S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing & Stormwater Management Report

9 & 11 Kerman Avenue

Residential Development

Town of Grimsby
Niagara Region

August 2022
SLA File: 21048

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Tarbutt Construction Limited to provide Consulting Engineering services for the proposed residential development at 9 & 11 Kerman Avenue in the Town of Grimsby (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 constructing 2 single family dwellings and 42 residential semi-detached units, asphalt driveways, concrete sidewalk/curbing and landscaped areas. The municipal cul-de-sac for Sumac Court will be constructed on the west side of the development. The site will have one access from Kerman Avenue and two access points from the future Sumac Court cul-de-sac.

This Functional Servicing Report will provide detailed information of the proposed stormwater management and servicing scheme for this development. Please refer to the preliminary engineering plans prepared by S. Llewellyn and Associates Limited and the site plan prepared by IBI Group. 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: Geotechnical Investigation – Proposed Residential Development, 9 Kerman Avenue and 250 Main Street, Grimsby, Ontario. Soil-Mat Limited. (May 18, 2021)

Ref. 3: Niagara Region Water & Wastewater Master Servicing Plan, Volume 3 (2016)

Ref. 4: Niagara Region Water & Wastewater Master Servicing Plan, Volume 4 (2016)

Ref. 5: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 6: Silver Maples Subdivision Stormwater Management Report – Town of Grimsby. Philips Engineering (August 12, 1999).

Ref. 7: Stormwater Management Report for Van Geest Greenhouse Expansion, Town of Grimsby. A.M. Candara Associates Inc. (July 2001).

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 Town of Grimsby requirements:

Quantity Control

The stormwater discharge rate from the proposed site shall be controlled to the allowable discharge rates as outlined in the Silver Maple Subdivision Stormwater Management Report prepared by Philips Engineering.

Quality Control

Stormwater quality control for the proposed development will be provided by the existing centralized stormwater management quality facility located downstream of the site.

Erosion Control

Erosion and sediment control measures will be implemented in accordance with the standards of the Town of Grimsby.

2.1 EXISTING CONDITIONS

Under existing conditions, the property contains a large greenhouse building along with 2 single-family residence, asphalt driveway/parking area and some small miscellaneous sheds. The site is bound by school lands to the north, existing residential lands and Kerman Avenue to the east, existing residential lands to the south and Sumac Court to the west.

In the existing conditions, based on existing drawings/reports, drainage from the greenhouse roof is either directed to the northwest through the school property (Outlet 2) or north through the school property (Outlet 3). See Figures A-1 and A-2 in Appendix A. There are no piped outlets and/or drainage easements to the north limits of the property and the ultimate outlet to Livingston Avenue.

Referring to Figure A-1 in Appendix A, for the northerly outlet (east of existing greenhouse building) draining to Outlet 3, storm runoff drains across the school property and then along the back property lines of the homes fronting Kerman Avenue. There is a small private storm system (200 mm subdrain) along these backyards to help with conveyance of flows to the private storm sewer system within the townhouse development on Livingston Avenue, which conveys flows to the municipal storm sewer.

The northwest outlet (ultimately draining to Outlet 2 in Figure A-1) drains overland through the school property. Although an existing piped outlet adjacent to the greenhouse was observed in the field and a previous SWM report by A.M. Candaras Associates Inc. for the greenhouse expansion (Candaras Associates - Ref. 7, see Appendix A) indicated a storm sewer connection in the school property, field investigations were undertaken within the school property and no storm sewers were found which extended to the greenhouse buildings. Based on Table 1 and Table 5 of the Stormwater Management Report for the Van Geest Greenhouse Expansion prepared by A.M. Candaras Associates Inc., the 5-year discharge from the property is 243 l/s (213 l/s for the existing uncontrolled portion of the site and 30 l/s for the existing controlled portion of the site).

The other storm sewer infrastructure in the area is an existing storm sewer system which drains in a northerly direction through the property. This system starts as a 200mmø sewer in the front yard of 250 Main Street West which drains north to a circular manhole structure (with open grate) at the back corner of the lot at 250 Main Street West. From there, a 525mmø storm sewer continues north to an existing manhole located east of the existing greenhouse building which then outlets into the school lands at the north property line. A condition survey of this system showed that the 200mmø section was in generally good condition. The 525mmø section was predominately reinforced concrete pipe which was shown to be in poor condition, with large joint offsets, longitudinal cracking, root intrusions, debris and one repaired section consisting of a different pipe material.

The existing pond/storage area located within the front yard of the 250 Main Street West accepts drainage from the existing 750mm culvert crossing under Main Street West, which collects runoff from an area of approximately 8.82ha south of Main Street West. Although the area south of Main Street West is reasonably large as it includes the slope of the escarpment, by accounts of people familiar with the properties in question, significant flow is rarely observed through the storm sewer which cross the subject lands, or at the outlet on the school grounds. The existing pond area fills to a depth of 0.60 m or more before it starts to spill through the existing 200mmø storm sewer. Given the sandy

soils in the area, the combination of storage volume and infiltration may be effective in controlling the downstream flow through the existing storm sewer system.

As part of the Silver Maples Subdivision SWM report (Ref. 6) as well as earlier work for the Blessed Trinity Secondary School, Philips Engineering defined drainage boundaries within the local area. The proposed development straddles Catchment areas 304 and 306. See Figures A-1 and A-2 in Appendix A. The proposed development occupies approximately 60% of the Catchment 306 drainage area and captures the remaining 40% of the Catchment. Therefore, the allowable post-development discharge will be the allotted discharge for Catchment 306 as indicated in Table 2.1.

Table 2.1 – Allowable Flow Rates for Proposed Development

Storm Event	Target Flow Rate (m^3/s) (Per Philips)
10-Yr Event	30
100-Yr Event	90

2.2 PROPOSED CONDITIONS

It is proposed to develop the site by constructing 2 single family dwellings and 42 residential semi-detached units, asphalt driveways, concrete sidewalk/curbing and landscaped areas. The municipal cul-de-sac for Sumac Court will be constructed on the west side of the development. The site will have one access from Kerman Avenue and two access points from the future Sumac Court cul-de-sac. It is proposed to service the site by extending a storm sewer from the existing 525mmø storm sewer at the intersection of Livingston Avenue and Kerman Avenue, along Kerman Avenue to the proposed site. The proposed storm sewer system will be designed and constructed in accordance with the standards and specifications of the Town of Grimsby.

Four catchment areas, Catchment 201, EXT1, EXT2 and EXT3, have been identified in the proposed condition. Catchment 201 represent the drainage area for the entire property which will be captured and controlled by the private storm sewer system, which will discharge to the proposed storm sewer along Kerman Avenue, and ultimately discharge to the existing 525mmø storm sewer along Livingston Avenue. Catchment EXT1 represents the drainage area for the external lands which sheet drains to the proposed development and is captured and controlled by the private storm sewer system. Catchment EXT2 represents the drainage area for the external lands which sheet drain to the existing catchbasin located at the northwest corner of 250 Main Street West. Catchment EXT3 represents the drainage area for the external lands south of Main Street West, which drain through the existing 750mm culvert through the 250 Main Street West property to the existing catchbasin. Both Catchment EXT2 and EXT3 will be captured by a proposed catchbasin and ditch inlet and will ultimately discharge north of the property to the existing school lands as it does in the existing condition. Refer to Table 2.2 below and the Proposed Condition Drainage Area Plan for details.

Table 2.2 – Proposed Condition Catchment Areas				
Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
201	Proposed Development	1.98	62	0.65
EXT1	External to Proposed Development	1.36	30	0.45
EXT2	External to Catchbasin	0.87	30	0.45
EXT3	External South of Main Street	8.82	20	0.30

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchment 201 and the external drainage which drains through the site (Catchment EXT1) by means of a dual stage orifice system which will contain a 103mmø and a 185mmø orifice plate within CBMH6 to restrict discharge from the site to the allowable discharge rate as outlined in Table 2.1.

With the installation of on-site quantity control measures for Catchments 201 and EXT1, 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 2.5 layers of ACO StormBrixx SD underground storage tanks under the amenity space between units 3 and 4. Details of the proposed tank can be found on the Preliminary Servicing Plan. The stage-storage-discharge characteristics can be seen in Table 2.3 below and Appendix A for details.

Table 2.3 – Proposed Condition Stage-Storage-Discharge		
Elevation (m)	Storage (m^3)	Discharge (m^3/s)
92.47 (Bottom of Tank)	0	0.0000
92.72 (0.25m Deep)	118	0.0174
92.97 (0.50m Deep)	237	0.0206
93.22 (0.75m Deep)	355	0.0234
93.47 (1.00m Deep)	473	0.0259
93.72 (1.25m Deep)	592	0.0282
93.97 (1.50m Deep)	710	0.0303
94.02 (1.55m Deep)	734	0.0466
94.22 (1.75m Deep)	828	0.0680
94.47 (2.00m Deep)	947	0.0846
94.72 (2.25m Deep)	1065	0.0977
94.78 (Top of Tank)	1093	0.1005

For the purpose of stormwater management, an analysis was performed on the proposed condition site using the SWMHYMO hydrologic modeling program to determine the volume of stormwater storage which is required during the 2-year to 100-year Town of Grimsby 12-hour SCS storm distribution. Catchments EXT2 and EXT3 were not included within the analysis, as they will not change from the existing conditions (Table 2.1). 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 – Proposed Condition Stormwater Discharge			
Storm Event	Controlled Discharge* (m^3/s)	Allowable Discharge (m^3/s)	Required Storage (m^3)
2-Yr Event	0.025	-	407
5-Yr Event	0.028	-	584
10-Yr Event	0.030	0.030	708
25-Yr Event	0.062	-	800
50-Yr Event	0.076	-	886
100-Yr Event	0.089	0.090	984
* Controlled discharge for Catchment 201 and EXT1 from SWMHYMO			

This analysis determined the following:

- The proposed condition discharge rates will not exceed the 10-year and 100-year allowable discharge rates.

- The proposed development will require 984m^3 of stormwater storage during the 100-year event, which can be accommodated within the proposed storage tank, having a volume of 1093m^3.

Water Quality Control
As indicated previously, water quality control will be provided by the centralized stormwater management quality facility constructed for the Civic Neighbourhood (Outlets 11 and 13). The proposed development will be required to cost-share it's portion of the facilities construction. Further discussions will be required with the Town to determine the contribution for the proposed development.

Storm Sewers
The proposed private storm sewer system within the development has been sized to accommodate the 100-year Chicago storm event from the subject lands and the external lands which drain through the site (Catchments 201 and EXT1). The proposed storm sewer system along Kerman Avenue has been sized to accommodate the controlled flows from the proposed development. Lastly, the proposed storm sewer draining to the school lands has been sized to accommodate the external lands (Catchment EXT2 and EXT3).

For the purpose of storm sewer sizing, an analysis was performed on the proposed condition site using the SWMHYMO hydrologic modeling program to determine the flow rates for the external drainage areas being captured by the proposed storm sewer system during the 2-year to 100-year Town of Grimsby Chicago storm distribution. Detailed SWMHYMO input/output information can be found in Appendix B.

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
- Install a mud mat at the construction entrance of the site to reduce mud tracking and sediment leaving the site via construction traffic; and
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

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

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

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

3.0 SANITARY SEWER SERVICING

3.1 EXISTING CONDITIONS

An existing 200mmø municipal sanitary sewer is located within the Kerman Avenue right-of-way which drains north to Livingston Avenue. An existing 200mmø sanitary sewer at 0.78% slope is located within the cul-de-sac on Sumac Court on the west side of the proposed development. The Sumac Court system drains west and then north through an easement where it connects to an existing 200mmø sanitary sewer draining through the Blessed Trinity Catholic Secondary School property which outlets to Livingston Avenue.

3.2 PROPOSED CONDITIONS

The proposed development will drain west to the 200mmø sanitary sewer system on Sumac Court. Table 3.1 summarizes the anticipated sanitary flows to the existing 200mmø sanitary sewer. For the purposes of this analysis, the semi-detached units were assumed to have a population of 3.05 people per unit. The total population is estimated to be 131 people. For the sanitary drainage to Sumac Court (Table 3.1), this results in a population density of approximately 66 people/hectare which is greater than the typically used value of 60 pp/ha for single family units and reasonable for a multi-family semi-

detached type of units which will have fewer bedrooms and gross floor area than a typical 2-storey unit.

A sanitary sewer design sheet was prepared for the existing municipal system which incorporates the larger sewershed analysis prepared by S. Llewellyn and Associates in 2009 for the Main Street West sanitary sewer, along with the sanitary flows from the existing Silver Maples Subdivision (Sumac Court), and the proposed sanitary flows from the proposed development. It should be noted that the Silver Maples Subdivision design assumed that 1.9 ha of the proposed development at 60 pp/ha (114 people) would drain to the Sumac Court sanitary sewer as part of the original design of the Sumac Court sewer. The proposed development at 131 people will be higher than the original design by 17 people.

Refer to Appendix B for the existing sanitary drainage area plans and the updated sanitary sewer design sheet. The analysis shows that, with the inclusion of the existing sanitary flow from the proposed development (Table 3.1) into the Sumac Court system, sanitary sewer capacity is at or below 31% of full flow capacity. Therefore, the existing system will not be adversely affected by the proposed development even with the slightly higher population count as noted above.

Table 3.1 – Proposed Sanitary Sewer Discharge

Population [A]	Avg. Dry weather flows (l/s) [B]	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [F] (l/s)**
131 persons	0.485	4.21	0.396	**2.44 l/s**

[A] Population = 43 semi-detached units x 3.05 persons/unit = 131 persons
[B] Average Dry Weather Flows = 320 L/Day/cap x 131 persons = 41,920 L/day (0.485 l/s)
[C] Peak Factor = 1+ 14/(4+$P^{0.5}$) with P being population in thousands = 1+ 14/(4+$0.131^{0.5}$) = 4.21
[E] Infiltration flow based on 0.20 l/sec/ha = 0.2 l/sec x 1.98 ha = 0.396 l/s
[F] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

Internally, the proposed development will be serviced with 200mmø private sanitary sewer with a minimum slope of 0.5% with a full flow capacity of 23 l/s which is sufficient to convey the estimated peak sanitary flow of 2.44 l/s.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

An existing 150mmø municipal watermain is located on the west side of the Kerman Avenue right-of-way. An existing 150mmø watermain stub is located at the dead end of Sumac Court immediately west of the proposed development.

4.2 DOMESTIC WATER DEMAND

Domestic water demands for the proposed development were calculated using per capita demand and peaking factor information from the Niagara Region Water & Wastewater Master Servicing Plan (Ref. 3). An average daily water demand of 300 L/capita/day was used with Max. Day and Peak Hour peaking factors of 2.0 and 4.0, respectively. A total population of 131 people (calculated in the pervious section on sanitary sewers) was

utilized. Table 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 4.1 - Proposed Domestic Water Demand

Population (Persons)	Average Daily Demand [A] (l/s)	Max. Daily Peaking Factor [B]	Max. Hourly Peaking Factor [B]	**Max. Daily Demand (l/s)**	**Max. Hourly Demand (l/s)**
131	0.455	2.0	4.0	**0.910**	**1.82**

[A] Average Daily Demand = 300 L/cap/day x Population per Niagara Region Water & Wastewater Master Servicing Plan, Volume 3 (2016)
[B] per Niagara Region Water & Wastewater Master Servicing Plan, Volume 3 (2016)

4.3 FIRE FLOW DEMAND

Fire flow demands for the development are governed by the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999). Preliminary calculations were prepared for what appeared to the worst case conditions within the development (see Appendix C for FUS calculations). At this time, architectural drawings for the proposed units are not available, so it was assumed that each unit (consisting of two homes) had a gross floor area (including garage) of approximately 475m^2. It was also noted that the sideyard separation of the units is less than 3 m. Within the FUS methodology, building units which are closer than 3m apart and have a combustible exterior (ie. siding, wood, stucco) are to be treated as a single contiguous building for calculation purposes.

At this stage of development, it is assumed that the proposed semi-detached units will be constructed of wood frame construction (C=1.5) and with limited combustible occupancy (-15% correction).

If the proposed units within the development have combustible exteriors (C=1.5), the approximate required fire flow would be 300 l/s. To reduce the fire flow requirements, the units can be constructed with a fully non-combustible exterior (C=1.0 - brick and/or stone), or non-combustible units can be constructed at strategic locations within the development to act as fire separations between those units or groups of units with combustible exteriors.

The following hydrant flow test data for the public fire hydrants in closest proximity to the proposed development has been analysed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 summarizes the hydrant flow data completed by Aquacom Contracting. Refer to Appedix D for the flow data prepared by Aquacom Contracting for more information.

Table 4.2 – Hydrant Flow Data	
Location	9 Kerman Avenue
Static Pressure	77 psi
Residual Pressure During Test Flow	66 psi
Test Flow Rate	2302 USGPM (145.2 l/s)
Theoretical Flow @ 20 psi	**5290 USGPM (334 l/s)**
Location	72 Sumac Court
Static Pressure	82 psi
Residual Pressure During Test Flow	70 psi
Test Flow Rate	2302 USGPM (145.2 l/s)
Theoretical Flow @ 20 psi	**5588 USGPM (353 l/s)**

4.4 PROPOSED WATER SERVICING AND ANALYSIS

The proposed development will be serviced by a private 150mmø watermain which will be looped through the development with connections to the existing 150mmø municipal watermains on Kerman Avenue and Sumac Court. Private hydrants will be installed within the development to provide the required building coverage per OBC requirements. The proposed 150mmø watermain will provide domestic and fire water service for the proposed development. Water services for the site are to be designed and constructed in accordant with the Town of Grimsby standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development of 9 & 11 Kerman Avenue can be constructed to meet the requirements of the Town of Grimsby. Therefore, it is recommended that:

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

- A dual stage orifice system be installed as per the Preliminary Servicing Plan and this report to provide adequate quantity control;

- ACO StromBrixx tanks be installed as per the Preliminary Servicing Plan and this report to provide effective stormwater storage;

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

- Stormwater quality controls will be provided within the centralized stormwater management quality facility constructed for the Civic Neighbourhood ;

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

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

Prepared by:
S. LLEWELLYN & ASSOCIATES LIMITED

M. Colosimo, Dipl. T.

S. Llewellyn, P.Eng.

APPENDIX A

STORMWATER MANAGEMENT INFORMATION

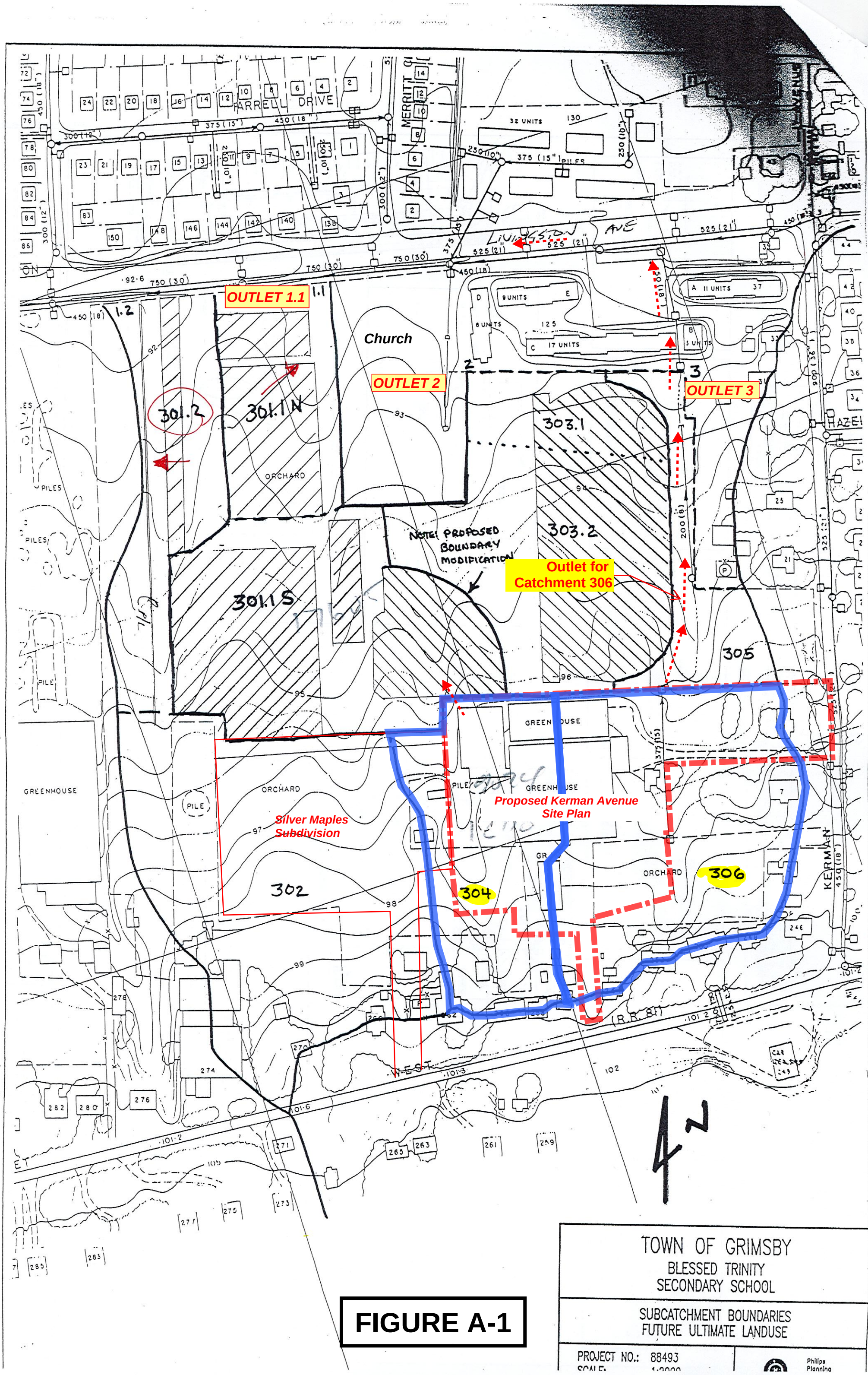

FIGURE A-1

TOWN OF GRIMSBY
BLESSED TRINITY SECONDARY SCHOOL

SUBCATCHMENT BOUNDARIES
FUTURE ULTIMATE LANDUSE

PROJECT NO.: 88493
SCALE: 1:2000

Philips Planning

N

KERMAN AVENUE

SUMAC COURT

Ex. 525mm storm

Limits of proposed development

Catchment 306
2.37 ha

Ex. 200mm storm/subdrain

Ex. pond/storage in front of 250 Main Street W.

Catchment 304
1.54 ha

LEGEND

Direction of Storm Drainage

FIGURE A-2
EXISTING CONDITIONS & DRAINAGE BOUNDARIES
1:1000

July 2021

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

9 and 11 Kerman Avenue
Grimsby, Ontario

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

STAGE-STORAGE-DISCHARGE CALCULATIONS

Outlet Device No. 1 (Quantity)

Type:	Orifice Pipe
Diameter (mm)	**103**
Area (m^2)	0.00833
Invert Elev. (m)	92.05
C/L Elev. (m)	92.10
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	Cd A (2 g H)$^{0.5}$
Number of Orifices:	1

Outlet Device No. 2 (Quantity)

Type:	Orifice Pipe
Diameter (mm)	**185**
Area (m^2)	0.02688
Invert Elev. (m)	93.97
C/L Elev. (m)	94.06
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	Cd A (2 g H)$^{0.5}$
Number of Orifices:	1

		SWM Pond Volumes					Outlet No. 1		Outlet No. 2		
	Elevation m	Area m^2	Tank Incremental Volume	Additional Incremental Underground	Cumulative Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s	H m	Discharge m^3/s	Total Discharge m^3/s
Orifice Invert	92.05	0	0	0.0	0	0	0.000	0.0000	0.000	0.0000	0.0000
Bottom of Tank	92.47	488	0	0.0	0	0	0.000	0.0000	0.000	0.0000	0.0000
0.25m Deep	92.72	488	118	0.0	118	118	0.618	0.0174	0.000	0.0000	0.0174
0.50m Deep	92.97	488	118	0.0	237	237	0.868	0.0206	0.000	0.0000	0.0206
0.75m Deep	93.22	488	118	0.0	355	355	1.119	0.0234	0.000	0.0000	0.0234
1.00m Deep	93.47	488	118	0.0	473	473	1.369	0.0259	0.000	0.0000	0.0259
1.25m Deep	93.72	488	118	0.0	592	592	1.619	0.0282	0.000	0.0000	0.0282
1.50m Deep	93.97	488	118	0.0	710	710	1.869	0.0303	0.000	0.0000	0.0303
1.55m Deep	94.02	488	24	0.0	734	734	1.918	0.0307	0.050	0.0160	0.0466
1.75m Deep	94.22	488	95	0.0	828	828	2.119	0.0322	0.250	0.0357	0.0680
2.00m Deep	94.47	488	118	0.0	947	947	2.369	0.0341	0.500	0.0505	0.0846
2.25m Deep	94.72	488	118	0.0	1065	1065	2.619	0.0358	0.750	0.0619	0.0977
Top of Tank	94.78	488	28	0.0	1093	1093	2.679	0.0362	0.810	0.0643	0.1005

Introduction to ACO StormBrixx® Range

ACO StormBrixx® is a unique, and patented, plastic geocellular stormwater management system. Designed for surface water infiltration and storage, its versatility allows it to be used in applications across all construction environments as a standalone solution or as part of a Water Sensitive Urban Design (WSUD).

What is ACO StormBrixx®?

Sustainable surface water management is becoming an integral part of most major planning applications. Consideration should be given to management of both quantity and quality of water discharged off-site, along with ongoing maintainability.

Plastic geocellular systems are a widely accepted method of creating retention, detention and infiltration tanks. They have been installed in a variety of applications for a number of years. A drawback of some types of systems is a lack of accessibility for maintenance.

ACO StormBrixx® addresses the ongoing maintenance requirements by providing 3D access for inspection and maintenance, while retaining the structural integrity of the installation.

The ACO StormBrixx® system

The ACO StormBrixx® system consists of a single, recyclable, polypropylene body that can be assembled in a variety of ways to form an open bonded structure.

ACO StormBrixx® has a unique pillar structure that gives a high void ratio of 95 to 97 percent. This minimises excavation required to achieve a specified storage capacity, reduces the aggregate needed for backfilling and improves the flow characteristics of runoff through the tank.

Side panels are added to the perimeter of the system for lateral support, and top covers are added to ensure consistent vertical support for cover fill material.

ACO StormBrixx® benefits from a patented cell brick and cross bonding feature, which provides unparalleled stability in the construction of the tank. Where brickbonding is not used, or for multilayered tank structures, connectors are available to support the integrity of the structure.

Additional accessories available include inspection point and pipe connectors, as well as a range of chambers for inspection and maintenance.

ACO StormBrixx® can be configured to minimise silt accumulation and can accommodate a sediment bay or silt trap facility, ensuring the system can be properly maintained throughout its life.

Project No. 21048
Sheet No. 1
Checked by:
Computed by: MC
Date: August 16, 2022

Town of Grimsby

STORM SEWER DESIGN - 100 YEAR

Project: 9 & 11 Kerman Avenue

$$i = \frac{A}{(T+B)^C}$$

Vmin=0.90m/s
Vmax=3.65m/s

100-YEAR
A= 1426.13
B= 8.00
C= 0.800
n= 0.013

Area No.	Street Name	From MH	To MH	Area [ha]	C	A*C	Cumulative A*C	Time of Conc.[A] [min]	Intensity [mm/hr]	Qpeak [m³/s]	SWMHYMO Flows [B] [m³/s]	Total Qpeak [m³/s]	Pipe Characteristcs					Travel Time [min]	Fraction Full [%]	Remarks
													Diameter [mm]	Slope [%]	Length [m]	Capacity [m³/s]	Velocity [m/s]			
E1	Fronting Main Street West	-	CB17.1	0.22	0.45	-	-	17.21	107.87	0.000	0.026	0.026	-	-	-	-	-	-	-	External Sheet Flow Drainage
								17.21*												
A1	Private Site	CB17.1	MH17	0.13	0.65	0.08	0.08	10.00	141.23	0.033	0.026	0.059	250	2.00%	1.0	0.088	1.73	0.01	67%	
								10.01												
-	Private Site	MH17	MH15	0.00	0.65	0.00	0.08	10.01	141.17	0.033	0.026	0.059	300	0.60%	47.5	0.078	1.07	0.74	76%	
								10.75												
-	Private Site	MH16	MH15	0.00	0.65	0.00	0.00	10.00	141.23	0.000		0.000	300	1.00%	14.5	0.101	1.38	0.17	0%	
								10.17												
E2	Fronting Main Street West	-	RLCB15.1	0.13	0.45	-	-	20.10	98.90	0.000	0.015	0.015	-	-	-	-	-	-	-	External Sheet Flow Drainage
								20.10*												
A2	Private Site	RLCB15.1	MH15	0.08	0.65	0.05	0.05	10.00	141.23	0.019	0.015	0.034	250	0.60%	27.5	0.048	0.95	0.48	71%	
								10.48												
-	Private Site	MH15	CBMH14	0.00	0.65	0.00	0.13	10.48	138.27	0.051	0.041	0.092	375	0.50%	35.5	0.129	1.13	0.52	71%	
								11.00												
E3	Fronting Main Street West	-	CBMH14	0.24	0.45	-	-	19.88	99.52	0.000	0.028	0.028	-	-	-	-	-	-	-	External Sheet Flow Drainage
								19.88*												
A3	Private Site	CBMH14	CBMH13	0.21	0.65	0.13	0.27	11.00	135.23	0.100	0.069	0.169	450	0.60%	12.5	0.230	1.40	0.15	74%	
								11.15												
A4	Private Site	CBMH13	MH12	0.03	0.65	0.02	0.29	11.15	134.39	0.107	0.069	0.176	450	0.60%	36.0	0.230	1.40	0.43	76%	
								11.58												
A5	Sumac Court	MH20	CBMH19	0.19	0.65	0.12	0.12	10.00	141.23	0.048		0.048	300	1.00%	16.5	0.101	1.38	0.20	48%	
								10.20												
A6	Private Site	CBMH19	MH12	0.13	0.65	0.08	0.20	10.20	140.00	0.080		0.080	300	1.00%	12.5	0.101	1.38	0.15	79%	
								10.35												
A7	Private Site	RLCB18.1	MH18	0.15	0.65	0.10	0.10	10.00	141.23	0.038		0.038	250	0.50%	30.5	0.044	0.87	0.59	87%	
								10.59												
-	Private Site	MH18	MH12	0.00	0.65	0.00	0.10	10.59	137.65	0.037		0.037	300	0.50%	24.0	0.071	0.98	0.41	52%	
								11.00												
-	Private Site	MH12	CBMH9	0.00	0.65	0.00	0.59	11.58	132.04	0.216	0.069	0.285	525	0.50%	53.0	0.317	1.42	0.62	90%	
								12.20												
E4	Fronting Main Street West	-	CB11.1	0.35	0.45	-	-	17.98	105.30	0.000	0.042	0.042	-	-	-	-	-	-	-	
								17.98*												
A8	Private Site	CB11.1	MH11	0.11	0.65	0.07	0.07	10.00	141.23	0.028	0.042	0.070	250	2.00%	1.0	0.088	1.73	0.01	80%	
								10.01												
A9	Private Site	RLCB11.2	MH11	0.06	0.65	0.04	0.04	10.00	141.23	0.015		0.015	250	0.60%	27.5	0.048	0.95	0.48	32%	
								10.48												
-	Private Site	MH11	MH10	0.00	0.65	0.00	0.11	10.48	138.27	0.042	0.042	0.084	300	1.00%	61.5	0.101	1.38	0.74	84%	
								11.22												
A10	Private Site	RLCB10.1	MH10	0.16	0.65	0.10	0.10	10.00	141.23	0.041		0.041	250	1.00%	33.5	0.062	1.22	0.46	66%	
								10.46												
A11	Private Site	CB10.2	MH10	0.16	0.65	0.10	0.10	10.00	141.23	0.041		0.041	250	2.00%	1.0	0.088	1.73	0.01	47%	
								10.01												
-	Private Site	MH10	CBMH9	0.00	0.65	0.00	0.32	11.22	133.99	0.119	0.042	0.161	375	2.00%	36.5	0.259	2.27	0.27	62%	
								11.49												
A12	Private Site	CBMH9	Tank	0.09	0.65	0.06	0.96	12.20	128.77	0.345	0.111	0.456	675	0.40%	42.0	0.555	1.50	0.47	82%	
								12.67												
E5	Fronting Kerman Avenue	-	CB12.1	0.30	0.45	-	-	18.95	102.26	0.000	0.036	0.036	-	-	-	-	-	-	-	
								18.95*												
A15	Private Site	CB8.1	Tank	0.09	0.65	0.06	0.06	10.00	141.23	0.022	0.036	0.058	250	3.00%	15.5	0.107	2.12	0.12	54%	
								10.12												
E6	Rear of 11 Kerman Avenue	-	AD1	0.11	0.45	-	-	13.40	122.98	0.000	0.014	0.014	-	-	-	-	-	-	-	

Project No. 21048
Sheet No. 1
Checked by:
Computed by: MC
Date: August 16, 2022

Town of Grimsby

STORM SEWER DESIGN - 100 YEAR

Project: 9 & 11 Kerman Avenue

$$i = \frac{A}{(T+B)^C}$$

Vmin=0.90m/s
Vmax=3.65m/s

100-YEAR
A= 1426.13
B= 8.00
C= 0.800
n= 0.013

Area No.	Street Name	From MH	To MH	Area [ha]	C	A*C	Cumulative A*C	Time of Conc.[A] [min]	Intensity [mm/hr]	Qpeak [m³/s]	SWMHYMO Flows[B] [m³/s]	Total Qpeak [m³/s]	Pipe Characteristcs					Travel Time [min]	Fraction Full [%]	Remarks
													Diameter [mm]	Slope [%]	Length [m]	Capacity [m³/s]	Velocity [m/s]			
								13.40*												
A16	Private Site	AD1	Tank	0.15	0.65	0.10	0.10	10.00	141.23	0.038	0.014	0.052	-	-	-	-	-	-	-	
								10.00												
-	Private Site	Tank	CBMH8	0.00	0.65	0.00	1.12	12.67	126.44	0.392	0.161	0.553	750	0.40%	7.0	0.735	1.61	0.07	75%	
								12.74												
A14	Private Site	CBMH8	MH7	0.19	0.65	0.12	1.24	12.74	126.09	0.435	0.161	0.596	750	0.40%	34.0	0.735	1.61	0.35	81%	
								13.09												
-	Private Site	MH7	CBMH6	0.00	0.65	0.00	1.24	13.09	124.40	0.429	0.161	0.590	750	0.40%	45.0	0.735	1.61	0.47	80%	
								13.56												
A13	Private Site	CBMH6	MH5	0.05	0.65	0.03	1.27	13.56	122.25	-	0.090	0.090	375	0.55%	10.5	0.136	1.19	0.15	66%	Controlled Flow From SWMHYMO
								13.71												
	Kerman Avenue	MH5	MH4	0.00	0.65	0.00	1.27	13.71	121.59	-	0.090	0.090	375	0.55%	100.0	0.136	1.19	1.40	66%	Controlled Flow From SWMHYMO
								15.11												
	Kerman Avenue	MH4	MH3	0.00	0.65	0.00	1.27	15.11	115.65	-	0.090	0.090	375	1.05%	100.0	0.187	1.64	1.01	48%	Controlled Flow From SWMHYMO
								16.12												
	Kerman Avenue	MH3	MH2	0.00	0.65	0.00	1.27	16.12	111.75	-	0.090	0.090	375	0.55%	91.5	0.136	1.19	1.28	66%	Controlled Flow From SWMHYMO
								17.40												
	Kerman Avenue	MH2	MH1	0.00	0.65	0.00	1.27	17.40	107.21	-	0.090	0.090	375	3.00%	31.0	0.317	2.78	0.19	28%	Controlled Flow From SWMHYMO
								17.59												
E7	Drainage from Ex. Pond	CBMH22	DIMH21	9.69	0.31	-	-	29.71	78.16	0.000	0.255	0.255	525	0.55%	6.0	0.332	1.49	0.07	77%	
								29.78												
E7	Drainage from Ex. Pond	DIMH21	Outlet	0.00	0.31	-	-	29.78	78.05	0.000	0.255	0.255	525	0.55%	85.0	0.332	1.49	0.95	77%	
								30.73												

[A] Tc time for external drainage areas were calculated using Airport Method
[B] External flows are derived from SWMHYMO modelling

a.m. candaras associates inc.
consulting engineers

5007-493

STORMWATER MANAGEMENT REPORT
FOR
VAN GEEST GREENHOUSE EXPANSION
TOWN OF GRIMSBY

1.0 DEVELOPMENT DESCRIPTION

The site presently contains a 7,550m^2 greenhouse which is connected to the adjacent storm sewer system via a 200mm diameter storm connection. The remainder of the site is landscaped area which drains via overland swales to the north. This proposal considers an additional greenhouse area of 4,953m^2. Stormwater management controls will be provided by means of a detention swale on the west side of the property.

2.0 DESIGN CRITERIA

(a) Maximum allowable stormwater discharge to be limited to the existing rates.

(b) On site detention must be provided for the 100 year storm.

...1

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3.0 EXISTING SITE CONDITIONS

The existing site consists of three distinct drainage areas. The first of these areas is the existing greenhouse which is connected to the existing storm sewer system by a 200mm diameter storm connection. The remaining areas are both grassed areas , one area drains to the west to and then follows an overland flow swale north, the second area flows to the east and enters an existing catch basin.

The existing runoff rates for the 2 year, 5 year an 100 year storms is provided below in table 1

TABLE 1

Area Description	Tributary Area		Peak Flows [1] (l/s)		
	C=0.25	C=0.90	2 year	5 Year	100 Year
Existing Greenhouse		7,550m^2	154.4	213.5	383.6
Landscaped (West)	5,982m^2		34.0	47.0	84.4
Landscaped (East)	1,952m^2		11.1	15.3	27.5

1. Peak flows based on Rational Formulae

$$Q = C \times A \times I \times N$$

$$Q = C \times A \times I \times 2.778 \times \frac{1ha}{1000m^2}$$

$$I_{2yr} = 81.8mm/hr$$

$$I_{5yr} = 113.1mm/hr$$

$$I_{100yr} = 203.2mm/hr$$

$$Tc = 10\,\text{min}$$

...2

4.0 POST DEVELOPMENT FLOWS

From the 4,593 m^2 greenhouse addition the runoff will be directed in a westerly direction to follow the drainage swale flowing north. The flows from the west drainage area will increase due to increased area and an increase in the imperviousness. All the runoff from the proposed greenhouse addition will be directed in a westerly direction by roof drains and the pitch and direction of the roof. Flows from the easterly drainage area decreased due to a decrease in the tributary area to the east catch basin. The flows from the existing greenhouse, into the existing storm sewer system will remain the same as no additional area will be directed in to the existing storm sewer system.

The post development flows after this addition are provided in table 2 .

TABLE 2

Area Description	Tributary Area		Peak Flows (1) (l/s)		
	C=0.25	C=0.90	2 year	5 Year	100 Year
Existing Greenhouse		7,550m^2	154.4	213.5	383.6
West Drainage	2,289m^2	4,593m^2	106.9	147.9	256.6
Landscaped (East)	1,052m^2		6.0	8.3	14.8

1. Peak flows based on Rational Formulae

$$Q = C \times A \times I \times N$$

$$Q = C \times A \times I \times 2.778 \times \frac{1ha}{1000m^2}$$

$$I_{2yr} = 81.8mm / hr$$

$$I_{5yr} = 113.1mm / hr$$

$$I_{100yr} = 203.2mm / hr$$

...3

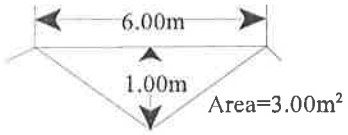
5.0 DETENTION VOLUME CALCULATIONS

To attenuate the flows from the site after building the addition, on-site storage will be required. The runoff rate will be controlled to the existing flows within the detention swale with an outlet orifice of 200mm in diameter.

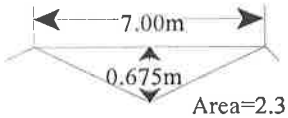
6.0 DETENTION SWALE VOLUME

To achieve the required volume of 168.62m^3 a detention swale will be constructed along the west side of the property. This detention swale will be 65m long at a slope of 0.5%. This will provide a detention volume of 174.2m^3 which is more than required for the 100 year storage as derived in the Otthymo simulation. The detention swale cross sections and volume calculations are provided below:

Bottom of Swale at Orifice end



Top of swale.



$$Volume = \frac{1}{2}(3.00m^2 + 2.36m)^2 \times 65m$$

$$Volume = 174.20m^2$$

...4

7.0 OUTLET CONTROLS

Outlet control will be provided by using a 200mm diameter orifice sized. The release rates for the orifice are calculated using the following equation.

$$Q = C \times A \times \sqrt{2 \times g \times h}$$

where

$$C = 0.6, g = 9.81, h = Depth(m) - diameter(d)$$

$$A = \frac{\pi \times d^2}{4}$$

The 200mm diameter outlet pipe from the detention facility will attenuate the post addition runoff rates to the existing runoff rates. Flows will follow the existing overland drainage route after the detention swale and orifice.

Prepared by,
a.m. candaras associates inc.

A.M. Candaras, P. Eng.
Consulting Engineer

February 7, 2001
0049

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Table 3: 100 YR Storm Runoff Computations for Westerly Drainage Area

	2 Year		5 Year		100 Year	
Time Period (min)	**Intensity (mm/hr.)**	**Runoff (l/s)**	**Intensity (mm/hr.)**	**Runoff (l/s)**	**Intensity (mm/hr.)**	**Runoff (l/s)**
35-40	6	2.16	7	2.52	11	14.38
40-45	7	2.52	9	3.24	14	18.30
45-50	9	3.24	12	4.32	19	24.84
50-55	14	5.04	18	6.48	30	39.22
55-60	33	11.88	44	15.84	76	99.36
60-65	116	41.76	161	57.96	292	381.74
65-70	43	15.48	58	20.88	101	132.04
70-75	23	8.28	31	11.16	52	67.98
75-80	16	5.76	21	7.56	35	45.76
80-85	12	4.32	16	5.76	26	33.99
85-90	10	3.60	13	4.68	21	27.45
90-95	8	2.88	11	3.96	18	23.53
95-100	7	2.52	9	3.24	14	18.30
100-105	6	2.16	8	2.88	11	14.38

Addition = 4,593 m^2 @ C =0.90

Landscaped = 2,289 m^2 @ C = 0.25

CAN $= \dfrac{[(4{,}593\ m^2 \times 0.90) + (2{,}289\ m^2 \times 0.25)] \times 2.778}{10{,}000}$

Runoff = CAIN

= 0.36

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Table 4: Storage Discharge Relationship

Depth	Length of Swale	Area at Top	Area at Outlet	Volume	Discharge
1.00m	65m	2.36m^2	3.00m^2	174.20m^3	74.7 l/s
0.90m	65m	1.71m^2	2.43m^2	134.69m^3	69.9 l/s
0.80m	65m	1.17m^2	1.92m^2	100.42m^3	64.7 l/s
0.70m	65m	0.73m^2	1.47m^2	71.47m^3	59.0 l/s
0.60m	65m	0.39m^2	1.08m^2	47.84m^3	52.8 l/s
0.50m	65m	0.16m^2	0.75m^2	29.54m^3	45.7 l/s
0.40m	65m	0.03m^2	0.48m^2	16.55m^3	37.3 l/s
0.30m	60m	0.00m^2	0.27m^2	8.10m^3	26.4 l/s
0.20m	40m	0.00m^2	0.12m^2	2.40m^3	8.35 l/s
0.00m	0m	0.00m^2	0.00m^2	0.00m^3	0

Table 5: Detention Swale Performance

Storm	Existing	Post-addition	Ponding Volume
2 year	34.0 l/s	30 l/s	10m^3
5 year	47.0 l/s	30 l/s	10m^3
100 year	84.4 l/s	70 l/s	140m^3

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```
      OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
     O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
     O   O    T      T    HHHHH    Y    M M M  O   O
     O   O    T      T    H   H    Y    M   M  O   O
      OOO     T      T    H   H    Y    M   M   OOO    E-9516061300506

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  Input    filename: a:0103.swm
  Output   filename: a:0103.out
  Summary filename: a:0103.sum



DATE: 01-27-2001                        TIME: 15:42:55

COMMENTS: _____
```

****
* SIMULATION OF HYDROGRAPH THROUGH STORAGE FACILITY FOR
* Van Geest Greenhouse
****

****
** SIMULATION NUMBER: 1 **
****

READ HYD (0001)	AREA (ha)= .69
ID= 1 PCYC= 1	QPEAK (cms)= .04
DT= 5.0 min	TPEAK (hrs)= .50
	VOLUME (mm)= 4.85

Filename: A:01032YR.HYD
Comments: 2 YR HYDROGRAPH FOR Van Geest Greenhouse

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.00	.33	.01	.67	.01	1.00	.00		
.08	.00	.42	.01	.75	.01	1.08	.00		
.17	.00	.50	.04	.83	.00	1.17	.00		
.25	.00	.58	.02	.92	.00				

RESERVOIR (0001)
IN= 1---> OUT= 3
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.000	.059	.007
.026	.001	.065	.010
.037	.002	.070	.013
.046	.003	.075	.017
.053	.005	.000	.000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1 (0001)	.69	.04	.50	4.85
OUTFLOW: ID= 3 (0001)	.69	.03	.58	4.84

PEAK FLOW REDUCTION [Qout/Qin](%)= 61.401
TIME SHIFT OF PEAK FLOW (min)= 5.000
MAXIMUM STORAGE USED (ha.m.)= .001

****
** SIMULATION NUMBER: 1 **
****

READ HYD (0001)	AREA (ha)= .69
ID= 1 PCYC= 1	QPEAK (cms)= .06
DT= 5.0 min	TPEAK (hrs)= .50
	VOLUME (mm)= 6.54

Filename: A:01035YR.HYD
Comments: 5 YR HYDROGRAPH FOR Van Geest Greenhouse

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.00	.33	.01	.67	.01	1.00	.00		
.08	.00	.42	.02	.75	.01	1.08	.00		
.17	.00	.50	.06	.83	.01	1.17	.00		
.25	.00	.58	.02	.92	.00				

RESERVOIR (0001)
IN= 1---> OUT= 3
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.000	.059	.007
.026	.001	.065	.010
.037	.002	.070	.013
.046	.003	.075	.017
.053	.005	.000	.000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1 (0001)	.69	.06	.50	6.54
OUTFLOW: ID= 3 (0001)	.69	.03	.58	6.53

PEAK FLOW REDUCTION [Qout/Qin](%)= 53.323
TIME SHIFT OF PEAK FLOW (min)= 5.000
MAXIMUM STORAGE USED (ha.m.)= .001

****

READ HYD (0001)	AREA (ha)= .69
ID= 1 PCYC= 1	QPEAK (cms)= .38
DT= 5.0 min	TPEAK (hrs)= .50
	VOLUME (mm)= 40.89

Filename: A:0103100.HYD
Comments: 100 YR HYDROGRAPH FOR Van Geest Greenhouse

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
.00	.00	.33	.04	.67	.07	1.00	.02		

.08	.01	.42	.10	.75	.05	1.08	.02
.17	.02	.50	.38	.83	.03	1.17	.01
.25	.02	.58	.13	.92	.03		

RESERVOIR (0001)
IN= 1---> OUT= 3
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.000	.059	.007
.026	.001	.065	.010
.037	.002	.070	.013
.046	.003	.075	.017
.053	.005	.000	.000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1 (0001)	.69	.38	.50	40.89
OUTFLOW: ID= 3 (0001)	.69	.07	.67	40.89

PEAK FLOW REDUCTION [Qout/Qin](%)= 18.589
TIME SHIFT OF PEAK FLOW (min)= 10.000
MAXIMUM STORAGE USED (ha.m.)= .014

FINISH

INSTITUTIONAL – SCHOOL

SP-YOI-118

INSTITUTIONAL – SCHOOL

NEW RESIDENTIAL

ROAD ALLOWANCE

NEW RESIDENTIAL

200mm# PIPE THROUGH BERM AT OUTLET END

WOOD ACCOUSTICAL BARRIER

WOOD ACCOUSTICAL BARRIER

EXISTING GREENHOUSE 7550 m2±

CONNECT EXISTING TO NEW LINE

GREENHOUSE OUTLINE

NEW GREENHOUSE POSTS

GREENHOUSE OUTLINE

RELOCATE DOWNSPOUTS

NEW GREENHOUSE POSTS

NEW GREENHOUSE
20 BAYS + 2 END BAYS = [63.70]±
PHASE 1

31 BAYS + 2 END BAYS = [100.24]

PROPOSED WEST GRASS AREA #1

PROPOSED EAST GRASS AREA #2

WOODEN RETAINING WALL

LOT 13, CONCESSION 2
TOWNSHIP OF NORTH GRIMSBY

14" STORM DRAIN

MH 12-21
ELEV 95.72

2 STOREY BRICK DWELLING

EXISTING PAVEMENT

HYDRO, WATER, GAS AND TELEPHONE CORRIDOR

HYDRO POLE #4195

HYDRO POLE #5732

FIRE HYDRANT

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

KERMAN AVENUE
ROAD ALLOWANCE BETWEEN TOWNSHIP LOTS 12 AND 13

PART 1 PLAN 30R-4018

GRAVEL FIRE ACCESS ROUTE

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

RESIDENTIAL DWELLING

FIRE HYDRANT

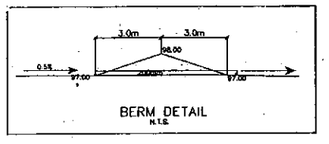
MAIN STREET WEST
REGIONAL ROAD 91

FIRE HYDRANT

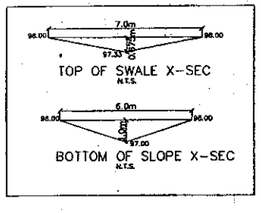
NEW RESIDENTIAL LANDS HAVE ALL STORMWATER DRAINAGE CONTAINED WITHIN THEIR OWN PROPERTY AND NO LONGER DRAIN ONTO VAN GEEST PROPERTY

ALL OF THE NEW GREENHOUSE ROOF LEADS ARE TO DISCHARGE ONTO THE GRASS AND OVERLAND FLOW TO THE DETENTION FACILITY

LOT AREA: [23362]± m2
LOT COVERAGE: [11175]± m2 (48%) - INCLUDING NEW ADDITION
PHASE 1: [2175]± m2
PHASE 2: [482]± m2

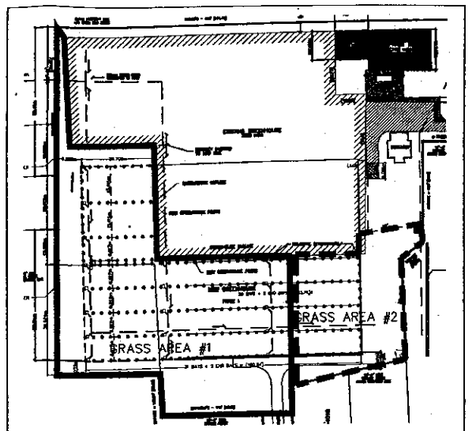


BERM DETAIL
N.T.S.



PROPOSED DRAINAGE AREAS

PROPOSED GREENHOUSE AREA	4593	m²
PROPOSED WEST GRASS AREA 1	2289	m²
PROPOSED EAST GRASS AREA 2	1052	m²
TOTAL	7934	m²



EXISTING DRAINAGE AREAS
SCALE 1:1000

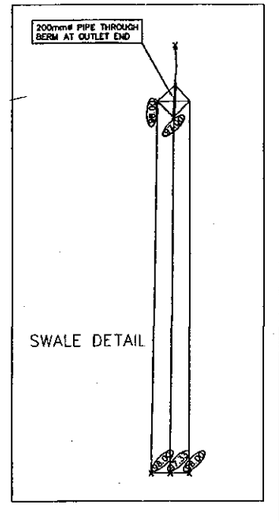
EXISTING DRAINAGE AREAS

EXISTING GRASS AREA 1	5982	m²
EXISTING GRASS AREA 2	1952	m²
TOTAL	7934	m²

LEGEND

98.15 EXISTING ELEVATION

98.15 PROPOSED ELEVATION



LICENSED PROFESSIONAL ENGINEER
A. M. CANDARAS
PROVINCE OF ONTARIO

No.	Date	By	REVISIONS

a.m.candaros associates inc.
consulting engineers
8400 Jane st., suite 203, concord ont. L4K 4L8
(905)738-0043 Fax (905)738-9461
Email: amcai@idirect.com

VAN GEEST EXPANSION

NORTH GRIMSBY

STORMWATER MANAGEMENT PLAN

SCALE: 1:500	DATE: FEB 2/01	PROJ No. 0103	
DRAWN: FP	CHK'D: A.M.C.	PLAN No. STM-1	
DESIGNED: A.M.C.	SHEET 1 OF 1		

APPENDIX B

SWMHYMO INFORMATION

```
2     Metric units
*#************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#************************************************************************|
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
                    GSCS_002.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*#************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[1.98](ha),
                    XIMP=[0.62], TIMP=[0.62], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[15](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[15](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|------------------------------------------------------------|
*# CATCHMENT EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
CALIB STANDHYD      ID=[2], NHYD=["EXT1"], DT=[1](min), AREA=[1.36](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[66](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[66](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|------------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["SITE"], IDs to add=[1, 2]
*%-----------------|------------------------------------------------------------|
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
ROUTE RESERVOIR     IDout=[4],   NHYD=["CONTROLLED"],  IDin=[3],
                    RDT=[    ](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                     0.0    , 0.0
                                     0.0174 , 0.0118
                                     0.0206 , 0.0237
                                     0.0234 , 0.0355
                                     0.0259 , 0.0473
                                     0.0282 , 0.0592
                                     0.0303 , 0.0710
                                     0.0466 , 0.0734
                                     0.0680 , 0.0828
                                     0.0846 , 0.0947
                                     0.0977 , 0.1065
                                     0.1005 , 0.1093
```

```
                                    -1  ,  -1    (max twenty pts)
                          IDovf=[5], NHYDovf=["OVF"]
*%-----------------|-------------------------------------------------------|
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
CALIB STANDHYD      ID=[6], NHYD=["EXT7"], DT=[1](min), AREA=[0.87](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[100](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
CALIB NASHYD        ID=[7], NHYD=["EXT8"], DT=[1]min, AREA=[8.82](ha),
                    DWF=[0](cms),  CN/C=[50], IA=[4.0](mm),
                    N=[3], TP=[0.37]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------|
ADD HYD             IDsum=[8], NHYD=["525"], IDs to add=[6, 7]
*%-----------------|-------------------------------------------------------|
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    GSCS_005.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
                    GSCS_010.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
                    GSCS_025.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
                    GSCS_050.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    GSCS_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: 2022-08-16     TIME: 15:14:17     RUN COUNTER: 000554          *
 ********************************************************************************
 * Input   filename: T:\projects\21048\FSR\SWMHYMO\21048.dat                     *
 * Output  filename: T:\projects\21048\FSR\SWMHYMO\21048.out                     *
 * Summary filename: T:\projects\21048\FSR\SWMHYMO\21048.sum                     *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#*****************************************************************************|
*
  ** END OF RUN :   1

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




--------------------
| START            |  Project  dir.: T:\projects\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=GSCS_002.stm
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 2 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  42.99 mm|    Comments: 2 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .20    .850 |   3.20   1.700 |   6.20  10.400 |   9.20   1.700
              .40    .850 |   3.40   1.700 |   6.40   6.160 |   9.40   1.700
              .60    .850 |   3.60   1.700 |   6.60   4.460 |   9.60   1.700
              .80    .850 |   3.80   1.700 |   6.80   4.250 |   9.80   1.700
             1.00    .850 |   4.00   1.700 |   7.00   2.980 |  10.00   1.700
             1.20    .850 |   4.20   2.980 |   7.20   2.550 |  10.20    .850
             1.40    .850 |   4.40   2.980 |   7.40   2.550 |  10.40    .850
             1.60    .850 |   4.60   2.980 |   7.60   2.550 |  10.60    .850
             1.80    .850 |   4.80   2.980 |   7.80   2.550 |  10.80    .850
             2.00    .850 |   5.00   2.980 |   8.00   2.550 |  11.00    .850
             2.20   1.700 |   5.20   3.830 |   8.20   1.700 |  11.20    .850
             2.40   1.700 |   5.40   5.530 |   8.40   1.700 |  11.40    .850
             2.60   1.700 |   5.60  12.700 |   8.60   1.700 |  11.60    .850
             2.80   1.700 |   5.80  27.800 |   8.80   1.700 |  11.80    .850
             3.00   1.700 |   6.00  58.200 |   9.00   1.700 |  12.00    .850

--------------------------------------------------------------------------------
002:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*****************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.98
| 01:201    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .75
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      15.00        15.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      58.20         7.04
               over (min)        1.00        15.00
     Storage Coeff.  (min)=      1.02 (ii)   14.96 (ii)
     Unit Hyd. Tpeak (min)=      1.00        15.00
     Unit Hyd. peak  (cms)=      1.06          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=       .20          .01          .204 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.17          6.000
     RUNOFF VOLUME    (mm)=     41.99         5.19         28.007
     TOTAL RAINFALL   (mm)=     42.99        42.99         42.992
     RUNOFF COEFFICIENT   =       .98          .12          .651

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.36
| 02:EXT1   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .41          .95
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      58.20         3.37
               over (min)        2.00        48.00
     Storage Coeff.  (min)=      2.47 (ii)   48.00 (ii)
     Unit Hyd. Tpeak (min)=      2.00        48.00
     Unit Hyd. peak  (cms)=       .48          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=       .07          .01          .067 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.73          6.000
     RUNOFF VOLUME    (mm)=     41.99         5.19         16.230
     TOTAL RAINFALL   (mm)=     42.99        42.99         42.992
     RUNOFF COEFFICIENT   =       .98          .12          .378

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
002:0005----------------------------------------------------------------------
----------------------
| ADD HYD (SITE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:201          1.98     .204    6.00  28.01    .000
                      +ID2 02:EXT1         1.36     .067    6.00  16.23    .000
                       ================================================================
                       SUM 03:SITE         3.34     .271    6.00  23.21    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0006----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>03:(SITE  )    |
| OUT<04:(CONTRO)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .030  .7100E-01
                           .017  .1180E-01    |     .047  .7340E-01
                           .021  .2370E-01    |     .068  .8280E-01
                           .023  .3550E-01    |     .085  .9470E-01
                           .026  .4730E-01    |     .098  .1065E+00
                           .028  .5920E-01    |     .101  .1093E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (SITE  )       3.34      .271     6.000     23.211
     OUTFLOW<04: (CONTRO)       3.34      .025     6.817     23.211
    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](%)=    9.034
                   TIME SHIFT OF PEAK FLOW          (min)=    49.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4074E-01

--------------------------------------------------------------------------------
002:0007----------------------------------------------------------------------
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 06:EXT7   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      58.20         2.64
               over (min)        3.00        68.00
     Storage Coeff.  (min)=       3.17 (ii)   67.64 (ii)
     Unit Hyd. Tpeak (min)=       3.00        68.00
     Unit Hyd. peak  (cms)=        .36          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .04          .00          .042 (iii)
     TIME TO PEAK    (hrs)=       6.00         7.08         6.000
     RUNOFF VOLUME    (mm)=      41.99         5.19        16.230
     TOTAL RAINFALL   (mm)=      42.99        42.99        42.992
     RUNOFF COEFFICIENT   =        .98          .12          .378

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

-------------------------------------------------------------------------------
002:0008-------------------------------------------------------------------------
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 07:EXT8   DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .083 (i)
     TIME TO PEAK    (hrs)=    6.317
     RUNOFF VOLUME    (mm)=    5.189
     TOTAL RAINFALL   (mm)=   42.992
     RUNOFF COEFFICIENT   =     .121

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

-------------------------------------------------------------------------------
002:0009-------------------------------------------------------------------------
------------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------  ---             (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 06:EXT7          .87     .042    6.00  16.23    .000
                      +ID2 07:EXT8         8.82     .083    6.32   5.19    .000
                       ============================================================
                       SUM 08:525           9.69     .089    6.28   6.18    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
002:0010-------------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
  ** END OF RUN :   4

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




--------------------
| START            |  Project  dir.: T:\projects\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
          #  1=GSCS_005.stm
-------------------------------------------------------------------------------
005:0002-------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#*****************************************************************************|
*
-------------------------------------------------------------------------------
005:0002-------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 5 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  56.50 mm|    Comments: 5 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .20   1.120 |   3.20   2.230 |   6.20  13.700 |   9.20   2.230
              .40   1.120 |   3.40   2.230 |   6.40   8.090 |   9.40   2.230
              .60   1.120 |   3.60   2.230 |   6.60   5.860 |   9.60   2.230
              .80   1.120 |   3.80   2.230 |   6.80   5.580 |   9.80   2.230
             1.00   1.120 |   4.00   2.230 |   7.00   3.910 |  10.00   2.230
             1.20   1.120 |   4.20   3.910 |   7.20   3.350 |  10.20   1.120
             1.40   1.120 |   4.40   3.910 |   7.40   3.350 |  10.40   1.120
             1.60   1.120 |   4.60   3.910 |   7.60   3.350 |  10.60   1.120
             1.80   1.120 |   4.80   3.910 |   7.80   3.350 |  10.80   1.120
             2.00   1.120 |   5.00   3.910 |   8.00   3.350 |  11.00   1.120
             2.20   2.230 |   5.20   5.020 |   8.20   2.230 |  11.20   1.120
             2.40   2.230 |   5.40   7.250 |   8.40   2.230 |  11.40   1.120
             2.60   2.230 |   5.60  16.700 |   8.60   2.230 |  11.60   1.120
             2.80   2.230 |   5.80  36.600 |   8.80   2.230 |  11.80   1.120
             3.00   2.230 |   6.00  76.500 |   9.00   2.230 |  12.00   1.120

-------------------------------------------------------------------------------
005:0003-------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#****************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.98
| 01:201    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .75
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      15.00        15.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      76.50        14.40
               over (min)        1.00        11.00
     Storage Coeff.  (min)=        .91 (ii)   11.38 (ii)
     Unit Hyd. Tpeak (min)=       1.00        11.00
     Unit Hyd. peak  (cms)=       1.13          .10
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .26          .02          .276 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.10         6.000
     RUNOFF VOLUME    (mm)=      55.50         8.99        37.828
     TOTAL RAINFALL   (mm)=      56.50        56.50        56.502
     RUNOFF COEFFICIENT   =        .98          .16          .670

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
---------------------
| CALIB STANDHYD     |   Area    (ha)=    1.36
| 02:EXT1   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .41          .95
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      76.50         7.18
               over (min)        2.00        36.00
     Storage Coeff.  (min)=       2.22 (ii)   35.86 (ii)
     Unit Hyd. Tpeak (min)=       2.00        36.00
     Unit Hyd. peak  (cms)=        .52          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .09          .01          .090 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.52         6.000
     RUNOFF VOLUME    (mm)=      55.50         8.99        22.946
     TOTAL RAINFALL   (mm)=      56.50        56.50        56.502
     RUNOFF COEFFICIENT   =        .98          .16          .406

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

-------------------------------------------------------------------------------
005:0005-------------------------------------------------------------------------
------------------------
| ADD HYD (SITE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------  ---             (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:201           1.98     .276    6.00  37.83    .000
                      +ID2 02:EXT1          1.36     .090    6.00  22.95    .000
                       ============================================================
                       SUM 03:SITE          3.34     .366    6.00  31.77    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
005:0006-------------------------------------------------------------------------
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(SITE  )   |
| OUT<04:(CONTRO)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .030  .7100E-01
                           .017  .1180E-01    |     .047  .7340E-01
                           .021  .2370E-01    |     .068  .8280E-01
                           .023  .3550E-01    |     .085  .9470E-01
                           .026  .4730E-01    |     .098  .1065E+00
                           .028  .5920E-01    |     .101  .1093E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (SITE  )       3.34      .366     6.000     31.768
     OUTFLOW<04: (CONTRO)       3.34      .028     7.000     31.768
    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](%)=    7.656
                   TIME SHIFT OF PEAK FLOW         (min)=    60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5837E-01

-------------------------------------------------------------------------------
005:0007-------------------------------------------------------------------------
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 06:EXT7   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      76.50         5.71
               over (min)        3.00        50.00
     Storage Coeff.  (min)=       2.84 (ii)   50.17 (ii)
     Unit Hyd. Tpeak (min)=       3.00        50.00
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```
     Unit Hyd. peak  (cms)=        .39          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .05          .01          .056 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.77         6.000
     RUNOFF VOLUME    (mm)=      55.50         8.99        22.946
     TOTAL RAINFALL   (mm)=      56.50        56.50        56.502
     RUNOFF COEFFICIENT   =        .98          .16          .406

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
005:0008----------------------------------------------------------------------
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
----------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 07:EXT8   DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .145 (i)
     TIME TO PEAK    (hrs)=    6.300
     RUNOFF VOLUME    (mm)=    8.993
     TOTAL RAINFALL   (mm)=   56.502
     RUNOFF COEFFICIENT   =     .159

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

--------------------------------------------------------------------------------
005:0009----------------------------------------------------------------------
------------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 06:EXT7           .87      .056    6.00  22.95    .000
                     +ID2 07:EXT8          8.82      .145    6.30   8.99    .000
                      ==========================================================
                      SUM 08:525           9.69      .155    6.30  10.25    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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005:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
  ** END OF RUN :   9

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




-------------------
| START            |  Project  dir.: T:\projects\21048\FSR\SWMHYMO\
-------------------  Rainfall dir.: T:\projects\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
          #  1=GSCS_010.stm
--------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
-------------------
| READ STORM       |    Filename: 10 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  65.35 mm|    Comments: 10 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
-------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   1.290 |   3.20   2.580 |   6.20  15.800 |   9.20   2.580
               .40   1.290 |   3.40   2.580 |   6.40   9.370 |   9.40   2.580
               .60   1.290 |   3.60   2.580 |   6.60   6.780 |   9.60   2.580
               .80   1.290 |   3.80   2.580 |   6.80   6.460 |   9.80   2.580
              1.00   1.290 |   4.00   2.580 |   7.00   4.520 |  10.00   2.580
              1.20   1.290 |   4.20   4.520 |   7.20   3.880 |  10.20   1.290
              1.40   1.290 |   4.40   4.520 |   7.40   3.880 |  10.40   1.290
              1.60   1.290 |   4.60   4.520 |   7.60   3.880 |  10.60   1.290
              1.80   1.290 |   4.80   4.520 |   7.80   3.880 |  10.80   1.290
              2.00   1.290 |   5.00   4.520 |   8.00   3.880 |  11.00   1.290
              2.20   2.580 |   5.20   5.810 |   8.20   2.580 |  11.20   1.290
              2.40   2.580 |   5.40   8.400 |   8.40   2.580 |  11.40   1.290
              2.60   2.580 |   5.60  19.400 |   8.60   2.580 |  11.60   1.290
              2.80   2.580 |   5.80  42.300 |   8.80   2.580 |  11.80   1.290
              3.00   2.580 |   6.00  88.500 |   9.00   2.580 |  12.00   1.290

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010:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*****************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.98
| 01:201    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .75
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      15.00        15.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      88.50        19.51
               over (min)        1.00        10.00
     Storage Coeff.  (min)=       .86 (ii)   10.13 (ii)
     Unit Hyd. Tpeak (min)=       1.00        10.00
     Unit Hyd. peak  (cms)=       1.17          .11
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .30          .03          .324 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08         6.000
     RUNOFF VOLUME    (mm)=      64.35        11.93        44.431
     TOTAL RAINFALL   (mm)=      65.35        65.35        65.348
     RUNOFF COEFFICIENT   =        .98          .18          .680

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.36
| 02:EXT1   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .41          .95
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      88.50        10.43
               over (min)        2.00        31.00
     Storage Coeff.  (min)=       2.09 (ii)  31.08 (ii)
     Unit Hyd. Tpeak (min)=       2.00        31.00
     Unit Hyd. peak  (cms)=        .54          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .10          .02          .107 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.43         6.000
     RUNOFF VOLUME    (mm)=      64.35        11.93        27.659
     TOTAL RAINFALL   (mm)=      65.35        65.35        65.348
     RUNOFF COEFFICIENT   =        .98          .18          .423

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0005----------------------------------------------------------------------
------------------------
| ADD HYD (SITE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:201            1.98      .324    6.00  44.43    .000
                     +ID2 02:EXT1           1.36      .107    6.00  27.66    .000
                      ==========================================================
                      SUM 03:SITE           3.34      .431    6.00  37.60    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0006----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(SITE  )   |
| OUT<04:(CONTRO)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .030  .7100E-01
                            .017  .1180E-01   |     .047  .7340E-01
                            .021  .2370E-01   |     .068  .8280E-01
                            .023  .3550E-01   |     .085  .9470E-01
                            .026  .4730E-01   |     .098  .1065E+00
                            .028  .5920E-01   |     .101  .1093E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (SITE  )       3.34      .431     6.000     37.601
     OUTFLOW<04: (CONTRO)       3.34      .030     7.083     37.601
    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](%)=    7.025
                    TIME SHIFT OF PEAK FLOW         (min)=    65.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.7084E-01

--------------------------------------------------------------------------------
010:0007----------------------------------------------------------------------
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 06:EXT7   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      88.50         8.44
               over (min)        3.00        43.00
     Storage Coeff.  (min)=       2.68 (ii)  43.16 (ii)
     Unit Hyd. Tpeak (min)=       3.00        43.00
     Unit Hyd. peak  (cms)=        .40          .03
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .06          .01          .066 (iii)
```

```
     TIME TO PEAK    (hrs)=       6.00         6.65         6.000
     RUNOFF VOLUME    (mm)=      64.35        11.93        27.659
     TOTAL RAINFALL   (mm)=      65.35        65.35        65.348
     RUNOFF COEFFICIENT   =        .98          .18          .423

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0     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.

---------------------------------------------------------------------------
010:0008-----------------------------------------------------------------------
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 07:EXT8   DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .193 (i)
     TIME TO PEAK    (hrs)=    6.300
     RUNOFF VOLUME    (mm)=   11.935
     TOTAL RAINFALL   (mm)=   65.348
     RUNOFF COEFFICIENT   =     .183

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

---------------------------------------------------------------------------
010:0009-----------------------------------------------------------------------
----------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                     (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 06:EXT7            .87      .066    6.00  27.66    .000
                    +ID2 07:EXT8           8.82      .193    6.30  11.93    .000
                     ============================================================
                     SUM 08:525            9.69      .207    6.30  13.35    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------
010:0010-----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
---------------------------------------------------------------------------
010:0002-----------------------------------------------------------------------
*
---------------------------------------------------------------------------
010:0002-----------------------------------------------------------------------
*
  ** END OF RUN :  24

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




-------------------
| START            |  Project  dir.: T:\projects\21048\FSR\SWMHYMO\
-------------------  Rainfall dir.: T:\projects\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
          #  1=GSCS_025.stm
---------------------------------------------------------------------------
025:0002-----------------------------------------------------------------------
*#***************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#***************************************************************************|
*
---------------------------------------------------------------------------
025:0002-----------------------------------------------------------------------
*
-------------------
| READ STORM       |    Filename: 25 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  76.61 mm|    Comments: 25 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
-------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   1.510 |   3.20   3.030 |   6.20  18.600 |   9.20   3.030
               .40   1.510 |   3.40   3.030 |   6.40  11.000 |   9.40   3.030
               .60   1.510 |   3.60   3.030 |   6.60   7.950 |   9.60   3.030
               .80   1.510 |   3.80   3.030 |   6.80   7.570 |   9.80   3.030
              1.00   1.510 |   4.00   3.030 |   7.00   5.300 |  10.00   3.030
              1.20   1.510 |   4.20   5.300 |   7.20   4.540 |  10.20   1.510
              1.40   1.510 |   4.40   5.300 |   7.40   4.540 |  10.40   1.510
              1.60   1.510 |   4.60   5.300 |   7.60   4.540 |  10.60   1.510
              1.80   1.510 |   4.80   5.300 |   7.80   4.540 |  10.80   1.510
              2.00   1.510 |   5.00   5.300 |   8.00   4.540 |  11.00   1.510
              2.20   3.030 |   5.20   6.810 |   8.20   3.030 |  11.20   1.510
              2.40   3.030 |   5.40   9.840 |   8.40   3.030 |  11.40   1.510
              2.60   3.030 |   5.60  22.700 |   8.60   3.030 |  11.60   1.510
              2.80   3.030 |   5.80  49.600 |   8.80   3.030 |  11.80   1.510
              3.00   3.030 |   6.00 103.700 |   9.00   3.030 |  12.00   1.510

---------------------------------------------------------------------------
025:0003-----------------------------------------------------------------------
*
*#***************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#***************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
---------------------
| CALIB STANDHYD     |   Area    (ha)=    1.98
| 01:201    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .75
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      15.00        15.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     103.70        26.84
               over (min)        1.00         9.00
     Storage Coeff.  (min)=       .81 (ii)    8.97 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=       1.21          .13
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .35          .04          .388 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.07         6.000
     RUNOFF VOLUME    (mm)=      75.61        16.14        53.015
     TOTAL RAINFALL   (mm)=      76.61        76.61        76.614
     RUNOFF COEFFICIENT   =        .99          .21          .692

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
---------------------
| CALIB STANDHYD     |   Area    (ha)=    1.36
| 02:EXT1   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .41          .95
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     103.70        15.45
               over (min)        2.00        27.00
     Storage Coeff.  (min)=       1.96 (ii)   26.73 (ii)
     Unit Hyd. Tpeak (min)=       2.00        27.00
     Unit Hyd. peak  (cms)=        .57          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .12          .03          .129 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.37         6.000
     RUNOFF VOLUME    (mm)=      75.61        16.14        33.985
     TOTAL RAINFALL   (mm)=      76.61        76.61        76.614
     RUNOFF COEFFICIENT   =        .99          .21          .444

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
025:0005-----------------------------------------------------------------------
----------------------
| ADD HYD (SITE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                     (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:201            1.98      .388    6.00  53.02    .000
                    +ID2 02:EXT1           1.36      .129    6.00  33.98    .000
                     ============================================================
                     SUM 03:SITE           3.34      .516    6.00  45.27    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------
025:0006-----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(SITE  )   |
| OUT<04:(CONTRO)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00    |     .030  .7100E-01
                            .017  .1180E-01    |     .047  .7340E-01
                            .021  .2370E-01    |     .068  .8280E-01
                            .023  .3550E-01    |     .085  .9470E-01
                            .026  .4730E-01    |     .098  .1065E+00
                            .028  .5920E-01    |     .101  .1093E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (SITE  )       3.34      .516     6.000     45.266
     OUTFLOW<04: (CONTRO)       3.34      .062     6.633     45.266
    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](%)=   11.930
                    TIME SHIFT OF PEAK FLOW         (min)=    38.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.7999E-01

---------------------------------------------------------------------------
025:0007-----------------------------------------------------------------------
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 06:EXT7   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     103.70        12.76
               over (min)        3.00        37.00
     Storage Coeff.  (min)=       2.52 (ii)   36.83 (ii)
     Unit Hyd. Tpeak (min)=       3.00        37.00
     Unit Hyd. peak  (cms)=        .42          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .07          .01          .079 (iii)
```

```
     TIME TO PEAK    (hrs)=       6.00         6.53         6.000
     RUNOFF VOLUME    (mm)=      75.61        16.14        33.985
     TOTAL RAINFALL   (mm)=      76.61        76.61        76.614
     RUNOFF COEFFICIENT   =        .99          .21          .444

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
025:0008----------------------------------------------------------------------
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
----------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 07:EXT8   DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .263 (i)
     TIME TO PEAK    (hrs)=    6.300
     RUNOFF VOLUME    (mm)=   16.144
     TOTAL RAINFALL   (mm)=   76.614
     RUNOFF COEFFICIENT   =     .211

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

--------------------------------------------------------------------------------
025:0009----------------------------------------------------------------------
-----------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 06:EXT7            .87      .079    6.00  33.99    .000
                    +ID2 07:EXT8           8.82      .263    6.30  16.14    .000
                     ============================================================
                     SUM 08:525            9.69      .282    6.30  17.75    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
  ** END OF RUN :  49

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




--------------------
| START            |  Project  dir.: T:\projects\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
          #  1=GSCS_050.stm
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 50 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  84.94 mm|    Comments: 50 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .20   1.680 |   3.20   3.360 |   6.20  20.600 |   9.20   3.360
              .40   1.680 |   3.40   3.360 |   6.40  12.200 |   9.40   3.360
              .60   1.680 |   3.60   3.360 |   6.60   8.810 |   9.60   3.360
              .80   1.680 |   3.80   3.360 |   6.80   8.390 |   9.80   3.360
             1.00   1.680 |   4.00   3.360 |   7.00   5.870 |  10.00   3.360
             1.20   1.680 |   4.20   5.870 |   7.20   5.030 |  10.20   1.680
             1.40   1.680 |   4.40   5.870 |   7.40   5.030 |  10.40   1.680
             1.60   1.680 |   4.60   5.870 |   7.60   5.030 |  10.60   1.680
             1.80   1.680 |   4.80   5.870 |   7.80   5.030 |  10.80   1.680
             2.00   1.680 |   5.00   5.870 |   8.00   5.030 |  11.00   1.680
             2.20   3.360 |   5.20   7.550 |   8.20   3.360 |  11.20   1.680
             2.40   3.360 |   5.40  10.900 |   8.40   3.360 |  11.40   1.680
             2.60   3.360 |   5.60  25.200 |   8.60   3.360 |  11.60   1.680
             2.80   3.360 |   5.80  55.000 |   8.80   3.360 |  11.80   1.680
             3.00   3.360 |   6.00 114.900 |   9.00   3.360 |  12.00   1.680

--------------------------------------------------------------------------------
050:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*****************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.98
| 01:201    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .75
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      15.00        15.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     114.90        33.03
                  over (min)        1.00         8.00
     Storage Coeff.  (min)=        .77 (ii)    8.29 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=       1.23          .14
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .39          .05          .437 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.05         6.000
     RUNOFF VOLUME    (mm)=      83.95        19.56        59.479
     TOTAL RAINFALL   (mm)=      84.94        84.94        84.944
     RUNOFF COEFFICIENT   =        .99          .23          .700

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.36
| 02:EXT1   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .41          .95
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     114.90        20.31
                  over (min)        2.00        24.00
     Storage Coeff.  (min)=       1.88 (ii)   24.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00        24.00
     Unit Hyd. peak  (cms)=        .58          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .13          .03          .146 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.32         6.000
     RUNOFF VOLUME    (mm)=      83.94        19.56        38.876
     TOTAL RAINFALL   (mm)=      84.94        84.94        84.944
     RUNOFF COEFFICIENT   =        .99          .23          .458

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
050:0005----------------------------------------------------------------------
-----------------------
| ADD HYD (SITE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:201            1.98      .437    6.00  59.48    .000
                    +ID2 02:EXT1           1.36      .146    6.00  38.88    .000
                     ============================================================
                     SUM 03:SITE           3.34      .583    6.00  51.09    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0006----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>03:(SITE  )  |
| OUT<04:(CONTRO)  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00    |     .030  .7100E-01
                          .017  .1180E-01    |     .047  .7340E-01
                          .021  .2370E-01    |     .068  .8280E-01
                          .023  .3550E-01    |     .085  .9470E-01
                          .026  .4730E-01    |     .098  .1065E+00
                          .028  .5920E-01    |     .101  .1093E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (SITE  )       3.34      .583     6.000     51.089
     OUTFLOW<04: (CONTRO)       3.34      .076     6.550     51.089
    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](%)=   13.047
                  TIME SHIFT OF PEAK FLOW         (min)=    33.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.8858E-01

--------------------------------------------------------------------------------
050:0007----------------------------------------------------------------------
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 06:EXT7   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     114.90        16.62
                  over (min)        2.00        33.00
     Storage Coeff.  (min)=       2.42 (ii)   33.28 (ii)
     Unit Hyd. Tpeak (min)=       2.00        33.00
```

```
     Unit Hyd. peak  (cms)=        .49          .03
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .08          .02          .089 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.47         6.000
     RUNOFF VOLUME    (mm)=      83.94        19.56        38.876
     TOTAL RAINFALL   (mm)=      84.94        84.94        84.944
     RUNOFF COEFFICIENT   =        .99          .23          .458

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

------------------------------------------------------------------------------
050:0008----------------------------------------------------------------------
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 07:EXT8   DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .320 (i)
     TIME TO PEAK    (hrs)=    6.300
     RUNOFF VOLUME    (mm)=   19.561
     TOTAL RAINFALL   (mm)=   84.944
     RUNOFF COEFFICIENT   =     .230

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

------------------------------------------------------------------------------
050:0009----------------------------------------------------------------------
------------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 06:EXT7            .87      .089    6.00  38.88    .000
                    +ID2 07:EXT8           8.82      .320    6.30  19.56    .000
                     ==========================================================
                     SUM 08:525            9.69      .344    6.30  21.30    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
  ** END OF RUN :  99

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




--------------------
| START            |  Project  dir.: T:\projects\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
          #  1=GSCS_100.stm
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (QUANTITY CONTROL)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : August 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048.DAT
*#*****************************************************************************|
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 100 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  93.20 mm|    Comments: 100 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .20   1.840 |   3.20   3.680 |   6.20  22.600 |   9.20   3.680
              .40   1.840 |   3.40   3.680 |   6.40  13.400 |   9.40   3.680
              .60   1.840 |   3.60   3.680 |   6.60   9.670 |   9.60   3.680
              .80   1.840 |   3.80   3.680 |   6.80   9.210 |   9.80   3.680
             1.00   1.840 |   4.00   3.680 |   7.00   6.450 |  10.00   3.680
             1.20   1.840 |   4.20   6.450 |   7.20   5.530 |  10.20   1.840
             1.40   1.840 |   4.40   6.450 |   7.40   5.530 |  10.40   1.840
             1.60   1.840 |   4.60   6.450 |   7.60   5.530 |  10.60   1.840
             1.80   1.840 |   4.80   6.450 |   7.80   5.530 |  10.80   1.840
             2.00   1.840 |   5.00   6.450 |   8.00   5.530 |  11.00   1.840
             2.20   3.680 |   5.20   8.290 |   8.20   3.680 |  11.20   1.840
             2.40   3.680 |   5.40  12.000 |   8.40   3.680 |  11.40   1.840
             2.60   3.680 |   5.60  27.600 |   8.60   3.680 |  11.60   1.840
             2.80   3.680 |   5.80  60.300 |   8.80   3.680 |  11.80   1.840
             3.00   3.680 |   6.00 126.200 |   9.00   3.680 |  12.00   1.840

------------------------------------------------------------------------------
100:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================

*#
**#*****************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Entire Site)
---------------------
| CALIB STANDHYD     |   Area    (ha)=    1.98
| 01:201    DT= 1.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.23          .75
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      15.00        15.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     126.20        39.16
               over (min)         1.00         8.00
     Storage Coeff.  (min)=        .75 (ii)    7.76 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=       1.25          .14
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .43          .06          .485 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.05         6.000
     RUNOFF VOLUME    (mm)=      92.20        23.18        65.977
     TOTAL RAINFALL   (mm)=      93.20        93.20        93.204
     RUNOFF COEFFICIENT   =        .99          .25          .708

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 EXT1 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
---------------------
| CALIB STANDHYD     |   Area    (ha)=    1.36
| 02:EXT1   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .41          .95
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     126.20        25.47
               over (min)         2.00        22.00
     Storage Coeff.  (min)=       1.81 (ii)   22.09 (ii)
     Unit Hyd. Tpeak (min)=       2.00        22.00
     Unit Hyd. peak  (cms)=        .59          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .14          .04          .165 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.28         6.000
     RUNOFF VOLUME    (mm)=      92.20        23.18        43.891
     TOTAL RAINFALL   (mm)=      93.20        93.20        93.204
     RUNOFF COEFFICIENT   =        .99          .25          .471

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

------------------------------------------------------------------------------
100:0005----------------------------------------------------------------------
------------------------
| ADD HYD (SITE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:201            1.98      .485    6.00  65.98    .000
                    +ID2 02:EXT1           1.36      .165    6.00  43.89    .000
                     ==========================================================
                     SUM 03:SITE           3.34      .650    6.00  56.98    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
100:0006----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 & EXT1 - THROUGH ORIFICE
*
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>03:(SITE  )    |
| OUT<04:(CONTRO)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .030  .7100E-01
                           .017  .1180E-01    |     .047  .7340E-01
                           .021  .2370E-01    |     .068  .8280E-01
                           .023  .3550E-01    |     .085  .9470E-01
                           .026  .4730E-01    |     .098  .1065E+00
                           .028  .5920E-01    |     .101  .1093E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (SITE  )       3.34      .650     6.000     56.984
     OUTFLOW<04: (CONTRO)       3.34      .089     6.517     56.983
    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](%)=   13.636
                   TIME SHIFT OF PEAK FLOW          (min)=    31.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9837E-01

------------------------------------------------------------------------------
100:0007----------------------------------------------------------------------
*# CATCHMENT EXT2 - PROPOSED CONDITIONS (External Lands North of Main Street Wes
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 06:EXT7   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
```

```
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     126.20        20.52
               over (min)        2.00        31.00
     Storage Coeff.  (min)=       2.33 (ii)   30.70 (ii)
     Unit Hyd. Tpeak (min)=       2.00        31.00
     Unit Hyd. peak  (cms)=        .51          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .09          .02          .100 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.43         6.000
     RUNOFF VOLUME    (mm)=      92.20        23.18        43.891
     TOTAL RAINFALL   (mm)=      93.20        93.20        93.204
     RUNOFF COEFFICIENT   =        .99          .25          .471

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
100:0008--------------------------------------------------------------------------
*# CATCHMENT EXT3 - PROPOSED CONDITIONS (External Lands South of Main Street Wes
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 07:EXT8   DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .380 (i)
     TIME TO PEAK    (hrs)=    6.300
     RUNOFF VOLUME    (mm)=   23.185
     TOTAL RAINFALL   (mm)=   93.204
     RUNOFF COEFFICIENT   =     .249

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

--------------------------------------------------------------------------------
100:0009--------------------------------------------------------------------------
------------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------- --------------     (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 06:EXT7           .87      .100    6.00  43.89    .000
                      +ID2 07:EXT8          8.82      .380    6.30  23.19    .000
                       ==========================================================
                       SUM 08:525            9.69      .411    6.30  25.04    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0010--------------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
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100:0002--------------------------------------------------------------------------
*
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100:0002--------------------------------------------------------------------------
*
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100:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2022-08-16     at 15:14:19
================================================================================
```

```
2     Metric units
*#**************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#**************************************************************************|
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
                    GRIM3002.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*#**************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#**************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[1], NHYD=["E1"], DT=[1](min), AREA=[0.22](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[66](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[66](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|--------------------------------------------------------|
*# CATCHMENT E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[2], NHYD=["E2"], DT=[1](min), AREA=[0.13](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[90](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[90](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|--------------------------------------------------------|
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[3], NHYD=["E3"], DT=[1](min), AREA=[0.24](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[88](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[88](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|--------------------------------------------------------|
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[4], NHYD=["E4"], DT=[1](min), AREA=[0.35](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[72](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[72](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|--------------------------------------------------------|
```

```
*# CATCHMENT E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[5], NHYD=["E5"], DT=[1](min), AREA=[0.30](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[80](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[80](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------------|
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[6], NHYD=["E6"], DT=[1](min), AREA=[0.11](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[40](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[40](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------------|
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
CALIB STANDHYD      ID=[7], NHYD=["E7"], DT=[1](min), AREA=[0.87](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[1.0](%),
                                         LGP=[100](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------------|
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
CALIB NASHYD        ID=[8], NHYD=["E8"], DT=[1]min, AREA=[8.82](ha),
                    DWF=[0](cms),  CN/C=[50], IA=[4.0](mm),
                    N=[3], TP=[0.37]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[9], NHYD=["525"], IDs to add=[7, 8]
*%-----------------|-------------------------------------------------------------|
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    GRIM3005.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
                    GRIM3010.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
                    GRIM3025.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
                    GRIM3050.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    GRIM3100.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: 2022-04-17     TIME: 14:26:15     RUN COUNTER: 000447          *
 ********************************************************************************
 * Input   filename: T:\PROJECTS\21048\FSR\SWMHYMO\21048Z.dat                    *
 * Output  filename: T:\PROJECTS\21048\FSR\SWMHYMO\21048Z.out                    *
 * Summary filename: T:\PROJECTS\21048\FSR\SWMHYMO\21048Z.sum                    *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


--------------------------------------------------------------------------------
001:0001--------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*****************************************************************************|
*
  ** END OF RUN :   1

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




--------------------
| START            |  Project  dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=GRIM3002.stm
--------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  29.15 mm|    Comments: CHICAGO STORM
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   2.617 |   1.00  17.549 |   1.83   5.664 |   2.67   2.733
              .33   3.090 |   1.17  67.490 |   2.00   4.615 |   2.83   2.494
              .50   3.806 |   1.33  21.188 |   2.17   3.914 |   3.00   2.297
              .67   5.031 |   1.50  10.890 |   2.33   3.410 |
              .83   7.646 |   1.67   7.408 |   2.50   3.031 |

--------------------------------------------------------------------------------
002:0003--------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#****************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .22
| 01:E1     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .15
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope    (%)=      1.00         1.00
     Length           (m)=     66.00        66.00
     Mannings n            =    .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         1.72
               over (min)       2.00        62.00
     Storage Coeff.  (min)=     2.33 (ii)   62.00 (ii)
     Unit Hyd. Tpeak (min)=     2.00        62.00
     Unit Hyd. peak  (cms)=      .50          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .01          .00          .012 (iii)
     TIME TO PEAK    (hrs)=     1.17         2.33         1.167
     RUNOFF VOLUME    (mm)=    28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=    29.15        29.15        29.146
     RUNOFF COEFFICIENT   =     .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 02:E2     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .04          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope    (%)=      1.00         1.00
     Length           (m)=     90.00        90.00
     Mannings n            =    .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         4.97
               over (min)       3.00        50.00
     Storage Coeff.  (min)=     2.81 (ii)   49.76 (ii)
     Unit Hyd. Tpeak (min)=     3.00        50.00
     Unit Hyd. peak  (cms)=      .39          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .01          .00          .007 (iii)
     TIME TO PEAK    (hrs)=     1.17         2.12         1.167
     RUNOFF VOLUME    (mm)=    28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=    29.15        29.15        29.146
     RUNOFF COEFFICIENT   =     .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
002:0005--------------------------------------------------------------------------
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .24
| 03:E3     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .17
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope    (%)=      1.00         1.00
     Length           (m)=     88.00        88.00
     Mannings n            =    .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         4.97
               over (min)       3.00        49.00
     Storage Coeff.  (min)=     2.77 (ii)   49.10 (ii)
     Unit Hyd. Tpeak (min)=     3.00        49.00
     Unit Hyd. peak  (cms)=      .40          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .01          .00          .013 (iii)
     TIME TO PEAK    (hrs)=     1.17         2.10         1.167
     RUNOFF VOLUME    (mm)=    28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=    29.15        29.15        29.146
     RUNOFF COEFFICIENT   =     .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
002:0006--------------------------------------------------------------------------
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .35
| 04:E4     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .11          .24
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope    (%)=      1.00         1.00
     Length           (m)=     72.00        72.00
     Mannings n            =    .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         4.70
               over (min)       2.00        44.00
     Storage Coeff.  (min)=     2.45 (ii)   44.46 (ii)
     Unit Hyd. Tpeak (min)=     2.00        44.00
     Unit Hyd. peak  (cms)=      .49          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=      .02          .00          .019 (iii)
     TIME TO PEAK    (hrs)=     1.17         2.02         1.167
     RUNOFF VOLUME    (mm)=    28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=    29.15        29.15        29.146
     RUNOFF COEFFICIENT   =     .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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002:0007--------------------------------------------------------------------------
```

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*# CATCHMENT E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .30
| 05:E5     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .09          .21
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     80.00        80.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         4.70
               over (min)       3.00        47.00
     Storage Coeff.  (min)=      2.62 (ii)   47.36 (ii)
     Unit Hyd. Tpeak (min)=      3.00        47.00
     Unit Hyd. peak  (cms)=       .41          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .016 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.07         1.167
     RUNOFF VOLUME    (mm)=     28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=     29.15        29.15        29.146
     RUNOFF COEFFICIENT   =       .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

------------------------------------------------------------------------------
002:0008----------------------------------------------------------------------
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .11
| 06:E6     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .08
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     40.00        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         2.18
               over (min)       2.00        42.00
     Storage Coeff.  (min)=      1.73 (ii)   41.88 (ii)
     Unit Hyd. Tpeak (min)=      2.00        42.00
     Unit Hyd. peak  (cms)=       .61          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .006 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.97         1.167
     RUNOFF VOLUME    (mm)=     28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=     29.15        29.15        29.146
     RUNOFF COEFFICIENT   =       .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

------------------------------------------------------------------------------
002:0009----------------------------------------------------------------------
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 07:E7     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .26          .61
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    100.00       100.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     67.49         5.24
               over (min)       3.00        52.00
     Storage Coeff.  (min)=      2.99 (ii)   51.97 (ii)
     Unit Hyd. Tpeak (min)=      3.00        52.00
     Unit Hyd. peak  (cms)=       .38          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .05          .00          .047 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.15         1.167
     RUNOFF VOLUME    (mm)=     28.15         2.27        10.029
     TOTAL RAINFALL   (mm)=     29.15        29.15        29.146
     RUNOFF COEFFICIENT   =       .97          .08          .344

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

------------------------------------------------------------------------------
002:0010----------------------------------------------------------------------
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
----------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 08:E8     DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .043 (i)
     TIME TO PEAK    (hrs)=    1.650
     RUNOFF VOLUME    (mm)=    2.265
     TOTAL RAINFALL   (mm)=   29.146
     RUNOFF COEFFICIENT   =     .078

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

------------------------------------------------------------------------------
002:0011----------------------------------------------------------------------
------------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 07:E7             .87     .047    1.17  10.03    .000
                     +ID2 08:E8            8.82     .043    1.65   2.27    .000
                      ================================================================
                      SUM 09:525           9.69     .053    1.17   2.96    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
002:0012----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
  ** END OF RUN :   4

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

--------------------
| START            |  Project  dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=GRIM3005.stm
------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*****************************************************************************|
*
------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  37.96 mm|    Comments: CHICAGO STORM
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.408 |   1.00  22.854 |   1.83   7.376 |   2.67   3.560
               .33   4.024 |   1.17  87.890 |   2.00   6.010 |   2.83   3.248
               .50   4.957 |   1.33  27.593 |   2.17   5.097 |   3.00   2.991
               .67   6.552 |   1.50  14.182 |   2.33   4.441 |
               .83   9.957 |   1.67   9.647 |   2.50   3.947 |

------------------------------------------------------------------------------
005:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#****************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .22
| 01:E1     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .15
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     66.00        66.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     87.89         3.66
               over (min)       2.00        46.00
     Storage Coeff.  (min)=      2.10 (ii)   46.15 (ii)
     Unit Hyd. Tpeak (min)=      2.00        46.00
     Unit Hyd. peak  (cms)=       .54          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .016 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.03         1.167
     RUNOFF VOLUME    (mm)=     36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=     37.96        37.96        37.956
     RUNOFF COEFFICIENT   =       .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 02:E2     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .04          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     90.00        90.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     87.89         3.13
               over (min)       3.00        59.00
     Storage Coeff.  (min)=      2.53 (ii)   59.00 (ii)
     Unit Hyd. Tpeak (min)=      3.00        59.00
     Unit Hyd. peak  (cms)=       .42          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .009 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.27         1.167
     RUNOFF VOLUME    (mm)=     36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=     37.96        37.96        37.956
     RUNOFF COEFFICIENT   =       .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

---------------------------------------------------------------------------
005:0005-----------------------------------------------------------------
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .24
| 03:E3     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .07          .17
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      88.00        88.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.89         3.17
               over (min)        2.00        58.00
     Storage Coeff.  (min)=       2.49 (ii)   57.98 (ii)
     Unit Hyd. Tpeak (min)=       2.00        58.00
     Unit Hyd. peak  (cms)=        .48          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .017 (iii)
     TIME TO PEAK    (hrs)=       1.17         2.25         1.167
     RUNOFF VOLUME    (mm)=      36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=      37.96        37.96        37.956
     RUNOFF COEFFICIENT   =        .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

---------------------------------------------------------------------------
005:0006-----------------------------------------------------------------
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .35
| 04:E4     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .11          .24
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      72.00        72.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.89         3.53
               over (min)        2.00        49.00
     Storage Coeff.  (min)=       2.21 (ii)   49.33 (ii)
     Unit Hyd. Tpeak (min)=       2.00        49.00
     Unit Hyd. peak  (cms)=        .52          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .025 (iii)
     TIME TO PEAK    (hrs)=       1.17         2.08         1.167
     RUNOFF VOLUME    (mm)=      36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=      37.96        37.96        37.956
     RUNOFF COEFFICIENT   =        .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .30
| 05:E5     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .09          .21
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      80.00        80.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.89         3.31
               over (min)        2.00        54.00
     Storage Coeff.  (min)=       2.35 (ii)   53.82 (ii)
     Unit Hyd. Tpeak (min)=       2.00        54.00
     Unit Hyd. peak  (cms)=        .50          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .022 (iii)
     TIME TO PEAK    (hrs)=       1.17         2.17         1.167
     RUNOFF VOLUME    (mm)=      36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=      37.96        37.96        37.956
     RUNOFF COEFFICIENT   =        .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

---------------------------------------------------------------------------
005:0008-----------------------------------------------------------------
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .11
| 06:E6     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .03          .08
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      40.00        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.89         4.65
               over (min)        2.00        31.00
     Storage Coeff.  (min)=       1.55 (ii)   31.20 (ii)
     Unit Hyd. Tpeak (min)=       2.00        31.00
     Unit Hyd. peak  (cms)=        .65          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .008 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.73         1.167
     RUNOFF VOLUME    (mm)=      36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=      37.96        37.96        37.956
     RUNOFF COEFFICIENT   =        .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

---------------------------------------------------------------------------
005:0009-----------------------------------------------------------------
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 07:E7     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      87.89         2.97
               over (min)        3.00        64.00
     Storage Coeff.  (min)=       2.69 (ii)   64.14 (ii)
     Unit Hyd. Tpeak (min)=       3.00        64.00
     Unit Hyd. peak  (cms)=        .40          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .06          .00          .062 (iii)
     TIME TO PEAK    (hrs)=       1.17         2.37         1.167
     RUNOFF VOLUME    (mm)=      36.96         4.00        13.890
     TOTAL RAINFALL   (mm)=      37.96        37.96        37.956
     RUNOFF COEFFICIENT   =        .97          .11          .366

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

---------------------------------------------------------------------------
005:0010-----------------------------------------------------------------
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 08:E8     DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .078 (i)
     TIME TO PEAK    (hrs)=    1.633
     RUNOFF VOLUME    (mm)=    4.004
     TOTAL RAINFALL   (mm)=   37.956
     RUNOFF COEFFICIENT   =     .105

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

---------------------------------------------------------------------------
005:0011-----------------------------------------------------------------
-----------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 07:E7              .87     .062    1.17  13.89    .000
                    +ID2 08:E8             8.82     .078    1.63   4.00    .000
                     ==========================================================
                     SUM 09:525            9.69     .086    1.62   4.89    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------
005:0012-----------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
---------------------------------------------------------------------------
005:0002-----------------------------------------------------------------
*
  ** END OF RUN :   9

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

```
--------------------
| START            |  Project  dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
           #  1=GRIM3010.stm
---------------------------------------------------------------------------
010:0002-----------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*************************************************************************|
*
---------------------------------------------------------------------------
010:0002-----------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  45.88 mm|    Comments: CHICAGO STORM
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.198 |   1.00  28.390 |   1.83   9.175 |   2.67   4.387
               .33   4.967 |   1.17 101.702 |   2.00   7.457 |   2.83   3.998
               .50   6.135 |   1.33  34.205 |   2.17   6.310 |   3.00   3.679
               .67   8.139 |   1.50  17.722 |   2.33   5.489 |
```

```
              .83  12.422 |   1.67  12.033 |   2.50   4.870 |

--------------------------------------------------------------------------------
010:0003----------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .22
| 01:E1     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .15
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     66.00        66.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         6.04
               over (min)        2.00        38.00
     Storage Coeff.  (min)=      1.98 (ii)   38.05 (ii)
     Unit Hyd. Tpeak (min)=      2.00        38.00
     Unit Hyd. peak  (cms)=       .56          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .019 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.88         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 02:E2     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .04          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     90.00        90.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         5.24
               over (min)        2.00        48.00
     Storage Coeff.  (min)=      2.38 (ii)   48.37 (ii)
     Unit Hyd. Tpeak (min)=      2.00        48.00
     Unit Hyd. peak  (cms)=       .50          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .011 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.07         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0005----------------------------------------------------------------------
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .24
| 03:E3     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .17
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     88.00        88.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         5.24
               over (min)        2.00        48.00
     Storage Coeff.  (min)=      2.35 (ii)   47.72 (ii)
     Unit Hyd. Tpeak (min)=      2.00        48.00
     Unit Hyd. peak  (cms)=       .50          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .020 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.07         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0006----------------------------------------------------------------------
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .35
| 04:E4     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .11          .24
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     72.00        72.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         5.78
               over (min)        2.00        41.00
     Storage Coeff.  (min)=      2.08 (ii)   40.76 (ii)
     Unit Hyd. Tpeak (min)=      2.00        41.00
     Unit Hyd. peak  (cms)=       .54          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .030 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.93         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .30
| 05:E5     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .09          .21
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     80.00        80.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         5.52
               over (min)        2.00        44.00
     Storage Coeff.  (min)=      2.22 (ii)   44.17 (ii)
     Unit Hyd. Tpeak (min)=      2.00        44.00
     Unit Hyd. peak  (cms)=       .52          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .025 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.98         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
010:0008----------------------------------------------------------------------
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .11
| 06:E6     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .08
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     40.00        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         7.45
               over (min)        1.00        26.00
     Storage Coeff.  (min)=      1.46 (ii)   26.02 (ii)
     Unit Hyd. Tpeak (min)=      1.00        26.00
     Unit Hyd. peak  (cms)=       .84          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .009 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.63         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0009----------------------------------------------------------------------
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 07:E7     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .26          .61
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    100.00       100.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.70         4.92
               over (min)        3.00        53.00
     Storage Coeff.  (min)=      2.54 (ii)   52.76 (ii)
     Unit Hyd. Tpeak (min)=      3.00        53.00
     Unit Hyd. peak  (cms)=       .42          .02
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .07          .00          .072 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.15         1.167
     RUNOFF VOLUME    (mm)=     44.88         5.93        17.613
     TOTAL RAINFALL   (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .13          .384

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0010----------------------------------------------------------------------
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 08:E8     DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370
```

```
     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .115 (i)
     TIME TO PEAK    (hrs)=    1.633
     RUNOFF VOLUME    (mm)=    5.928
     TOTAL RAINFALL   (mm)=   45.880
     RUNOFF COEFFICIENT   =     .129

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

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010:0011-----------------------------------------------------------------------
-----------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 07:E7             .87     .072    1.17  17.61    .000
                      +ID2 08:E8            8.82     .115    1.63   5.93    .000
                       ============================================================
                       SUM 09:525           9.69     .126    1.63   6.98    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
010:0012-----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
---------------------------------------------------------------------------------
010:0002-----------------------------------------------------------------------
*
---------------------------------------------------------------------------------
010:0002-----------------------------------------------------------------------
*
  ** END OF RUN :  24

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




--------------------
| START            |  Project  dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
           #  1=GRIM3025.stm
---------------------------------------------------------------------------------
025:0002-----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*****************************************************************************|
*
---------------------------------------------------------------------------------
025:0002-----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  53.84 mm|    Comments: CHICAGO STORM
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.926 |   1.00  33.313 |   1.83  10.766 |   2.67   5.148
               .33   5.829 |   1.17 119.339 |   2.00   8.751 |   2.83   4.692
               .50   7.199 |   1.33  40.137 |   2.17   7.405 |   3.00   4.317
               .67   9.550 |   1.50  20.795 |   2.33   6.440 |
               .83  14.577 |   1.67  14.120 |   2.50   5.715 |

---------------------------------------------------------------------------------
025:0003-----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ===============================================
*#
**#*****************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .22
| 01:E1     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .07          .15
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      66.00        66.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     119.34         9.25
               over (min)        2.00        32.00
     Storage Coeff.  (min)=       1.86 (ii)   32.27 (ii)
     Unit Hyd. Tpeak (min)=       2.00        32.00
     Unit Hyd. peak  (cms)=        .59          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .022 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.75         1.167
     RUNOFF VOLUME    (mm)=      52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 02:E2     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .04          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      90.00        90.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     119.34         7.98
               over (min)        2.00        41.00
     Storage Coeff.  (min)=       2.23 (ii)   41.08 (ii)
     Unit Hyd. Tpeak (min)=       2.00        41.00
     Unit Hyd. peak  (cms)=        .52          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .013 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.92         1.167
     RUNOFF VOLUME    (mm)=      52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
025:0005-----------------------------------------------------------------------
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .24
| 03:E3     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .07          .17
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      88.00        88.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     119.34         8.11
               over (min)        2.00        40.00
     Storage Coeff.  (min)=       2.20 (ii)   40.29 (ii)
     Unit Hyd. Tpeak (min)=       2.00        40.00
     Unit Hyd. peak  (cms)=        .52          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .024 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.90         1.167
     RUNOFF VOLUME    (mm)=      52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
025:0006-----------------------------------------------------------------------
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .35
| 04:E4     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .11          .24
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      72.00        72.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     119.34         8.76
               over (min)        2.00        35.00
     Storage Coeff.  (min)=       1.95 (ii)   34.70 (ii)
     Unit Hyd. Tpeak (min)=       2.00        35.00
     Unit Hyd. peak  (cms)=        .57          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .035 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.80         1.167
     RUNOFF VOLUME    (mm)=      52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .30
| 05:E5     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .09          .21
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      80.00        80.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     119.34         8.35
               over (min)        2.00        38.00
     Storage Coeff.  (min)=       2.08 (ii)   37.64 (ii)
     Unit Hyd. Tpeak (min)=       2.00        38.00
     Unit Hyd. peak  (cms)=        .54          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .030 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.87         1.167
     RUNOFF VOLUME    (mm)=      52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
025:0008--------------------------------------------------------------------------
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .11
| 06:E6     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .08
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     40.00        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    119.34        11.32
               over (min)       1.00        22.00
     Storage Coeff.  (min)=      1.37 (ii)   22.14 (ii)
     Unit Hyd. Tpeak (min)=      1.00        22.00
     Unit Hyd. peak  (cms)=       .88          .05
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .011 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.53         1.167
     RUNOFF VOLUME    (mm)=     52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=     53.84        53.84        53.836
     RUNOFF COEFFICIENT   =       .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
025:0009--------------------------------------------------------------------------
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 07:E7     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .26          .61
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    100.00       100.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    119.34         7.52
               over (min)       2.00        45.00
     Storage Coeff.  (min)=      2.38 (ii)   44.76 (ii)
     Unit Hyd. Tpeak (min)=      2.00        45.00
     Unit Hyd. peak  (cms)=       .50          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .09          .01          .086 (iii)
     TIME TO PEAK    (hrs)=      1.17         2.00         1.167
     RUNOFF VOLUME    (mm)=     52.84         8.17        21.573
     TOTAL RAINFALL   (mm)=     53.84        53.84        53.836
     RUNOFF COEFFICIENT   =       .98          .15          .401

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
025:0010--------------------------------------------------------------------------
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
----------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 08:E8     DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .160 (i)
     TIME TO PEAK    (hrs)=    1.633
     RUNOFF VOLUME    (mm)=    8.174
     TOTAL RAINFALL   (mm)=   53.836
     RUNOFF COEFFICIENT   =     .152

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

--------------------------------------------------------------------------------
025:0011--------------------------------------------------------------------------
-----------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 07:E7             .87     .086    1.17  21.57    .000
                     +ID2 08:E8            8.82     .160    1.63   8.17    .000
                      ========================================================
                      SUM 09:525           9.69     .175    1.63   9.38    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0012--------------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
*
  ** END OF RUN :  49

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




--------------------
| START            |  Project  dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
          #  1=GRIM3050.stm
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  59.18 mm|    Comments: CHICAGO STORM
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   5.313 |   1.00  37.542 |   1.83  11.899 |   2.67   5.558
              .33   6.319 |   1.17 128.922 |   2.00   9.610 |   2.83   5.052
              .50   7.857 |   1.33  45.256 |   2.17   8.088 |   3.00   4.636
              .67  10.517 |   1.50  23.366 |   2.33   7.004 |
              .83  16.251 |   1.67  15.728 |   2.50   6.191 |

--------------------------------------------------------------------------------
050:0003--------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#****************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .22
| 01:E1     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .15
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     66.00        66.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    128.92        11.83
               over (min)       2.00        29.00
     Storage Coeff.  (min)=      1.80 (ii)   29.36 (ii)
     Unit Hyd. Tpeak (min)=      2.00        29.00
     Unit Hyd. peak  (cms)=       .60          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .024 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.70         1.167
     RUNOFF VOLUME    (mm)=     58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=     59.18        59.18        59.185
     RUNOFF COEFFICIENT   =       .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 02:E2     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .04          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     90.00        90.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    128.92        10.25
               over (min)       2.00        37.00
     Storage Coeff.  (min)=      2.17 (ii)   37.32 (ii)
     Unit Hyd. Tpeak (min)=      2.00        37.00
     Unit Hyd. peak  (cms)=       .53          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .014 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.85         1.167
     RUNOFF VOLUME    (mm)=     58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=     59.18        59.18        59.185
     RUNOFF COEFFICIENT   =       .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
050:0005--------------------------------------------------------------------------
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .24
| 03:E3     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .17
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     88.00        88.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    128.92        10.25
               over (min)       2.00        37.00
```

```
     Storage Coeff.  (min)=       2.14 (ii)   36.82 (ii)
     Unit Hyd. Tpeak (min)=       2.00        37.00
     Unit Hyd. peak  (cms)=        .53          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .026 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.85         1.167
     RUNOFF VOLUME    (mm)=      58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
050:0006----------------------------------------------------------------------
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .35
| 04:E4     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .11          .24
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      72.00        72.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     128.92        11.40
               over (min)        2.00        31.00
     Storage Coeff.  (min)=       1.90 (ii)   31.36 (ii)
     Unit Hyd. Tpeak (min)=       2.00        31.00
     Unit Hyd. peak  (cms)=        .58          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .04          .00          .038 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.73         1.167
     RUNOFF VOLUME    (mm)=      58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .30
| 05:E5     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .09          .21
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      80.00        80.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     128.92        10.77
               over (min)        2.00        34.00
     Storage Coeff.  (min)=       2.02 (ii)   34.13 (ii)
     Unit Hyd. Tpeak (min)=       2.00        34.00
     Unit Hyd. peak  (cms)=        .56          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .032 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.78         1.167
     RUNOFF VOLUME    (mm)=      58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
050:0008----------------------------------------------------------------------
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .11
| 06:E6     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .03          .08
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      40.00        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     128.92        14.44
               over (min)        1.00        20.00
     Storage Coeff.  (min)=       1.33 (ii)   20.17 (ii)
     Unit Hyd. Tpeak (min)=       1.00        20.00
     Unit Hyd. peak  (cms)=        .90          .06
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .012 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.50         1.167
     RUNOFF VOLUME    (mm)=      58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
050:0009----------------------------------------------------------------------
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 07:E7     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .26          .61
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     100.00       100.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     128.92         9.65
               over (min)        2.00        41.00
     Storage Coeff.  (min)=       2.31 (ii)   40.67 (ii)
     Unit Hyd. Tpeak (min)=       2.00        41.00
     Unit Hyd. peak  (cms)=        .51          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .09          .01          .093 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.92         1.167
     RUNOFF VOLUME    (mm)=      58.18         9.85        24.350
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .17          .411

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.

--------------------------------------------------------------------------------
050:0010----------------------------------------------------------------------
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 08:E8     DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .194 (i)
     TIME TO PEAK    (hrs)=    1.633
     RUNOFF VOLUME    (mm)=    9.850
     TOTAL RAINFALL   (mm)=   59.185
     RUNOFF COEFFICIENT   =     .166

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

--------------------------------------------------------------------------------
050:0011----------------------------------------------------------------------
-----------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 07:E7            .87     .093    1.17  24.35    .000
                       +ID2 08:E8           8.82     .194    1.63   9.85    .000
                        ==========================================================
                        SUM 09:525           9.69     .213    1.63  11.15    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0012----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
  ** END OF RUN :  99

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




--------------------
| START            |  Project  dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\21048\FSR\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=GRIM3100.stm
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 9 & 11 KERMAN AVENUE (STORM SEWER SIZING)
*#               GRIMSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : APRIL 2022
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21048Z.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  64.84 mm|    Comments: CHICAGO STORM
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   5.820 |   1.00  41.127 |   1.83  13.035 |   2.67   6.089
              .33   6.922 |   1.17 141.235 |   2.00  10.527 |   2.83   5.534
              .50   8.608 |   1.33  49.578 |   2.17   8.861 |   3.00   5.079
              .67  11.522 |   1.50  25.597 |   2.33   7.673 |
              .83  17.803 |   1.67  17.230 |   2.50   6.782 |

--------------------------------------------------------------------------------
100:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
```

```
*#
**#**************************************************************************|
*# CATCHMENT E1 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .22
| 01:E1     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .15
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     66.00        66.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        14.66
               over (min)        2.00        27.00
     Storage Coeff.  (min)=      1.73 (ii)   27.03 (ii)
     Unit Hyd. Tpeak (min)=      2.00        27.00
     Unit Hyd. peak  (cms)=       .61          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .026 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.65         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.76        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E2 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 02:E2     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .04          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     90.00        90.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        12.88
               over (min)        2.00        34.00
     Storage Coeff.  (min)=      2.09 (ii)   34.17 (ii)
     Unit Hyd. Tpeak (min)=      2.00        34.00
     Unit Hyd. peak  (cms)=       .54          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .015 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.78         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.76        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.


--------------------------------------------------------------------------------
100:0005----------------------------------------------------------------------
*# CATCHMENT E3 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .24
| 03:E3     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .07          .17
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     88.00        88.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        12.88
               over (min)        2.00        34.00
     Storage Coeff.  (min)=      2.06 (ii)   33.72 (ii)
     Unit Hyd. Tpeak (min)=      2.00        34.00
     Unit Hyd. peak  (cms)=       .55          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .028 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.78         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.76        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.


--------------------------------------------------------------------------------
100:0006----------------------------------------------------------------------
*# CATCHMENT E4 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .35
| 04:E4     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .11          .24
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     72.00        72.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        14.15
               over (min)        2.00        29.00
     Storage Coeff.  (min)=      1.83 (ii)   28.85 (ii)
     Unit Hyd. Tpeak (min)=      2.00        29.00
     Unit Hyd. peak  (cms)=       .59          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .04          .01          .042 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.68         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.76        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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 E5 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .30
| 05:E5     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .09          .21
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     80.00        80.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        13.64
               over (min)        2.00        31.00
     Storage Coeff.  (min)=      1.95 (ii)   31.17 (ii)
     Unit Hyd. Tpeak (min)=      2.00        31.00
     Unit Hyd. peak  (cms)=       .57          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .04          .00          .036 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.73         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.76        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.


--------------------------------------------------------------------------------
100:0008----------------------------------------------------------------------
*# CATCHMENT E6 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .11
| 06:E6     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .08
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     40.00        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        17.55
               over (min)        1.00        19.00
     Storage Coeff.  (min)=      1.28 (ii)   18.71 (ii)
     Unit Hyd. Tpeak (min)=      1.00        19.00
     Unit Hyd. peak  (cms)=       .92          .06
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .014 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.47         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.76        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.


--------------------------------------------------------------------------------
100:0009----------------------------------------------------------------------
*# CATCHMENT E7 - PROPOSED CONDITIONS (External Lands North of Main Street West)
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .87
| 07:E7     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .26          .61
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    100.00       100.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    141.23        12.25
               over (min)        2.00        37.00
     Storage Coeff.  (min)=      2.23 (ii)   37.09 (ii)
     Unit Hyd. Tpeak (min)=      2.00        37.00
     Unit Hyd. peak  (cms)=       .52          .03
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .10          .01          .103 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.85         1.167
     RUNOFF VOLUME    (mm)=     63.84        11.75        27.380
     TOTAL RAINFALL   (mm)=     64.84        64.84        64.837
     RUNOFF COEFFICIENT   =       .98          .18          .422

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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.


--------------------------------------------------------------------------------
100:0010----------------------------------------------------------------------
*# CATCHMENT E8 - PROPOSED CONDITIONS (External Lands South of Main Street West)
---------------------
| CALIB NASHYD       |   Area    (ha)=    8.82   Curve Number   (CN)=50.00
| 08:E8     DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .370

     Unit Hyd Qpeak  (cms)=     .910

     PEAK FLOW       (cms)=     .232 (i)
     TIME TO PEAK    (hrs)=    1.617
     RUNOFF VOLUME    (mm)=   11.756
     TOTAL RAINFALL   (mm)=   64.837
     RUNOFF COEFFICIENT   =     .181
```

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

------------------------------------------------------------------------------
100:0011----------------------------------------------------------------------
-------------------------
| ADD HYD (525       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 07:E7              .87     .103    1.17  27.38    .000
                    +ID2 08:E8             8.82     .232    1.62  11.76    .000
                     ============================================================
                     SUM 09:525            9.69     .255    1.63  13.16    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
100:0012----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (TOWN OF GRIMSBY 5 TO 100-YR)
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
      FINISH
------------------------------------------------------------------------------
******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2022-04-17     at 14:26:17
==============================================================================
```

APPENDIX C

SANITARY SEWER INFORMATION

See Silver Maples Subdivision Sanitary Drainage Area Plan by Philips (attached)

Proposed Development
Sanitary Drainage to Sumac Court
Population = 131
Area = 1.98ha

0.39ha
60

KEY MAP
N.T.S.

CANADIAN NATIONAL RAILWAY
MERRITT CRES.
WILLOW LN.
LIVINGSTON AVE.
EVERGREENS DR.
LINCOLN CRES.
LINDEN LN.
MAIN ST. W.
KERMAN AVE.

SUMAC COURT
LINDEN LANE
KERMAN AVENUE
MAIN STREET WEST
REGIONAL ROAD No 81

SERVICED TO THE NORTH

0.83 / 40
0.71 / 22
1.01 / 12
1.88 / 30
1.77 / 24
5.94 / 33
2.34 / 15

MH 1A — MH 2A — MH 3A — MH 4A — MH 5A — MH 6A — MH 7A

75.5m.– 200mm. SAN. at 0.41%
73.0m.– 200mm. SAN. at 0.50%
77.3m.– 200mm. SAN. at 0.40%
80.0m.– 200mm. SAN. at 0.50%
81.7m.– 200mm. SAN. at 0.40%
80.5m.– 200mm. SAN. at 0.50%
77.8m.– 200mm. SAN. at 0.41%
79.0m.– 200mm. SAN. at 0.50%
75.1m.– 200mm. SAN. at 0.37%
75.0m.– 200mm. SAN. at 0.50%
72.6m.– 200mm. SAN. at 0.43%
74.0m.– 200mm. SAN. at 0.50%
EX. 89.0m.– 200mm. SAN. at 0.50%
Ex. 105.5m.– 200mm. SAN. at 0.50%
EX. 81.4m.– 250mm. SAN. at 0.43%
EX.114.90m.– 250mm. SAN. at 0.41%
84.0m.– 200mm. SAN. at 1.28%
85.0m.– 200mm. SAN. at 1.06%
13.0m.– 200mm. SAN. at 1.69%
15.0m.– 200mm. SAN. at 1.54%
Ex. 70.0m.– 200mm. SAN. at 1.00%

HOUSE # 280, # 278, # 284, # 282, # 280A, # 276, # 270, # 266, # 262, # 260, # 258, # 256, # 254, # 252, # 250, # 248, # 246, # 245, # 285, # 283, # 277, # 275, # 271 NO BASEMENT, VACANT LOT # 267, # 265, # 263, # 261, # 259, # 257, # 249 NO BASEMENT

Project No.	09032																		
Sheet No.	1																		
Checked by:	SL																		
Computed by:	SL																		
Date:	July 16, 2010																		

TOWN OF GRIMSBY
SANITARY SEWER DESIGN
Project: Main Street West Sanitary Sewer

Design flow factor = 320 l/day per person
$M = \frac{4}{\sqrt{P}}$ P is in thousands
Infiltration factor = 0.2 l/s per hectare

Area No.	Street Name	From MH	To MH	Pop. Density [per/ha]	Increment Area [ha]	Cumulative Area [ha]	Population Increment [per]	Cumulative Population [per]	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Infiltration l/s	Total Flow l/s	Proposed Sewer Design: Diameter [mm]	Material	Grade %	Capacity l/s	Velocity m/s	Remarks
	Main Street West	MH7A	MH6A	13.6	1.77	1.77	24	24	4.60	0.09	0.40	0.35	0.76	200	PVC	0.43%	21.84	0.69	
	Main Street West	MH6A	MH5A	16	1.88	3.65	30	54	4.60	0.20	0.90	0.73	1.63	200	PVC	0.37%	20.26	0.64	
	Main Street West	MH5A	MH4A	12	1.01	4.66	12	66	4.60	0.25	1.10	0.93	2.04	200	PVC	0.41%	21.33	0.67	
	Main Street West	MH1A	MH2A	5.5	5.94	5.94	33	33	4.60	0.12	0.54	1.19	1.73	200	PVC	0.41%	21.33	0.67	
	Main Street West	MH2A	MH3A	12	0.83	6.77	40	73	4.60	0.27	1.21	1.35	2.56	200	PVC	0.40%	21.07	0.66	
	Main Street West	MH3A	MH4A	6.4	2.34	9.11	15	87	4.60	0.32	1.46	1.82	3.28	200	PVC	0.40%	21.07	0.66	
	Linden Lane	MH4A	MH5A	31	0.71	14.48	22	176	4.60	0.65	2.93	2.90	5.83	200	PVC	1.26%	37.39	1.18	
	Linden Lane	MH8A	Ex. MH	0	0.00	14.48	0	176	4.60	0.65	2.93	2.90	5.83	200	PVC	1.54%	41.33	1.30	Connect to Exist

ONTARIO HERITAGE FOUNDATION

See updated design sheet which includes Silver Maples Subdivision and proposed Kerman Ave. Site

CERTIFICATE OF COMPLETION

IT IS HEREBY DECLARED THAT THE WORK SHOWN ON THIS DRAWING RELATED TO UNDERGROUND WORKS REQUIRED BY THE TOWN OF GRIMSBY HAS BEEN COMPLETED IN THE FIELD AS PER THE SUBDIVISION AGREEMENTS. ALL SERWCES ARE "AS-CONSTRUCTED".

Signature of Scott Llewellyn, P.Eng — Date: Feb 7/12.

LEGEND
- 0.35 / 60 — AREA IN HECTARES / POPULATION
- SANITARY AREA DRAINAGE BOUNDARY

BENCH MARK NOTE:

SITE BENCH MARK

MANHOLE 12-59
TOP OF LID ELEVATION – 91.693
AS PROVIDED BY THE TOWN OF GRIMSBY

NOTES:

1. FOR GENERAL NOTES SEE DWG. No. 1

LICENSED PROFESSIONAL ENGINEER — B.S. LLEWELLYN — PROVINCE OF ONTARIO

No.	REVISION	INITIAL	DATE
AC1	AS-CONSTRUCTED INFO ADDED	S.K.	2010
2.	REVISED TOP OF GRATE ON MANHOLES	B.E.K.	2009
1.	REVISED AS PER TOWN COMMENTS	B.E.K.	2009

TOWN OF GRIMSBY
MAIN STREET WEST SANITARY SEWER
SANITARY AREA DRAINAGE PLAN
AS-CONSTRUCTED

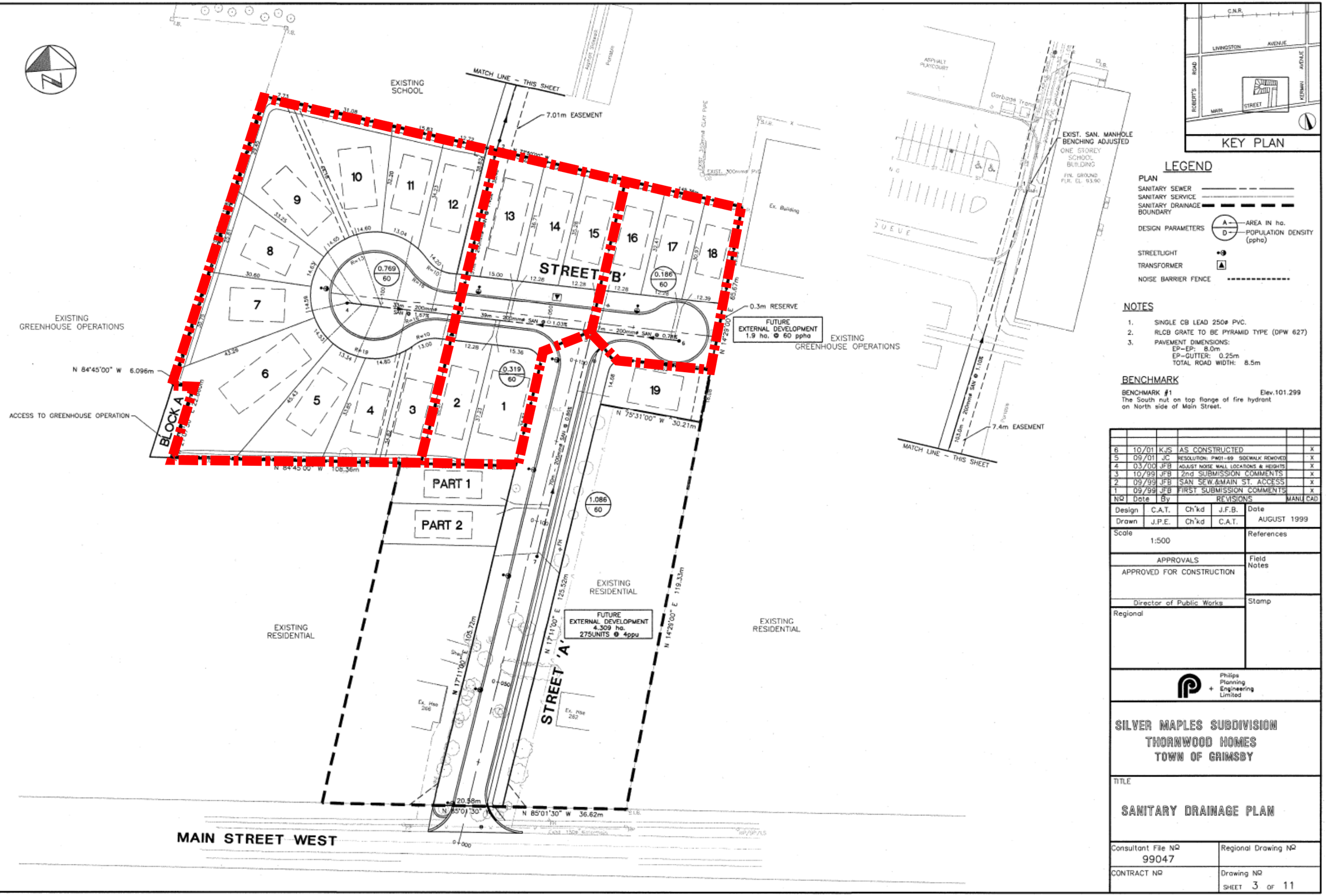
Town of Grimsby
Engineering
Department of Public Works

		DATE
DESIGNED	S.L.	
CHECKED	S.L.	JULY 09
DRAWN	B.E.K.	JULY 09

SCALE: 1:1000

DRAWING NO.: 5 OF 5

SD-YOI-56C



KEY PLAN

LEGEND

PLAN

- SANITARY SEWER
- SANITARY SERVICE
- SANITARY DRAINAGE BOUNDARY
- DESIGN PARAMETERS (A – AREA IN ha.; D – POPULATION DENSITY (ppha))
- STREETLIGHT
- TRANSFORMER
- NOISE BARRIER FENCE

NOTES

1. SINGLE CB LEAD 250ø PVC.
2. RLCB GRATE TO BE PYRAMID TYPE (DPW 627)
3. PAVEMENT DIMENSIONS:
   EP–EP: 8.0m
   EP–GUTTER: 0.25m
   TOTAL ROAD WIDTH: 8.5m

BENCHMARK

BENCHMARK #1 Elev.101.299
The South nut on top flange of fire hydrant on North side of Main Street.

№	Date	By	REVISIONS	MANU CAD
6	10/01	KJS	AS CONSTRUCTED	X
5	09/01	JC	RESOLUTION: PW01-69 SIDEWALK REMOVED	X
4	03/00	JFB	ADJUST NOISE WALL LOCATIONS & HEIGHTS	X
3	10/99	JFB	2nd SUBMISSION COMMENTS	X
2	09/99	JFB	SAN SEW.&MAIN ST. ACCESS	X
1	09/99	JFB	FIRST SUBMISSION COMMENTS	X

Design	C.A.T.	Ch'kd	J.F.B.	Date AUGUST 1999
Drawn	J.P.E.	Ch'kd	C.A.T.	
Scale 1:500				References
APPROVALS: APPROVED FOR CONSTRUCTION				Field Notes
Director of Public Works				Stamp
Regional				

Philips Planning + Engineering Limited

SILVER MAPLES SUBDIVISION
THORNWOOD HOMES
TOWN OF GRIMSBY

TITLE

SANITARY DRAINAGE PLAN

Consultant File №	Regional Drawing №
99047	
CONTRACT №	Drawing № SHEET 3 OF 11

JAN 8/02 – B.G.N

G:\WORK\99047\HWY\DWG\AS_CONSTRUCTED\99047-03.DWG

Project No. 09032 ***(Updated for Project 21048)***
Sheet No. 1
Checked by: SL
Computed by: SL
Date: July 16, 2010

TOWN OF GRIMSBY

SANITARY SEWER DESIGN

Main Street West + Silver Maples + Kerman Site Sanitary Sewer

Design flow factor = 320 l/day per person

$M = \frac{5}{\sqrt[5]{P}}$ P is in thousands

Infiltration factor = 0.2 l/s per hectare

Area No.	Street Name	From MH	To MH	Pop. Density [per/ha]	Incremental Area [ha]	Cumulative Area [ha]	Population Increment [per]	Cumulative Population [per]	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Infil-tration l/s	Total Flow l/s	Proposed Sewer Design					% Capacity	Remarks
														Diameter [mm]	Material	Grade %	Capacity l/s	Velocity m/s		
	Main Street West	MH7A	MH6A	13.6	1.77	1.77	24	24	4.50	0.09	0.40	0.35	0.76	200	PVC	0.43%	21.84	0.69	3%	
	Main Street West	MH6A	MH5A	16	1.88	3.65	30	54	4.50	0.20	0.90	0.73	1.63	200	PVC	0.37%	20.26	0.64	8%	
	Main Street West	MH5A	MH4A	12	1.01	4.66	12	66	4.50	0.25	1.10	0.93	2.04	200	PVC	0.41%	21.33	0.67	10%	
	Main Street West	MH1A	MH2A	5.5	5.94	5.94	33	33	4.50	0.12	0.54	1.19	1.73	200	PVC	0.41%	21.33	0.67	8%	
	Main Street West	MH2A	MH3A	48	0.83	6.77	40	73	4.50	0.27	1.21	1.35	2.56	200	PVC	0.40%	21.07	0.66	12%	
	Main Street West	MH3A	MH4A	6.4	2.34	9.11	15	87	4.50	0.32	1.46	1.82	3.28	200	PVC	0.40%	21.07	0.66	16%	
	Linden Lane	MH4A	MH8A	31	0.71	14.48	22	176	4.50	0.65	2.93	2.90	5.83	200	PVC	1.26%	37.39	1.18	16%	
	Linden Lane	MH8A	Ex.MH (MH 7)	0	0.00	14.48	0	176	4.50	0.65	2.93	2.90	5.83	200	PVC	1.54%	41.33	1.30	14%	Connect to Exist
	Silver Maples Subdivsion and Proposed Kerman Avenue Site Added (See Silver Maples Subdivision Sanitary Drainage Area Plan by Philips)																			
	Linden Lane	MH7	MH5	60	0.39	14.87	23	199	4.50	0.74	3.32	2.97	6.29	200	PVC	0.89%	31.42	0.99	20%	
	Kerman Site	**Site**	**MH6**		1.98	1.98	**131**	131	4.50	0.49	2.18	0.40	2.58	200	PVC	0.89%	31.42	0.99	8%	
	Sumac Court	MH6	MH5	60	0.186	2.17	11	142	4.50	0.53	2.37	0.43	2.80	200	PVC	0.78%	29.42	0.93	10%	
	Sumac Court	MH5	MH3	60	0.319	17.36	19	360	4.50	1.34	6.01	3.47	9.48	200	PVC	0.78%	29.42	0.93	32%	
	Sumac Court	MH4	MH3	60	0.769	0.769	46	46	4.50	0.17	0.77	0.15	0.92	200	PVC	1.67%	43.04	1.35	2%	
	Sumac Crt / Easement	MH3	MH2	0	0.000	18.124	0	407	4.50	1.51	6.78	3.62	10.40	200	PVC	1.43%	39.83	1.25	26%	
	Easement	MH2	Ex MH	0	0.000	18.124	0	407	4.50	1.51	6.78	3.62	10.40	200	PVC	1.10%	34.93	1.10	30%	
	Easement	Ex. MH	Ex. Sanitary	0	0.000	18.124	0	407	4.50	1.51	6.78	3.62	10.40	200	PVC	1.00%	33.31	1.05	31%	

APPENDIX D

WATER ANALYSIS INFORMATION

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

Project Number: 21048
Project Name: 9 & 11 Kerman Avenue
Date: 20-Apr-22

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

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

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

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 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)**
Lots 4 to 15	**2200**	**1**	**2200**	**1.5**	15000	250.0	**-15**	-2250.0	**12750.0**	**0**	0.0	40	5100.0	**18000**	**300**
Lots 25 to 32	**1200**	**1**	**1200**	**1.5**	11000	183.3	**-15**	-1650.0	**9350.0**	**0**	0.0	35	3272.5	**13000**	**217**

(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

0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
30.1 to 45m	5%	exceed 75%

AQUACOM CONTRACTING
81 Todd Road Suite 202 Georgetown Ont. L7G 4R8
(o) 905-467-5853 (C) 905-971-9956 (e) mark@aquacom.ca

SITE NAME	TARBUTT CONSTRUCTION
TEST DATE TIME	FRIDAY 13 AUGUST 2021 @ 715 AM
SITE ADDRESS	KERMAN AVENUE, TOWN OF GRIMSBY
TECHNICIANS	MARC COULTER & JEFF DAM
COMMENTS	MUNICIPAL HYDRANTS

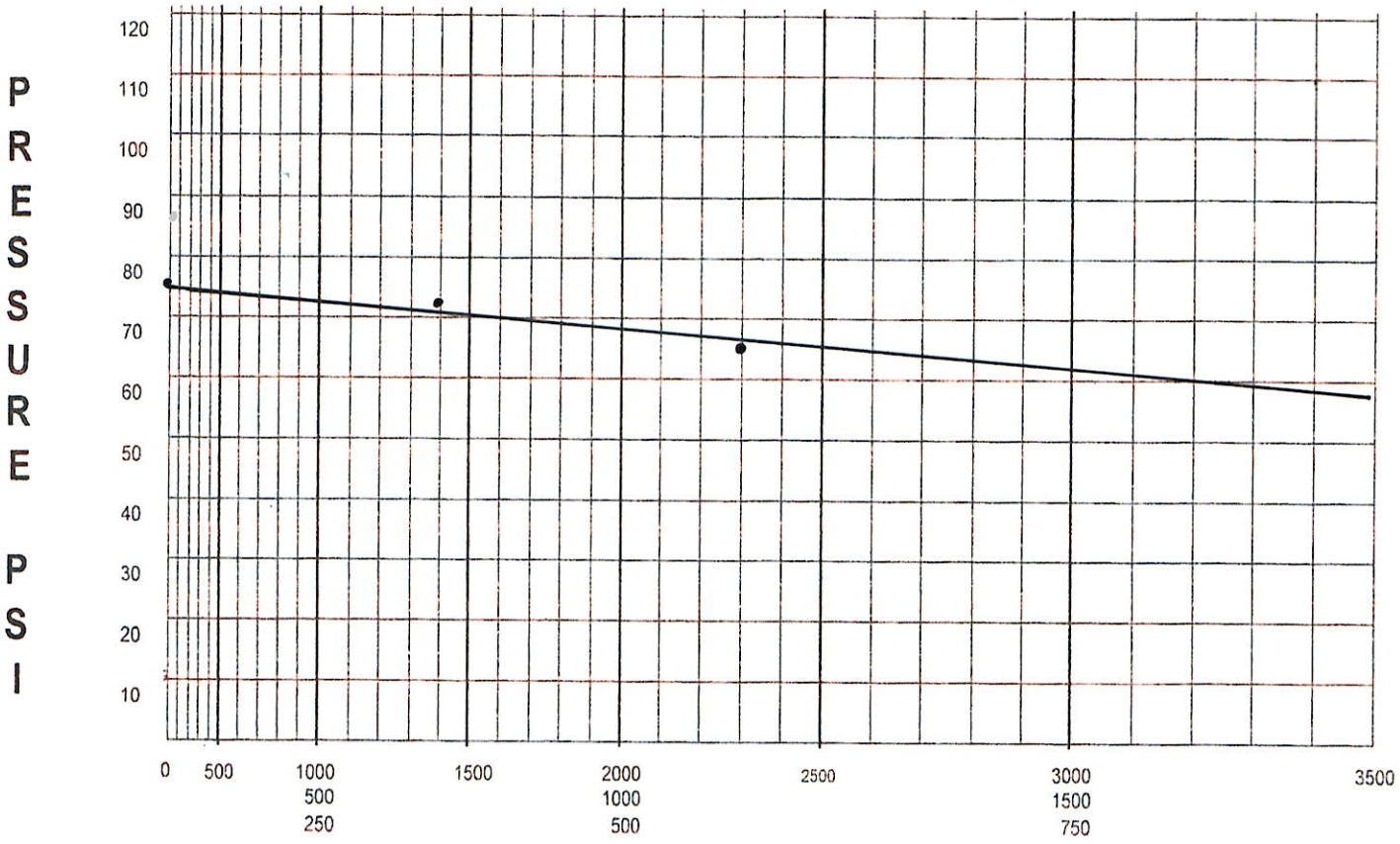
LOCATION OF FLOW HYDRANT

9 KERMAN AVE

LOCATION OF RESIDUAL HYDRANT

17 KERMAN

# OUTLETS	SIZE INCHES	PITO PSI	FLOW USGPM	RESIDUAL PSI	STATIC PSI	PIPE DIA. MM
ONE	2.50	69	1395	73	77	150
TWO	2.50	42	2302	66		
		THEORETICAL	5290	20	TEST #	ONE
NOZZLE COEFF.		.90				



AQUACOM CONTRACTING
81 Todd Road Suite 202 Georgetown Ont. L7G 4R8
(o) 905-467-5853 (C) 905-971-9956 (e) mark@aquacom.ca

SITE NAME	TARBUTT CONSTRUCTION
TEST DATE TIME	FRIDAY 13 AUGUST 2021 @ 730 AM
SITE ADDRESS	SUMAC CT + LINDEN LANE, TOWN OF GRIMSBY
TECHNICIANS	MARC COULTER & JEFF DAM
COMMENTS	MUNICIPAL HYDRANTS

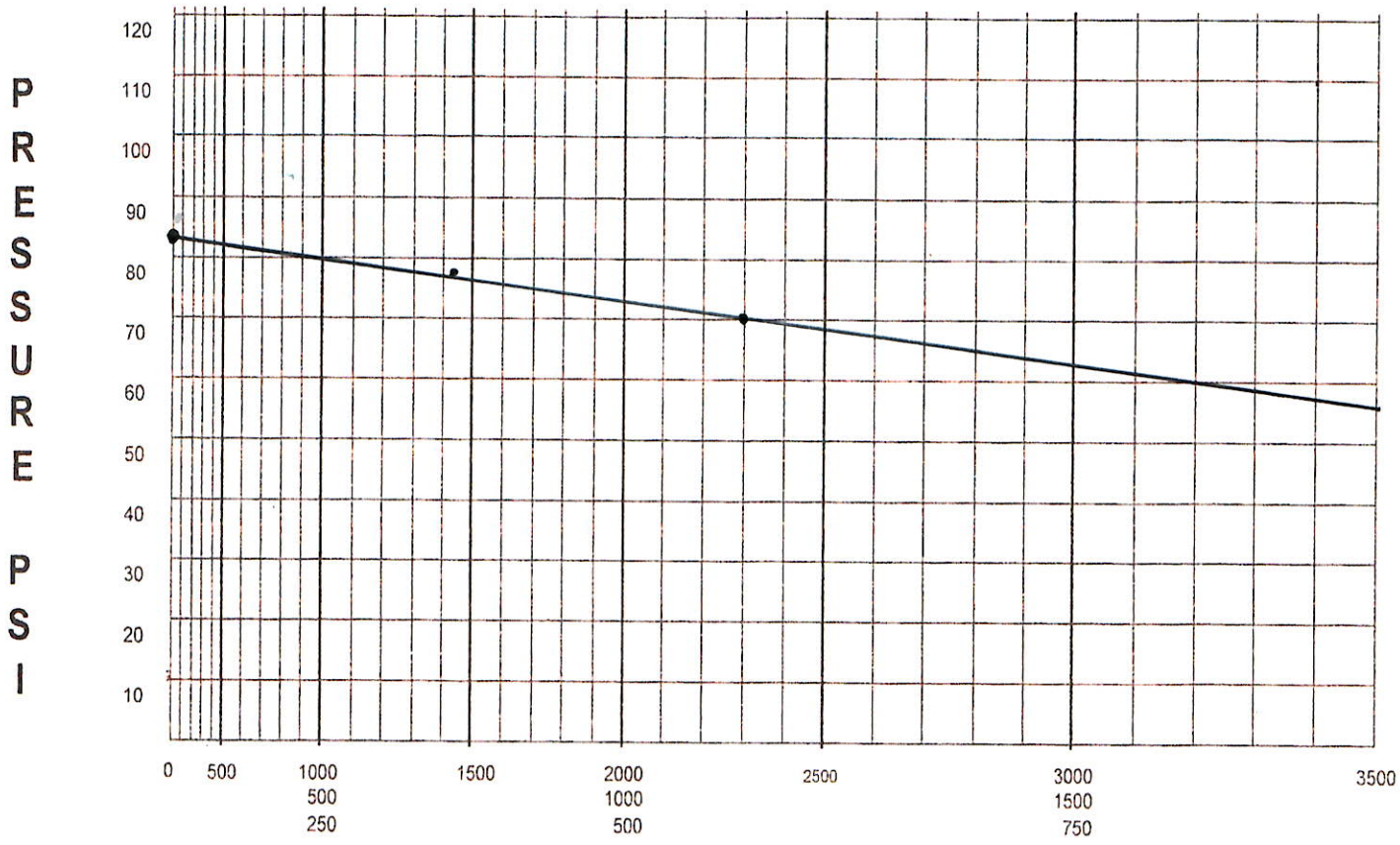
LOCATION OF FLOW HYDRANT

72 SUMAC

LOCATION OF RESIDUAL HYDRANT

17 LINDEN

# OUTLETS	SIZE INCHES	PITO PSI	FLOW USGPM	RESIDUAL PSI	STATIC PSI	PIPE DIA. MM
ONE	2.50	73	1435	78	82	150
TWO	2.50	47	2302	70		
		THEORETICAL	5588	20	TEST #	ONE
NOZZLE COEFF.		.90				



APPENDIX E

GEOTECHNICAL REPORT

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

www.soil-mat.ca info@soil-mat.ca TF: 800.243.1922

Hamilton: 130 Lancing Drive L8W 3A1 T: 905.318.7440 F: 905.318.7455
Milton: PO Box 40012 Derry Heights PO L9T 7W4 T: 800.243.1922

PROJECT NO.: SM 188510-G

August 15, 2018
Reissued: May 18, 2021

TARBUTT CONSTRUCTION
189 South Service Road
Grimsby, Ontario
L3M 4H6

Attention: Mr. Jim Tarbutt

GEOTECHNICAL INVESTIGATIONS
PROPOSED RESIDENTIAL DEVELOPMENT
9 KERMAN AVENUE AND 250 MAIN STREET
GRIMSBY, ONTARIO

Dear Mr. Tarbutt,

We have completed the fieldwork, laboratory testing, and report preparation in connection with the above noted project. The work was undertaken in general accordance with our proposal P7471, dated June 8, 2018. Our comments and recommendations, based on our findings at the ten [10] borehole locations, are presented herein.

1. INTRODUCTION

We understand that the project will involve the construction of a residential redevelopment of the subject lands, which are presently a commercial greenhouse operation. The details of the proposed development have not been established at present but are anticipated to consist of townhouse units with single basement levels. Construction would also include the installation of underground services and asphalt paved roadways. The purpose of this geotechnical investigation work is to assess the subsurface soil conditions, and to provide our comments and recommendations with respect to the design and construction of the proposed development, from a geotechnical point of view.

This report is based on the above summarised project description, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design

with respect to the results of this investigation. It is noted that this report is not intended to address the environmental aspects of the site, which have been addressed in separate Phase One and Two ESA reports.

2. PROCEDURE

A total of ten [10] sampled boreholes were advanced at the locations shown on the enclosed Drawing No. 1, Borehole Location Plan. The borings were advanced on June 28 and 29, and July 12, 2018 under the supervision and direction of a representative of SOIL-MAT ENGINEERS, to depths of approximately 4.8 to 5.3 metres below the existing surface. Upon completion of drilling, groundwater monitoring wells were installed at Borehole Nos. 3, 5, 8 and 10 to allow for future measurements of the static groundwater elevation. The monitoring wells were installed to depths of approximately 3.7 to 5.3 metres, consisting of 50-millimetre diameter PVC pipe, screened in the lower 3.1 metres. The monitoring wells were then surrounded with well filter sand to approximately 0.3 metres above the screened section, and then with a bentonite 'hole plug' medium to ground surface, and fitted with a protective steel 'stick up' casing. All remaining boreholes were backfilled in general accordance with Ontario Regulation 903, and the grade reinstated even with the surrounding ground surface.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of the ASTM test specification D1586, Standard Penetration Resistance Testing, [CSA A119.1]. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings.

The boreholes were located on site by a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD. The ground surface elevation at the borehole locations was referenced to a site specific benchmark, described as the top of the manhole located at the west side of Kerman Avenue, as illustrated on our Borehole Location Plan. This benchmark has been assigned an elevation of 100.00 metres for convenience. If topographic survey information for the site can be provided then these elevations can be revised to geodetic.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Log of Borehole Nos. 1 to 10, inclusive, following the text of this report. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made

during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed at the exact depths of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site is located on the properties identified as 9 and 11 Kerman Avenue, in Grimsby, Ontario. The property is currently occupied by a residential dwelling on the east side fronting to Main Street West [11 Kerman] and a commercial greenhouse occupying the majority of the site [9 Kerman]. The site is bounded to the north by vacant land, to the east by residential dwellings and Kerman Avenue, to the south by residential dwellings and Main Street West, and to the west by residential development. The site is relatively even with a total relief of approximately 2.5 metres dropping from south to north.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Pavement Structure

Borehole No. 1 was advanced through the pavement structure of the existing driveway, which was found to consist of approximately 50 millimetres of asphaltic concrete overlying 500 millimetres of compact granular base. Borehole No. 10 was advanced inside the existing greenhouse where the ground surface was found to consist of 90 millimetre thick interlocking paver stone overlaying approximately 100 millimetres of compact granular base. It is noted that the majority of the green house floor area was exposed soil.

Sand and Gravel Fill

A surficial veneer of sand and gravel fill was encountered in Borehole Nos. 2, 3, 6 and 7 to depths of approximately 75 to 300 millimetres. It should be noted the depth of sand and gravel fill may vary across the site and from the thickness measured at the borehole locations.

Topsoil

A surficial veneer of topsoil approximately 125 to 750 millimetres in thickness was encountered in Borehole Nos. 4, 5, 8 and 9. It should be noted that the depth of topsoil may vary across the site and from the thicknesses measured at these borehole

locations. It should be noted too that the term “topsoil” has been used strictly from a geotechnical point of view and does not necessarily reflect the soils nutrient content or ability to support plant life.

Silty Sand

Silty sand was encountered beneath the pavement structure, sand and gravel fill or topsoil at all boreholes. This fine grained granular soil is brown in colour, contains trace clay and gravel, as well as some coarser sand seams, and is generally in a compact to dense state. The upper levels of the silty sand have a ‘reworked’ appearance, in a loose condition, likely associated with agricultural use, as well as being exposed to continual freeze/thaw cycles. It is noted too that the silty sand soils tend to be in a wet condition which makes them more sensitive to disturbance, such as from drilling. This may have influenced some of the measure N-values to be artificially low in the upper levels. The native silty sand was proven to termination to depths of approximately 4.8 to 5.3 metres at all borehole locations.

A review of available published information [Quaternary Geology of Ontario, Southern Sheet Map 2556] indicate the subsurface soils to consist of coarse-textured glaciolacustrine deposits of sand and gravel, with minor silt and clay, consistent with our experience in the area and observations during our fieldwork.

Groundwater Conditions

All boreholes were recorded as ‘wet’ at depths of between approximately 2.1 to 3.4 metres below the ground surface. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. As noted above, Borehole Nos. 3, 5, 8, and 10 were fitted with monitoring wells to allow for measurement of the static groundwater level. A representative of SOIL-MAT measured the groundwater level in the wells on July 27 and August 1, 2018, which have been summarised as follows:

TABLE A
GROUND WATER LEVEL MEASUREMENTS

Borehole No.	Surface Elevation [m]	July 27, 2018		August 1, 2018	
		Ground Water Depth (m)	Ground Water Elevation (m)	Ground Water Depth (m)	Ground Water Elevation (m)
BH3	99.95	2.58	97.37	1.7	98.25
BH5	101.61	2.51	99.1	2.5	99.11
BH8	101.73	2.75	98.98	2.8	98.93
BH10	100.54	2.0	98.54	2	98.54

* It is noted that the referenced elevations above are relative to a temporary local benchmark and are not geodetic.

These monitoring well observations may be considered to have generally stabilised, given the time elapsed since installation within the silty sand deposit. The present data would indicate a static groundwater level at a depth of approximately 2.0 to 2.5 metres below the existing grade. It is noted that the static groundwater level would also be anticipated to be subject to seasonal fluctuations, being highest during the 'wetter' spring and fall periods of the year.

4. EXCAVATIONS

Excavations for the installation of foundations and municipal services are generally expected to extend to depths of approximately 2 to 4 metres below the existing grade. Excavations into the native silty sand soils may be expected to remain stable for the short construction period at 45 degrees to the horizontal, or steeper. Where wet seams are encountered, during periods of extended precipitation, or where excavations extend below the static groundwater level, the excavations may tend to 'slough' in to as flat as 3 horizontal to 1 vertical, or flatter. Nevertheless, all excavations must comply with the current Occupational Health and Safety Act and Regulations for Construction Projects. Excavation slopes steeper than those required in the Safety Act must be supported or a trench box must be provided, and a senior geotechnical engineer from this office should monitor the work.

As noted above the static groundwater level is estimated at depths of between approximately 2 and 2.5 metres below the existing grade, generally near or slightly below the anticipated depths of construction for foundations and water services, while excavations for storm and sanitary sewers will likely extend below this level. The moderate to highly permeable sand soils will yield relatively high rates of infiltration, as

well as infiltration from surface runoff. For excavations to depths of about 2 to 2.5 metres the rate of infiltration should be sufficiently low, such that it should be possible to adequately control groundwater infiltration for the short construction period using conventional construction dewatering methods, such as pumping from sumps in the base of the excavation.

Excavations extending below depths of about 2 to 2.5 metres or more should be anticipated to experience a greater rate of groundwater infiltration, requiring greater pumping efforts, and possibly more sophisticated dewatering methods for deeper excavations. The contractor should be prepared to undertake work in 'wet' conditions, requiring wider excavations, greater dewatering controls, base stabilisation, etc. Excavations should begin at the 'low-end' of the sewer alignment to allow drainage away from the working areas. In this regard it is recommended that a number of test pit excavations be advanced to allow observation of the conditions first hand to assess the requirements of excavation operations during the installation of underground services. More groundwater control should be anticipated when connections are made to existing services. Surface water should be directed away from the excavations.

The base of the excavations above the groundwater level in the native silty sand encountered in the boreholes should generally remain firm and stable, however may be prone to some disturbance and instability, requiring the use of additional bedding or ballast stone. Where excavations approach or extend below the groundwater level the base of excavations would be expected to experience instability and some stabilisation efforts such as the placement of coarse ballast stone, or additional bedding material, may be required depending on the groundwater conditions at the time of construction.

With firm and stable excavation bases, stabilised where required, standard pipe bedding, as typically specified by the Ontario Provincial Standard Specification [OPSS] or by Town of Grimsby, compacted to a minimum of 95 per cent of its standard Proctor density [SPMDD], should suffice. The bedding should be well compacted to provide sufficient support to the pipes and components (i.e. valve chambers, manholes etc.), and to minimise settlements of the roadway above the service trenches. Special attention should be paid to compaction under the pipe haunches.

It is recommended that the invert elevations of any storm sewer pipes for rear yard catch basins be located above the proposed underside of footing elevations of adjacent structures, or that the trench excavations should be filled with lean mix [~5 MPa] concrete or non-shrink fill product to the proposed underside of footing level where the excavations extend below an imaginary one horizontal to one vertical line extending outwards and down from a point 0.3 metres beyond the proposed foundations.

5. BACKFILL CONSIDERATIONS

The majority of the excavated soils will consist of the native silty sand encountered in the boreholes as described above. These soils are generally considered suitable for use as engineered fill, trench backfill, etc., provided that they are free of organics or otherwise deleterious material, and that their moisture content can be controlled to within 3 per cent of their standard Proctor optimum moisture content.

The fine grained granular soils are sensitive to moisture conditions and will become practically impossible to compact if they are 'wet' of their optimum moisture content. The wet to saturated silty and sandy soils will need to be spread out and allowed to air dry if they will not drain sufficiently 'fast' to allow for adequate compaction operations. Water conditioning [wetting or drying] will be required depending upon the weather conditions at the time of construction. It is also noted that these fine grained granular soils will present difficulties in achieving effective compaction where access with compaction equipment is restricted, such as at the end of compaction runs. Dust could a problem during the dry months of the year. The soils encountered on site are also considered to be highly frost susceptible and will have a tendency to 'heave' significantly under sub-freezing weather conditions.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. Correspondingly, the shear strength of the 'wet' backfill material is also lowered, thereby reducing its ability to support construction traffic and therefore impacting roadway construction. If the soil is well dry of its optimum value, it will appear to be very strong when compacted, but will tend to settle with time as the moisture content in the fill increases to equilibrium condition. The silty sand soils may require high compaction energy to achieve acceptable densities if the moisture content is not close to its standard Proctor optimum value. It is therefore very important that the placement moisture content of the backfill soils be within 3 per cent of its standard Proctor optimum moisture content during placement and compaction to minimise long term subsidence [settlement] of the fill mass. Any imported fill required in service trenches or to raise the subgrade elevation should have its moisture content within 3 per cent of its optimum moisture content and meet the necessary environmental guidelines.

A representative of SOIL-MAT should be present on-site during the backfilling and compaction operations to confirm the uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction 'runs'. All structural fill should be compacted to 100 per cent of its SPMDD. Backfill

within service trenches, areas to be paved, etc., should be compacted to a minimum of 95 per cent of its SPMDD, and to 100 per cent of its SPMDD in the upper 1 metre below the design subgrade level. The appropriate compaction equipment should be employed based on soil type, i.e. pad-toe for cohesive soils and smooth drum/vibratory plate for granular soils. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction.

6. MANHOLES, CATCHBASINS AND VALVE CHAMBERS

Where manholes, catch basins, valve chambers, etc. are founded in the native soils with the founding surfaces carefully prepared to remove all loose and disturbed material, stabilised as required, the bearing surfaces should be practically non-yielding under the anticipated loads. Proper preparation of the founding soils will therefore accentuate the protrusion of these structures above the pavement surface if compaction of the fill around these structures is not adequate, causing settlement of the surrounding paved surfaces. Conversely, the pavement surfaces may rise above the valve chambers under frost action. To alleviate the potential for these types of differential movements, free draining, non-frost susceptible material should be provided as backfill around the structures located within the paved roadway limits, and compacted to 100 percent of its standard Proctor maximum dry density. A geofabric separator should be provided between the free draining material and the on-site fine soils to prevent the intrusion of fines.

Where thrust blocks are to be founded in the native soils, they may be conservatively sized as recommended by the applicable Ontario Provincial Standard Specification using an allowable bearing pressure of 100 kPa [~2,000 psf]. Any backfill required behind the blocks should be a crushed limestone product and should be compacted to 100 percent of its standard Proctor maximum dry density.

7. PAVEMENT CONSIDERATIONS

The roadway areas should be stripped of all topsoil or otherwise unsuitable materials. The exposed subgrade should be proofrolled with 3 to 4 passes of a loaded tandem truck in the presence of a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means must be subexcavated and replaced with suitable backfill material, or additional depth of Granular B sub-base material. Alternatively, the soft areas may be stabilised by their displacement into the interstitial spaces of 50-millimetre clear crushed stone ‘punched’ into the soft areas. In more severe ‘wet’

conditions it may be necessary to make use of coarse 'rip-rap' stone to sufficiently stabilise the subgrade level. The need for the treatment of softened subgrade will be reduced if construction is undertaken during the dry summer months and careful attention is paid to the compaction operations. The fill over shallow utilities cut into or across the subdivision streets, such as telephone, hydro, gas, etc. must also be compacted to 100 percent of its standard Proctor maximum dry density.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and mitigate softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction; therefore, precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. These measures would include minimising the amount of heavy traffic travelling over the subgrade, such as during the placement of granular base layers.

If construction is conducted under adverse weather conditions, additional subgrade preparation may be required. During wet weather conditions, such as during the fall and spring months, it should be anticipated that additional subgrade preparation will be required, such as additional depth of Ontario Provincial Standard Specification [OPSS] Granular 'B', Type II sub-base material. It is also important that the sub-base and base granular layers of the pavement structure be placed as soon as possible after exposure, preparation and approval of the subgrade level.

The proposed pavement structure would be required to adequately support cars, trucks and intermittent delivery and garbage trucks. For this project, a recommended pavement structure would consist of 300 millimetres of OPSS Granular 'B', Type II sub-base course, 150 millimetres of OPSS Granular 'A' base course, 65 millimetres of HL8 binder course asphaltic concrete, and 40 millimetres of HM3 surface course asphaltic concrete. Notwithstanding, the pavement structure should conform to the relevant Town of Grimsby requirements where they are to be assumed by the Town. It is our opinion that this design is suitable for use on a residential roadway section, provided that the subgrade has been prepared as specified and is good and firm before the sub-base course material is placed. If the subgrade is soft, remedial measures as discussed above may have to be implemented and/or the sub-base thickness may have to be increased. The granular sub-base and base courses and asphaltic concrete layers should be compacted to OPSS or Town of Grimsby requirements. Typical requirements would for granular base materials to be compacted to a minimum of 98 percent of

SPMDD, and asphalt layers to a minimum of 92 percent of Marshall maximum relative density [MRD]. A program of in-place density testing must be carried out to monitor that compaction requirements are being met. We note that this pavement structure is not to be considered as a construction roadway design.

To minimise segregation of the finished asphalt mat, a uniform asphalt temperature must be maintained throughout the mat during placement and compaction. Frequently, significant temperature gradients exist in the delivered and placed asphalt with cooler portions of the mat resisting compaction and presenting a 'honey combed' surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure smoothness and uniformity. The contractor can mitigate the surface segregation by 'back-casting' or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

Asphalt paving of driveways should be consistent with the general recommendations provided above. Proper preparation of the subgrade soils is essential to good long-term performance of the pavement. Likewise, sufficient depth and compaction of granular base materials and adequate drainage will be important in achieving good long-term performance, i.e. preventing/limiting premature cracking, subgrade failure, rutting, etc. A recommended light duty pavement structure for residential driveways would consist of a minimum of 200 millimetres of OPSS Granular 'A' base course, compacted to 100 percent standard Proctor maximum dry density, followed by 50 millimetres of HL3 or HL3F asphaltic concrete, compacted to a minimum of 93 percent of MRD.

8. HOUSE AND TOWNHOUSE CONSTRUCTION

The native soils encountered at the borehole locations are considered capable of supporting the loads typically associated with townhouse construction on conventional spread footings. Based on the subsurface conditions, including the potential influence of established groundwater conditions, it is recommended that foundations be designed on the basis of bearing pressures of 100 kPa [~2,000 psf] SLS and 150 kPa [~3,000 psf] ULS in the native soils. It is noted that the founding level must extend through any upper disturbed zone in the native soils. However, it is also important that the founding level ideally be designed at no deeper than 2.0 metres below the existing grade, in order to minimum difficulties with disturbance of the founding soils due to groundwater conditions. The founding surfaces must be hand cleaned of any loose or disturbed material, along with any ponded water, immediately prior to placement of foundation concrete.

The support conditions afforded by the native soils are generally not uniform across the building footprint, nor are the loads on the various foundations elements. As such it is recommended that consideration be given to the provision of nominal reinforcement in the footings and foundation walls to account for variable support and loading conditions. The use of nominal reinforcement is considered good construction practice as it will act to reduce the potential for cracking in the foundation walls due to minor settlements, heaving, shrinkage, etc. and will assist in resisting the pressures generated against the foundation walls by the backfill. Such nominal reinforcement is an economical approach to the reduction and prevention of costly foundation repairs after completion and later in the life of the buildings. This reinforcement would typically consist of two continuous 15M steel bars placed in the footings [directly below the foundation wall], and similarly two steel bars placed approximately 300 millimeters from the top of the foundation walls at a minimum, depending on ground conditions exposed during construction. These reinforcement bars would be bent to reinforce all corners and under basement windows, and be provided with sufficient overlap at staggered splice locations. At 'steps' in the foundations and at window locations, the reinforcing steel should transition diagonally, rather than at 90 degrees, to maintain the continuous tensile capacity of the reinforcement. Where footings are founded on, or partially on, engineered fill the above provision for nominal reinforcement would be required.

All basement foundation walls should be suitably damp proofed, including the provision of a 'dimple board' type drainage product, and provided with a perimeter drainage tile system outlet to a gravity sewer connection or positive sump pit a minimum of 150 millimetres below the basement floor slab. The clear stone material surrounding the weeping tile should be encased with a geotextile material to prevent the migration of fines from the foundation wall backfill into the clear stone product. It is likely that sump pit systems will be required, and as such we would recommend that the sump pump system should be constructed with an 'oversized' reservoir and a 'back-flow' prevention valve so that the sump pump will not cycle repeatedly within short time periods. The enclosed Drawing Nos. 2 shows schematics of the typical requirements for foundation construction with a basement level.

All footings exposed to the environment must be provided with a minimum of 1.2 meters of earth or equivalent insulation to protect against frost penetration. This frost protection would also be required if construction were undertaken during the winter months. All footings must be proportioned to satisfy the requirements of the Ontario Provincial Building Code.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the

project. This is to observe compliance with the design concepts and recommendations outlined in this report, and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the borehole locations.

9. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and borehole information are only intended to describe conditions at the borehole locations. Contractors placing bids or undertaking this project should carry out due diligence in order to verify the results of this investigation and to determine how the subsurface conditions will affect their operations.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Yaroslav Mormil, B. Eng.

Ian Shaw, P. Eng.
Senior Engineer

Enclosures: Drawing No. 1, Borehole Location Plan
Borehole Log Nos. 1 to 10, inclusive

Distribution: Tarbutt Construction [pdf by email]

LEGEND

BH# Borehole Location

TBM Temporary Benchmark
[Catch Basin on west side of Kerman Avenue. Assumed elevation of 100.00 metres]

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 188510-G.

2. Borehole locations are approximate.

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Preliminary Geotechnical Investigation
Proposed Residential Development
9 Kerman Avenue
Grimsby, Ontario

Borehole Location Plan

Project No. SM 188510-G

Date: August 2018

Drawn: MC	Checked: IS

SM 188510-G Borehole Location Plan

Drawing No. 1

Log of Borehole No. 1

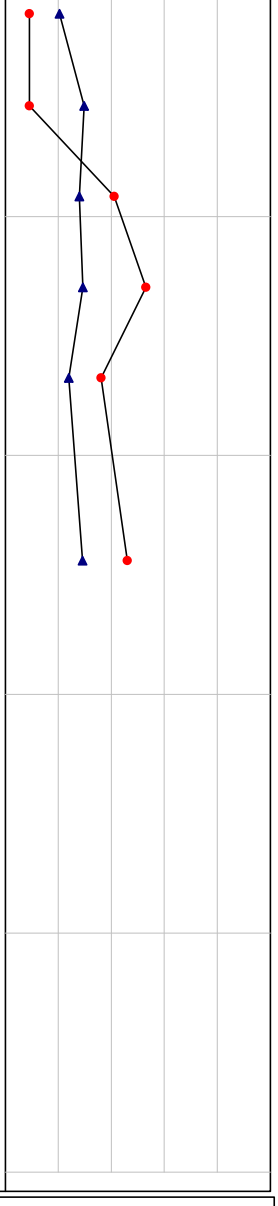
Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	99.72	Ground Surface								
0–2 / 0–1	99.17	**Pavement Structure** Approximately 50 millimetres of asphaltic concrete over 500 millimetres of compact granular base.								
2–16 / 1–5	94.52	**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to very dense.		SS	1	10,6,3,2	9			
				SS	2	4,4,5,5	9			
				SS	3	18,21,20,30	41			
				SS	4	26,26,27,29	53			
				SS	5	14,19,17,24	36			
				SS	6	17,21,25,30	46			
16–17 / 5	94.52	End of Borehole								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using direct push probe equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.4 metres and 'wet' at a depth of 2.7 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push Method
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

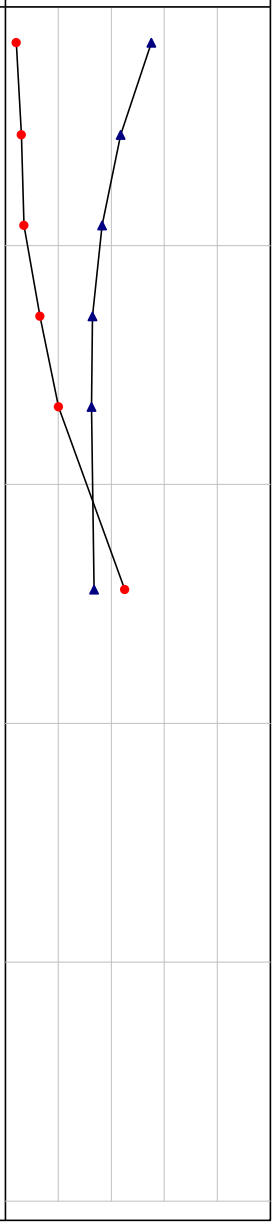
Log of Borehole No. 2

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	99.98	Ground Surface								
0 / 0	99.68	**Sand and Gravel Fill** Approximately 300 millimetres of sand and gravel fill.		SS	1	6,2,2,2	4			
3 / 1		**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, very loose to dense.		SS	2	3,2,4,3	6			
7 / 2				SS	3	2,3,4,3	7			
10 / 3				SS	4	11,7,6,7	13			
13 / 4				SS	5	7,11,9,11	20			
16 / 5	94.78			SS	6	34,24,21,32	45			
17		End of Borehole								
20 / 6		NOTES: 1. Borehole was advanced using direct push probe equipment on June 28, 2018 to termination at a depth of 5.2 metres. 2. Borehole was recorded as 'wet' at a depth of 2.1 metres upon completion and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
23 / 7										
26 / 8										
29 / 9										
33										



Drill Method: Direct Push Method
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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E: info@soil-mat.ca

Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

Log of Borehole No. 3

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		99.95	Ground Surface							
0	0		**Sand and Gravel Fill** Approximately 125 millimetres of sand and gravel fill.							
1			**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to very dense.	SS	1	6,4,6,8	10			
2	1			SS	2	4,3,4,6	7			
3				SS	3	2,3,2,8	5			
4				SS	4	6,8,20,25	28			
5	2			SS	5	30,50/4"	100			
6				SS	6	35,44,50/5"	100			
7	3			SS	7	8,30,45,46	75			
8		94.75	End of Borehole							
9	4		NOTES: 1. Borehole was advanced using solid stem auger equipment on July 12, 2018 to termination at a depth of 5.2 metres. 2. Borehole was recorded as open to a depth of 2.6 metres and 'wet' at a depth of 2.3 metres upon completion and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client. 4. A monitoring well was installed. The following free groundwater level readings have been measured: July 27th - 2.58 metres August 1st - 1.70 metres							
10										
11										
12										
13	4									
14										
15										
16										
17	5									
18										
19										
20	6									
21										
22										
23	7									
24										
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26	8									
27										
28										
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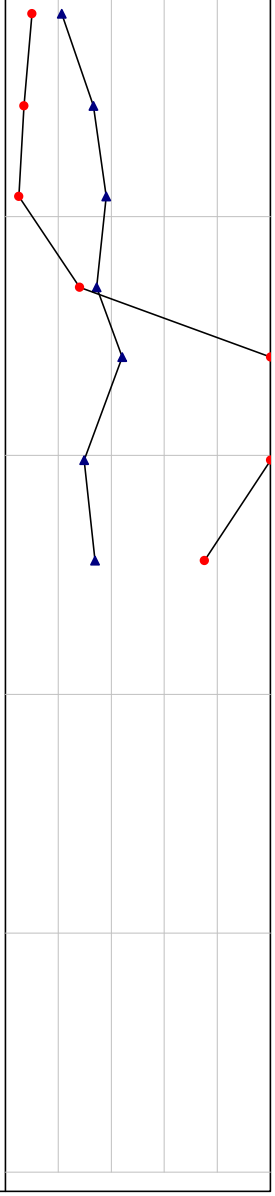

Drill Method: Solid Stem Augers
Drill Date: July 12, 2018
Hole Size: 100 millimetres
Drilling Contractor: Kodiak Drilling

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T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
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Log of Borehole No. 4

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
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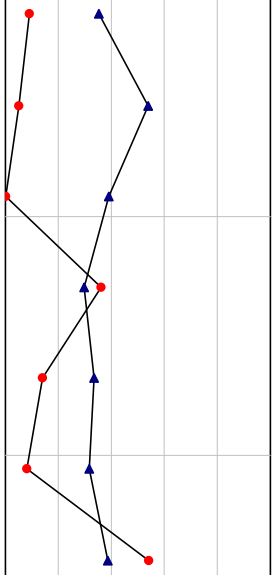
Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		100.72	Ground Surface								
0	0	100.47	**Topsoil** Approximately 250 millimetres of topsoil.		SS	1	2,5,4,3	9			
3	1		**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, very loose to very dense.		SS	2	2,2,3,2	5			
6	2				SS	3	1,0,0,6	0			
9	3				SS	4	12,18,18,20	36			
11	4				SS	5	8,9,5,10	14			
13	4				SS	6	1,3,5,19	8			
16	5	95.52			SS	7	16,28,26,27	54			
17			End of Borehole								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.7 metres and 'wet' at a depth of 3.0 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Soild Stem Augers
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

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Datum: Temporary Benchmark
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Log of Borehole No. 5

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 Kerman Avenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
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Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	101.61	Ground Surface							
0–3 / 0–1		**Topsoil** Approximately 125 millimetres of topsoil.							
3–16 / 1–5		**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to compact.	SS	1	1,1,1,2	2			
			SS	2	2,2,3,8	5			
			SS	3	4,8,6,7	14			
			SS	4	7,13,15,18	28			
			SS	5	7,10,10,12	20			
16 / 5	96.41	End of Borehole	SS	6	5,8,9,13	17			

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

NOTES:

1. Borehole was advanced using hollow stem auger equipment on June 29, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as 'wet' at a depth of 2.3 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:

July 27th - 2.51 metres
August 1st - 2.50 metres

Drill Method: Hollow Stem Augers
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

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Log of Borehole No. 6

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
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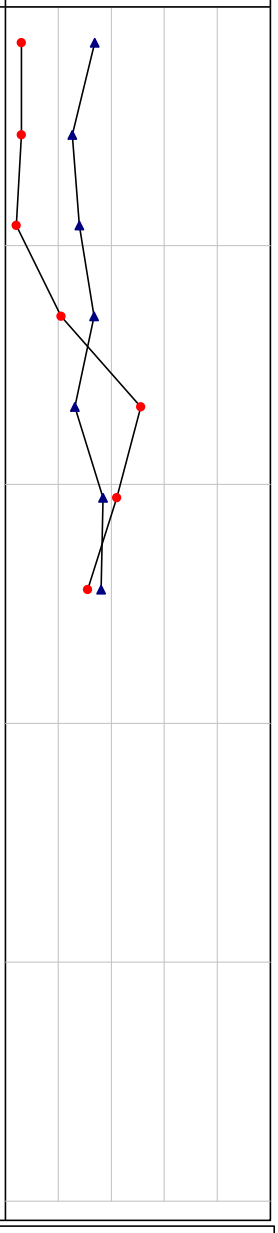
Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		101.76	Ground Surface								
0–5	0–1.5		**Sand and Gravel Fill** Approximately 75 millimtres of sand and gravel fill.		SS	1	4,4,2,2	6			
			Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to very dense.		SS	2	3,3,3,2	6			
					SS	3	3,3,1,2	4			
					SS	4	10,9,12,16	21			
					SS	5	26,24,27,32	51			
					SS	6	38,24,18,20	42			
16–17	5	96.56			SS	7	22,15,16,27	31			
			End of Borehole								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using direct push probe equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.0 metres and 'wet' at a depth of 2.4 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push Method
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

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Log of Borehole No. 7

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
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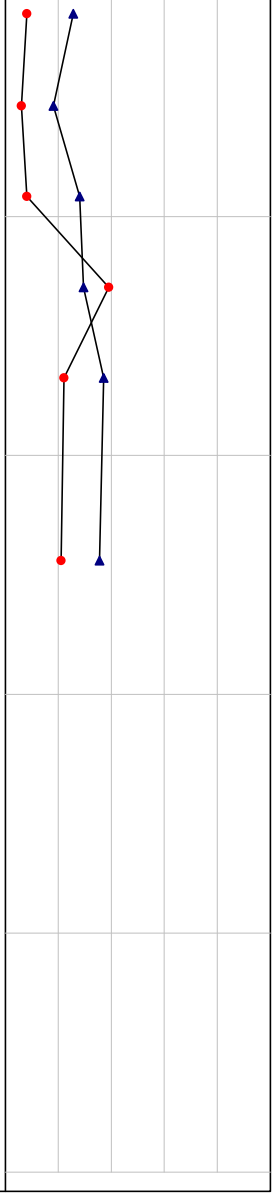
Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		102.61	Ground Surface								
0	0	102.38	**Sand and Gravel Fill** Approximately 225 millimetres of sand and gravel fill.		SS	1	7,5,3,3	8			
3	1		**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to dense.		SS	2	2,3,3,3	6			
7	2				SS	3	3,4,4,4	8			
10	3				SS	4	9,19,20,22	39			
13	4				SS	5	9,12,10,12	22			
16	5	97.41			SS	6	3,9,12,18	21			
17			End of Borehole								
20	6		NOTES: 1. Borehole was advanced using hollow stem auger equipment on June 29, 2018 to termination at a depth of 5.2 metres. 2. Borehole was recorded as open to 3.4 metres and 'wet' at a depth of 3.4 metres upon completion and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
23	7										
26	8										
29	9										
33											



Drill Method: Hollow Stem Augers
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

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Log of Borehole No. 8

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		101.73	Ground Surface							
0	0	101.50	**Topsoil** Approximately 225 millimetres of topsoil.							
1–3	1		**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to dense.	SS	1	2,3,3,3	6			
3–5	1			SS	2	3,4,3,3	7			
5–7	2			SS	3	3,2,2,5	4			
7–9	2			SS	4	8,6,6,13	12			
9–11	3			SS	5	11,15,19,20	34			
15–17	5	96.39		SS	6	3,5,8,32	13			
17	5		End of Borehole							

NOTES:

1. Borehole was advanced using hollow stem auger equipment on June 29, 2018 to termination at a depth of 5.3 metres.

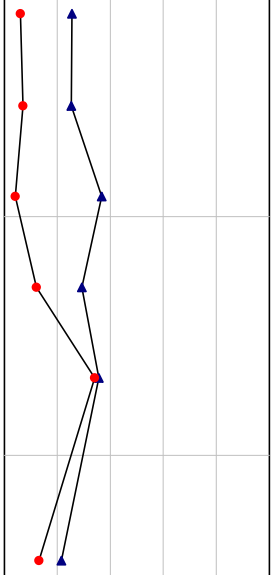
2. Borehole was recorded as 'wet' at a depth of 3.0 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:

July 27th - 2.75 metres
August 1st - 2.80 metres

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



Drill Method: Hollow Stem Augers
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

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Log of Borehole No. 9

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
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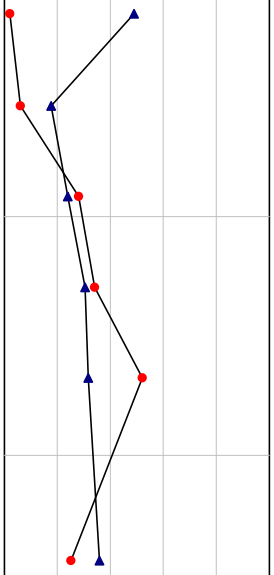
Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		100.19	Ground Surface							
0-2	0	100.19 – 99.44	**Topsoil** Approximately 750 millimetres of topsoil.	SS	1	1,1,1,0	2			
3-16	1-5	99.44 – 94.99	**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to very dense.	SS	2	2,2,4,8	6			
				SS	3	12,14,14,20	28			
				SS	4	18,16,18,23	34			
				SS	5	32,28,24,20	52			
				SS	6	15,15,10,17	25			
17	5	94.99	End of Borehole							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using direct push probe equipment on June 29, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.4 metres and 'wet' at a depth of 2.6 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Direct Push Method
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

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Log of Borehole No. 10

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
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Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	100.54	Ground Surface							
0 / 0	100.35	**Pavement Structure** Approximately 90 millimetre thick interlocking tile over 100 millimetres of compact granular base.							
		Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to very dense.	SS	1	2,2,2,2	4			
			SS	2	1,2,3,3	5			
			SS	3	14,4,6,4	10			
			SS	4	5,6,10,12	16			
			SS	5	13,24,34,40	58			
			SS	6	50/5"	100			
15 / 4	95.74		SS	7	24,50/5"	100			
16 / 5		End of Borehole							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

NOTES:

1. Borehole was advanced using soilid stem auger equipment on July 12, 2018 to termination at a depth of 4.8 metres.

2. Borehole was recorded as open to a depth of 2.4 metres and 'wet' at a depth of 2.3 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:

July 27th - 2.00 metres
August 1st - 2.00 metres

Drill Method: Solid Stem Augers
Drill Date: July 12, 2018
Hole Size: 100 millimetres
Drilling Contractor: Kodiak Drilling

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