] Total discharge = Computed using SWMHYMO ADD HYD

2.2 POST-DEVELOPMENT CONDITIONS

It is proposed to develop the site by constructing a 20-storey mixed-use condominium building with associated underground and surface parking. It is proposed to service the site with a private storm sewer system, designed and constructed in accordance with the City of Burlington Standards.

Three catchment areas, Catchment 201, 202 and 203, have been identified in the post-development condition. Catchment 201 represents the drainage area for the majority of the site which will be captured and controlled before ultimately discharging to the existing 375mmø storm sewer on Appleby Line. Catchment 202 represents the drainage area for the external lands north of the subject lands on Upper Middle Road, which will continue to sheet drain south into the site. These lands are also captured and controlled by the proposed private storm sewer system and conveyed to Appleby Line. Catchment 203 represents the drainage area for the remainder of the site, which will sheet drain uncontrolled. See Table 2.3 below and the Post-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.3- Post-Development Catchment Area

Catchment ID	Description	Area (ha)	% Imp.	Runoff Coefficient
201	Subject Lands Controlled	0.57	95	0.87
202	External Lands Controlled	0.25	5	0.28
203	Subject Lands Uncontrolled	0.03	0	0.25

An analysis was performed on the proposed condition site using the SWMHYMO hydrologic modeling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington design storms. A summary of the results can be found in the Table 2.4 and detailed SWMHYMO input/output information can be found in Appendix B.

Table 2.4 – Post-Development Stormwater Discharge (Uncontrolled)

Storm Event	Catchment 201 Discharge (m^3/s)	Catchment 202 Discharge (m^3/s)	Catchment 203 Discharge (m^3/s)
2-year	0.118	0.011	0.001
5-year	0.154	0.018	0.002
10-year	0.177	0.024	0.003
25-year	0.207	0.032	0.004
50-year	0.228	0.039	0.005
100-year	0.250	0.045	0.005

Water Quantity Control

It is proposed to apply quantity control measures to the stormwater runoff from Catchments 201 and 202 by means of a dual stage orifice pipe system located at the outlet of the proposed stormwater storage vault. The dual stage orifice system will include a 150mmø and a 200mmø orifice pipe to restrict discharge from the site to the pre-development discharge rates for all storm events up to and including the 100-year event.

With the installation of on-site quantity control measures for Catchments 201 and 202, it will be required to provide stormwater storage during storm events up to and including the 100-year event. To provide the required storage, it is proposed to install a stormwater storage vault within the level 1 underground parking garage. This storage vault will be cast into the foundation of the mixed-use building and will accommodate the required stormwater storage.

Details of the proposed storage vault and dual stage orifice pipe system can be found on the Site Servicing Plan. The stage-storage-discharge characteristics can be seen in Table 2.5 below and Appendix A for details.

Table 2.5 – Post-Development Condition Stage-Storage-Discharge		
Elevation (m)	Total Storage (m^3)	Discharge (m^3/s)
137.22 (Orifice 1 Invert/Bottom of Tank)	0	0.0000
137.32 (0.10m Depth)	11	0.0198
137.42 (0.20m Depth)	23	0.0280
137.62 (0.40m Depth)	46	0.0396
137.82 (0.60m Depth)	68	0.0485
138.02 (Orifice 2 Invert)	91	0.0560
138.22 (1.00m Depth)	114	0.1124
138.42 (1.20m Depth)	137	0.1390
138.52 (Top of Tank)	148	0.1501

An analysis was performed on Catchments 201 and 202 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington Design Storms. A summary of the results can be found in Table 2.6 below and the detailed SWMHYMO input/output information in Appendix B.

Table 2.6 – Post-Development Condition Stormwater Discharge					
	Controlled Discharge[1] (m^3/s)	Uncontrolled Discharge[2] (m^3/s)	Total Discharge[3] (m^3/s)	Allowable Discharge[4] (m^3/s)	Required Storage (m^3)
2-Yr	0.048	0.001	0.049	0.061	66.0
5-Yr	0.062	0.002	0.064	0.093	93.5
10-Yr	0.087	0.003	0.090	0.117	103.6
25-Yr	0.118	0.004	0.122	0.150	119.3
50-Yr	0.133	0.005	0.137	0.174	131.7
100-Yr	0.146	0.005	0.151	0.203	144.2

[1] Controlled discharge = Catchment 201 + Catchment 202 controlled.
[2] Uncontrolled discharge = Catchment 203 discharge from Table 2.4.
[3] Total discharge = Computed using SWMHYMO ADD HYD.
[4] Allowable discharge = Pre-development discharge rate (see Table 2.2).

This analysis determined the following:

- The post-development discharge rates will not exceed the pre-development discharge rates during all storm events up to and including the 100-year storm, with the installation of the dual stage orifice pipe system at the outlet of the stormwater storage vault.

- 144.2m^3 of stormwater storage is required during the 100-year event, which can be accommodated by the proposed storage vault, having a volume of 148m^3.

Water Quality Control

The proposed development is required to achieve an "Enhanced" (80% TSS removal) level of water quality protection. To achieve this criteria, discharge from Catchments 201 will be subject to treatment from a HydroStorm oil/grit separator before ultimately discharging to the existing storm sewer on Appleby Line. The HydroStorm sizing software was used to determine the required size of oil/grit separator unit for the site. It was determined that HydroStorm HS5 units will be installed at MH1, providing 83% TSS removal and 96% average annual runoff treatment, which satisfies the requirements for an "Enhanced" level for quality control. See HydroStorm unit sizing procedures in Appendix C for details.

As part of pre-treatment for stormwater runoff from Catchment 201, the proposed area drains within the asphalt parking lot/laneway will be fitted with FlexStrom Pure inlet filters. The installation of the inlet filters will contribute to the removal of TSS and the capture of floatable within the area drains. The units also provide scour protection and reduce the resuspension of solids during heavy rain events, which would otherwise enter the storm system.

HydroStorm units and Flexstorm inlet filters require regular inspection and maintenance as per the manufacturer's specifications, to ensure the units operate properly. Refer to the maintenance manuals within Appendix C 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 catchbasins as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system;
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion;
- Install a mud mat at the construction entrance of the site to reduce mud tracking and sediment leave the site via construction traffic;

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;

3.0 SANITARY SEWER SERVICING

3.1 EXISTING CONDITIONS

The site is located at the southeast corner of Appleby Line and Upper Middle Road, with an existing 300mmø sanitary sewer on Upper Middle Road and an existing 375mmø sanitary sewer on Appleby Line.

3.2 SANITARY DEMAND

Sanitary discharge from the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Table 3.1 summarizes the sanitary sewer discharge rate for the subject lands.

Table 3.1- Post-Development Sanitary Sewer Discharge

Population [A]	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
777 persons	2.47	3.87	0.17	**9.74**

[A] Population = 475 units x 1.62 persons/unit = 769 persons
Commercial = 891m^2 x 90 persons/ha = 8 persons
Total = 769 + 8 = 777 persons

[B] Average demand = Residential = 275 l/cap/day x 769 persons = 2.45 l/s
Commercial = 24750 l/ha/day x 0.089 ha of commercial area = 0.025

[C] Peaking Factor = $1+((14/(4+P^{0.5})))$ with P expressed in thousands Min=2.0

[D] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Site Area (0.2 hectares)

[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed condominium building will be serviced by a private 200mmø sanitary sewer, designed and constructed in accordance with the Region of Halton standards. Drainage from this sewer will discharge to the existing 375mmø sanitary sewer on Appleby Line. The sanitary sewer connection was made to Appleby Line rather than Upper Middle Road to avoid crossing of the hydro corridor and the Enbridge pipeline.

The minimum grade of the proposed 200mmø sanitary will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.046 m^3/s (46 l/s). Therefore, the proposed 200mmø sanitary sewer at 2.0% grade is adequately sized to service the proposed development.

A sanitary sewer capacity analysis was completed from the existing manhole at the intersection of Upper Middle Road and Appleby Line (MH1A) to the existing manhole upstream of the existing trunk sanitary sewer located along Ironstone Drive (MH15A). The existing sanitary sewer system flowing south on Appleby Line and west on Ironstone Drive increases in size from a 375mmø to a 450mmø along Ironstone Drive. A population density of 90 persons per hectare was used to determine the population of the existing subject site and a flow per hectare for commercial space of 24750 L/ha/day was used. The sanitary drainage area plan and design sheet can be found in Appendix D.

The subject lands are estimated to be currently contributing 0.86 l/s to the Appleby Line sewer system. As per Table 3.1, it is proposed that **9.48 l/s of dry weather flow and 0.17 l/s of infiltration allowance** will be contributed by the proposed re-development.

It is worth noting that the 375mmø sanitary sewer runs analyzed along Appleby Line, south of Upper Middle Road are overcapacity in the existing condition.

The proposed sanitary discharge from the subject site will result in a **6.8% increase** in capacity of the 375mmø sewer fronting the site. Therefore, given that the 375mmø sewer runs are over capacity both in the proposed and existing condition, it is recommended that discussions with the Region of Halton should take place regarding upgrades to the 375mmø sanitary sewer on Appleby Line. Refer to the External Drainage Area Calculations, Sanitary Drainage Area Plan and the Sanitary Sewer Design Sheet for details in Appendix D for details.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 600mmø CPP watermain on Appleby Line and a 400mmø and 750mmø CPP watermain on Upper Middle Road. There are no local watermains on Appleby Line and Upper Middle Road adjacent to the subject lands. The nearest existing fire hydrants are located at the southeast corner of Ironstone Drive and Appleby Line and along Upper Middle Road east and west of Appleby Line.

4.2 DOMESTIC WATER DEMAND

Water demand for the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Table 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 4.1 - Post-Development Domestic Water Demand

Population [A]	Average Daily Demand [B] (l/s)	Max. Daily Peaking Factor [C]	Max. Hourly Peaking Factor [D]	**Max. Daily Demand [E] (l/s)**	**Max. Hourly Demand [F] (l/s)**
777 persons	2.47	2.25	4.00	**5.56**	**9.88**

[A] Population = 475 units x 1.62 persons/unit = 769 persons
Commercial = 891m^2 x 90 persons/ha = 8 persons
Total = 769 + 8 = 777 persons

[B] Average demand = Residential = 275 l/cap/day x 769 persons = 2.45 l/s
Commercial = 24750 l/ha/day x 0.089 ha of commercial area = 0.025

[C] Max. Daily Peaking Factor = 2.25 (refer to sentence 2.4.1 in Ref.3)

[D] Max. Hourly Peaking Factor = 4.00 (refer to Table 2-2 in Ref. 3)

[E] Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor

[F] Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

4.3 FIRE FLOW DEMAND

Fire flow demands for development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020),

Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA). Since the FUS criteria provides adjustment for sprinklered buildings (OBC does not), the FUS method was used to determine the fire flow demand for the proposed development.

The condominium building will be constructed of non-combustible construction (C=0.8), with limited combustible occupancy (-15% correction) and sprinkler system (-50% correction). Exposure corrections are based on the following:
North Face: 0% correction (+45m)
South Face: 0% correction – if the subject and exposed buildings are fully protected with an automatic sprinkler system than no exposure adjustment should be applied.
East Face: 0% correction – if the subject and exposed buildings are fully protected with an automatic sprinkler system than no exposure adjustment should be applied.
West Face: 0% correction (+45m)

It is estimated that the required fire flow for the proposed condominium building development will be **133 l/s**. Hydrant flow tests will be scheduled to determine the maximum available flow rate within the municipal system along Appleby Line. The hydrant flow test results will be provided once it is available. See Fire Flow Demand Requirements in Appendix C for calculations and details.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

The proposed water servicing for the subject site consists of installing a 200mmø watermain which will be split at property line to provide a 100mmø domestic and 200mmø fire water service for the proposed development. The proposed 200mmø watermain will connect into the existing 600mmø CPP watermain along Appleby Line. The proposed connection to the existing 600mmø CPP watermain will require special review and permission from the Region of Halton. Water services for the site are to be designed and constructed in accordance with the Halton Region standards.

In the event the proposed connection to the existing 600mmø CPP watermain as mentioned above, is not permitted by the Region of Halton, a watermain will be required to be extended from the existing 300mmø watermain on Ironstone Drive to the subject site.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development of 1989 Appleby Line can be constructed to meet the requirements of the City of Burlington and Halton Region. 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;

- 150mmø and 200mmø orifice pipes 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 as per the Preliminary Site Servicing Plan to provide stormwater storage;

- A HydroStorm HS5 oil/grit separator and FlexStorm inlet filters be install as per the Preliminary Site Servicing Plan and this report to provide efficient stormwater quantity control;

- Area drains within the parking lot are to be fitted with FlexStorm inlet filters as illustrated on the Preliminary Site Servicing Plan and this report;

- Erosion and sediment controls be installed as described in this report to meet City of Burlington requirements;

- The proposed sanitary and water servicing system be installed as per the Site Servicing Plan and this report to adequately service the proposed development;

- It is recommended that discussions with the Region of Halton should take place regarding upgrades to the existing 375mmø sanitary sewer on Appleby Line and the proposed watermain service connection to the existing 600mmø CPP watermain.

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



M. Colosimo, Dipl.T

S. Llewellyn, P.Eng.

APPENDIX A
STORMWATER MANAGEMENT INFORMATION

S:\22004\WORKING\Current\22004-GRADING & SERVICING PLAN.dwg

5/16/2022 10:55:23 AM - Michael Colosimo

UPPER MIDDLE ROAD

EX. 6 STOREY BRICK BUILDING

EX. METAL FENCE

EX. BOARD FENCE

EX. BF
EX. 0.16N

EX. PILLAR

EX. BUSH

EX. SIGN

EX. BO
EX. ICV

EX. CAR WASH AREA

EX. CONCRETE

EX. BOARD FENCE

EX. VAC. BASE

EX. LS

EX. CONC. CURB

EX. GARBAGE BIN

EX. CONC. PAD

EX. LS

EX. CB

EX. CLN

EX. BO

EX. GAS PUMP

EX. AD SIGN

EX. ROOF LINE

EX. OVERHANG

EX. CONC. SIDEWALK

EX. STORAGE

EX. WALL

EX. MH

EX. HYDRO BOX

EX. T. BOOTH

EX. CP

EX. 5-STOREY BRICK BUILDING

EX. CANOPY

EX. PLANTER

EX. CONC. CURB

EX. CONC. PAD

EX. OVERHEAD HYDRO

EX. BOM OF HEDGE

EX. METAL FENCE

EX. PILLAR

EX. CURB CUT

EX. CONC. CURB

EX. CB

EX. GAS EASEMENT

EX. CONC. CURB

EX. BOULDER

EX. BUSH

EX. CLN

EX. CB

EX. GM

EX. ROOF LINE

EX. BICYCLE STAND

EX. BOULDER

EX. BOULDER

EX. ILB

EX. GAS PIPE

EX. BOULDER

EX. ASPHALT SIDEWALK

EX. LS

EX. CONC. CURB

EX. DRIVEWAY

EX. OUT CURB

EX. DRIVEWAY

EX. LS

EX. AD SIGN

EX. CONC. CURB

EX. CB
T/G 139.51

EX. CB
T/G 138.32

EX. CONC. CURB

EX. CONC. SIDEWALK

EX. CURB CUT

EX. GRASS

EX. CONC. WALKWAY

EX. HYDRO POLE
EX. CONCRETE BASE

EX. 1-STOREY BRICK AND CONCRETE BUILDING

EX. HYDRO CORRIDOR

EX. CONC. CURB

EX. ASPHALT SIDEWALK

EX. HPLS

EX. LS BOX

EX. TS

EX. HPTS

EX. 128.0m-965x1525mm STM. @ 0.30%

EX. MH
T/G 139.32
N.INV. 206.71
S.INV. 206.65

EX. 135.0m-965x1525mm STM. @ 0.30%

EX. STM MH
T/G 139.58
INV. 136.85

EX. 98.0m-375mm# STM. @ 1.2%

APPLEBY LINE

102
0.25
17
0.36

101
0.60
60
0.64

LEGEND

101
0.39
11
0.32

DRAINAGE AREA I.D.
DRAINAGE AREA (ha)
PERCENT IMPERVIOUS
RUNOFF COEFFICENT

DIRECTION OF SHEET FLOW

FIGURE 1.0
PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:500

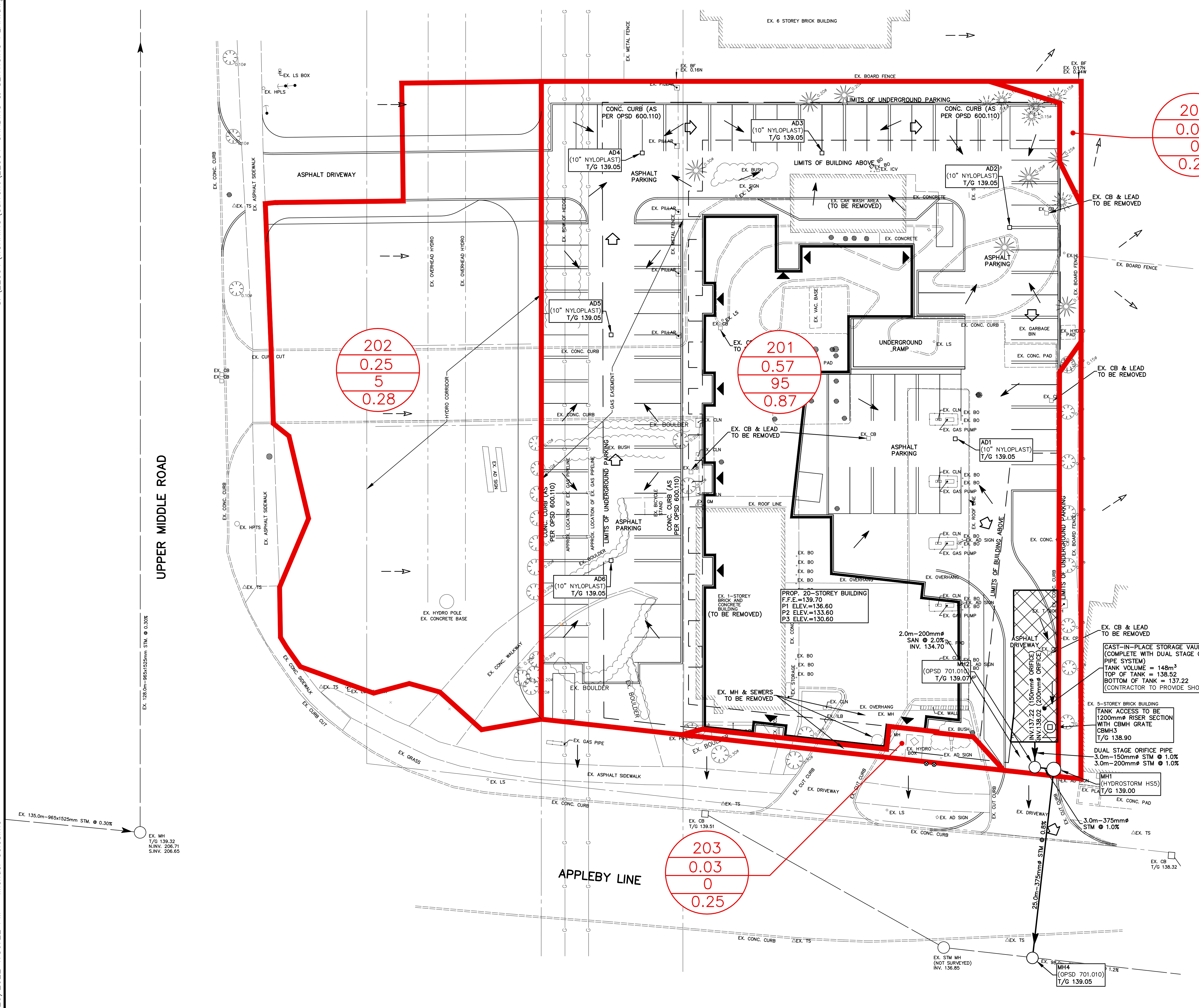
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PROJECT No.: 22004

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

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LEGEND

201	DRAINAGE AREA I.D.
0.39	DRAINAGE AREA (ha)
11	PERCENT IMPERVIOUS
0.32	RUNOFF COEFFICENT
→	DIRECTION OF SHEET FLOW

FIGURE 2.0
POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:500

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CONSULTING ENGINEERS

Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

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1989 Appleby Line
Burlington, Ontario

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

STAGE-STORAGE-DISCHARGE CALCULATIONS

Outlet Device No. 1 (Quantity)

Type:	Orifice Pipe 1	Type:	Orifice Pipe 2
Diameter (mm)	150	Diameter (mm)	200
Area (m^2)	0.01767	Area (m^2)	0.03142
Invert Elev. (m)	137.22	Invert Elev. (m)	138.02
C/L Elev. (m)	137.30	C/L Elev. (m)	138.12
Disch. Coeff. (C_d)	0.8	Disch. Coeff. (C_d)	0.8
Discharge (Q) =	C_d A (2 g H)$^{0.5}$	Discharge (Q) =	C_d A (2 g H)$^{0.5}$
Number of Orifices:	1	Number of Orifices:	1

		SWM Tank Volumes				Outlet No. 1		Outlet No. 2		
	Elevation m	Area m^2	Incremental Volume m^3	Cumulative Volume m^3	**Total Active Storage Volume m^3**	H m	Discharge m^3/s	H m	Discharge m^3/s	**Total Discharge m^3/s**
Orifice 1 Invert/Bottom of Tank	137.22	114	0	0	**0**	0.000	0.0000	0.000	0.0000	**0.0000**
0.10m Depth	137.32	114	11	11	**11**	0.100	0.0198	0.000	0.0000	**0.0198**
0.20m Depth	137.42	114	11	23	**23**	0.200	0.0280	0.000	0.0000	**0.0280**
0.40m Depth	137.62	114	23	46	**46**	0.400	0.0396	0.000	0.0000	**0.0396**
0.60m Depth	137.82	114	23	68	**68**	0.600	0.0485	0.000	0.0000	**0.0485**
Orifice 2 Invert	138.02	114	23	91	**91**	0.800	0.0560	0.000	0.0000	**0.0560**
1.00m Depth	138.22	114	23	114	**114**	1.000	0.0626	0.200	0.0498	**0.1124**
1.20m Depth	138.42	114	23	137	**137**	1.200	0.0686	0.400	0.0704	**0.1390**
Top of Tank	138.52	114	11	148	**148**	1.300	0.0714	0.500	0.0787	**0.1501**

APPENDIX B
SWMHYMO INPUT/OUTPUT INFORMATION

```
2     Metric units
*#*************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#                BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*************************************************************************|
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
                    BUR6_002.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
*#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
CALIB STANDHYD      ID=[1], NHYD=["101"], DT=[1](min), AREA=[0.60](ha),
                    XIMP=[0.36], TIMP=[0.36], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[20](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[20](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
CALIB NASHYD        ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.25](ha),
                    DWF=[0](cms),  CN/C=[80], IA=[6.35](mm),
                    N=[3], TP=[0.1]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["TOTAL"], IDs to add=[1, 2]
*%-----------------|-------------------------------------------------------|
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[0.57](ha),
                    XIMP=[0.95], TIMP=[0.95], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[20](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.5](%),
                                         LGI=[20](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
CALIB NASHYD        ID=[2], NHYD=["202"], DT=[1]min, AREA=[0.25](ha),
```

```
                    DWF=[0](cms),  CN/C=[80], IA=[6.35](mm),
                    N=[3], TP=[0.1]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["CONTROLLED"], IDs to add=[1, 2]
*%-----------------|-------------------------------------------------------|
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
ROUTE RESERVOIR     IDout=[4],   NHYD=["201 & 202"],  IDin=[3],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                      0.0    , 0.0
                                      0.0198 , 0.0011
                                      0.0280 , 0.0023
                                      0.0396 , 0.0046
                                      0.0485 , 0.0068
                                      0.0560 , 0.0091
                                      0.1124 , 0.0114
                                      0.1390 , 0.0137
                                      0.1501 , 0.0148
                                         -1  ,  -1    (max twenty pts)
                          IDovf=[5], NHYDovf=["OVF"]
*%-----------------|-------------------------------------------------------|
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
CALIB NASHYD        ID=[6], NHYD=["203"], DT=[1]min, AREA=[0.03](ha),
                    DWF=[0](cms),  CN/C=[80], IA=[6.35](mm),
                    N=[3], TP=[0.1]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------|
ADD HYD             IDsum=[7], NHYD=["TOTAL"], IDs to add=[4, 5, 6]
**#*****************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    BUR6_005.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
                    BUR6_010.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
                    BUR6_025.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
                    BUR6_050.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    BUR6_100.stm
*
*%-----------------|-------------------------------------------------------|
FINISH
```

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

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                          9   9  9   9   # 3902680
        StormWater Management HYdrologic Model            999    999    =========

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

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: S. Llewellyn & Associates Ltd                +++++++++
 +++++++++                in any City           SERIAL#:3902680       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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



 *********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2022-05-16     TIME: 11:58:19     RUN COUNTER: 000498          *
 ********************************************************************************
 * Input   filename: T:\PROJECTS\22004\FSR\SWMHYMO\22004.dat                     *
 * Output  filename: T:\PROJECTS\22004\FSR\SWMHYMO\22004.out                     *
 * Summary filename: T:\PROJECTS\22004\FSR\SWMHYMO\22004.sum                     *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


--------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*****************************************************************************|
*
  ** END OF RUN :   1

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=BUR6_002.stm
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 2-yr 6hr CHICAGO  (A=681.52,
| Ptotal=  40.93 mm|    Comments: Burlington 2-yr 6hr CHICAGO  (A=681.52,
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   1.715 |   1.67   8.325 |   3.17   4.467 |   4.67   2.213
              .33   1.858 |   1.83  19.646 |   3.33   3.978 |   4.83   2.105
              .50   2.032 |   2.00  78.391 |   3.50   3.595 |   5.00   2.008
              .67   2.247 |   2.17  25.776 |   3.67   3.286 |   5.17   1.920
              .83   2.522 |   2.33  13.777 |   3.83   3.030 |   5.33   1.841
            1.00   2.888 |   2.50   9.511 |   4.00   2.815 |   5.50   1.769
            1.17   3.399 |   2.67   7.331 |   4.17   2.632 |   5.67   1.703
            1.33   4.172 |   2.83   6.005 |   4.33   2.474 |   5.83   1.642
            1.50   5.492 |   3.00   5.111 |   4.50   2.335 |   6.00   1.586

--------------------------------------------------------------------------------
002:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
*#*****************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .60
| 01:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .22          .38
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      78.39        18.32
               over (min)        1.00        10.00
     Storage Coeff.  (min)=        .87 (ii)   10.05 (ii)
     Unit Hyd. Tpeak (min)=       1.00        10.00
     Unit Hyd. peak  (cms)=       1.16          .11
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .05          .01          .053 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.15         2.000
     RUNOFF VOLUME    (mm)=      39.93        12.19        22.179
     TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
     RUNOFF COEFFICIENT   =        .98          .30          .542

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0004----------------------------------------------------------------------
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .011 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   12.193
     TOTAL RAINFALL   (mm)=   40.933
     RUNOFF COEFFICIENT   =     .298

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

--------------------------------------------------------------------------------
002:0005----------------------------------------------------------------------
----------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                     (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:101             .60     .053    2.00  22.18    .000
                     +ID2 02:102             .25     .011    2.07  12.19    .000
                      ================================================================
                      SUM 03:TOTAL           .85     .061    2.00  19.24    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0006----------------------------------------------------------------------
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#****************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .57
| 01:201    DT= 1.00 |   Total Imp(%)=   95.00   Dir. Conn.(%)=   95.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .54          .03
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       1.50         2.00
     Length            (m)=      20.00        20.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      78.39        18.32
               over (min)        1.00        10.00
     Storage Coeff.  (min)=        .95 (ii)   10.13 (ii)
     Unit Hyd. Tpeak (min)=       1.00        10.00
     Unit Hyd. peak  (cms)=       1.11          .11
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .12          .00          .118 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.15         2.000
     RUNOFF VOLUME    (mm)=      39.93        12.19        38.546
     TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
     RUNOFF COEFFICIENT   =        .98          .30          .942

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0007----------------------------------------------------------------------
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:202    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .011 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   12.193
     TOTAL RAINFALL   (mm)=   40.933
     RUNOFF COEFFICIENT   =     .298

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

--------------------------------------------------------------------------------
002:0008----------------------------------------------------------------------
----------------------
| ADD HYD (CONTROLLED) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
```

```
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:201              .57     .118    2.00  38.55    .000
                    +ID2 02:202              .25     .011    2.07  12.19    .000
                     ============================================================
                     SUM 03:CONTROLLED       .82     .127    2.00  30.51    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0009----------------------------------------------------------------------
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(CONTRO)   |
| OUT<04:(201 & )   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .056  .9100E-02
                           .020  .1100E-02    |     .112  .1140E-01
                           .028  .2300E-02    |     .139  .1370E-01
                           .040  .4600E-02    |     .150  .1480E-01
                           .049  .6800E-02    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (CONTRO)        .82      .127     2.000     30.511
     OUTFLOW<04: (201 & )        .82      .048     2.167     30.511
    OVERFLOW<05: (OVF   )        .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](%)=   37.689
                    TIME SHIFT OF PEAK FLOW       (min)=    10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.6602E-02

--------------------------------------------------------------------------------
002:0010----------------------------------------------------------------------
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .03   Curve Number   (CN)=80.00
| 06:203    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .011

     PEAK FLOW       (cms)=     .001 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   12.186
     TOTAL RAINFALL   (mm)=   40.933
     RUNOFF COEFFICIENT   =     .298

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

--------------------------------------------------------------------------------
002:0011----------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:201 & 202        .82     .048    2.17  30.51    .000
                    +ID2 05:OVF              .00     .000     .00    .00    .000
                    +ID3 06:203              .03     .001    2.07  12.19    .000
                     ============================================================
                     SUM 07:TOTAL            .85     .049    2.13  29.86    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0012----------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
  ** END OF RUN :   4

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
          #  1=BUR6_005.stm
--------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*************************************************************************|
*
--------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 5-yr 6hr CHICAGO    (A=802.04
| Ptotal=  53.05 mm|    Comments: Burlington 5-yr 6hr CHICAGO    (A=802.04
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             .17   2.348 |   1.67  10.690 |   3.17   5.897 |   4.67   3.004
             .33   2.537 |   1.83  24.479 |   3.33   5.279 |   4.83   2.862
             .50   2.766 |   2.00 101.312 |   3.50   4.790 |   5.00   2.734
             .67   3.048 |   2.17  31.941 |   3.67   4.394 |   5.17   2.619
             .83   3.407 |   2.33  17.333 |   3.83   4.065 |   5.33   2.514
            1.00   3.881 |   2.50  12.145 |   4.00   3.788 |   5.50   2.419
            1.17   4.539 |   2.67   9.469 |   4.17   3.550 |   5.67   2.331
            1.33   5.523 |   2.83   7.826 |   4.33   3.344 |   5.83   2.251
            1.50   7.185 |   3.00   6.709 |   4.50   3.164 |   6.00   2.176

--------------------------------------------------------------------------------
005:0003----------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#       PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ==========================================
*#
*#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
---------------------
| CALIB STANDHYD    |   Area    (ha)=     .60
| 01:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .22          .38
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     101.31        35.40
               over (min)        1.00         8.00
     Storage Coeff.  (min)=        .79 (ii)    7.84 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=       1.22          .14
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .06          .02          .078 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.10         2.000
     RUNOFF VOLUME    (mm)=      52.05        19.79        31.406
     TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
     RUNOFF COEFFICIENT   =        .98          .37          .592

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0004----------------------------------------------------------------------
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .018 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   19.792
     TOTAL RAINFALL   (mm)=   53.053
     RUNOFF COEFFICIENT   =     .373

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

--------------------------------------------------------------------------------
005:0005----------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:101             .60     .078    2.00  31.41    .000
                     +ID2 02:102             .25     .018    2.07  19.79    .000
                      ============================================================
                      SUM 03:TOTAL           .85     .093    2.00  27.99    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
005:0006----------------------------------------------------------------------
*#*************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ===========================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
---------------------
| CALIB STANDHYD    |   Area    (ha)=     .57
| 01:201    DT= 1.00 |   Total Imp(%)=   95.00   Dir. Conn.(%)=   95.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .54          .03
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       1.50         2.00
     Length            (m)=      20.00        20.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     101.31        35.40
               over (min)        1.00         8.00
     Storage Coeff.  (min)=        .86 (ii)    7.91 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=       1.17          .14
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .15          .00          .154 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.10         2.000
     RUNOFF VOLUME    (mm)=      52.05        19.79        50.440
     TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
     RUNOFF COEFFICIENT   =        .98          .37          .951

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0007----------------------------------------------------------------------
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:202    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
```

```
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .018 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   19.792
     TOTAL RAINFALL   (mm)=   53.053
     RUNOFF COEFFICIENT   =     .373

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

-------------------------------------------------------------------------------
005:0008---------------------------------------------------------------------
------------------------
| ADD HYD (CONTROLLED) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:201           .57     .154    2.00  50.44    .000
                      +ID2 02:202           .25     .018    2.07  19.79    .000
                       ============================================================
                       SUM 03:CONTROLLED     .82     .169    2.00  41.10    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
005:0009---------------------------------------------------------------------
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(CONTRO)   |
| OUT<04:(201 & )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .056  .9100E-02
                           .020  .1100E-02    |     .112  .1140E-01
                           .028  .2300E-02    |     .139  .1370E-01
                           .040  .4600E-02    |     .150  .1480E-01
                           .049  .6800E-02    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (CONTRO)        .82      .169     2.000     41.096
     OUTFLOW<04: (201 & )        .82      .062     2.167     41.096
    OVERFLOW<05: (OVF   )        .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](%)=   36.811
                  TIME SHIFT OF PEAK FLOW         (min)=    10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9353E-02

-------------------------------------------------------------------------------
005:0010---------------------------------------------------------------------
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .03   Curve Number   (CN)=80.00
| 06:203    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .011

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   19.785
     TOTAL RAINFALL   (mm)=   53.053
     RUNOFF COEFFICIENT   =     .373

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

-------------------------------------------------------------------------------
005:0011---------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 04:201 & 202      .82     .062    2.17  41.10    .000
                      +ID2 05:OVF            .00     .000     .00    .00    .000
                      +ID3 06:203            .03     .002    2.07  19.79    .000
                       ============================================================
                       SUM 07:TOTAL          .85     .064    2.17  40.34    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
005:0012---------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
-------------------------------------------------------------------------------
005:0002---------------------------------------------------------------------
*
  ** END OF RUN :   9

*******************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
            #  1=BUR6_010.stm
-------------------------------------------------------------------------------
010:0002---------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#                BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*************************************************************************|
*
-------------------------------------------------------------------------------
010:0002---------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 10-yr 6hr CHICAGO     (A=918.
| Ptotal=  61.10 mm|    Comments: Burlington 10-yr 6hr CHICAGO     (A=918.
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   2.714 |   1.67  12.326 |   3.17   6.808 |   4.67   3.472
               .33   2.933 |   1.83  28.176 |   3.33   6.095 |   4.83   3.308
               .50   3.197 |   2.00 116.310 |   3.50   5.532 |   5.00   3.161
               .67   3.523 |   2.17  36.748 |   3.67   5.075 |   5.17   3.027
               .83   3.937 |   2.33  19.967 |   3.83   4.696 |   5.33   2.907
              1.00   4.483 |   2.50  14.001 |   4.00   4.376 |   5.50   2.796
              1.17   5.242 |   2.67  10.921 |   4.17   4.102 |   5.67   2.695
              1.33   6.377 |   2.83   9.030 |   4.33   3.864 |   5.83   2.602
              1.50   8.291 |   3.00   7.743 |   4.50   3.656 |   6.00   2.516

-------------------------------------------------------------------------------
010:0003---------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
*#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .60
| 01:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
---------------------                    IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .22          .38
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        48.24
                  over (min)        1.00         7.00
     Storage Coeff.  (min)=        .74 (ii)    6.98 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=       1.26          .16
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .07          .03          .096 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.07         2.000
     RUNOFF VOLUME    (mm)=      60.10        25.35        37.861
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .41          .620

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
010:0004---------------------------------------------------------------------
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .024 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   25.350
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .415

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

-------------------------------------------------------------------------------
010:0005---------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:101            .60     .096    2.00  37.86    .000
                      +ID2 02:102            .25     .024    2.05  25.35    .000
                       ============================================================
                       SUM 03:TOTAL          .85     .117    2.00  34.18    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
010:0006---------------------------------------------------------------------
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .57
| 01:201    DT= 1.00 |   Total Imp(%)=   95.00   Dir. Conn.(%)=   95.00
---------------------                    IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .54          .03
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       1.50         2.00
     Length            (m)=      20.00        20.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        48.24
                  over (min)        1.00         7.00
     Storage Coeff.  (min)=        .81 (ii)    7.04 (ii)
     Unit Hyd. Tpeak (min)=       1.00         7.00
     Unit Hyd. peak  (cms)=       1.20          .16
                                                      *TOTALS*
```

```
     PEAK FLOW      (cms)=        .17          .00          .177 (iii)
     TIME TO PEAK   (hrs)=       2.00         2.07         2.000
     RUNOFF VOLUME   (mm)=      60.10        25.35        58.364
     TOTAL RAINFALL  (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT  =        .98          .41          .955

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
010:0007---------------------------------------------------------------------
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:202    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW      (cms)=     .024 (i)
     TIME TO PEAK   (hrs)=    2.050
     RUNOFF VOLUME   (mm)=   25.350
     TOTAL RAINFALL  (mm)=   61.101
     RUNOFF COEFFICIENT  =     .415

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

-------------------------------------------------------------------------------
010:0008---------------------------------------------------------------------
-----------------------
| ADD HYD (CONTROLLED) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:201            .57      .177    2.00  58.36    .000
                    +ID2 02:202            .25      .024    2.05  25.35    .000
                     ========================================================
                     SUM 03:CONTROLLED      .82     .197    2.00  48.30    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
010:0009---------------------------------------------------------------------
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(CONTRO)   |
| OUT<04:(201 & )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .056  .9100E-02
                           .020  .1100E-02   |     .112  .1140E-01
                           .028  .2300E-02   |     .139  .1370E-01
                           .040  .4600E-02   |     .150  .1480E-01
                           .049  .6800E-02   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (CONTRO)        .82      .197     2.000     48.298
     OUTFLOW<04: (201 & )        .82      .087     2.050     48.298
    OVERFLOW<05: (OVF   )        .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](%)=   44.047
                    TIME SHIFT OF PEAK FLOW       (min)=     3.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1036E-01

-------------------------------------------------------------------------------
010:0010---------------------------------------------------------------------
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .03   Curve Number   (CN)=80.00
| 06:203    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .011

     PEAK FLOW      (cms)=     .003 (i)
     TIME TO PEAK   (hrs)=    2.050
     RUNOFF VOLUME   (mm)=   25.343
     TOTAL RAINFALL  (mm)=   61.101
     RUNOFF COEFFICIENT  =     .415

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

-------------------------------------------------------------------------------
010:0011---------------------------------------------------------------------
-----------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 04:201 & 202       .82      .087    2.05  48.30    .000
                    +ID2 05:OVF             .00      .000     .00    .00    .000
                    +ID3 06:203             .03      .003    2.05  25.34    .000
                     ========================================================
                     SUM 07:TOTAL           .85      .090    2.05  47.49    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
010:0012---------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
-------------------------------------------------------------------------------
010:0002---------------------------------------------------------------------
*
-------------------------------------------------------------------------------
010:0002---------------------------------------------------------------------
*
  ** END OF RUN :  24

*******************************************************************************
```

```
--------------------
| START              |  Project  dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
           #  1=BUR6_025.stm
-------------------------------------------------------------------------------
025:0002---------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*************************************************************************|
*
-------------------------------------------------------------------------------
025:0002---------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 25-yr 6hr CHICAGO      (A=106
| Ptotal=  71.35 mm|    Comments: Burlington 25-yr 6hr CHICAGO      (A=106
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   3.182 |   1.67  14.410 |   3.17   7.968 |   4.67   4.068
              .33   3.437 |   1.83  32.881 |   3.33   7.135 |   4.83   3.876
              .50   3.746 |   2.00 135.380 |   3.50   6.477 |   5.00   3.704
              .67   4.128 |   2.17  42.866 |   3.67   5.943 |   5.17   3.548
              .83   4.612 |   2.33  23.321 |   3.83   5.499 |   5.33   3.407
             1.00   5.251 |   2.50  16.365 |   4.00   5.125 |   5.50   3.278
             1.17   6.138 |   2.67  12.771 |   4.17   4.805 |   5.67   3.160
             1.33   7.465 |   2.83  10.563 |   4.33   4.527 |   5.83   3.051
             1.50   9.700 |   3.00   9.061 |   4.50   4.284 |   6.00   2.950

-------------------------------------------------------------------------------
025:0003---------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
*#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .60
| 01:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .22          .38
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =      .013         .250

     Max.eff.Inten.(mm/hr)=     135.38        65.70
               over (min)        1.00         6.00
     Storage Coeff.  (min)=        .70 (ii)    6.21 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.29          .18
                                                      *TOTALS*
     PEAK FLOW      (cms)=        .08          .05          .123 (iii)
     TIME TO PEAK   (hrs)=       2.00         2.05         2.000
     RUNOFF VOLUME   (mm)=      70.35        32.88        46.366
     TOTAL RAINFALL  (mm)=      71.35        71.35        71.347
     RUNOFF COEFFICIENT  =        .99          .46          .650

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
025:0004---------------------------------------------------------------------
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD      |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW      (cms)=     .032 (i)
     TIME TO PEAK   (hrs)=    2.050
     RUNOFF VOLUME   (mm)=   32.876
     TOTAL RAINFALL  (mm)=   71.347
     RUNOFF COEFFICIENT  =     .461

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

-------------------------------------------------------------------------------
025:0005---------------------------------------------------------------------
-----------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:101             .60      .123    2.00  46.37    .000
                    +ID2 02:102             .25      .032    2.05  32.88    .000
                     ========================================================
                     SUM 03:TOTAL           .85      .150    2.00  42.40    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
025:0006---------------------------------------------------------------------
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
```

```
*#        ================================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .57
| 01:201    DT= 1.00 |   Total Imp(%)=   95.00   Dir. Conn.(%)=   95.00
---------------------
                        IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .54          .03
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.50         2.00
     Length            (m)=     20.00        20.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    135.38        65.70
                 over (min)       1.00         6.00
     Storage Coeff.  (min)=       .76 (ii)    6.27 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.24          .18
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .20          .00          .207 (iii)
     TIME TO PEAK    (hrs)=      2.00         2.05         2.000
     RUNOFF VOLUME    (mm)=     70.35        32.88        68.473
     TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
     RUNOFF COEFFICIENT   =       .99          .46          .960

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
025:0007---------------------------------------------------------------------
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:202    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .032 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   32.876
     TOTAL RAINFALL   (mm)=   71.347
     RUNOFF COEFFICIENT   =     .461

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

-------------------------------------------------------------------------------
025:0008---------------------------------------------------------------------
-------------------------
| ADD HYD (CONTROLLED) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:201            .57      .207    2.00  68.47    .000
                     +ID2 02:202            .25      .032    2.05  32.88    .000
                      ========================================================
                      SUM 03:CONTROLLED      .82      .234    2.00  57.62    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
025:0009---------------------------------------------------------------------
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>03:(CONTRO)    |
| OUT<04:(201 & )    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .056  .9100E-02
                            .020  .1100E-02   |     .112  .1140E-01
                            .028  .2300E-02   |     .139  .1370E-01
                            .040  .4600E-02   |     .150  .1480E-01
                            .049  .6800E-02   |     .000  .0000E+00

     ROUTING RESULTS           AREA     QPEAK     TPEAK       R.V.
     --------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (CONTRO)       .82      .234     2.000     57.620
     OUTFLOW<04: (201 & )       .82      .118     2.033     57.620
    OVERFLOW<05: (OVF   )       .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](%)=   50.572
                    TIME SHIFT OF PEAK FLOW         (min)=     2.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1193E-01

-------------------------------------------------------------------------------
025:0010---------------------------------------------------------------------
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .03   Curve Number   (CN)=80.00
| 06:203    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .011

     PEAK FLOW       (cms)=     .004 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   32.870
     TOTAL RAINFALL   (mm)=   71.347
     RUNOFF COEFFICIENT   =     .461

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

-------------------------------------------------------------------------------
025:0011---------------------------------------------------------------------
-------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 04:201 & 202       .82      .118    2.03  57.62    .000
                     +ID2 05:OVF             .00      .000     .00    .00    .000
                     +ID3 06:203             .03      .004    2.05  32.87    .000
                      ========================================================
                      SUM 07:TOTAL           .85      .122    2.03  56.75    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
025:0012---------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
-------------------------------------------------------------------------------
025:0002---------------------------------------------------------------------
*
-------------------------------------------------------------------------------
025:0002---------------------------------------------------------------------
*
-------------------------------------------------------------------------------
025:0002---------------------------------------------------------------------
*
  ** END OF RUN :  49

*************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
             #  1=BUR6_050.stm
-------------------------------------------------------------------------------
050:0002---------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#                BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*************************************************************************|
*
-------------------------------------------------------------------------------
050:0002---------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 50-yr 6hr CHICAGO     (A=1172
| Ptotal=  78.93 mm|    Comments: Burlington 50-yr 6hr CHICAGO     (A=1172
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.533 |   1.67  15.961 |   3.17   8.836 |   4.67   4.516
               .33   3.817 |   1.83  36.356 |   3.33   7.913 |   4.83   4.304
               .50   4.160 |   2.00 149.296 |   3.50   7.185 |   5.00   4.113
               .67   4.582 |   2.17  47.374 |   3.67   6.593 |   5.17   3.940
               .83   5.119 |   2.33  25.806 |   3.83   6.102 |   5.33   3.783
              1.00   5.827 |   2.50  18.121 |   4.00   5.688 |   5.50   3.640
              1.17   6.809 |   2.67  14.149 |   4.17   5.333 |   5.67   3.509
              1.33   8.278 |   2.83  11.707 |   4.33   5.025 |   5.83   3.388
              1.50  10.753 |   3.00  10.045 |   4.50   4.755 |   6.00   3.277

-------------------------------------------------------------------------------
050:0003---------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
*#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .60
| 01:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
---------------------
                        IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .22          .38
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.00         2.00
     Length            (m)=     20.00        20.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.30        77.86
                 over (min)       1.00         6.00
     Storage Coeff.  (min)=       .67 (ii)    5.82 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.31          .19
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .09          .06          .141 (iii)
     TIME TO PEAK    (hrs)=      2.00         2.05         2.000
     RUNOFF VOLUME    (mm)=     77.93        38.71        52.832
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .49          .669

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
050:0004---------------------------------------------------------------------
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095
```

```
     PEAK FLOW      (cms)=     .039 (i)
     TIME TO PEAK   (hrs)=    2.050
     RUNOFF VOLUME   (mm)=   38.713
     TOTAL RAINFALL  (mm)=   78.932
     RUNOFF COEFFICIENT  =     .490

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

------------------------------------------------------------------------------
050:0005----------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:101            .60     .141    2.00  52.83    .000
                      +ID2 02:102            .25     .039    2.05  38.71    .000
                       ========================================================
                       SUM 03:TOTAL          .85     .174    2.00  48.68    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0006----------------------------------------------------------------------
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .57
| 01:201    DT= 1.00 |   Total Imp(%)=   95.00   Dir. Conn.(%)=   95.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .54          .03
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.50         2.00
     Length            (m)=     20.00        20.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.30        77.86
               over (min)         1.00         6.00
     Storage Coeff.  (min)=      .73 (ii)    5.88 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.26          .19
                                                    *TOTALS*
     PEAK FLOW      (cms)=       .22          .00          .228 (iii)
     TIME TO PEAK   (hrs)=      2.00         2.05         2.000
     RUNOFF VOLUME   (mm)=     77.93        38.71        75.971
     TOTAL RAINFALL  (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT  =       .99          .49          .962

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
050:0007----------------------------------------------------------------------
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:202    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW      (cms)=     .039 (i)
     TIME TO PEAK   (hrs)=    2.050
     RUNOFF VOLUME   (mm)=   38.713
     TOTAL RAINFALL  (mm)=   78.932
     RUNOFF COEFFICIENT  =     .490

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

------------------------------------------------------------------------------
050:0008----------------------------------------------------------------------
------------------------
| ADD HYD (CONTROLLED) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:201            .57     .228    2.00  75.97    .000
                      +ID2 02:202            .25     .039    2.05  38.71    .000
                       ========================================================
                       SUM 03:CONTROLLED     .82     .261    2.00  64.61    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0009----------------------------------------------------------------------
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(CONTRO)   |
| OUT<04:(201 & )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .056  .9100E-02
                            .020  .1100E-02   |     .112  .1140E-01
                            .028  .2300E-02   |     .139  .1370E-01
                            .040  .4600E-02   |     .150  .1480E-01
                            .049  .6800E-02   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (CONTRO)        .82      .261     2.000     64.612
     OUTFLOW<04: (201 & )        .82      .133     2.033     64.612
    OVERFLOW<05: (OVF   )        .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](%)=   50.748
                    TIME SHIFT OF PEAK FLOW         (min)=    2.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1317E-01

------------------------------------------------------------------------------
050:0010----------------------------------------------------------------------
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .03   Curve Number   (CN)=80.00
| 06:203    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .011

     PEAK FLOW      (cms)=     .005 (i)
     TIME TO PEAK   (hrs)=    2.050
     RUNOFF VOLUME   (mm)=   38.706
     TOTAL RAINFALL  (mm)=   78.932
     RUNOFF COEFFICIENT  =     .490

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

------------------------------------------------------------------------------
050:0011----------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 04:201 & 202      .82     .133    2.03  64.61    .000
                      +ID2 05:OVF            .00     .000     .00    .00    .000
                      +ID3 06:203            .03     .005    2.05  38.71    .000
                       ========================================================
                       SUM 07:TOTAL          .85     .137    2.03  63.70    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0012----------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
  ** END OF RUN :  99

**************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\22004\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
          #  1=BUR6_100.stm
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 1989 APPLEBY LINE
*#                BURLINGTON, ONTARIO
*#  JOB NUMBER  : 22004
*#       Date   : MAY 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 22004.DAT
*#*************************************************************************|
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 100-yr 6hr CHICAGO        (A=
| Ptotal=  86.27 mm|    Comments: Burlington 100-yr 6hr CHICAGO        (A=
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   3.862 |   1.67  17.445 |   3.17   9.657 |   4.67   4.936
              .33   4.172 |   1.83  39.736 |   3.33   8.649 |   4.83   4.704
              .50   4.546 |   2.00 163.177 |   3.50   7.853 |   5.00   4.495
              .67   5.008 |   2.17  51.779 |   3.67   7.206 |   5.17   4.306
              .83   5.595 |   2.33  28.205 |   3.83   6.670 |   5.33   4.135
             1.00   6.369 |   2.50  19.806 |   4.00   6.217 |   5.50   3.979
             1.17   7.443 |   2.67  15.465 |   4.17   5.829 |   5.67   3.835
             1.33   9.048 |   2.83  12.795 |   4.33   5.492 |   5.83   3.703
             1.50  11.752 |   3.00  10.979 |   4.50   5.197 |   6.00   3.581

------------------------------------------------------------------------------
100:0003----------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS ENTIRE SITE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .60
| 01:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .22          .38
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.00         2.00
     Length            (m)=     20.00        20.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    163.18        92.48
```

```
              over (min)        1.00         5.00
     Storage Coeff.  (min)=       .65 (ii)    5.45 (ii)
     Unit Hyd. Tpeak (min)=      1.00         5.00
     Unit Hyd. peak  (cms)=      1.33          .21
                                                  *TOTALS*
     PEAK FLOW       (cms)=       .10          .07          .164 (iii)
     TIME TO PEAK    (hrs)=      2.00         2.03         2.000
     RUNOFF VOLUME    (mm)=     85.27        44.54        59.201
     TOTAL RAINFALL   (mm)=     86.27        86.27        86.271
     RUNOFF COEFFICIENT   =       .99          .52          .686

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0004----------------------------------------------------------------------
*# CATCHMENT 102 -  EXISTING CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .045 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   44.535
     TOTAL RAINFALL   (mm)=   86.271
     RUNOFF COEFFICIENT   =     .516

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

--------------------------------------------------------------------------------
100:0005----------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 01:101           .60     .164    2.00  59.20    .000
                       +ID2 02:102           .25     .045    2.05  44.54    .000
                        ========================================================
                        SUM 03:TOTAL          .85     .203    2.00  54.89    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0006----------------------------------------------------------------------
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - CONTROLLED DISCHARGE TO APPLEBY LINE
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .57
| 01:201    DT= 1.00 |   Total Imp(%)=   95.00   Dir. Conn.(%)=   95.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .54          .03
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.50         2.00
     Length            (m)=     20.00        20.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    163.18        90.27
              over (min)        1.00         6.00
     Storage Coeff.  (min)=       .71 (ii)    5.56 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.29          .20
                                                  *TOTALS*
     PEAK FLOW       (cms)=       .25          .01          .250 (iii)
     TIME TO PEAK    (hrs)=      2.00         2.05         2.000
     RUNOFF VOLUME    (mm)=     85.27        44.54        83.234
     TOTAL RAINFALL   (mm)=     86.27        86.27        86.271
     RUNOFF COEFFICIENT   =       .99          .52          .965

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0007----------------------------------------------------------------------
*# CATCHMENT 202 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .25   Curve Number   (CN)=80.00
| 02:202    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .095

     PEAK FLOW       (cms)=     .045 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   44.535
     TOTAL RAINFALL   (mm)=   86.271
     RUNOFF COEFFICIENT   =     .516

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

--------------------------------------------------------------------------------
100:0008----------------------------------------------------------------------
------------------------
| ADD HYD (CONTROLLED) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 01:201           .57     .250    2.00  83.23    .000
                       +ID2 02:202           .25     .045    2.05  44.54    .000
                        ========================================================
                        SUM 03:CONTROLLED     .82     .289    2.00  71.44    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0009----------------------------------------------------------------------
*# ROUTE CATCHMENT - CONTROLLED FLOWS FROM 201 & 202
*
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>03:(CONTRO)    |
| OUT<04:(201 & )    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)   (ha.m.)
                           .000  .0000E+00    |     .056  .9100E-02
                           .020  .1100E-02    |     .112  .1140E-01
                           .028  .2300E-02    |     .139  .1370E-01
                           .040  .4600E-02    |     .150  .1480E-01
                           .049  .6800E-02    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (CONTRO)        .82      .289     2.000     71.436
     OUTFLOW<04: (201 & )        .82      .146     2.033     71.436
    OVERFLOW<05: (OVF   )        .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](%)=   50.599
                   TIME SHIFT OF PEAK FLOW         (min)=     2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1442E-01

--------------------------------------------------------------------------------
100:0010----------------------------------------------------------------------
*# CATCHMENT 203 -  PROPOSED CONDITIONS EXTERNAL LANDS
*
---------------------
| CALIB NASHYD       |   Area    (ha)=     .03   Curve Number   (CN)=80.00
| 06:203    DT= 1.00 |   Ia      (mm)=   6.350   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .011

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   44.529
     TOTAL RAINFALL   (mm)=   86.271
     RUNOFF COEFFICIENT   =     .516

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

--------------------------------------------------------------------------------
100:0011----------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 04:201 & 202     .82     .146    2.03  71.44    .000
                       +ID2 05:OVF           .00     .000     .00    .00    .000
                       +ID3 06:203           .03     .005    2.05  44.53    .000
                        ========================================================
                        SUM 07:TOTAL          .85     .151    2.03  70.49    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0012----------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2022-05-16     at 11:58:22
================================================================================
```

APPENDIX C
QUANTITY CONTROL INFORMATION

Hydroworks Sizing Summary

1989 Appleby Line
Burlington, Ontario

05-13-2022

Recommended Size: HS 5

A HydroStorm HS 5 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.57 (ha) with an imperviousness of 95 % and Hamilton RBG, Ontario rainfall for the 20 um to 2000 um particle size distribution.

The recommended HydroStorm HS 5 treats 96 % of the annual runoff and provides 83 % annual TSS removal for the Hamilton RBG rainfall records and 20 um to 2000 um particle size distribution.

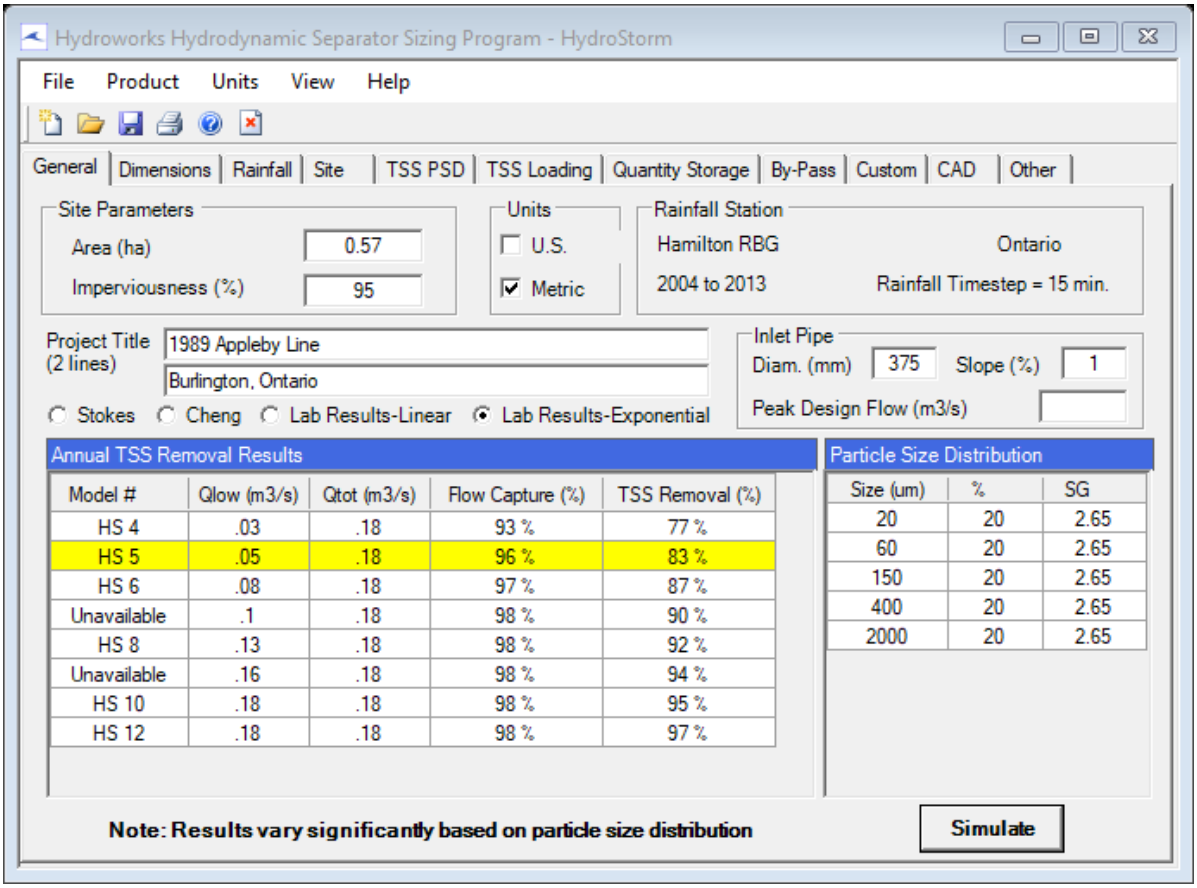
The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .18 (m3/s) for the given 375 (mm) pipe diameter at 1% slope. The headloss was calculated to be 134 (mm) based on a flow depth of 375 (mm) (full pipe flow).

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.

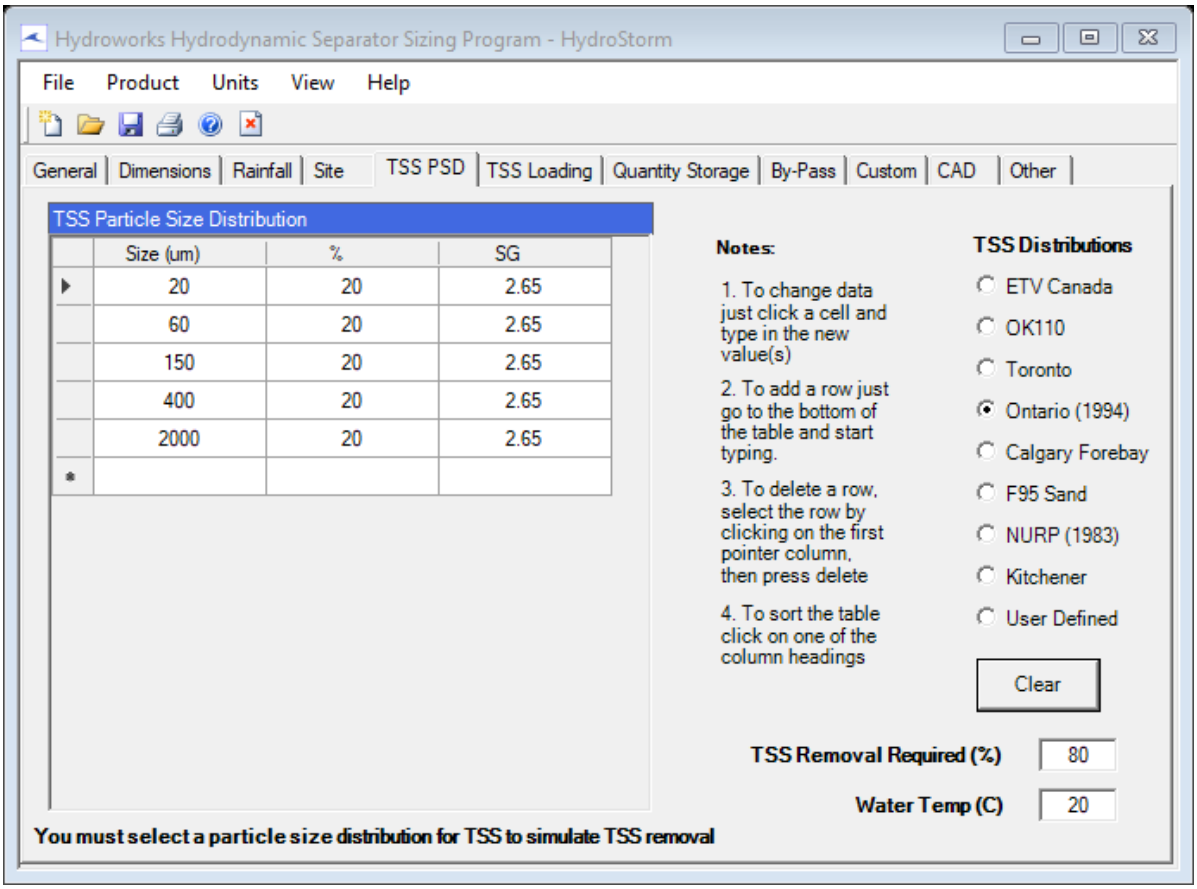
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm . Design liability is only valid for lawsuits brought within the United States where Hydroworks has its corporate headquarters.

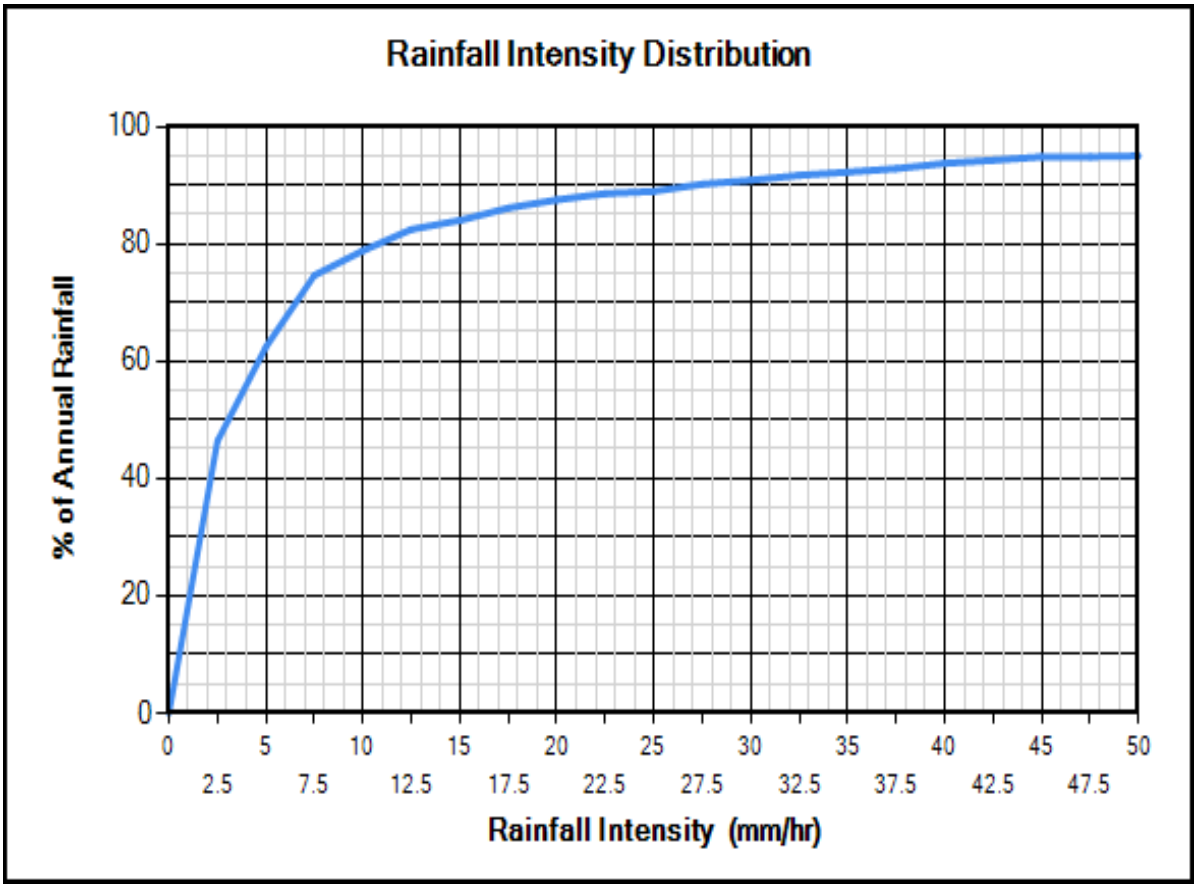
TSS Removal Sizing Summary



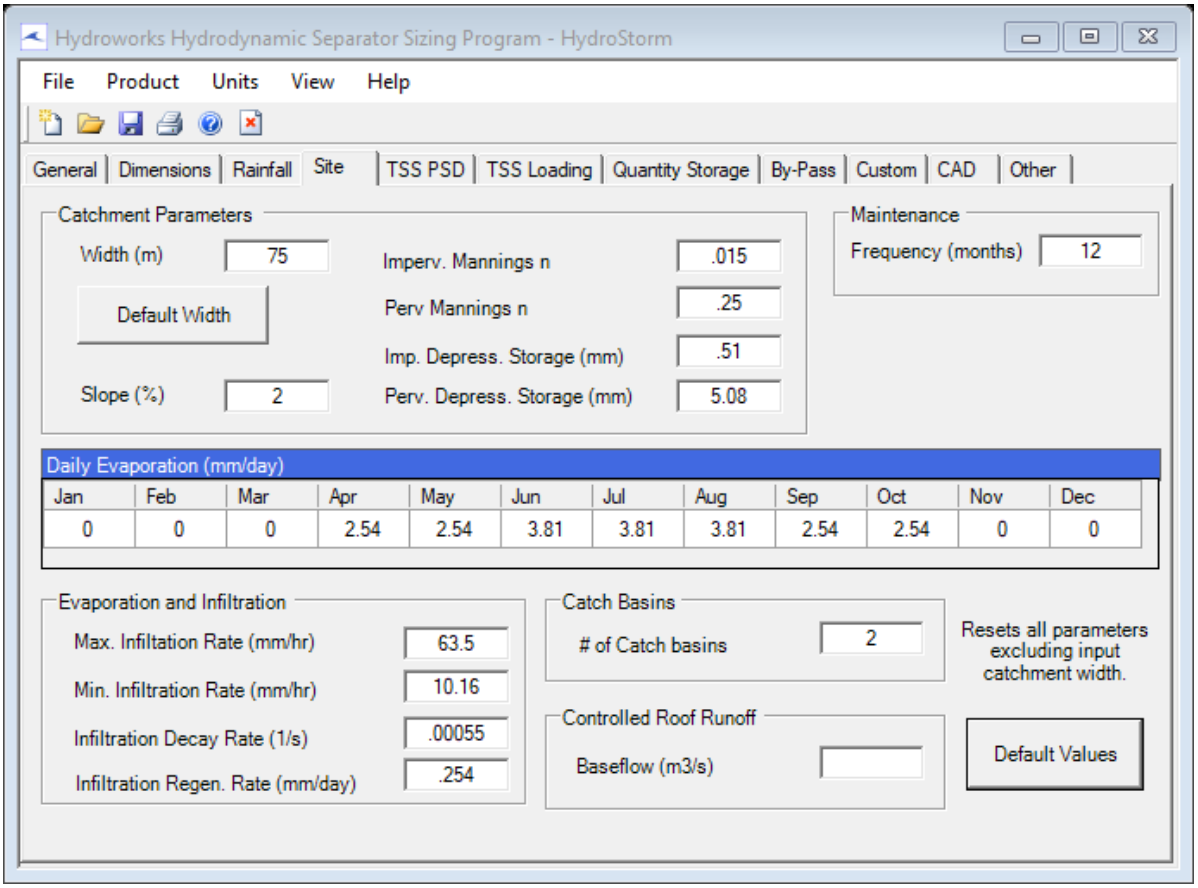
TSS Particle Size Distribution



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

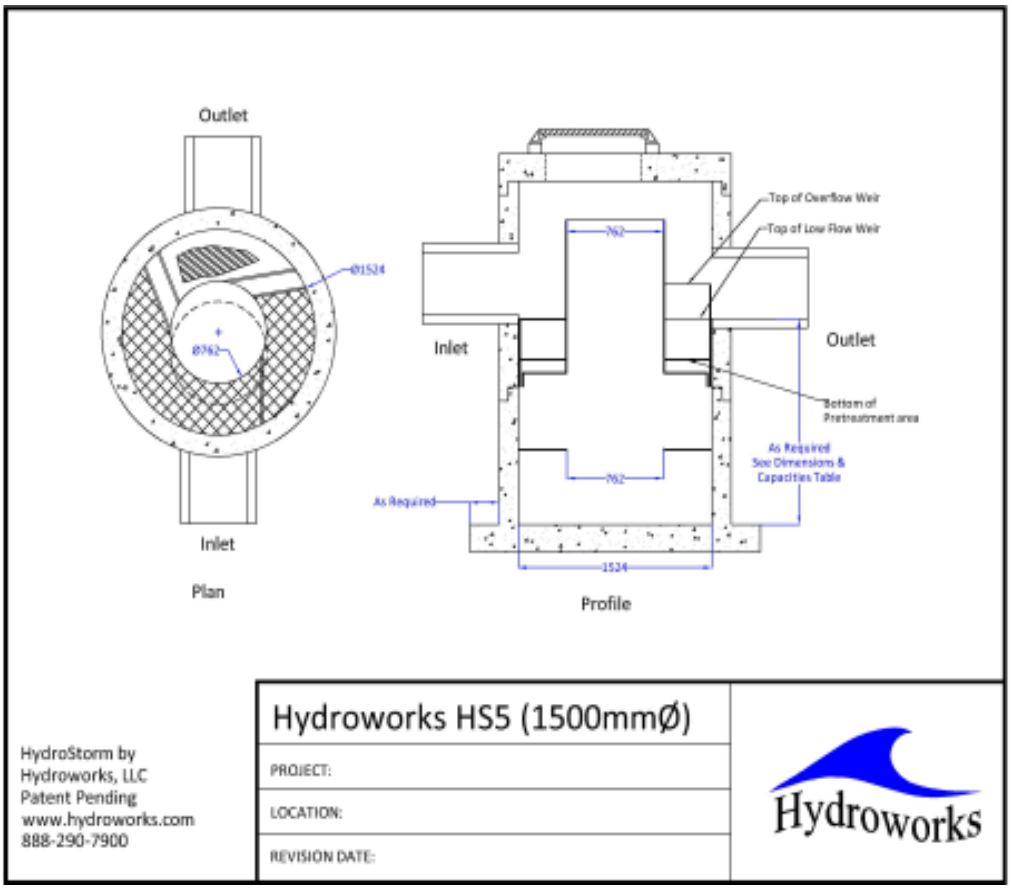
General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Other

Dimensions and Capacities

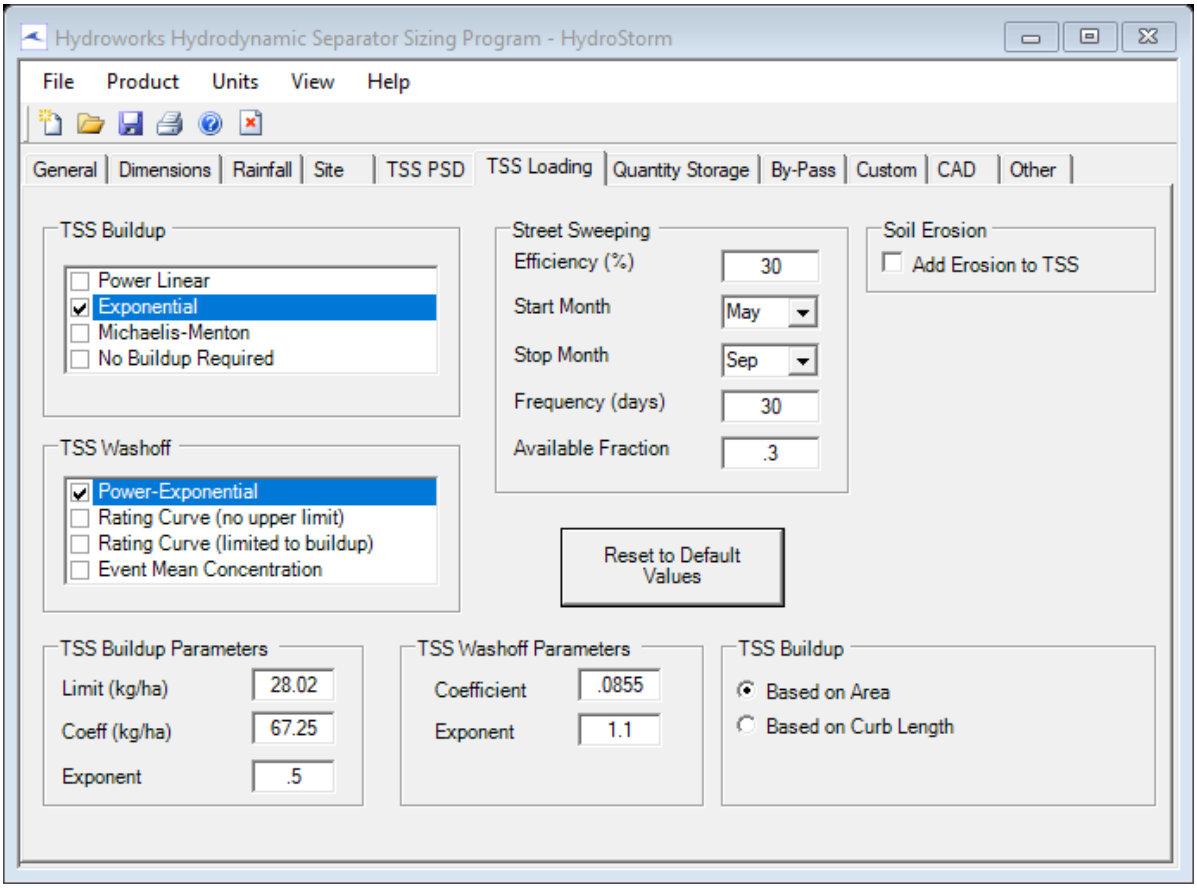
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 9	2.74	2.44	3242	9.3	14.4
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

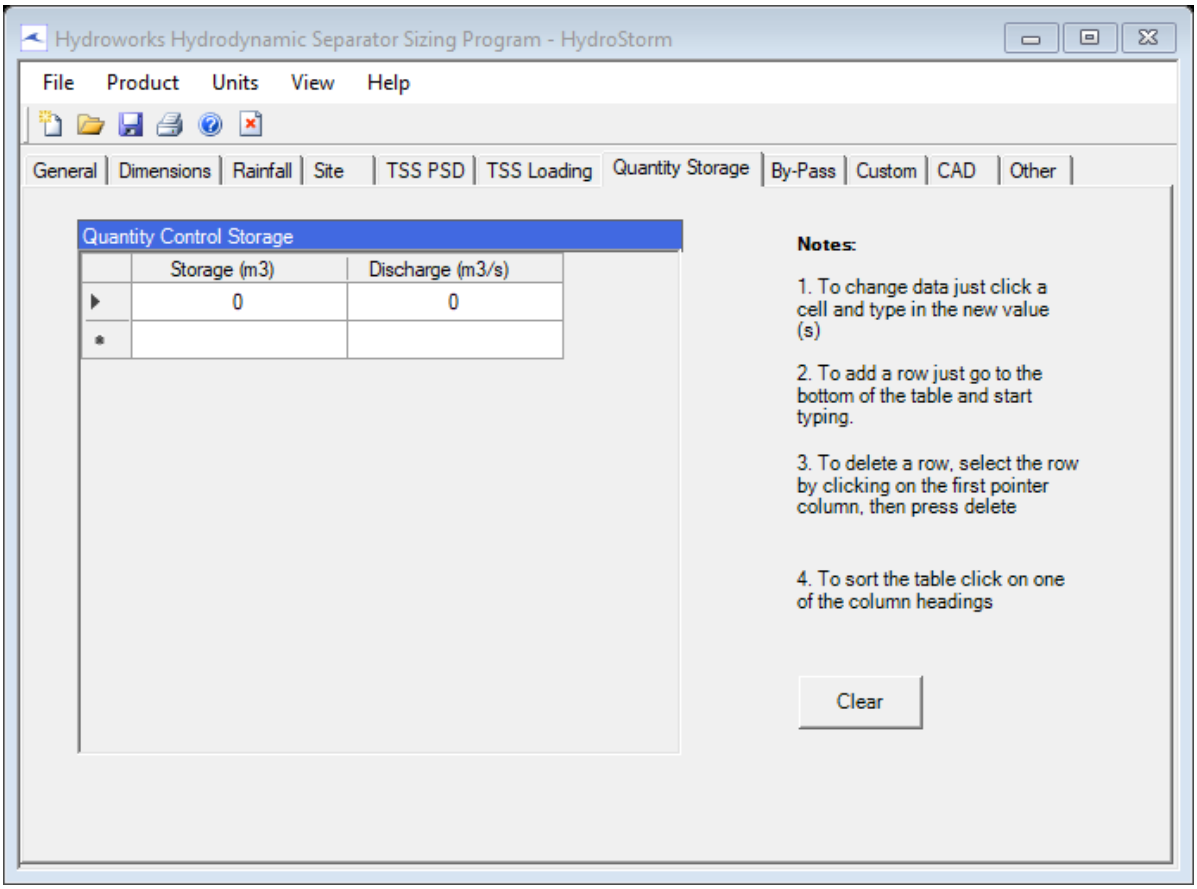
Generic HS 5 CAD Drawing



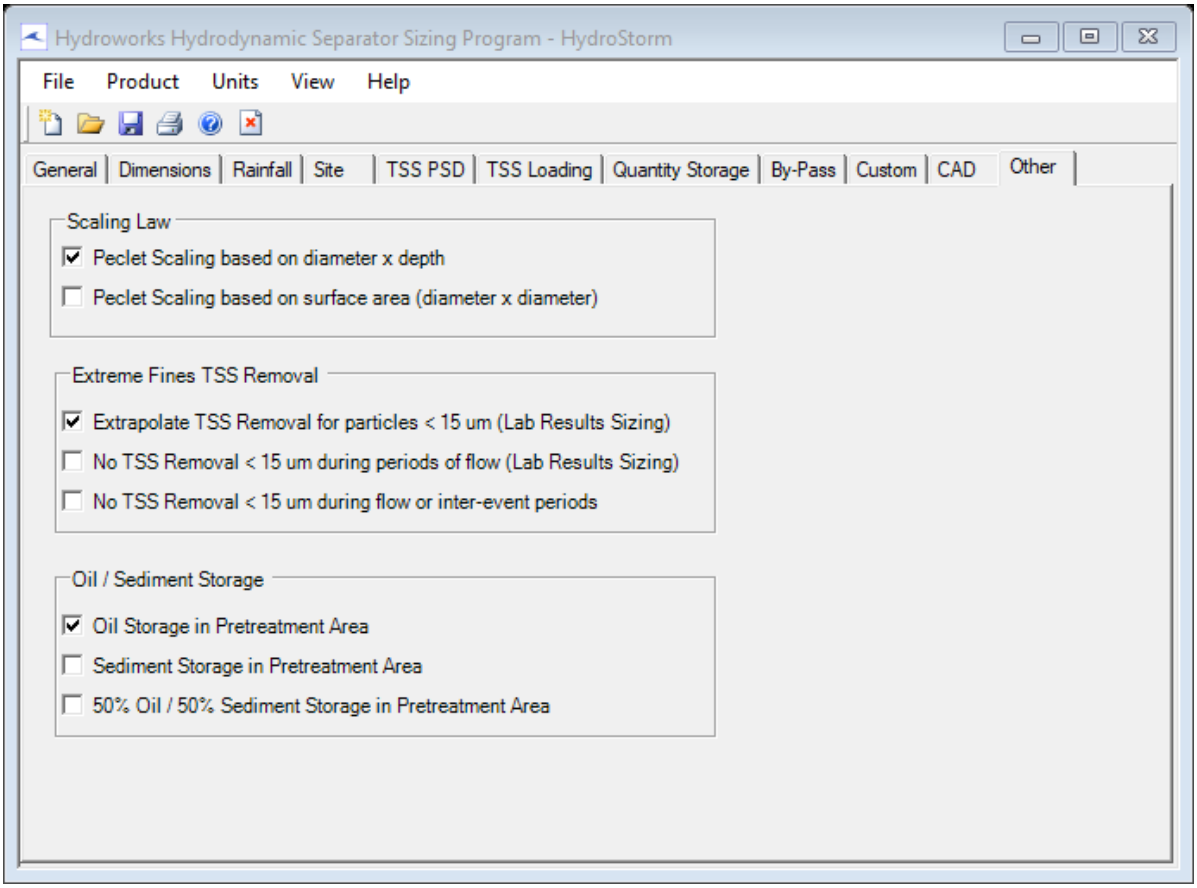
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Hydroworks Sizing Program - Version 4.9
Copyright Hydroworks, LLC, 2019

APPENDIX D
SANITARY ANALYSIS INFORMATION

External Sanitary Sewer Discharge to Ex. MH1A							
Land Use Type	Area (ha)	Population Density [A]	Population	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
Residential	58.27	96.7	5,635 persons	17.94	3.01	22.98	**96.53**
Apartment Residential	2.78	288	467 persons	1.49			
Commercial	5.32	90	479 persons	1.52			
Institutional	9.02		2,240 persons	3.50			
Right-of-Way	4.97						

[A] Population Density:
Residential (Single Family/Semi-Detached/Townhouse) = (55 + 100 + 135 persons/ha)/3 =96.7 persons/ha
Apartment Residential = 1.62 persons/unit (High Density)
Commercial = 90 persons/hectare
School= Number of Students + Employees

[B] Average demand:
Residential=275 l/cap/day
Commercial=24,750 l/ha/day
Institutional=135/cap/day

[C] Peaking Factor:
Peaking Factor= $1+((14/(4+P^{0.5}))$ with P expressed in thousands Min=2.0, Max=4.0

[D] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Area

[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

External Sanitary Sewer Discharge to Ex. MH4A							
Land Use Type	Area (ha)	Population Density [A]	Population	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
Residential	0.47	135	63 persons	0.20	4.00	0.88	**6.54**
Apartment Residential	1.78	236	382 persons	1.22			
Right-of-Way	0.81						

[A] Population Density:
Residential (Townhouse) = 135 persons/ha
Apartment Residential = 1.62 persons/unit (High Density)
Commercial = 90 persons/hectare
School= Number of Students + Employees

[B] Average demand:
Residential=275 l/cap/day
Commercial=24,750 l/ha/day
Institutional=135/cap/day

[C] Peaking Factor:
Peaking Factor= $1+((14/(4+P^{0.5}))$ with P expressed in thousands Min=2.0, Max=4.0

[D] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Area

[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

[F] Commercial infiltration=6.49 ha - 0.57 ha (Mixed Use)= 5.92 ha

External Sanitary Sewer Discharge to Ex. MH9A							
Land Use Type	Area (ha)	Population Density [A]	Population	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
Commercial	11.56	90	1,040 persons	3.31	3.79	3.68	**16.23**
Right-of-Way	1.31						

[A] Population Density:
Residential (Single Family/Semi-Detached/Townhouse) = (55 + 100 + 135 persons/ha)/3 =96.7 persons/ha
Apartment Residential = 1.62 persons/unit (High Density)
Commercial = 90 persons/hectare
School= Number of Students + Employees

[B] Average demand:
Residential=275 l/cap/day
Commercial=24,750 l/ha/day
Institutional=135/cap/day

[C] Peaking Factor:
Peaking Factor= $1+((14/(4+P^{0.5}))$ with P expressed in thousands Min=2.0, Max=4.0

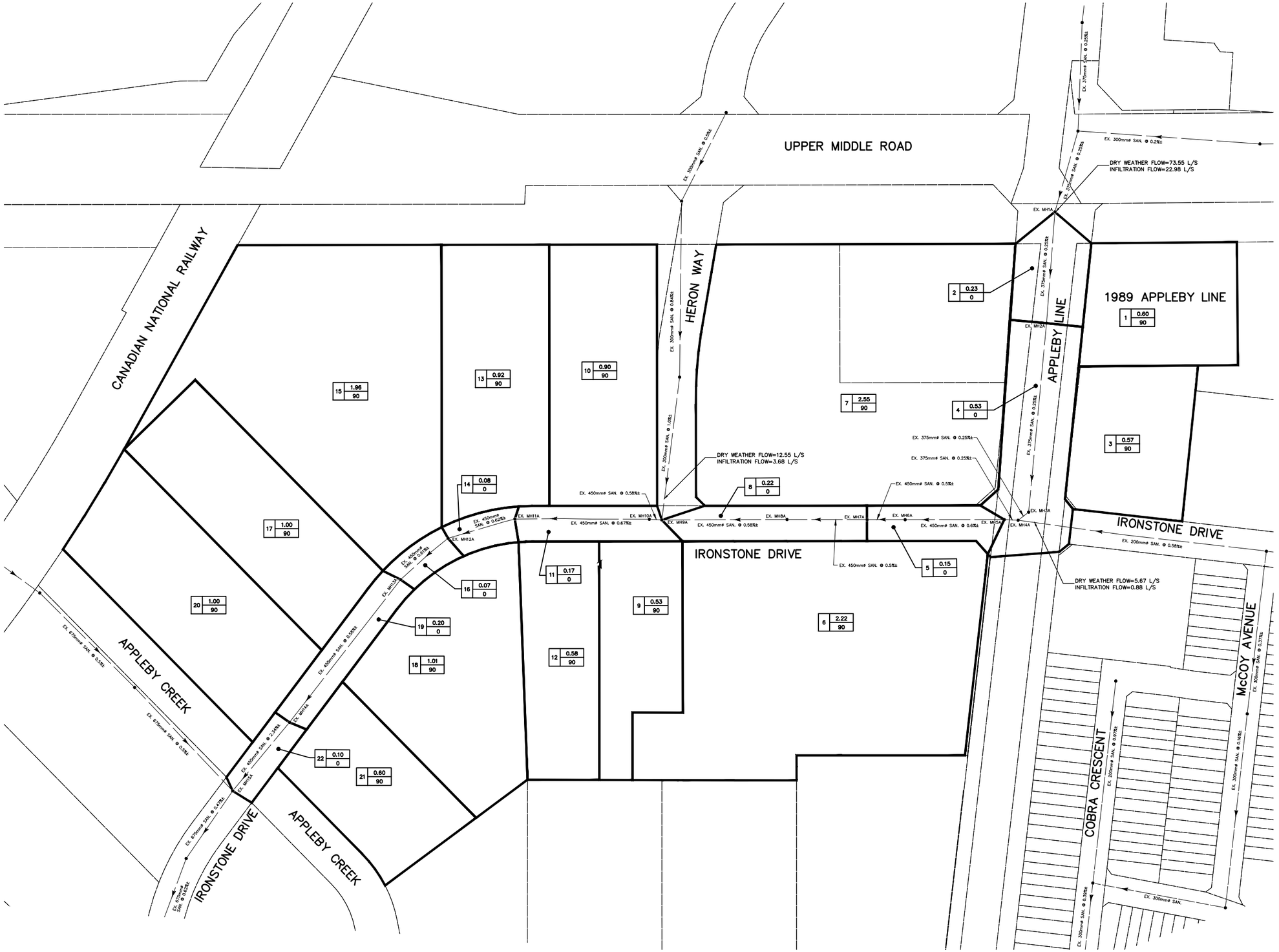
[D] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Area

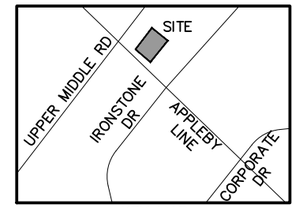
[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

DWG No.: 22004 –SANDAP–1

EXTERNAL SANITARY DRAINAGE AREA PLAN

S:\22004\WORKING\Current\22004 – External Sanitary Drainage Area Plan.dwg





KEY MAP
N.T.S.

LEGEND:

1 | 0.15 | 0 — AREA IN HECTARES; PERSONS PER HECTARE; AREA NUMBER

SANITARY DRAINAGE AREA BOUNDARY

NO.	DATE	BY	REVISIONS

NOTES TO CONTRACTOR:

1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

DESIGN	MC	CHK'D	SL	DATE
DRAWN	MC	CHK'D	SL	May. 9, 22

SCALE 1:1000 (0 5 10 15 20 25 50 75 100)

APPROVALS

STAMP

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT

LATCH DEVELOPMENTS LTD.
2 BLOOR STREET WEST, SUITE 700
TORONTO, ONTARIO

PROJECT NAME

1989 APPLEBY LINE
CITY OF BURLINGTON

TITLE

EXTERNAL SANITARY DRAINAGE AREA PLAN

PROJECT No. 22004

DRAWING No. SANDAP–1

S:\22004\WORKING\Current\22004 – External Sanitary Drainage Area Plan.dwg
Plotted: May 16, 2022 5:38:03 PM By: Michael Colosimo

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Computed by: M. Colosimo
Revised by:
Checked by: S. Llewellyn
Version: Sanitary Capacity
May 5, 2022

City of Burlington
1989 Appleby Line
Project Number 22004
Sanitary Sewer Design Calculations
Existing Conditions

Design Characteristics			
Infiltration Rate		0.286	L/sec
Residential		275	L/day/cap
Commercial		24750	L/ha/day
Institutional		135	L/day/cap
Velocities	V_{min} =	0.60	m/s
	V_{max} =	3.00	m/s
Manning's n Factors	< 600	=	0.013
	≥ 600	=	0.013
Peak Factor = $1+((14/(4+P^{0.5})))$ P expressed in thousands			
2.00	≤ M ≤	4.00	
Maximum Capacity	75%		

Area ID	Street Name			Population Density			Area					Population				Peaking Factor	Flow				Proposed Sewer Design						Remarks
				Residential [per/ha]	Commercial [per/ha]	Institutional [per/ha]	Residential [ha]	Commercial [ha]	Institutional [ha]	ROW [ha]	Total [ha]	Residential [per]	Commercial [per]	Institutional [per]	Total [per]	M	Average l/s	Peak l/s	Infiltration l/s	Total l/s	Diameter [mm]	Material	Grade %	Capacity l/s	Capacity %	Velocity m/s	
EXISTING CONDITIONS																											
	Appleby Line	External	EX. MH1A	100	90	248	61.05	5.32	9.02	4.97	80.36	6102	479	2240	8821	3.01	24.45	73.55	22.98	96.53	375	PVC	0.25	87.67	X 110.1%	0.79	
1	1989 Appleby Line	SITE	EX. MH1A	0	90	0	0.00	0.60	0.00	0.00	0.60	0	54	0	54	4.00	0.17	0.69	0.17	0.86	200	PVC	1.00	32.80	2.6%	1.04	
2	Appleby Line	EX. MH1A	EX. MH2A	0	0	0	0.00	0.00	0.00	0.23	81.19	0	0	0	8875	3.01	24.62	74.00	23.22	97.22	375	PVC	0.25	87.67	X 110.9%	0.79	
3	1940 Appleby Line	SITE	EX. MH2A	596	90	0	0.57	0.57	0.00	0.00	81.76	340	51	0	9266	2.99	25.86	77.27	23.38	100.65	375	PVC	0.25	87.67	X 114.8%	0.79	
4	Appleby Line	EX. MH2A	EX. MH4A	0	0	0	0.00	0.00	0.00	0.53	82.29	0	0	0	9266	2.99	25.86	77.27	23.53	100.80	375	PVC	0.25	87.67	X 115%	0.79	
	Ironstone Drive	External	EX. MH4A	198	0	0	2.25	0	0	0.81	3.06	445	0	0	445	4.00	1.42	5.67	0.88	6.54	375	PVC	0.25	87.67	7.5%	0.79	
	Ironstone Drive	EX. MH4A	EX. MH5A	0	0	0	0.00	0.00	0.00	0.00	85.35	0	0	0	9711	2.97	27.28	80.95	24.41	105.36	375	PVC	0.25	87.67	X 120.2%	0.79	
5	Ironstone Drive	EX. MH5A	EX. MH7A	0	0	0	0.00	0.00	0.00	0.15	85.50	0	0	0	9711	2.97	27.28	80.95	24.45	105.40	450	PVC	0.50	201.60	52.3%	1.27	
6	Ironstone Drive	SITE	EX.MH7A	0	90	0	0.00	2.22	0.00	0.00	2.22	0	200	0	200	4.00	0.64	2.54	0.63	3.18	200	PVC	1.00	32.80	9.7%	1.04	
7	Ironstone Drive	SITE	EX.MH7A	0	90	0	0.00	2.55	0.00	0.00	2.55	0	230	0	230	4.00	0.73	2.92	0.73	3.65	200	PVC	1.00	32.80	11.1%	1.04	
8	Ironstone Drive	EX. MH7A	EX. MH9A	0	0	0	0.00	0.00	0.00	0.13	90.40	0	0	0	10140	2.95	28.65	84.47	25.85	110.32	450	PVC	0.50	201.60	54.7%	1.27	
	Heron Way	External	EX. MH9A	0	90	0	0.00	11.56	0.00	1.31	12.87	0	1040	0	1040	3.79	3.31	12.55	3.68	16.23	300	PVC	1.00	96.70	16.8%	1.37	
9	Ironstone Drive	SITE	EX.MH9A	0	90	0	0.00	0.53	0.00	0.00	0.53	0	48	0	48	4.00	0.15	0.61	0.15	0.76	200	PVC	1.00	32.80	2.3%	1.04	
9, 10, 11, 12	Ironstone Drive	EX. MH9A	EX. MH11A	0	90	0	0.00	2.01	0.00	0.17	105.98	0	181	0	11409	2.90	32.68	94.71	30.31	125.02	450	PVC	0.60	220.84	56.6%	1.39	
13, 14	Ironstone Drive	EX. MH11A	EX. MH12A	0	90	0	0.00	0.92	0.00	0.08	106.98	0	83	0	11492	2.89	32.95	95.37	30.60	125.96	450	PVC	0.62	224.49	56.1%	1.41	
13, 14	Ironstone Drive	EX. MH11A	EX. MH12A	0	90	0	0.00	0.92	0.00	0.08	107.98	0	83	0	11575	2.89	33.21	96.03	30.88	126.91	450	PVC	0.62	224.49	56.5%	1.41	
15, 16	Ironstone Drive	EX. MH12A	EX. MH13A	0	90	0	0.00	1.96	0.00	0.07	110.01	0	176	0	11751	2.88	33.77	97.43	31.46	128.89	450	PVC	0.61	222.68	57.9%	1.40	
17, 18, 19	Ironstone Drive	EX. MH13A	EX. MH14A	0	90	0	0.00	2.01	0.00	0.20	112.22	0	181	0	11932	2.88	34.35	98.86	32.09	130.96	450	PVC	0.58	217.13	60.3%	1.37	
20, 21, 22	Ironstone Drive	EX. MH14A	EX. MH15A	0	90	0	0.00	1.60	0.00	0.10	113.92	0	144	0	12076	2.87	34.81	100.00	32.58	132.58	450	PVC	2.34	436.13	30.4%	2.74	

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Computed by: M. Colosimo
Revised by:
Checked by: S. Llewellyn
Version: Sanitary Capacity
May 5, 2022

City of Burlington
1989 Appleby Line
Project Number 22004
Sanitary Sewer Design Calculations
Proposed Conditions

Design Characteristics			
Infiltration Rate		0.286	L/sec
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Commercial		24750	L/ha/day
Institutional		135	L/day/cap
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	V_{max} =	3.00	m/s
Manning's n Factors	< 600	=	0.013
	≥ 600	=	0.013
Peak Factor = $1+((14/(4+P^{0.5})))$ P expressed in thousands			
2.00	≤ M ≤	4.00	
Maximum Capacity	75%		

Area ID	Street Name			Population Density			Area					Population				Peaking Factor	Flow				Proposed Sewer Design						Remarks
				Residential [per/ha]	Commercial [per/ha]	Institutional [per/ha]	Residential [ha]	Commercial [ha]	Institutional [ha]	ROW [ha]	Total [ha]	Residential [per]	Commercial [per]	Institutional [per]	Total [per]	M	Average l/s	Peak l/s	Infiltration l/s	Total l/s	Diameter [mm]	Material	Grade %	Capacity l/s	Capacity %	Velocity m/s	
EXISTING CONDITIONS																											
	Appleby Line	External	EX. MH1A	100	90	248	61.05	5.32	9.02	4.97	80.36	6102	479	2240	8821	3.01	24.45	73.55	22.98	96.53	375	PVC	0.25	87.67	X 110.1%	0.79	
1	1989 Appleby Line	SITE	EX. MH1A	1508	90	0	0.51	0.09	0.00	0.00	0.60	769	8	0	777	3.87	2.47	9.57	0.17	9.74	200	PVC	2.00	46.38	21.0%	1.48	
2	Appleby Line	EX. MH1A	EX. MH2A	0	0	0	0.00	0.00	0.00	0.23	81.19	0	0	0	9598	2.97	26.92	80.01	23.22	103.23	375	PVC	0.25	87.67	X 117.8%	0.79	
3	1940 Appleby Line	SITE	EX. MH2A	596	90	0	0.57	0.57	0.00	0.00	81.76	340	51	0	9989	2.96	28.16	83.23	23.38	106.61	375	PVC	0.25	87.67	X 121.6%	0.79	
4	Appleby Line	EX. MH2A	EX. MH4A	0	0	0	0.00	0.00	0.00	0.53	82.29	0	0	0	9989	2.96	28.16	83.23	23.53	106.77	375	PVC	0.25	87.67	X 121.8%	0.79	
	Ironstone Drive	External	EX. MH4A	198	0	0	2.25	0	0	0.81	3.06	445	0	0	445	4.00	1.42	5.67	0.88	6.54	375	PVC	0.25	87.67	7.5%	0.79	
	Ironstone Drive	EX. MH4A	EX. MH5A	0	0	0	0.00	0.00	0.00	0.00	85.35	0	0	0	10434	2.94	29.58	86.86	24.41	111.27	375	PVC	0.25	87.67	X 126.9%	0.79	
5	Ironstone Drive	EX. MH5A	EX. MH7A	0	0	0	0.00	0.00	0.00	0.15	85.50	0	0	0	10434	2.94	29.58	86.86	24.45	111.31	450	PVC	0.50	201.60	55.2%	1.27	
6	Ironstone Drive	SITE	EX.MH7A	0	90	0	0.00	2.22	0.00	0.00	2.22	0	200	0	200	4.00	0.64	2.54	0.63	3.18	200	PVC	1.00	32.80	9.7%	1.04	
7	Ironstone Drive	SITE	EX.MH7A	0	90	0	0.00	2.55	0.00	0.00	2.55	0	230	0	230	4.00	0.73	2.92	0.73	3.65	200	PVC	1.00	32.80	11.1%	1.04	
8	Ironstone Drive	EX. MH7A	EX. MH9A	0	0	0	0.00	0.00	0.00	0.13	90.40	0	0	0	10863	2.92	30.95	90.33	25.85	116.19	450	PVC	0.50	201.60	57.6%	1.27	
	Heron Way	External	EX. MH9A	0	90	0	0.00	11.56	0.00	1.31	12.87	0	1040	0	1040	3.79	3.31	12.55	3.68	16.23	300	PVC	1.00	96.70	16.8%	1.37	
9	Ironstone Drive	SITE	EX.MH9A	0	90	0	0.00	0.53	0.00	0.00	0.53	0	48	0	48	4.00	0.15	0.61	0.15	0.76	200	PVC	1.00	32.80	2.3%	1.04	
9, 10, 11, 12	Ironstone Drive	EX. MH9A	EX. MH11A	0	90	0	0.00	2.01	0.00	0.17	105.98	0	181	0	12132	2.87	34.99	100.44	30.31	130.75	450	PVC	0.60	220.84	59.2%	1.39	
13, 14	Ironstone Drive	EX. MH11A	EX. MH12A	0	90	0	0.00	0.92	0.00	0.08	106.98	0	83	0	12215	2.87	35.25	101.09	30.60	131.69	450	PVC	0.62	224.49	58.7%	1.41	
13, 14	Ironstone Drive	EX. MH11A	EX. MH12A	0	90	0	0.00	0.92	0.00	0.08	107.98	0	83	0	12298	2.86	35.51	101.74	30.88	132.63	450	PVC	0.62	224.49	59.1%	1.41	
15, 16	Ironstone Drive	EX. MH12A	EX. MH13A	0	90	0	0.00	1.96	0.00	0.07	110.01	0	176	0	12474	2.86	36.07	103.13	31.46	134.59	450	PVC	0.61	222.68	60.4%	1.40	
17, 18, 19	Ironstone Drive	EX. MH13A	EX. MH14A	0	90	0	0.00	2.01	0.00	0.20	112.22	0	181	0	12655	2.85	36.65	104.55	32.09	136.64	450	PVC	0.58	217.13	62.9%	1.37	
20, 21, 22	Ironstone Drive	EX. MH14A	EX. MH15A	0	90	0	0.00	1.60	0.00	0.10	113.92	0	144	0	12799	2.85	37.11	105.67	32.58	138.25	450	PVC	2.34	436.13	31.7%	2.74	

APPENDIX E
WATER ANALYSIS INFORMATION

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Project Number: 22004
Project Name: 1989 Appleby Line
Date: 17-May-22

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 2020).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A} \qquad (1)$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for Type V wood frame construction (structure essentially all combustible)
= 0.8 for Type IV-A mass timber construction (encapsulated mass timber)
= 0.9 for Type IV-B mass timber construction (rated mass timber)
= 1.0 for Type IV-C mass timber construction (ordinary mass timber)
= 1.5 for Type IV-D mass timber construction (un-rated mass timber)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

	Building Area				(1)		(2)			(3)		(4)		Final Adjusted Fire Flow	
Building / Location	Footprint Area (m^2)	# of Storeys	**Total GFA (m^2)**	Type of Construction	***Fire Flow "F"*** (l/min)	(l/s)	***Occupancy*** %	Adjustment (l/min)	**Adjusted Fire Flow (l/min)**	***Sprinkler*** %	Adjustment (l/min)	***Exposure*** %	Adjustment (l/min)	**(l/min)**	**(l/s)**
1989 Appleby Line	**11325.0**	**1**	**11325**	**0.8**	19000	316.7	**-15**	-2850.0	**16150.0**	**-50**	-8075.0	0	0.0	**8000**	**133**

Total Area Calculation	**Floor**	**Area**	**Tot. Area**	**Cumm. Area**
Two largest ajoinding floors plus 50% of any floors immediately above them up to eight floors	2-3	2150	4300	4300.0
	4-6	2150	3225	7525.0
	7-11	1520	3800	11325.0

(2) Occupancy	
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

(4) Exposure			Side	Exposure (m)	Charge (%)
0 to 3m	25%		North =	**45+**	**0**
3.1 to 10m	20%	Calculate for all	South =	**	**0**
10.1 to 20m	15%	sides. Maximum	East =	**	**0**
20.1 to 30m	10%	charge shall not	West =	**45+**	**0**
30.1 to 45m	5%	exceed 75%	***Total Exposure =***		***0***

*exposed building is fully protected with an automatic sprinkler system = 50% of total exposure
**subject and exposed buildings are fully protected with an automatic sprinkler system = no adjustment
***subject building and the area between the buildings are fully protected with an automatic sprinkler system = no adjustment
****exposed building face of a Type V building has an exterior cladding with min. 1 hour FRR, than the exposure charge may be treated as a Type III/IV building