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Servicing and Stormwater Management Report

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SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared By:

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Issued: May 31, 2021

Novatech File: 121137
Report Ref: R-2021-076

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May 31, 2021

City of Ottawa
Planning Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor
Ottawa, ON
K1P 1J1

Attention: **Cameron Hodgins**

Reference: **99 Bill Leathem Drive, 2 & 20 Leikin Drive, Ottawa**
Servicing and Stormwater Management Report
Novatech File No.: 121137

Please find enclosed the 'Servicing and Stormwater Management Report' for the above noted project. This report has been submitted in support of the Site Plan Application and is hereby resubmitted for review and approval.

Should you have any questions or comments, please do not hesitate to contact us.

Sincerely,

NOVATECH

Matt Hrehoriak, P.Eng.
Project Engineer| Land Development Engineering

cc:

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

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- PCSWMM Packaged Model Files
  - 100-year 3-hour Chicago Storm

1.0 INTRODUCTION

Novatech has been retained to prepare a Servicing and Stormwater Management Report for the proposed development located at 99 Bill Leathem Drive, 2 & 20 Leikin Drive within the South Merivale Business Park Development (SMBP) in the City of Ottawa. This report will support a Site Plan Application for the proposed development. **Figure 1** is a Key Plan showing the site location.

This report outlines the site sanitary and water servicing, along with the proposed storm drainage and stormwater management strategy for the proposed development.

1.1 Existing Conditions

The property is approximately 30.6 hectares in size, and currently consists of undeveloped vacant land, and cultivated farm field. The property can be accessed from Bill Leathem Drive, Paragon Avenue, and Leikin Drive. There are existing easements containing a sanitary trunk sewer and overhead hydro lines that cross through the property in an east west orientation.

The property is bound by agricultural lands that are part of the City of Ottawa Greenbelt to the north and west and by the remainder of the South Merivale Business Park to the south and east including Leikin Drive, Paragon Avenue, Bill Leathem Drive, a 3-storey office building and vacant parcels. ***Figure 2*** shows the existing site conditions.

In 1992 the City of Nepean prepared a Development Plan (R-Plan by Farley, Smith & Murray Surveying Ltd.) for the South Merivale Business Park. However, this plan did not include a connection to Woodroffe Avenue via Longfields Drive. In 2009/2010 a connection between Woodroffe Avenue to Bill Leatham Drive was designed and constructed to provide westerly connectivity from the South Merivale Business Park. A contemplated draft plan was developed which revised the alignment of the future section of Bill Leatham Drive from Longfields Drive to Leikin Drive but was never deposited. In early 2021, the City of Ottawa removed the requirement for a connection from Bill Leatham Drive to Leikin Drive by returning unopened road allowances to the owners.

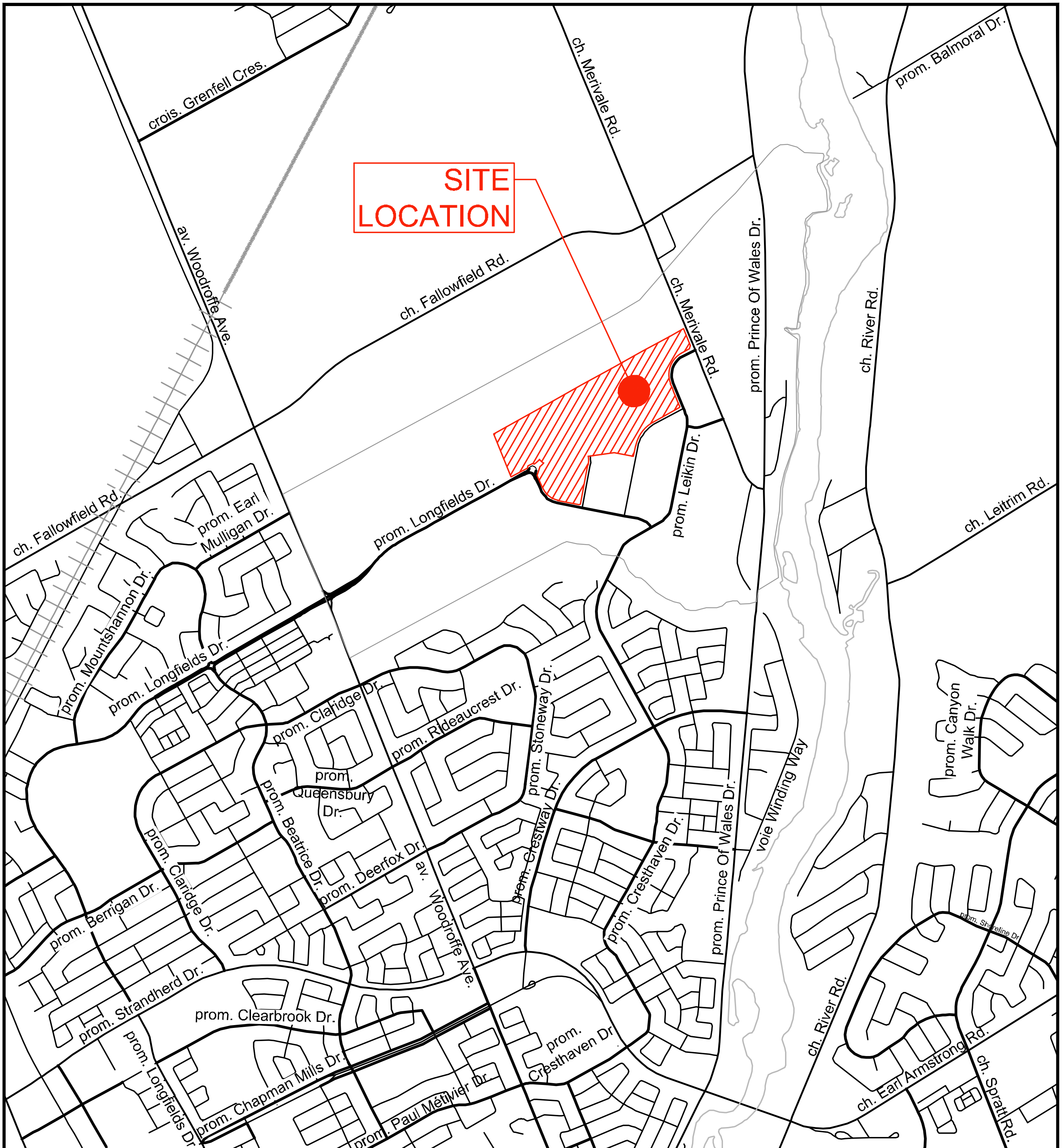
A servicing concept for the South Merivale Business Park has been completed and initial phases have been constructed (i.e. Leikin Drive, Bill Leathem Drive, Paragon Avenue). The servicing design information is provided in a report entitled 'City of Nepean, South Merivale Business Park, Phase II and III, Services Design Report' prepared by Novatech, dated June 23, 1992, hereafter referred to as SMBP Servicing Report. This report outlines the servicing for the roadways with consideration of future lot development.

1.2 Proposed Development

The proposed development consists of a single storey light industrial sortation facility, truck and trailer parking and staff parking lots which will cover approximately 16.2 hectares of the 30.6-hectare site. The remaining 14.4 hectares will remain vacant for the time being with the potential for future developments on the site. Access to the site would be provided by 4 separate entrances, two from the round-a-bout at the Bill Leathem Drive and Longfield Drive intersection, one from Paragon Avenue. A private road will be constructed with a connection to Leikin Drive and Paragon Avenue. **Figure 3** shows the proposed development.

It should be noted that this report should be read in conjunction with the engineering drawing set:

121137-ND Notes and Details
121137-GP General Plan of Services



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N

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PROPERTY LOCATION MAP

SCALE N.T.S

DATE	JOB	FIGURE
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LEGEND

PROPERTY LINE

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EXISTING CONDITIONS PLAN

SCALE	DATE	JOB	FIGURE
1 : 3000 (0 30 60 90 120)	MAY 2021	121137	2

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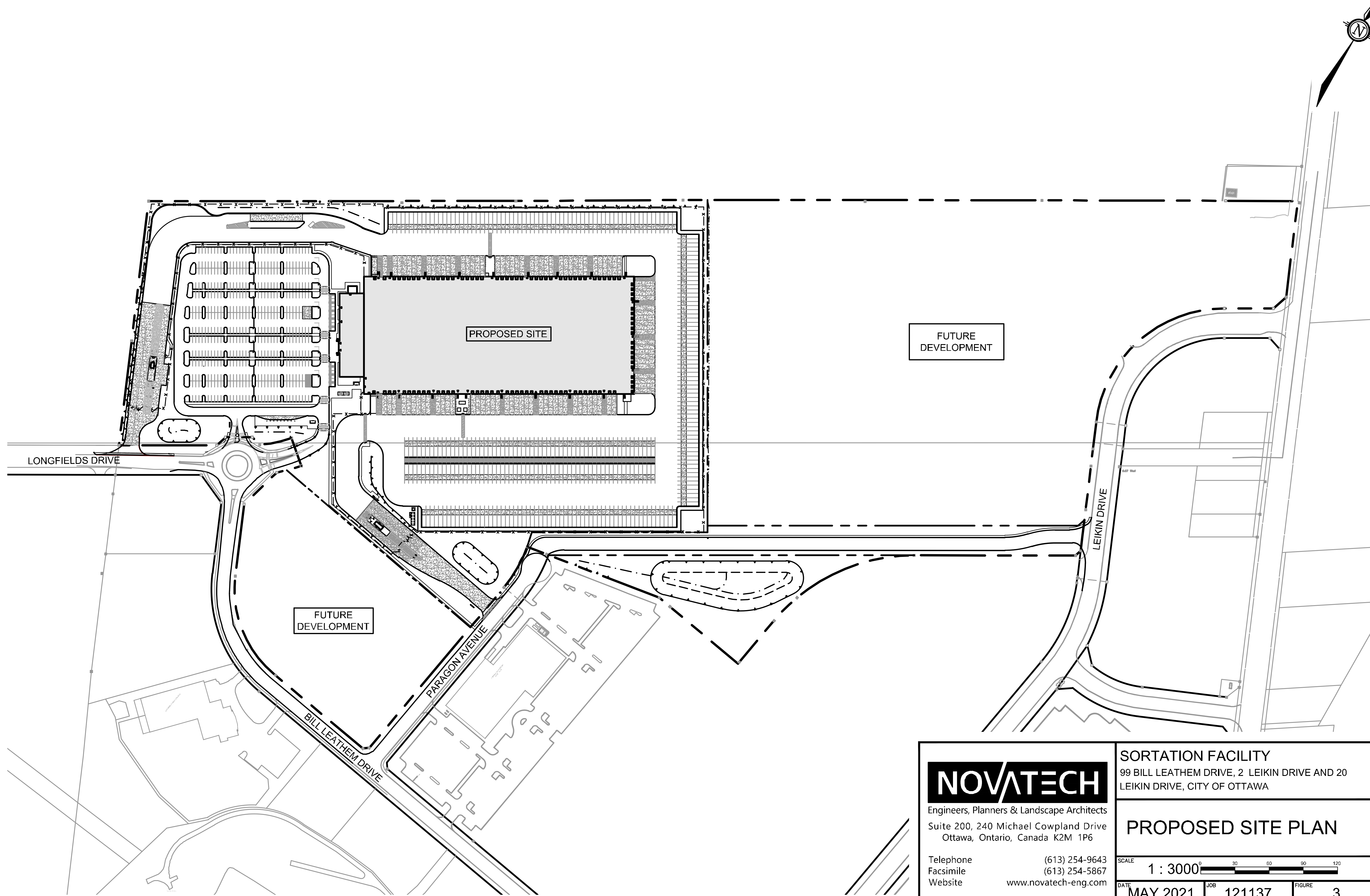

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PROPOSED SITE PLAN

SCALE 1 : 3000 (0 30 60 90 120)

DATE MAY 2021 | JOB 121137 | FIGURE 3

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121137-GR Grading Plan
121137-ESC Erosion Sediment Control Plan

1.3 Site Design and Constraints

As indicated previously the subject site is part of the South Merivale Business Park Development in the City of Ottawa. Servicing design criteria and information for the South Merivale Business Park Development is provided in a report entitled '*City Of Nepean, South Merivale Business Park Phase II and III, Services Deign Report,*' prepared by Novatech, dated June 23,1992. Stormwater Management design criteria and information is provided in a report entitled *'City of Nepean, South Merivale Business Park, Stormwater Management Report'* prepared by Novatech, revised dated December 3, 1991. The South Merivale Business Park Reports provide design criteria for the interior sites and designed the overall servicing systems including sanitary sewers, watermain and stormwater management systems. Each system is discussed in more detail in the appropriate sections of this report.

1.4 Background Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing and stormwater management strategies. This report should be read in conjunction with the following:

- *South Merivale Business Park, 99 Bill Leathem Drive, 2 Leikin Drive and 20 Leikin Drive, Serviceability Report, prepared by Novatech dated March 25, 2021.*
- *City of Nepean, South Merivale Business Park Phase II and III, Services Design Report,*' prepared by Novatech, dated June 23,1992.
- *'City of Nepean, South Merivale Business Park, Stormwater Management Report'* prepared by Novatech, revised dated December 3, 1991.

2.0 WATER SERVICING

2.1 Existing Water Services

There are existing 300mm diameter watermains within the Bill Leathem Drive and Paragon Avenue rights-of-way, and an existing 400mm diameter watermain within the Leikin Drive right-of-way. There are also, existing 200mm and 300mm diameter stubs at the end of Bill Leathem Drive, Paragon Avenue and Leikin Drive for use as future service connections to service the subject property. Refer to **Figure 4** for details on the existing watermain network.

2.2 Proposed Water Servicing

It is proposed to service the development by constructing approximately 900 meters of 250mm dia. private domestic watermain on site. The private watermain on site will provide service for both the domestic and the fire suppression systems. The proposed 250mm dia. watermain on site will connect to the existing 200mm dia. watermain stub in Bill Leathem Drive (north leg of the round-a-bout), to the 300mm dia. watermain stub at the end of Paragon Avenue and to the 400mm dia. Watermain in Leikin Drive. As per the City of Ottawa Technical Bulletin ISDTB-2014-02, the proposed development will require two service connections as the average day demand is greater than 50 cubic meters of water. The two services will be separated by an isolation valve on the existing watermain system in the event maintenance on the system is required. Refer to the General Plan of Services (121137-GP) for water servicing details.

2.2.1 Proposed Development Domestic Water Demands

Design Criteria from the City of Ottawa Water Distribution Guidelines and Section 8 of the Ontario Building Code were used to calculate the theoretical water demands for proposed development. The demand calculations are based on flow requirements for the proposed different uses on site.

The water demand calculations for the proposed development are calculated based on the following criteria:

- Industrial Water Demand
  - per each water closet = 950L/day
  - per each loading bay = 150L/day (each)
- Commercial Office Water Demand
  - per each 9.3m² floor space = 75L/day
- Peaking Factor
  - Max Day = 1.5
  - Peak Hour = 1.8

The domestic water demands for the proposed development are summarized in **Table 2.1** below.

Table 2.1: Domestic Water Demand Summary

Use	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)
Industrial Flows	0.218	0.326	0.588
Commercial Flows	0.142	0.213	0.383
Total Domestic Demands	**0.36**	**0.54**	**0.97**

2.2.2 Proposed Development Fire Protection System

The fire flow requirements and fire protection systems for this type of development are complex therefore Civelec Consulting Inc. a specialized fire consulting engineer was retained. They have calculated the required fire flow for the development to be 2150 USGPM. Civelec has also designed the fire protection infrastructure on site which includes the following:

- An internal pump room in the southwest corner of the building contains a fire pump which draws water from the City watermain to pressurize the fire protection system, which includes:
  - 900 meters of 250mm dia. high pressure fire protection watermain that loops around the building.
  - Six fire hydrants evenly spaced around the building that are directly connected to the high-pressure fire protection watermain loop.
  - Three 200mm connections to the building from the high-pressure fire protection watermain loop to supply the internal sprinkler system.
  - Two fire hydrants connected to the incoming City watermain are located within 45 meters to the Siamese connection.

2.3 Boundary Conditions and Hydraulic Analysis

Watermain boundary conditions were requested as part of the serviceability study that was prepared in support of the Re-Zoning application for the proposed development. The boundary conditions are based on connections to the existing 300mm dia. watermain in Bill Leathem Drive and Paragon Avenue and the 400mm dia. watermain in Leikin Drive. The boundary conditions were based on domestic water demands calculated for a 50% commercial and 50% industrial land use, and the fire flow demands were calculated using the Fire Underwriters Survey method. The boundary condition water demands were calculated using the following criteria provided in Section 4 of City of Ottawa Design Guidelines – Water Distribution:

- Light Industrial Water Demand = 35,000L/ha/day
- Commercial Water Demand = 28,000L/ha/day
- Peaking Factor
  - Max Day = 1.5 ; Peak Hour = 1.8
- Fire Flows = Fire Underwriters Survey

The boundary condition water demands for the development are summarized below in **Table 2.3.**

Table 2.2: Boundary Condition Water Demand Summary

Use	Area (ha)	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
Industrial Flows	15.29	6.19	11.14	20.05	267.00
Commercial Flows	15.29	4.95	7.43	13.37	
Total Water Demands	**30.57**	**11.1**	**18.6**	**33.4**	**267.0**

The boundary conditions provide system pressures and head based on the ground elevation at the site connection locations for three theoretical conditions:

1. High Pressure check under Average Day conditions
2. Peak Hour demand
3. Maximum Day + Fire Flow demand.

A summary of the boundary condition results are provided below in **Table 2.3**.

Table 2.3: Boundary Condition Summary (Existing Conditions)

Condition	Min/Max Allowable Operating Pressures (psi)	Operating Pressures (psi)		
		Connection 1 Bill Leathem Dr	Connection 2 Paragon Ave	Connection 3 Leikin Dr
High Pressure	80psi (Max)	60.0	60.4	59.2
Max Day + Fire Flow	20psi (Min)	49.1	49.5	48.3
Peak Hour	40psi (Min)	21.4	28.0	46.9

Note: Pressures based on Ground Elevation of 90.5m, 90.2m and 91.0m respectively.

Through correspondence with the City it is understood that planned watermain improvements (SUC Zone reconfiguration), will result in altered boundary conditions for the site. The future boundary conditions are provided in **Table 2.4**.

Table 2.4: Boundary Condition Summary (Post SUC Zone Reconfiguration)

Condition	Min/Max Allowable Operating Pressures (psi)	Operating Pressures (psi)		
		Connection 1 Bill Leathem Dr	Connection 2 Paragon Ave	Connection 3 Leikin Dr
High Pressure	80psi (Max)	78.4	78.8	58.7
Max Day + Fire Flow	20psi (Min)	74.8	75.2	52.1
Peak Hour	40psi (Min)	39.2	45.9	33.1

Note: Pressures based on Ground Elevation of 90.5m, 90.2m and 91.0m respectively.

The SUC zone reconfiguration will result in a notable increase in available pressures at the Bill Leathem Drive, and Paragon Avenue connections, and a negligible decrease in the available head at the Leikin Drive connection. The future pressures at Bill Leathem Drive and Paragon avenue will be +/- 78 psi, which is just below the allowable 80 psi threshold. Thus, it is recommended that a pressure reduction valve be installed at the property limits to prevent high pressures within the private watermain system. The SUC Zone reconfiguration will improve the pressures to the site and will not adversely affect the feasibility of the subject development.

Based on the watermain pressures outlined in the City boundary conditions it can be concluded that the watermain infrastructure surrounding the South Merivale Business can provide adequate pressures for domestic use and flows for fire protection. The boundary conditions were based on water demands that are significantly greater than the requirements of the current proposed development. The flows accounted for are conservative and would allow for future development on the site. Based on the latest boundary conditions Refer to **Appendix A** for water demand calculations, fire flow calculations, watermain schematics, and City of Ottawa watermain boundary conditions.

3.0 SANITARY SERVICING

3.1 Existing Sanitary Services

The 1050mm dia. Barrhaven Sanitary Trunk sewer is in an easement which crosses the site. There is an existing 250m dia. municipal sanitary sewer in Paragon Avenue, Bill Leathem Drive and Leikin Drive (north of the sanitary trunk sewer easement). There is also an existing 750mm dia. sanitary trunk sewer in Leikin Drive (south of the trunk sewer easement).

The sanitary sewer outlet for the South Merivale Business Park is the Barrhaven Trunk Sanitary Sewer which flows to the West Rideau Collector Sewer. Sanitary manhole 62 on the sanitary trunk sewer was indicated as the outlet location for most of the proposed development area.

Refer to **Figure 4** for details on the existing sanitary servicing network.

3.2 Proposed Sanitary Services

It is proposed to service the majority of the development by constructing approximately 325m of 250mm dia. private sanitary sewer on site. The proposed 250mm dia. sewer will outlet to the existing 1050mm dia. Barrhaven Sanitary Trunk Sewer at EX SANMH 62 as per the SMBP Phase II and III Services design Report. It is proposed to service the western Guardhouse by constructing approximately 120m of 200mm dia. private sanitary sewer on site with a connection to the 250mm dia. sanitary sewer in Bill Leathem Drive (capped stub north leg of round-a-bout). Refer to the General Plan of Services (120025-GP) for details.

3.2.1 Proposed Peak Sanitary Flows

The total theoretical peak sanitary flow for the proposed development was calculated based on the following criteria from Section 4 of the City of Ottawa Sewer Design Guidelines and Section 8 of the Ontario Building Code:

- Total Development Area = 28.3ha
- Industrial Sanitary Flow
  - per each water closet = 950L/day
  - per each loading bay = 150L/day (each)
  - Future Development Area = 35,000 L/ha/day
- Commercia Office Sanitary Flow
  - per each 9.3m² floor space = 75L/day
  - Future Development Area = 28,000 L/ha/day
- Commercial Peaking Factor = 1.5
- Light Industrial Peaking Factor = 3.5 (Appendix 4-B)
- Infiltration Rate = 0.33L/s/ha

The proposed sanitary flows are summarized below in **Table 3.1**.

Table 3.1: Peak Sanitary Flow Summary

Proposed Use	**Peak Flow (L/s)**
Industrial Flows	0.78
Commercial Flows	0.27
Sewer Infiltration Flow	4.62
Total Peak Flows	**5.67**
Future Commercial Development Flow Allotment	1.36
Future Light Industrial Flow Allotment	16.81
Future Sewer Infiltration Flow Allotment	4.73
Total Additional Future Peak Flows	**22.90**
Total Development Peak Flows	**28.57**

3.3 SMBP Sanitary Flow Allotment

The SMBP Phase II and III Services Design Report provides design criteria which was used to calculate the sanitary flow allotments for the development area. Based on the existing sanitary design sheet and drainage area plan there are multiple local municipal sanitary sewer outlets available for the proposed development. The sanitary flow allotment to each sanitary sewer outlet was calculated based on the following design criteria provided SMBP Services Report:

- Population Equivalent = 100 persons/ha
- Design Sanitary Flow = 450 L/person/day (Commercial/Institutional Flow Rate)
- Light Industrial Peaking Factor =2.8
- Infiltration Rate = 0.11L/s/ha

The sanitary flow allotments to each sanitary sewer outlet are summarized below in **Table 3.2**.

Table 3.2: Sanitary Flow Allotment Summary

SEWER OUTLET LOCATION	Area (ha)	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Design Flow (L/s)
Bill Leathem Dr	4.9	7.15	0.53	7.53
Paragon Ave	2.0	2.92	0.21	2.98
Trunk Sewer EX SANMH 62	17.4	25.38	1.91	27.29
Leikin Dr	3.4	4.96	0.37	5.33
Bill Leatham Dr (via Street C)	2.8	4.08	0.31	4.39
Total Allocation	**30.5**	**44.48**	**3.36**	**47.83**

The total flow allotment for the development area to the Barrhaven Sanitary Trunk Sewer was calculated to be 47.8 L/s. A copy of the existing sanitary drainage area plans and sanitary sewer design sheet from the SMBP Phase I and II Report are provided in **Appendix B** for reference.

The proposed 250mm dia. private sanitary sewer on site has a theoretical capacity of 32.5 L/s at the minimum slope of 0.3%. Therefore, there is adequate capacity in the proposed infrastructure to convey the required peak flow of 5.67 L/s from the site. Also, based on the total flow allotment of 47.8 L/s there is capacity in the existing infrastructure for the proposed development and future developments on the site. Refer to **Appendix B**, for the proposed detailed sanitary flow calculations, sanitary drainage area pans and sanitary sewer design sheets.

4.0 STORM SERVICING AND STORMWATER MANAGEMENT

The storm servicing and stormwater management strategy for the site is based on the established criteria in the 1991 SMBP SWM Report.

4.1 Existing Storm Services

The storm infrastructure servicing the South Merivale Business Park includes a downstream stormwater management facility and storm sewers with sizes ranging from 525mm to 2400mm in diameter. There is an existing 675mm dia. storm sewer in Bill Leathem Drive and a 1050mm dia. storm sewer in Paragon Avenue which are the proposed storm sewer outlets for the development. The stormwater management facility is located to the south of Bill Leatham Dr and provides quality control of stormwater prior to out letting to Barrhaven Creek. Refer to **Figure 4** for details on the existing storm servicing network.

4.2 Stormwater Management Criteria

4.2.1 Stormwater Quality Control

The existing downstream stormwater management facility was sized to provide quality control for the development. No further lot level quality control measures are required.

4.2.2 Stormwater Quantity Control – Allowable Release Rate

The 1991 SMBP SWM Report included the following stormwater management criteria for the future development blocks that drain to the downstream SWM Facility:

- Stormwater is to be controlled to a 5-year release rate using a runoff coefficient of 0.24 and a time of concentration of 15 minutes. Stormwater is to be controlled up to and including the 100-year storm event.
- Ensure no overland flow for all storms up-to and including the 100-year event.

The proposed development will outlet to storm maintenance holes 139 in Bill Leathem Drive and 159 & 160 in Paragon Avenue. The 5-year allowable release rate to these manholes were calculated using the rational method with the criteria provided above to be:

Structure	100-year Allowable Release Rate
EX STM 139	165.0 L/s
EX STM 159/160	1,034.2 L/s

Note that the off-site storm sewer was designed to convey the 5-year peak flow and surcharge during larger storm events. The storm sewer can surcharge as there are no basement connections.

4.3 Proposed On-Site Storm Infrastructure

The on-site storm sewer and stormwater management system will include storm sewers ranging in size from 300mm to 1500mm in diameter. On-site storage will be provided underground in the storm sewer system and on the surface in dry ponds. Peak flows will be attenuated to the allowable release rates specified using orifices. The inlet controls at each flow control structures are as follows:

HW1001: 230mm orifice
HW2001: 235mm orifice
HW3001: 533mm orifice

No surface storage in the parking areas or on the building roofs are accounted for in the storm servicing design. The 100-year peak flow will be attenuated to the allowable release rate via the underground storm sewer system and dry ponds (at the request of the client).

Refer to the General Plan of Services (121137-GP) for details.

4.3.1 Storm Sewer Sizing Criteria

The storm drainage design is based on the principals of dual drainage (i.e. minor and major system). The on-site storm sewers (i.e. minor system) have been designed based on the criteria outlined in the City of Ottawa Sewer Design Guidelines (October 2012) and associated technical bulletins. The design criteria used in sizing the storm sewers are summarized in **Table 4.1**.

Table 4.1: Storm Sewer Design Parameters

Parameter	Design Criteria
Private Roads	5 Year Return Period
Storm Sewer Design	Rational Method
IDF Rainfall Data	Ottawa Sewer Design Guidelines
Initial Time of Concentration (Tc)	10 min
Minimum Velocity	0.8 m/s
Maximum Velocity	3.0 m/s
Minimum Diameter	250 mm

Refer to the storm sewer design sheets provided in **Appendix C** and Storm Drainage Area Plan (Drawing 120025-STM).

4.3.2 Overland Flow Sizing Criteria

As previously indicated all flows will be contained underground and in the dry ponds for all storm events up-to and including the 100-year storm event. Storm events that exceed the 100-year storm will pond on the surface and be conveyed through major system flow pathways. The grading design includes maximum 0.35m of surface ponding before ‘spilling’ over a high-point. This would happen only in very rare events that exceed the 100-year storm.

Refer to the Grading Plan (Drawing 121137-GR).

4.4 Stormwater Management Modeling

The *City of Ottawa Sewer Design Guidelines* (October 2012) requires hydrologic / hydraulic modeling for all dual drainage systems. The performance of the proposed storm drainage system for the site was evaluated using the PCSWMM hydrologic / hydraulic model.

The PCSWMM model schematics and 100-year model output data are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided on the enclosed CD.

4.4.1 Design Storms

The hydrologic analysis was completed using the following synthetic design storms:

- 3-hour Chicago storm distribution
- 12-hour SCS Type II storm distribution

The return periods analyzed include the 5-year & 100-year storm events. The IDF parameters used to generate the design storms were taken from the *City of Ottawa Sewer Design Guidelines* (October 2012).

The 3-hour Chicago distribution generated the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The proposed drainage system was also 'stress tested' using a 100-year (+20%) 3-hour Chicago design storm. This design storm has a 20% higher intensity and total volume compared to the 100-year event.

4.4.2 Model Development

The PCSWMM model includes the subcatchment areas for the proposed development and the future development drainage area (FUT-1) to the east which is tributary to Pond 3 and ultimately the 1050mm dia. storm sewer outlet in Paragon Ave. Individual drainage areas to each inlet have been lumped together to determine the total area to each pipe run. The purpose of the model is to ensure that the proposed storm drainage and stormwater management system adheres to the allowable release rates specified and that there is no surface ponding during the 100-year storm event.

Infiltration

Infiltration losses for all catchment areas were modeled using Horton's infiltration equation, which defines the infiltration capacity of soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values as specified in the City of Ottawa Sewer Design Guidelines were used for all catchments.

Horton's Equation:	Initial infiltration rate:	$f_o = 76.2$ mm/hr
$f(t) = f_c + (f_o - f_c)e^{-k(t)}$	Final infiltration rate:	$f_c = 13.2$ mm/hr
	Decay Coefficient:	$k = 4.14$/hr

Depression Storage

The default values for depression storage in the City of Ottawa were used for all subcatchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

The rooftops assumed to provide no depression storage (zero-impervious parameter).

Equivalent Width

'Equivalent Width' refers to the width of the sub-catchment flow path. This parameter (Table 5.1) is calculated as described in Section 5.4.5.6 of the City of Ottawa Sewer Design Guidelines. The flow path lengths are shown on the PCSWMM model schematics provided in **Appendix D**.

Impervious Values

Runoff coefficients for each subcatchment area were determined based on the proposed site plan. Refer to the Storm Drainage Area Plan (120025-SWM) for details. Percent impervious values were calculated using:

%imp = (C – 0.20) / 0.70

Storm Drainage Areas

For modeling purposes, the site has been divided into subcatchments based on the drainage areas tributary to each inlet of the proposed storm sewer system. The subcatchment areas are shown on the Storm Drainage Area Plan (121137-STM).

The hydrologic modeling parameters for each subcatchment were developed based on the Site Plan (**Figure 3**) and Storm Drainage Area Plan specified above. Subcatchment parameters are provided in **Table 4.2**.

Table 4.2: Subcatchment Parameters

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	Zero-Imperv. (%)	Equiv. Width (Flow Length) (m)	Average Slope (%)
Controlled Areas						
A-01	0.46	0.87	96	0	68(68)	1.5
A-02	0.30	0.82	89	0	40(75)	1.5
A-03	0.26	0.86	94	0	70(37)	1.5
A-04	0.16	0.84	91	0	70(23)	1.5
A-05	0.73	0.78	83	0	100(73)	1.5
B-01	0.29	0.83	90	0	70(42)	1.5
B-02	0.27	0.84	91	0	74(37)	1.5
B-03	0.08	0.9	100	100	36(22)	1.5
B-04	0.17	0.86	94	0	74(23)	1.5
B-05	0.08	0.9	100	100	36(22)	1.5
B-06	0.61	0.7	71	0	70(87)	1.5
B-07	0.30	0.65	64	0	42(71)	1.5
B-08	0.21	0.76	80	0	35(60)	1.5
B-09	0.23	0.64	63	0	30(76)	1.5
C-01	0.66	0.56	51	0	55(119)	1.5
C-02	0.73	0.9	100	0	60(121)	1.5
C-03	0.72	0.9	100	100	140(52)	1.5
C-04	0.75	0.85	93	0	60(125)	1.5
C-05	0.50	0.9	100	100	97(51)	1.5
C-06	0.54	0.79	84	0	65(58)	1.5
C-07	0.38	0.84	91	0	65(48)	1.5
C-08	0.91	0.85	93	0	55(165)	1.5
C-09	0.76	0.9	100	100	147(51)	1.5
C-10	0.45	0.9	100	100	88(52)	1.5
C-11	0.51	0.87	96	0	56(90)	1.5
C-12	0.31	0.8	86	0	65(48)	1.5
C-13	0.82	0.85	93	0	64(129)	1.5
C-14	0.57	0.9	100	0	64(90)	1.5
C-15	0.41	0.78	83	0	65(62)	1.5
C-16	0.19	0.65	64	0	20(97)	1.5
C-17	0.19	0.61	59	0	20(95)	1.5

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	Zero-Imperv. (%)	Equiv. Width (Flow Length) (m)	Average Slope (%)
C-18	0.22	0.56	51	0	26(85)	1.5
C-19	0.22	0.56	51	0	26(84)	1.5
C-20	0.35	0.56	51	0	26(134)	1.5
PND1	0.20	0.2	0	0	25(79)	1.5
PND2	0.34	0.2	0	0	50(68)	1.5
PND3	1.09	0.2	0	0	55(198)	1.5
FUT 1	8.45	0.85	93	25	280(302)	1.5
TOTAL (Controlled)	**24.42**	**0.78**	**83**	**-**	**-**	**-**
Uncontrolled / Direct Runoff Areas						
D-01	0.09	0.2	0%	0	4(223)	1.5
D-02	0.18	0.2	0%	0	6.3	1.5
D-03	0.01	0.34	20%	0	15	1.5
TOTAL (Uncontrolled)	**0.28**	**0.20**	**0**	**-**	**-**	**-**

4.4.3 Model Results

The on-site storage and conveyance system requirements were refined using the PCSWMM model. The model was used to ensure that peak flows are controlled to the allowable release rates and ensure that the 100-year hydraulic grade line is contained on-site within the storm sewer system.

Storage Requirements

Per the client request, the 100-year storm event is to be confined underground in the proposed storm sewer and dry pond stormwater management system. The PCSWMM model provided the storage volume requirements for the system. The storage required and storage provided in the storm sewers and stormwater management system is shown in **Table 4.3** below.

Table 4.3: Required (100-year) and Provided Storage Volumes

Storage Node	Drainage Area (ha)	Inlet Control Device	Required 100-yr Storage Volume* (m^3)	Provided Storage Volume (m^3)
Storage-PND-1	19.73	230mm dia. Plate ICD	545	739
Storage-PND-2	2.11	235mm dia. Plate ICD	559	877
Storage-PND-3	2.58	533mm dia. Plate ICD	6,678	9,333
TOTAL	**24.42**	**-**	**7,782**	**10,949**

**Based on PCSWMM Model Results for a 100-year, 3-hour Chicago Storm.*
***Required and Provided Storage Volumes are for the Dry Pond Only*

Peak Flows

As shown in **Table 4.4**, the overall release rates from the site will adhere to the allowable release rates specified in **Section 4.2.2**. Peak flows from the site are release at a controlled rate to storm

MH's 139, 159 & 160. The uncontrolled drainage areas are not tributary to the SMBP storm sewer and generate negligible flows and have therefore, been excluded from the results.

Table 4.4: Summary of Peak Flows

Outfall	Allowable Release Rate (L/s)	Peak Flow (L/s)		
		5 Year	100 Year	100 Year +20%
EX STMMH 139	165.0	131.7	163.2	173.9
EX STMMH 159 /160	1034.2	774.3	1012.6	1105.2

**Based on PCSWMM Model Results for a 3-hour Chicago Storm; outfall results account for hydrograph timing.*

Hydraulic Grade Line (HGL)

The PCSWMM model was used to estimate the hydraulic grade line (HGL) elevation of the of the storm sewer system during the 100-year storm event. **Table 4.5** provides a summary of the 100-year HGL elevation at each storm manhole within the proposed development. The model results indicate that the 100-year HGL elevations will be confined within the storm sewer system.

Table 4.5: Estimated Hydraulic Grade Line (HGL) Elevations

MH ID	Obvert Elevation (m)	T/G Elevation (m)	100-yr HGL Elevation (m)	Surcharge (m)	Clearance from T/G (m)	HGL in Stress Test (m)
CBMH-101	88.74	90.65	90.07	1.33	0.58	90.37
CBMH-102	88.86	90.75	90.08	1.22	0.67	90.37
CBMH-103	88.93	90.75	90.09	1.16	0.66	90.39
CBMH-104	89.11	90.91	90.34	1.24	0.57	90.63
CBMH-105	89.36	90.80	90.60	1.24	0.20	90.80
CBMH-202	88.10	90.15	89.23	1.13	0.92	89.54
CBMH-203	88.29	89.67	89.34	1.05	0.33	89.67
CBMH-204	88.42	90.10	89.39	0.97	0.71	89.84
CBMH-205	88.65	90.75	89.75	1.10	1.00	90.36
CBMH-206	88.76	90.80	89.90	1.14	0.90	90.55
CBMH-207	88.83	90.85	90.00	1.17	0.85	90.65
CBMH-208	88.95	90.90	90.33	1.38	0.57	90.90
CBMH-303	88.60	89.45	88.97	0.37	0.48	89.40
CBMH-314	89.05	90.15	89.89	0.84	0.26	90.15
MH-201	88.01	90.51	89.22	1.21	1.29	89.53
MH-301	88.23	89.91	88.96	0.73	0.95	89.39
MH-302	88.35	89.76	88.97	0.62	0.79	89.40
MH-304	88.46	89.83	88.99	0.53	0.84	89.48
MH-305	88.56	90.08	89.20	0.64	0.88	89.77
MH-306	88.78	90.30	89.56	0.78	0.74	90.26
MH-307	88.52	90.16	89.15	0.63	1.01	89.67
MH-308	88.64	90.34	89.43	0.79	0.91	90.06

MH ID	Obvert Elevation (m)	T/G Elevation (m)	100-yr HGL Elevation (m)	Surcharge (m)	Clearance from T/G (m)	HGL in Stress Test (m)
MH-309	88.76	90.35	89.60	0.84	0.75	90.31
MH-310	88.59	90.35	89.28	0.69	1.07	89.79
MH-311	88.67	90.29	89.38	0.71	0.91	89.89
MH-312	88.84	90.34	89.58	0.74	0.76	90.11
MH-313	88.96	90.35	89.67	0.71	0.68	90.18
MH-401	88.48	89.83	88.96	0.48	0.87	89.39
MH-402	88.60	90.09	88.97	0.37	1.12	89.40
MH-403	88.84	90.22	88.97	0.13	1.25	89.40

**Based on PCSWMM Model Results for a 3-hour Chicago Storm.*

<u>*Stress Test*</u>

Table 4.5 also provides the estimated HGL elevations for the 'stress test' event. The stress test event represents a 20% increase (rainfall intensity and total precipitation) in the 100-year design event. The 'stress test' event will not be confined within the storm sewer system. Ponding will occur within the parking lot sags and may cascade off-site. The major system overland flow will be diverted through overland pathways and spill off-site to Bill Leathem Drive and Paragon Avenue; ultimately discharging to Barrhaven Creek.

<u>*Foundation Drains*</u>

The proposed building will be slab-on-grade, as such, there are no concerns with the surcharged HGL elevations. The general grade of the site will allow water to pond in the parking lot and overflow downstream before impacting the building, which is at a higher grade. Refer to the Grading Plan (drawing 121137-GR).

4.4.4 Future Development Area

The PCSWMM model includes the 8.45 ha future development area to the east. This area is tributary to Pond 3 and the required storage volume will be accounted for in the design. A 1500mm dia. storm sewer stub will be constructed for future connection. This area is represented in the model based on the following:

Drainage Area: 8.45 ha
Imperviousness: 93% (C=0.85)

5.0 EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter socks (catchbasin inserts) will be placed in existing and proposed catchbasins and catchbasin manholes, and will remain in place until vegetation has been established and construction is completed;
- Silt fencing will be placed along the surrounding construction limits;
- Mud mats will be installed at the site entrances;

- Strawbale or rock check dams will be installed in swales and ditches;
- The contractor will be required to perform regular street sweeping and cleaning as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site;

Erosion and sediment control measures should be inspected daily and after every rain event to determine maintenance, repair or replacement requirements. Sediments or granulars that enter site sewers shall be removed immediately by the contractor. These measures will be implemented prior to the commencement of construction and maintained in good order until vegetation has been established. Refer to the Erosion and Sediment Control Plan (121137-ESC) for additional information.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Watermain

The analysis of the proposed watermain network confirms the following:

- The proposed private 250mm dia. watermain that connects to the existing 300mm dia. watermain in Bill Leathem Drive and Paragon Avenue and the 400mm dia. watermain in Leikin Drive can service the proposed development.
- There are adequate pressures in the existing watermain infrastructure to meet the required domestic demands for the development.
- There is adequate flow to service the proposed fire protections system.

Sanitary Servicing

The analysis of the proposed sanitary servicing confirms the following:

- There is adequate capacity within the existing sanitary infrastructure to service the proposed development.
- The existing sanitary allotment would allow for future expansion or development on site.

Stormwater Management

The following provides a summary of the storm sewer and stormwater management system:

- Proposed storm sewer system is to connect with the existing storm sewer system on Bill Leathem Drive and Paragon Avenue.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 5-year peak flow using the Rational Method.
    - Underground storage is to be provided within the storm sewer system and surface storage is provided in dry ponds.
    - There will be no surface ponding in the parking lot or truck court area during the 100-year storm event as the 100-year hydraulic grade line (HGL) is contained within the storm sewer system.
- Parking lot graded to ensure that static ponding depths do not exceed 0.35m.
    - Surface ponding would only office for storm events greater than the 100-year event.

  - A major overland flow route is provided to Bill Leathem Drive/ Paragon Avenue and ultimately to the down stream stormwater management facility.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, catchbasin inserts, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.

7.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:

Matt Hrehoriak, P.Eng.
Project Engineer
Land Development Engineering

Reviewed by:

J. Lee Sheets, C.E.T.
Director
Land Development Engineering

Appendix A
Water Servicing Information

Detailed Building Use Domestic Water Demands

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Industrial Building:	150	L/day/loading bay
	950	L/day/bathroom
Commercial Office:	75	L/day/9.3m² Floor area

Commercial / Industrial Peaking Factors City of Ottawa Water Distrubution Guidelines

Conditions	Peaking Factor	
Maximum Day	1.5	x avg day
Peak Hour	1.8	x max day

Proposed Development Conditions

	Commercial Office	Industrial Building	Totals
Floor Area	1520	N/A	
No. Bathrooms	N/A	4	
No. Loading Bays	N/A	100	
Total Daily Volume (Liters)	12258.1	18800.0	31058.1
Avg Day Demand (L/s)	0.142	0.218	0.36
Max Day Demand (L/s)	0.213	0.326	0.54
Peak Hour Demand (L/s)	0.383	0.588	0.97

Land Use Water Demands Calculations

Table 1

Water Demand

	Area (ha)	Demand (L/s)		
		Avg Day	Max. Daily	Peak Hour
Light Industrial use	**15.29**	6.19	11.14	20.05
Commercial Use	**15.29**	4.95	7.43	13.37
Total	30.57	11.14	18.6	33.42

Avg. Daily Demand (City of Ottawa Sewer Design Guidelines):

- Light Industrial	35000	L/ha/day
- Commercial	28000	L/ha/day

Commercial / Industrial Peaking Factors (City of Ottawa Water Distrubution Guidelines)

Max. Daily Demand:	1.5	x Avg. Day
Peak Hourly Demand:	1.8	x Max. Day

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 120187
Project Name: 99 Bill Leathem Dr., 2 Leikin Dr., and 20 Leikin Dr
Date: 3/4/2021
Input By: Anthony Mestwarp
Reviewed By: Cara Ruddle

Legend: Input by User; No Information or Input Required

Building Description: Industrial
Fire Resistive Construction

Step			Choose		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame		1.5	0.6	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)	Yes	0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	37200			
		Number of Floors/Storeys	5			
		Protected Openings (1 hr)	Yes			
		Area of structure considered (m^2)			**55,800**	
	F	**Base fire flow without reductions**				**31,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	0%	**31,000**
		Limited combustible		-15%		
		Combustible	Yes	0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-15,500**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	Yes	-10%	-10%	
				Cumulative Total	**-50%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	> 45.1m		0%	**0**
		East Side	> 45.1m		0%	
		South Side	> 45.1m		0%	
		West Side	> 45.1m		0%	
				Cumulative Total	**0%**	
Results						
6	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**16,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**267**
				or	USGPM	4,227
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	3.5
		Required Volume of Fire Flow (m^3)			m^3	3360

Boundary Conditions
South Merivale Business Park

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	668	11.14
Maximum Daily Demand	1,116	18.60
Peak Hour	2,005	33.42
Fire Flow Demand #1	16,000	266.67

Location

Results – Existing Conditions

Connection 1 – Bill Leathem Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.7	60.0
Peak Hour	125.0	49.1
Max Day plus Fire 1	105.5	21.4

Ground Elevation = 90.5 m

Connection 2 – Paragon Ave.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.7	60.4
Peak Hour	125.0	49.5
Max Day plus Fire 1	109.9	28.0

Ground Elevation = 90.2 m

Connection 3 – Leikin Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.7	59.2
Peak Hour	125.0	48.3
Max Day plus Fire 1	124.1	46.9

Ground Elevation = 91.0 m

Results – SUC Zone Reconfiguration

Connection 1 – Bill Leathem Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	145.7	78.4
Peak Hour	143.1	74.8
Max Day plus Fire 1	118.1	39.2

Ground Elevation = 90.5 m

Connection 2 – Paragon Ave.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	145.6	78.8
Peak Hour	143.1	75.2
Max Day plus Fire 1	122.5	45.9

Ground Elevation = 90.2 m

Connection 3 – Leikin Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.3	58.7
Peak Hour	127.7	52.1
Max Day plus Fire 1	114.4	33.1

Ground Elevation = 91.0 m

Notes

1. **Watermain looping on Bill Leathem Dr. and Paragon Ave. was added to meet minimum fire flow requirements of 20 psi.**

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix B

Sanitary Servicing Information

Detailed Building Use Sanitary Flows

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Industrial Building:	150	L/day/loading bay
	950	L/day/bathroom
Commercial Office:	75	L/day/9.3m² Floor area

Daily Demands from City of Ottawa Sewer Design Guidelines

Establishment	Daily Demand Volume	
Avg Commercial Flow	28000	L/ha/day
Avg Industrial Flow	35000	L/ha/day

Commercial / Industrial Peaking Factors City of Ottawa Sewer Design Guidelines

Building Use	Peaking Factor	
Commercial	1.5	Sewer Design Guidelines Appendix 4A
Industrial	3.6	Sewer Design Guidelines Appendix 4B

Proposed Building Sanitary Flows

	Commercial Office	Industrial Building	West Guard House	East Guard House	Totals
Floor Area	1520	N/A	13.82	25.85	
No. Bathrooms	N/A	4	N/A	N/A	
No. Loading Bays	N/A	100	N/A	N/A	
Total Daily Volume (Liters)	12258.1	18800.0	1036.5	1938.8	34033.3
Peak Building Sanitary Flow (L/s)	0.213	0.783	0.018	0.034	**1.05**

Future Development Area

	FUT 1 (Commercial)	FUT 2 (Light Industrial)	Totals
Area (ha)	2.8	11.5	14.3
Total Daily Volume (Liters)	78400.0	403550.0	481950.0
Peak Building Sanitary Flow (L/s)	1.36	16.81	18.18

Extraneous Flows

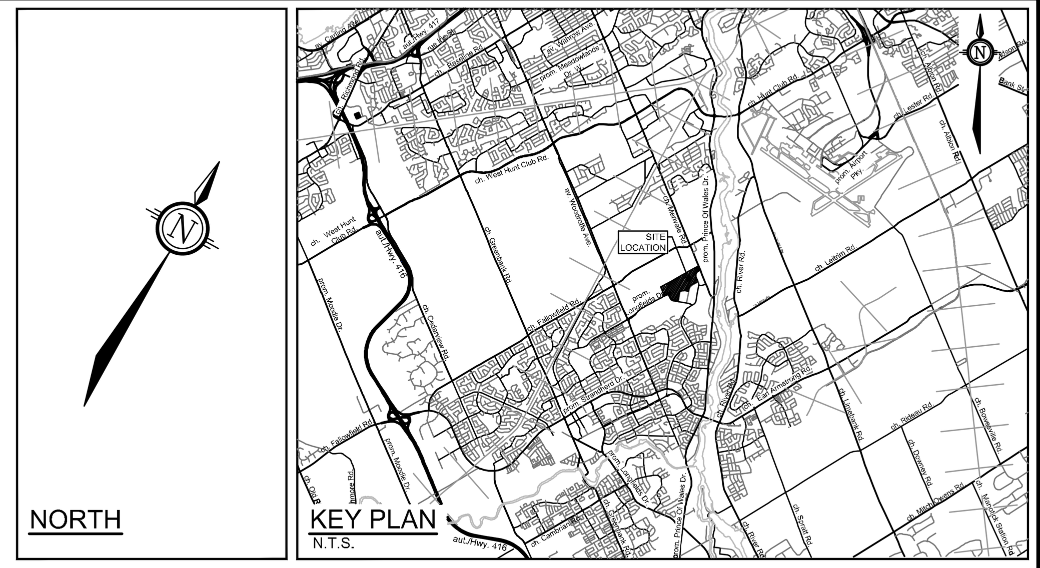
Total Site Area (ha)	Extraneous Flow Alottment (L/s/ha)	Total Extraneous Flows (L/s)
28.34	0.33	**9.35**

Total Site Peak Sanitary Flows

Total Peak Building Sanitary Flows (L/s)	Future Development Area Sanitary Flows (L/s)	Total Extraneous Flows (L/s)	Total Site Peak Flows (L/s)
1.05	18.18	9.35	**28.58**

LEGEND

- PROPERTY LINE
- PROPOSED SANITARY SEWER AND MANHOLE
- DIRECTION OF FLOW
- SAN MH — EXISTING SANITARY MANHOLE & SEWER
- SANITARY SEWER DRAINAGE AREA BOUNDARY
- 6.388 — DRAINAGE AREA (ha)
- A-01 — SAN SEWER PIPE RUN
- N/A N/A — POPULATION / NO. UNITS



REFER TO 121137-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN APPROVAL	MAY 31/2021	MJH

SCALE
1:1250
1:1250
0 10 20 30 40 50

DESIGN	MJH/ARM
CHECKED	JLS
DRAWN	MJH/ARM
CHECKED	JLS
APPROVED	JLS

FOR REVIEW ONLY

ISSUED FOR REVIEW

ISSUED FOR REVIEW

NOVATECH
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Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
SORTATION FACILITY
99 BILL LEATHEM DR, 2 & 20 LEIKIN DR, CITY OF OTTAWA

DRAWING NAME
SANITARY SEWER DRAINAGE AREA PLAN

PROJECT No. 121137
REV REV #1
DRAWING No. 121137-SAN

PLANB1.DWG - 1000mmx707mm

Project No. 121137
Project Name: Sortation Facility
Project Location: South Merivale Business Park, Ottawa

NOVATECH
Engineers, Planners & Landscape Architects

Date: May 2021

Sanitary Sewer Design Sheet

LOCATION			COMMERCIAL / INDUTRIAL FLOW							PIPE					
AREA ID	FROM	TO	AREA (ha)	ACCUM AREA (ha)	PEAK FACTOR	PEAK FLOW (l/s)	ACCUM PEAK FLOW (l/s)	INFIL. FLOW (l/s)	TOTAL PEAK FLOW (l/s)	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	Q/Qfull
West System															
A-01	103	102	3.23	3.23	1.5	0.018	0.02	1.07	1.08	200	2.00	42.2	46.3	1.5	2.3%
	102	101		3.23	0.0	0.000	0.02	1.07	1.08	200	0.50	55.0	23.2	0.7	4.7%
	101	ex		3.23	0.0	0.000	0.02	1.07	1.08	200	0.30	22.5	17.9	0.6	6.0%
East System (Trunk Sewer Connection)															
A-05	205	203	0.78	0.78	1.5	0.034	0.03	0.26	0.29	250	0.30	77.8	32.5	0.7	0.9%
A-02	204	205	2.95	2.95	Varies	0.474	0.47	0.97	1.45	150	2.00	23.2	21.5	1.2	6.7%
A-03	203	201	3.11	6.84	3.6	0.261	0.77	2.26	3.03	250	0.30	102.2	32.5	0.7	9.3%
A-04	202	201	3.94	3.94	3.6	0.261	0.26	1.30	1.56	250	1.00	66.5	59.4	1.2	2.6%
	201	EX 62		10.78	0.0	0.000	1.03	3.56	4.59	250	0.50	33.2	42.0	0.9	10.9%
							1.05	4.62	5.67						

* Area A-02 contains commercial and industrial land uses with peaking factors of 1.5 and 3.5 respectively. Refer to the detailed building use sanitary flows for a comprehensive breakdown.

** The Industrial portion of the building was divided evenly between the 3 proposed building services (areas A-02, A-03, and A-04).

Design Parameters:

City of Ottawa Sewer Design Guidelines (Appendix 4-A)

- Extraneous Flows 0.33 l/s/ha
- Commercial Peaking Factor 1.5

City of Ottawa Sewer Design Guidelines (Appendix 4-B)

Industrial Peaking factor 3.6

DATE: 5/28/2021
PREPARED BY: NOVATECH

M:\2021\121137\DATA\Calculations\Sewer Calcs\SAN\121137 - San Design.xlsx

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1	REVISED PER R.M.O.C. COMMENTS	01.06.92	JFB

LICENSED PROFESSIONAL ENGINEER UDO BOEHME PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER R.S. CEBRYK PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD.
OTTAWA, ONTARIO

DESIGN	UB/JFB
CHECKED	UB
DRAWN	JFB
CHECKED	UB
APPROVED	RSC

SCALE
1 : 2500 HORIZONTAL
VERTICAL

CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK - PHASE 2 & 3

SANITARY DRAINAGE AREA PLAN

CONTRACT No. 92019
DATE JULY 1992
DRAWING No. 92019-SAN

Sanitary Flow Allotment Calculations

Sewer Outlet Location	Area (ha)	Equivalent Population	Peak Flow (L/s)	Extraneous Flow (L/s)	Total Peak Sanitary Flow Allotment (L/s)
250mm dia. Bill Leathem Dr.	4.9	490	7.15	0.54	7.68
250mm dia. Paragon Ave.	2.0	200	2.92	0.22	3.14
1050mm dia. Trunk Sewer EX SANMH 62	17.4	1740	25.38	1.91	27.29
250mm/750mm dia. Leikin Dr.	3.4	340	4.96	0.37	5.33
375mm dia. Bill Leathem Dr Via Street C	2.8	280	4.08	0.31	4.39
Total	30.5	3050	44.48	3.36	47.83

Design Criteria From SMB Ph II & III Services Design Report :

Equivalent Population =	100	People/ha
Design Flow =	450	L/day/person
Peaking Factor =	2.8	
Extraneous Flows=	0.11	L/s/ha

SANITARY SEWER DESIGN SHEET

PROJECT: **SOUTH MERIVALE BUSINESS PARK Phases II and III** PAGE: 1 of 5

DESIGNED BY : LJ DEVELOPER: **CITY OF NEPEAN** DATE: June 22, 1992

CHECKED BY : ENGINEERS: **NOVATECH ENGINEERING CONSULTANTS LTD.** Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'F'	19	10	190	1.9	190	1.9	2.80	2.77	0.21	2.98	154.0	250	PVC	0.30	33.98	0.67
'F'	20	21	120	1.2	120	1.2	2.80	1.75	0.13	1.88	58.0	250	PVC	0.30	33.98	0.67
'F'	21	22	210	2.1	330	3.3	2.80	4.81	0.36	5.18	80.0	250	PVC	0.30	33.98	0.67
'F'	22	23	250	2.5	580	5.8	2.80	8.46	0.64	9.10	111.0	250	PVC	0.30	33.98	0.67
'F'	23	24	150	1.5	730	7.3	2.80	10.65	0.80	11.45	80.0	250	PVC	0.30	33.98	0.67
Flow From Future Development Into Manhole																
			170	1.7												
'F'	24	26	210	2.1	1110	11.1	2.80	16.19	1.22	17.41	64.0	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 L/ha/s)

M = peaking factor =2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s) n = 0.013

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

SANITARY SEWER DESIGN SHEET

PROJECT: **SOUTH MERIVALE BUSINESS PARK Phases II and III**

DESIGNED BY : LJ

DEVELOPER: **CITY OF NEPEAN**

DATE: SEPTEMBER 6, 1990

CHECKED BY :

ENGINEERS: **NOVATECH ENGINEERING CONSULTANTS LTD.**

Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'F'	26	27	130	1.3	1240.0	12.4	2.80	18.08	1.36	19.45	64.0	250	PVC	0.30	33.98	0.67
'F'	27	28	120	1.2	1360	13.6	2.80	19.83	1.50	21.33	66.0	250	PVC	0.30	33.98	0.67
'F'	28	29	60	0.6	1420	14.2	2.80	20.71	1.56	22.27	24.0	250	PVC	0.30	33.98	0.67
'F'	29	14	70	0.7	1490	14.9	2.80	21.73	1.64	23.37	150.0	250	PVC	0.30	33.98	0.67
'D'	62	59	130	1.3	130	1.3	2.80	1.90	0.14	2.04	44.0	250	PVC	0.30	33.98	0.67
'D'	59	58	190	1.9	320	3.2	2.80	4.67	0.35	5.02	87.0	250	PVC	0.30	33.98	0.67
'D'	58	35	120	1.2	440	4.4	2.80	6.42	0.48	6.90	110.0	250	PVC	0.31	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 l/ha/s)

M = peaking factor = 2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s) n = 0.013

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

	PROJECT:	SOUTH MERIVALE BUSINESS PARK Phases II and III	PAGE: 3 of 5
DESIGNED BY : SG	DEVELOPER:	CITY OF NEPEAN	DATE: June 22, 1992
CHECKED BY : LJ	ENGINEERS:	NOVATECH ENGINEERING CONSULTANTS LTD.	Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'B'	40	39	360	3.6	360	3.6	2.80	5.25	0.40	5.65	113.0	250	PVC	0.30	33.98	0.67
'B'	39	38	240	2.4	600	6.0	2.80	8.75	0.66	9.41	95.0	250	PVC	0.30	33.98	0.67
'B'	38	37	160	1.6	760	7.6	2.80	11.08	0.84	11.92	61.0	250	PVC	0.30	33.98	0.67
'B'	37	36	160	1.6	920	9.2	2.80	13.42	1.01	14.43	60.8	250	PVC	0.30	33.98	0.67
'B'	36	35	90	0.9	1010	10.1	2.80	14.73	1.11	15.84	75.0	250	PVC	0.30	33.98	0.67
'B'	35	34	130	1.3	1580	15.8	2.80	23.04	1.74	24.78	106.0	250	PVC	0.30	33.98	0.67
'B'	41	42	290	2.9	290	2.9	2.80	4.23	0.32	4.55	110.0	250	PVC	0.30	33.98	0.67
'B'	42	43	190	1.9	480	4.8	2.80	7.00	0.53	7.53	113.0	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)   Q (p) = peak population flow (L/s)   Q (p) = (P*q*M)/(86,400) (L/s)   n = 0.013

I = unit of peak extraneous flow (0.11 l/ha/s)   Q (i) = peak extraneous flow (L/s)   Q (i) = I*A (L/s), A in hectares

SANITARY SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK Phases II and III

DESIGNED BY : LJ

DEVELOPER: CITY OF NEPEAN

DATE: SEPTEMBER 6, 1990

CHECKED BY :

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'B'	49	47	170	1.7	170	1.7	2.80	2.48	0.19	2.67	105.0	250	PVC	0.30	33.98	0.67
'B'	47	46	200	2.0	370	3.7	2.80	5.40	0.41	5.80	86.0	250	PVC	0.30	33.98	0.67
'B'	46	45	220	2.2	590	5.9	2.80	8.60	0.65	9.25	99.0	250	PVC	0.30	33.98	0.67
'B'	45	44	230	2.3	820	8.2	2.80	11.96	0.90	12.86	101.0	250	PVC	0.30	33.98	0.67
'B'	44	43	160	1.6	980	9.8	2.80	14.29	1.08	15.37	97.0	250	PVC	0.30	33.98	0.67
'D'	43	62	120	1.2	1580	15.8	2.80	23.04	1.74	24.78	118.0	250	PVC	0.30	33.98	0.67
'D'	61	62	160	1.6	160	1.6	2.80	2.33	0.18	2.51	38.0	250	PVC	0.30	33.98	0.67

total flow to EX SAN MH 62

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 l/ha/s)

M = peaking factor = 2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

n = 0.013

SANITARY SEWER DESIGN SHEET

	PROJECT:	SOUTH MERIVALE BUSINESS PARK Phases II and III	PAGE: 5 of 5
DESIGNED BY : LJ	DEVELOPER:	CITY OF NEPEAN	DATE: June 22, 1992
CHECKED BY :	ENGINEERS:	NOVATECH ENGINEERING CONSULTANTS LTD.	Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'E'	17	8	120	1.2	120	1.2	2.80	1.75	0.13	1.88	111.3	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 l/ha/s)

M = peaking factor = 2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s) n = 0.013

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

SANITARY SEWER DESIGN SHEET

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 5, 1991
Revision: Dec. 31/91

LOCATION			INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'A'	EXT.	15A	Constant Flow from Longfield-Davidson Heights = 249.45 L/s*							249.45		750	CONC	0.15	449.81	0.99
	15A	15								249.45	18.0	750	CONC	0.15	449.81	0.99
	15	14	200	2.0	200	2.0	2.80	2.92	0.22	252.59	105.0	750	CONC	0.15	449.81	0.99
Flow from Street 'B' into MH 34:			1580	15.8												
'B'	34	33	170	1.7	1750	17.5	2.80	25.52	1.93	27.45	94.0	375	CONC	0.18	77.60	0.68
Flow from Street 'C' into MH 33:			830	8.3												
'B'	33	32	110	1.1	2690	26.9	2.80	39.23	2.96	42.19	79.0	375	CONC	0.18	77.60	0.68
	32	31			2690	26.9	2.80	39.23	2.96	42.19	27.5	375	CONC	0.18	77.60	0.68
	31	14			2690	26.9	2.80	39.23	2.96	42.19	34.0	375	CONC	0.18	77.60	0.68

* Constant flow from external area = 249.45 L/s per Delcan Design Sheet dated 91.10.21

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
M = peaking factor = 2.8 for Light Industrial land use

Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)
Q (i) = I*A (L/s), A in hectares
Q (d) = Q (p) + Q (i) (L/s)

n = 0.013

SANITARY SEWER DESIGN SHEET

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 4, 1991
Revision: Dec. 31/91

LOCATION			INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
Flow from Street 'F' into MH 14:			1540	15.4												
'A'	14	13	120	1.2	4550	45.5	2.80	66.35	5.01	320.81	72.0	750	CONC	0.14	434.56	0.95
	13	12	120	1.2	4670	46.7	2.80	68.10	5.14	322.69	40.5	750	CONC	0.14	434.56	0.95
	12	11	220	2.2	4890	48.9	2.80	71.31	5.38	326.14	119.0	750	CONC	0.15	449.81	0.99
	11	10	260	2.6	5150	51.5	2.80	75.10	5.67	330.22	115.0	750	CONC	0.15	449.81	0.99
Flow from Street 'F' into MH 10:			190	1.9												
'A'	10	9	180	1.8	5520	55.2	2.80	80.50	6.07	336.02	86.5	750	CONC	0.15	449.81	0.99
	9	8	140	1.4	5660	56.6	2.80	82.54	6.23	338.22	86.0	750	CONC.	0.15	449.81	0.99

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
M = peaking factor = 2.8 for Light Industrial land use

Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)
Q (i) = I*A (L/s), A in hectares
Q (d) = Q (p) + Q (i) (L/s)

n = 0.013

SANITARY SEWER DESIGN SHEET

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV.4, 1991
Revision: Dec. 31/91

LOCATION			INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
Flow from Street 'E' into MH 8:			-120	1.2												
'A'	8	7	250	2.5	6030	60.3	2.80	87.94	6.63	344.02	44.0	750	CONC	0.16	464.57	1.02
	7	6			6030	60.3	2.80	87.94	6.63	344.02	44.0	750	CONC	0.16	464.57	1.02
	6	5	250	2.5	6280	62.8	2.80	91.58	6.91	347.94	96.0	750	CONC	0.16	464.57	1.02
'A'	1	2	230	2.3	230	2.3	2.80	3.35	0.25	3.61	23.5	250	PVC	0.30	33.98	0.67
	2	3			230	2.3	2.80	3.35	0.25	3.61	49.0	250	PVC	0.30	33.98	0.67
	3	4	190	1.9	420	4.2	2.80	6.13	0.46	6.59	43.0	250	PVC	0.30	33.98	0.67
	4	5			420	4.2	2.80	6.13	0.46	6.59	56.0	250	PVC	0.30	33.98	0.67
'A'	* Service Connections:															
		S9			290	2.9	2.80	4.23	0.32	4.55		250	PVC	1.00	62.04	1.22

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
M = peaking factor = 2.8 for Light industrial land use

Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)
Q (i) = I*A (L/s), A in hectares
Q (d) = Q (p) + Q (i) (L/s)

n = 0.013

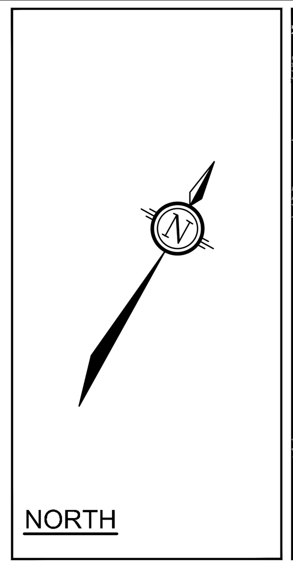
* Note: 10 service connections - worst case @ manhole S9

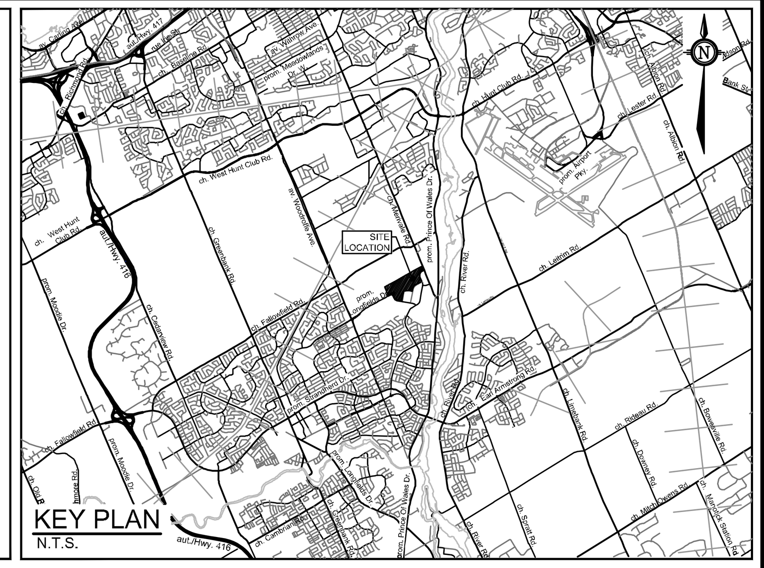
Appendix C

Storm Servicing Information

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER AND MANHOLE
- DIRECTION OF FLOW
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- STM MH — EXISTING STORM MANHOLE & SEWER
- CB 1 — EXISTING CATCHBASIN
- STORM SEWER DRAINAGE AREA BOUNDARY
- 0.085 / A-16 / 0.78 — DRAINAGE AREA (ha) / DRAINAGE AREA ID / RUNOFF COEFFICIENT





REFER TO 121137-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN APPROVAL	MAY 31/2021	MJH

SCALE 1:1250

DESIGN	MJH/ARM
CHECKED	JLS
DRAWN	MJH/ARM
CHECKED	JLS
APPROVED	JLS

FOR REVIEW ONLY

ISSUED FOR REVIEW

NOVATECH
Engineers, Planners & Landscape Architects
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Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
SORTATION FACILITY
99 BILL LEATHEM DR, 2 & 20 LEIKIN DR, CITY OF OTTAWA

DRAWING NAME
STORM SEWER DRAINAGE AREA PLAN

PROJECT No. 121137
REV #1
DRAWING No. 121137-STM

Sortation Facility

Project No.: 121137

STORM SEWER DESIGN SHEET

FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION			AREA (ha)					FLOW							TOTAL FLOW	SEWER DATA								
AREA ID	From Manhole	To Manhole	Total Area (ha)	C = 0.20	C = 0.90	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
WEST PARKING SYSTEM - POND 1 (1:5 YEAR STORM EVENT)																								
						0.00	0.00	0.000	0.000	10.00														
A-01	CBMH 105	CBMH 104	0.462	0.019	0.443	0.87	0.40	1.120	1.120	10.00		104.19		116.7	116.7	0.381	375	PVC	1.00	26.3	182.8	1.60	0.27	64%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000	0.000	10.27														
A-02	CBMH 104	CBMH 103	0.301	0.034	0.266	0.82	0.25	0.685	1.805	10.27		102.77		185.5	185.5	0.533	525	Conc	0.45	39.3	300.8	1.35	0.49	62%
						0.00	0.00	0.000	0.000	10.27														
						0.00	0.00	0.000	0.000	10.76														
A-03	CBMH 103	CBMH 102	0.259	0.016	0.242	0.86	0.22	0.616	2.421	10.76		100.34		242.9	242.9	0.610	600	Conc	0.30	23.9	350.6	1.20	0.33	69%
						0.00	0.00	0.000	0.000	10.76														
						0.00	0.00	0.000	0.000	11.09														
A-04	CBMH 102	CBMH 101	0.162	0.013	0.148	0.84	0.14	0.378	2.799	11.09		98.76		276.4	276.4	0.686	675	Conc	0.30	35.9	480.0	1.30	0.46	58%
						0.00	0.00	0.000	0.000	11.09														
						0.00	0.00	0.000	0.000	11.55														
A-05	CBMH 101	POND 1	0.735	0.121	0.614	0.78	0.58	1.603	4.403	11.55		96.65		425.5	425.5	0.762	750	Conc	0.30	35.1	635.8	1.39	0.42	67%
						0.00	0.00	0.000	0.000	11.55														
EAST PARKING SYSTEM - POND 2 (1:5 YEAR STORM EVENT)																								
						0.00	0.00	0.000	0.000	10.00														
B-01	CBMH 208	CBMH 207	0.294	0.031	0.264	0.83	0.24	0.677	0.677	10.00		104.19		70.5	70.5	0.381	375	PVC	0.30	39.0	100.1	0.88	0.74	70%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000	0.000	10.74														
B-02, B-03	CBMH 207	CBMH 206	0.353	0.023	0.330	0.85	0.30	0.839	1.516	10.74		100.44		152.3	152.3	0.533	525	Conc	0.30	23.9	245.6	1.10	0.36	62%
						0.00	0.00	0.000	0.000	10.74														
						0.00	0.00	0.000	0.000	11.10														
B-04,B-05	CBMH 206	CBMH 205	0.252	0.011	0.241	0.87	0.22	0.609	2.125	11.10		98.71		209.7	209.7	0.610	600	Conc	0.30	35.9	350.6	1.20	0.50	60%
						0.00	0.00	0.000	0.000	11.10														
						0.00	0.00	0.000	0.000	11.60														
B-06	CBMH 205	CBMH 204	0.574	0.145	0.429	0.72	0.42	1.155	3.279	11.60		96.44		316.3	316.3	0.686	675	Conc	0.30	76.3	480.0	1.30	0.98	66%
						0.00	0.00	0.000	0.000	11.60														
						0.00	0.00	0.000	0.000	12.58														
B-07	CBMH 204	CBMH 203	0.297	0.104	0.193	0.65	0.19	0.541	3.820	12.58		92.29		352.6	352.6	0.762	750	Conc	0.30	103.2	635.8	1.39	1.23	55%
						0.00	0.00	0.000	0.000	12.58														
						0.00	0.00	0.000	0.000	13.81														
B-08	CBMH 203	STMMH 201	0.212	0.043	0.168	0.76	0.16	0.445	4.265	13.81		87.60		373.6	373.6	0.762	750	Conc	0.30	12.8	635.8	1.39	0.15	59%
						0.00	0.00	0.000	0.000	13.81														
						0.00	0.00	0.000	0.000	10.00														
B-09	CBMH 202	STMMH 201	0.229	0.086	0.143	0.64	0.15	0.406	0.406	10.00		104.19		42.3	42.3	0.305	300	PVC	0.50	45.9	71.3	0.98	0.78	59%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000		13.97														
	STMMH 201	POND			0.000	0.00	0.00	0.000	4.671	13.97		87.05		406.6	406.6	0.762	750	Conc	0.30	16.3	635.8	1.39	0.19	64%
						0.00	0.00	0.000	0.000	13.97														

Sortation Facility

Project No.: 121137

STORM SEWER DESIGN SHEET

FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION			AREA (ha)					FLOW							TOTAL FLOW	SEWER DATA								
AREA ID	From Manhole	To Manhole	Total Area (ha)	C = 0.20	C = 0.90	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
TRUCK COURT SYSTEM - POND 3 (1:5 YEAR STORM EVENT)																								
						0.00	0.00	0.000	0.000	10.00														
C-01	CBMH 314	STMMH 313	0.657	0.317	0.340	0.56	0.37	1.028	1.028	10.00		104.19		107.1	107.1	0.381	375	PVC	0.50	17.2	129.2	1.13	0.25	83%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000	0.000	10.25														
C-02,C-03	STMMH 313	STMMH 312	1.447		1.447	0.90	1.30	3.621	4.649	10.25		102.88		478.3	478.3	1.067	1050	Conc	0.10	120.0	900.5	1.01	1.99	53%
						0.00	0.00	0.000	0.000	10.25														
						0.00	0.00	0.000	0.000	12.24														
C-04,C-05	STMMH 312	STMMH 311	1.250	0.051	1.199	0.87	1.09	3.028	7.678	12.24		93.69		719.3	719.3	1.219	1200	Conc	0.10	114.4	1,285.7	1.10	1.73	56%
						0.00	0.00	0.000	0.000	12.24														
						0.00	0.00	0.000	0.000	13.97														
C-06	STMMH 311	STMMH 310	0.538	0.081	0.457	0.79	0.43	1.188	8.865	13.97		87.04		771.7	771.7	1.219	1200	Conc	0.10	70.9	1,285.7	1.10	1.07	60%
						0.00	0.00	0.000	0.000	13.97														
						0.00	0.00	0.000	0.000	15.04														
C-07	STMMH 310	STMMH 307	0.377	0.032	0.345	0.84	0.32	0.881	9.746	15.04		83.42		813.0	813.0	1.219	1200	Conc	0.10	73.5	1,285.7	1.10	1.11	63%
						0.00	0.00	0.000	0.000	15.04														
						0.00	0.00	0.000	0.000	10.00														
C-08,C-09	CBMH 309	STMMH 308	1.666	0.060	1.606	0.87	1.46	4.052	4.052	10.00		104.19		422.2	422.2	0.914	900	Conc	0.10	120.0	596.9	0.91	2.20	71%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000	0.000	12.20														
C-10, C-11	STMMH 308	STMMH 307	0.960	0.021	0.939	0.88	0.85	2.361	6.413	12.20		93.85		601.9	601.9	1.067	1050	Conc	0.10	120.0	900.5	1.01	1.99	67%
						0.00	0.00	0.000	0.000	12.20														
						0.00	0.00	0.000	0.000	16.15														
C-12	STMMH 307	STMMH 304	0.315	0.044	0.270	0.80	0.25	0.701	16.860	16.15		80.00		1,348.9	1,348.9	1.372	1350	Conc	0.10	60.4	1,760.2	1.19	0.85	77%
						0.00	0.00	0.000	0.000	16.15														
						0.00	0.00	0.000	0.000	10.00														
C-13	CBMH 306	STMMH 305	0.825	0.058	0.767	0.85	0.70	1.951	1.951	10.00		104.19		203.2	203.2	0.610	600	Conc	0.20	113.9	286.3	0.98	1.94	71%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000	0.000	11.94														
C-14	STMMH 305	STMMH 304	0.573		0.573	0.90	0.52	1.433	3.384	11.94		94.97		321.4	321.4	0.838	825	Conc	0.10	96.8	473.3	0.86	1.88	68%
						0.00	0.00	0.000	0.000	11.94														
						0.00	0.00	0.000	0.000	17.00														
C-15	STMMH 304	STMMH 302	0.405	0.072	0.333	0.78	0.31	0.874	21.119	17.00		77.61		1,639.0	1,639.0	1.524	1500	Conc	0.10	46.9	2,331.3	1.28	0.61	70%
						0.00	0.00	0.000	0.000	17.00														
						0.00	0.00	0.000	0.000	10.00														
C-16	CBMH 303	STMMH 302	0.192	0.068	0.124	0.65	0.13	0.348	0.348	10.00		104.19		36.3	36.3	0.305	300	PVC	0.35	68.9	59.6	0.82	1.41	61%
						0.00	0.00	0.000	0.000	10.00														
						0.00	0.00	0.000	0.000	17.61														
C-17	STMMH 302	STMMH 301	0.177	0.072	0.106	0.62	0.11	0.304	21.770	17.61		75.97		1,653.9	1,653.9	1.524	1500	Conc	0.10	59.9	2,331.3	1.28	0.78	71%
						0.00	0.00	0.000	0.000	17.61														
						0.00	0.00	0.000	0.000	18.39														
	STMMH 301	POND			0.000	0.00	0.00	0.000	21.770	18.39		73.99		1,610.8	1,610.8	1.524	1500	Conc	0.10	28.2	2,331.3	1.28	0.37	69%
						0.00	0.00	0.000	0.000	18.39														

Sortation Facility

Project No.: 121137

STORM SEWER DESIGN SHEET

FLOW RATES BASED ON RATIONAL METHOD

Engineers, Planners & Landscape Architects

LOCATION			AREA (ha)					FLOW							TOTAL FLOW	SEWER DATA								
AREA ID	From Manhole	To Manhole	Total Area (ha)	C = 0.20	C = 0.90	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full

Q = 2.78 AIC, where
Q = Peak Flow in Litres per Second (L/s)
A = Area in hectares (ha)
I = Rainfall Intensity (mm/hr), 5 year storm
C = Runoff Coefficient

Consultant:	Novatech
Date:	May 25, 2020
Design By:	Anthony Mestwarp
Client:	
Dwg. Reference:	121137-STM
Checked By:	LS

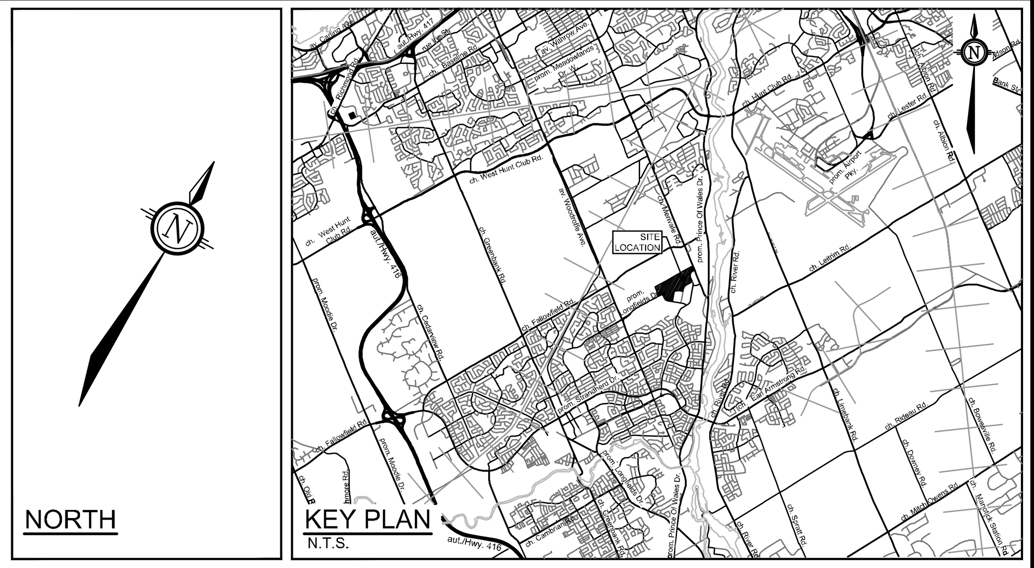
Legend:
* Indicates 100 Year intensity for storm sewers
10.00 Storm sewers designed to the 2 year event (without ponding) for local roads
10.00 Storm sewers designed to the 5 year event (without ponding) for collector roads
10.00 Storm sewers designed to the 10 year event (without ponding) for arterial roads

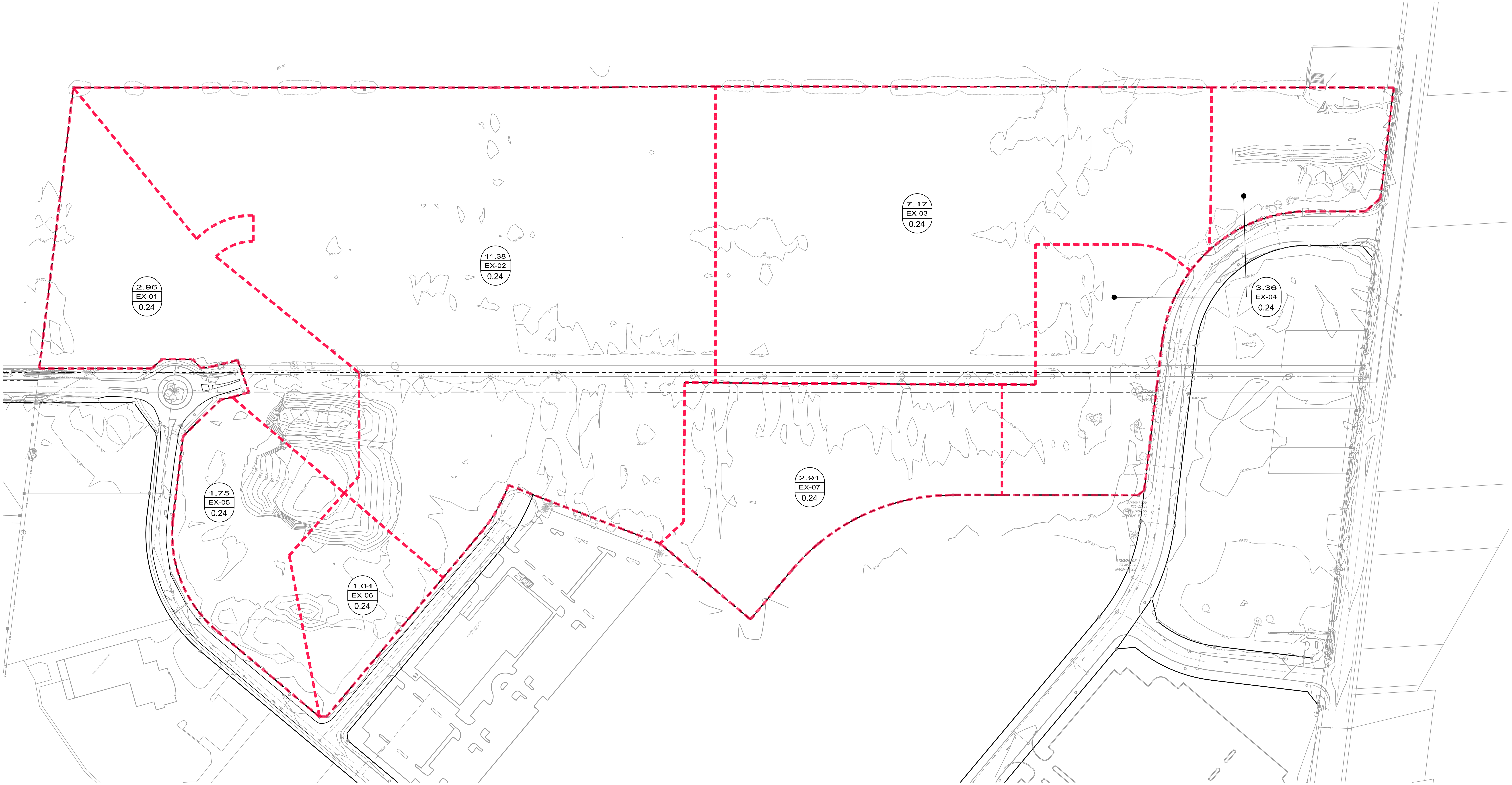
Appendix D

Stormwater Management Modeling

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER AND MANHOLE
- DIRECTION OF FLOW
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- STM MH — EXISTING STORM MANHOLE & SEWER
- CB — EXISTING CATCHBASIN
- STORM SEWER DRAINAGE AREA BOUNDARY
- 11.38 — DRAINAGE AREA (ha)
- EX-02 — DRAINAGE AREA ID
- 0.24 — RUNOFF COEFFICIENT





REFER TO 121137-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN APPROVAL	MAY 31/2021	MJH

SCALE: 1:1250

1:1250 — 0 10 20 30 40 50

DESIGN: MJH/ARM
CHECKED: JLS
DRAWN: MJH/ARM
CHECKED: JLS
APPROVED: JLS

FOR REVIEW ONLY

ISSUED FOR REVIEW

ISSUED FOR REVIEW

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
SORTATION FACILITY
99 BILL LEATHEM DR, 2 & 20 LEIKIN DR, CITY OF OTTAWA

DRAWING NAME
EXISTING STORM DRAINAGE PLAN

PROJECT No. 121137
REV: REV #1
DRAWING No. 121137-XSTM

PLANB1.DWG - 1000mmx707mm

NOVATECH
Engineers, Planners & Landscape Architects

Table 1: Allowable Release Rates - Bill Leathem Drive

Area ID	Area (ha)	C_{Allow}	I_{5Year}	Q_{Allow}
EX-01	2.96	0.24	83.56	**165.0**
Total (Current Development)	**2.96**			**165.0**
EX-05 (Future)	1.75	0.24	83.56	**97.6**
Total	**4.71**			**427.6**

Table 2: Allowable Release Rates - Paragon Avenue

Area ID	Area (ha)	C_{Allow}	I_{5Year}	Q_{Allow}
EX-02	11.38	0.24	83.56	**634.4**
EX-03 (Future)	7.17	0.24	83.56	**399.7**
Total (Current Development)	**18.55**			**1034.2**
EX-06 (Future)	1.04	0.24	83.56	**58.0**
Total	**19.59**			**1092.1**

Table 3: Allowable Release Rates - Leikin Drive

Area ID	Area (ha)	C_{Allow}	I_{5Year}	Q_{Allow}
EX-04 (Future)	3.36	0.24	83.56	**187.3**
Total	**3.36**			**187.3**

Time of Concentration Tc= 15.0 min
Intensity (5 Year Event) I_5= 83.56 mm/hr
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$

Equations:
Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

DRAINAGE AREA SCHEDULE	
AREA No.	AREA (ha)
1	23.7
2	1.2
3	2.4
4	15.3
5	8.5
6	33.3
TOTAL	84.4

LEGEND

- PROPOSED STORM SEWER
- SUB CATCHMENT AREA
- STORM DRAINAGE AREA - PHASE I
- EXTERNAL STORM DRAINAGE AREA BOUNDARY
- 2.4 ha — STORM DRAINAGE AREA (HECTARES)
- MH — MANHOLE

NOTE
RUNOFF COEFFICIENTS FOR ALL DRAINAGE AREAS : C=0.25
(FLOWS TO BE RESRICTED TO PREDEVELOPMENT LEVEL)

NOTE.
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
3	ISSUED FOR TENDER	JAN.15/92	SG
2	REVISED AS PER RMOC COMMENTS	DEC 9/91	SG
1	REVISED AS PER NEPEAN COMMENTS	NOV.28/91	SG

LICENSED PROFESSIONAL ENGINEER — UDO BOEHME — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — S.M. GORDON — PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD
OTTAWA, ONTARIO

DESIGN SG
CHECKED UB
DRAWN JFB
CHECKED UB
APPROVED MJH

SCALE
1 : 2500 HORIZONTAL
VERTICAL

CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK

STORM DRAINAGE AREA PLAN
PHASE I

CONTRACT No. 90041
DATE OCT. 1991
DRAWING No. 90041-STM

No.	REVISION	DATE	BY
1.	ROAD PATTERN REVISED	AUG 16/91	SMG

LICENSED PROFESSIONAL ENGINEER UDO BOEHME PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER S. M. GORDON PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD.
OTTAWA, ONTARIO

DESIGN	JMD
CHECKED	UB
DRAWN	MGB
CHECKED	UB
APPROVED	MJH

SCALE 1 : 2500 HORIZONTAL
VERTICAL

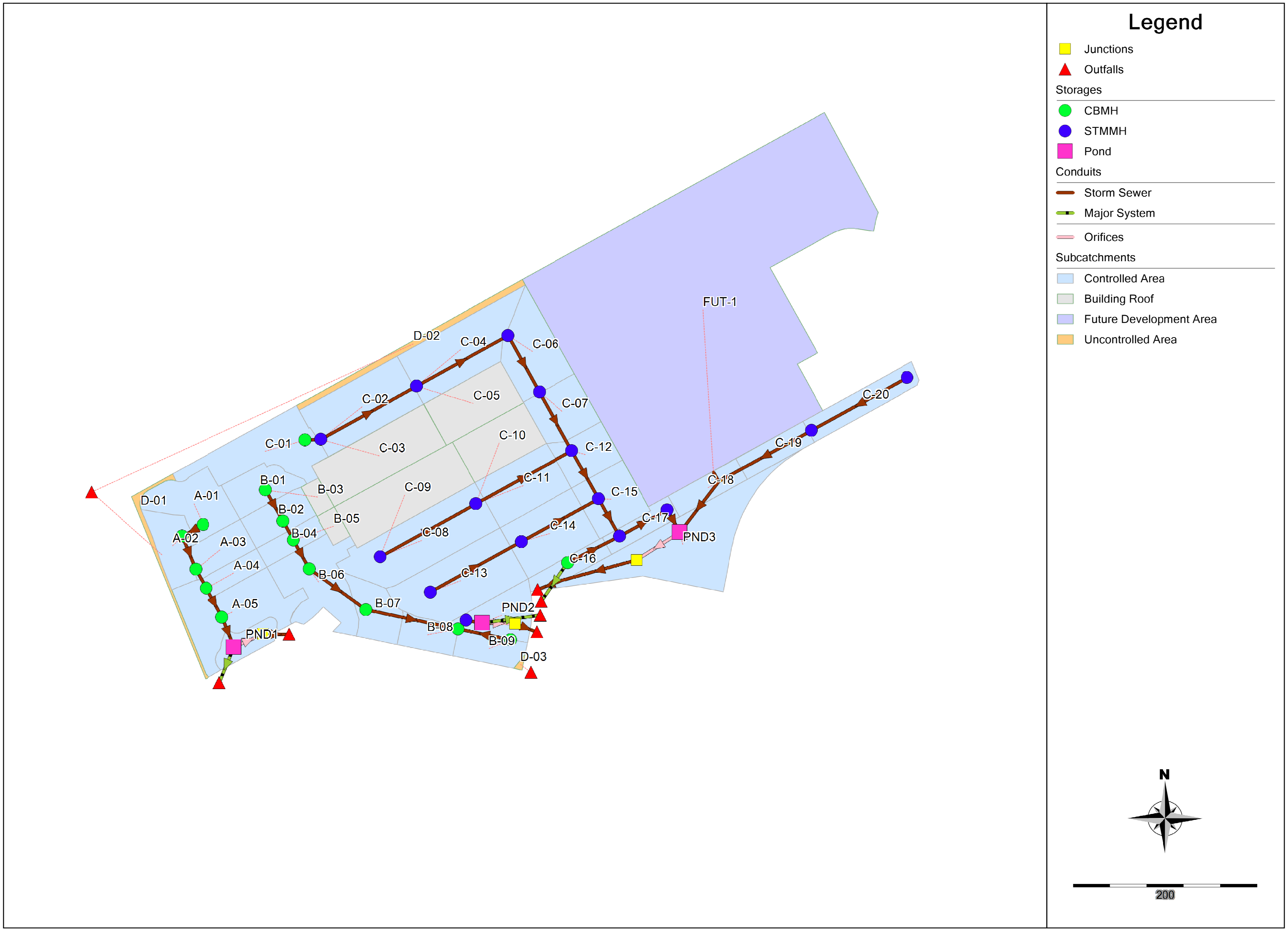
CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK

STORM DRAINAGE AREAS

CONTRACT No. 90041
DATE SEPT. 1990
DRAWING No. STM-002


Legend
Junctions
Outfalls
Storages
CBMH
STMMH
Pond
Conduits
Storm Sewer
Major System
Orifices
Subcatchments
Controlled Area
Building Roof
Future Development Area
Uncontrolled Area
N
200
FUT-1
D-01
D-02
D-03
A-01
A-02
A-03
A-04
A-05
B-01
B-02
B-03
B-04
B-05
B-06
B-07
B-08
B-09
C-01
C-02
C-03
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C-08
C-09
C-10
C-11
C-12
C-13
C-14
C-15
C-16
C-17
C-18
C-19
C-20
PND1
PND2
PND3

PCSWMM Model Output - 100-year, 3-hour Chicago Storm

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)
--------------------------------------------------------------

WARNING 03: negative offset ignored for Link 101-PND1
WARNING 03: negative offset ignored for Link 2001-159
WARNING 03: negative offset ignored for Link 205-204
WARNING 03: negative offset ignored for Link 207-206
WARNING 03: negative offset ignored for Link 208-207
WARNING 03: negative offset ignored for Link 3001-501
WARNING 03: negative offset ignored for Link 301-PND3
WARNING 03: negative offset ignored for Link 403-402

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 41
Number of nodes ........... 46
Number of links ........... 41
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
---------------------------------------------------------------------------
Raingage1            C3hr-100yr                     INTENSITY   10 min.


********************
Subcatchment Summary
********************
Name                       Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------------
A-01                       0.46     68.00     96.00    1.5000 Raingage1            CBMH-105
A-02                       0.30     40.00     89.00    1.5000 Raingage1            CBMH-104
A-03                       0.26     70.00     94.00    1.5000 Raingage1            CBMH-103
A-04                       0.16     70.00     91.00    1.5000 Raingage1            CBMH-102
A-05                       0.73    100.00     83.00    1.5000 Raingage1            CBMH-101
B-01                       0.29     70.00     90.00    1.5000 Raingage1            CBMH-208
B-02                       0.27     74.00     91.00    1.5000 Raingage1            CBMH-207
B-03                       0.08     36.00    100.00    1.5000 Raingage1            CBMH-208
B-04                       0.17     74.00     94.00    1.5000 Raingage1            CBMH-206
B-05                       0.08     36.00    100.00    1.5000 Raingage1            CBMH-206
B-06                       0.61     70.00     71.00    1.5000 Raingage1            CBMH-205
B-07                       0.30     42.00     64.00    1.5000 Raingage1            CBMH-204
B-08                       0.21     35.00     80.00    1.5000 Raingage1            CBMH-202
B-09                       0.23     30.00     63.00    1.5000 Raingage1            CBMH-203
C-01                       0.66     55.00     51.00    1.5000 Raingage1            CBMH-314
C-02                       0.73     60.00    100.00    1.5000 Raingage1            MH-313
C-03                       0.72    140.00    100.00    1.5000 Raingage1            MH-313
C-04                       0.75     60.00     93.00    1.5000 Raingage1            MH-312
C-05                       0.50     97.00    100.00    1.5000 Raingage1            MH-312
C-06                       0.54     65.00     84.00    1.5000 Raingage1            MH-311
C-07                       0.38     65.00     91.00    1.5000 Raingage1            MH-310
C-08                       0.91     55.00     93.00    1.5000 Raingage1            MH-309
C-09                       0.76    147.00    100.00    1.5000 Raingage1            MH-309
C-10                       0.45     88.00    100.00    1.5000 Raingage1            MH-308
C-11                       0.51     56.00     96.00    1.5000 Raingage1            MH-308
C-12                       0.31     65.00     86.00    1.5000 Raingage1            MH-307
C-13                       0.82     64.00     93.00    1.5000 Raingage1            MH-306
C-14                       0.57     64.00    100.00    1.5000 Raingage1            MH-305
C-15                       0.41     65.00     83.00    1.5000 Raingage1            MH-304
C-16                       0.19     20.00     64.00    1.5000 Raingage1            CBMH-303
C-17                       0.19     20.00     59.00    1.5000 Raingage1            MH-302
C-18                       0.22     26.00     51.00    1.5000 Raingage1            MH-401
C-19                       0.22     26.00     51.00    1.5000 Raingage1            MH-402
C-20                       0.35     26.00     51.00    1.5000 Raingage1            MH-403
D-01                       0.09      4.00      0.00    1.5000 Raingage1            OF1
D-02                       0.18      6.30      0.00    1.5000 Raingage1            OF1
D-03                       0.01     15.00     20.00    1.5000 Raingage1            OF5
FUT-1                      8.45    280.00     93.00    1.5000 Raingage1            CAP
PND1                       0.20     25.00      0.00    1.5000 Raingage1            POND1
PND2                       0.34     50.00      0.00    1.5000 Raingage1            POND2
PND3                       1.09     55.00      0.00    1.5000 Raingage1            POND3

************
Node Summary
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                                           Invert      Max.    Ponded    External
Name                 Type                   Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
CAP                  JUNCTION               87.02      2.80       0.0
HW-1001              JUNCTION               87.70      0.95       0.0
HW-2001              JUNCTION               86.98      6.00       0.0
HW-3001              JUNCTION               86.33      1.66       0.0
MH-501               JUNCTION               85.89      4.79       0.0
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EX-MH139	OUTFALL	87.17	0.90	0.0
EX-MH159	OUTFALL	86.10	1.20	0.0
EX-MH160	OUTFALL	85.82	1.38	0.0
OF1	OUTFALL	90.65	0.00	0.0
OF2	OUTFALL	89.60	2.00	0.0
OF3	OUTFALL	89.50	1.00	0.0
OF4	OUTFALL	0.00	90.70	0.0
OF5	OUTFALL	89.70	0.00	0.0
CBMH-101	STORAGE	87.99	2.66	0.0
CBMH-102	STORAGE	88.18	2.57	0.0
CBMH-103	STORAGE	88.33	2.42	0.0
CBMH-104	STORAGE	88.58	2.33	0.0
CBMH-105	STORAGE	88.91	1.89	0.0
CBMH-202	STORAGE	87.35	2.80	0.0
CBMH-203	STORAGE	87.99	1.68	0.0
CBMH-204	STORAGE	87.67	2.43	0.0
CBMH-205	STORAGE	87.98	2.77	0.0
CBMH-206	STORAGE	88.16	2.64	0.0
CBMH-207	STORAGE	88.31	2.54	0.0
CBMH-208	STORAGE	88.58	2.32	0.0
CBMH-303	STORAGE	88.30	1.15	0.0
CBMH-314	STORAGE	88.67	1.48	0.0
MH-201	STORAGE	87.26	3.25	0.0
MH-301	STORAGE	86.73	3.18	0.0
MH-302	STORAGE	86.85	2.91	0.0
MH-304	STORAGE	86.96	2.87	0.0
MH-305	STORAGE	87.73	2.35	0.0
MH-306	STORAGE	88.18	2.12	0.0
MH-307	STORAGE	87.17	2.99	0.0
MH-308	STORAGE	87.59	2.75	0.0
MH-309	STORAGE	87.86	2.49	0.0
MH-310	STORAGE	87.39	2.96	0.0
MH-311	STORAGE	87.47	2.82	0.0
MH-312	STORAGE	87.64	2.70	0.0
MH-313	STORAGE	87.91	2.44	0.0
MH-401	STORAGE	86.98	2.85	0.0
MH-402	STORAGE	88.07	2.02	0.0
MH-403	STORAGE	88.39	1.83	0.0
POND1	STORAGE	87.70	2.70	0.0
POND2	STORAGE	87.00	2.75	0.0
POND3	STORAGE	86.35	3.30	0.0

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
1001-139	HW-1001	EX-MH139	CONDUIT	45.0	0.5111	0.0130
101-PND1	CBMH-101	POND1	CONDUIT	35.1	0.3130	0.0130
102-101	CBMH-102	CBMH-101	CONDUIT	35.9	0.3009	0.0130
103-102	CBMH-103	CBMH-102	CONDUIT	23.9	0.3019	0.0130
104-103	CBMH-104	CBMH-103	CONDUIT	39.3	0.4582	0.0130
105-104	CBMH-105	CBMH-104	CONDUIT	26.3	0.9874	0.0130
2001-159	HW-2001	EX-MH159	CONDUIT	25.3	0.5145	0.0130
201-PND2	MH-201	POND2	CONDUIT	22.4	0.4911	0.0130
202-201	CBMH-202	MH-201	CONDUIT	18.1	0.3315	0.0130
203-202	CBMH-203	CBMH-202	CONDUIT	58.8	0.4936	0.0130
204-203	CBMH-204	CBMH-202	CONDUIT	103.2	0.3005	0.0130
205-204	CBMH-205	CBMH-204	CONDUIT	76.3	0.3015	0.0130
206-205	CBMH-206	CBMH-205	CONDUIT	35.9	0.3010	0.0130
207-206	CBMH-207	CBMH-206	CONDUIT	23.9	0.3144	0.0130
208-207	CBMH-208	CBMH-207	CONDUIT	39.0	0.3076	0.0130
3001-501	HW-3001	MH-501	CONDUIT	85.5	0.1520	0.0130
301-PND3	MH-301	POND3	CONDUIT	28.2	0.1066	0.0130
302-301	MH-302	MH-301	CONDUIT	59.9	0.1002	0.0130
303-302	CBMH-303	MH-302	CONDUIT	63.4	0.4006	0.0130
304-302	MH-304	MH-302	CONDUIT	46.9	0.1066	0.0130
306-305	MH-306	MH-305	CONDUIT	113.9	0.1984	0.0130
307-304	MH-307	MH-304	CONDUIT	60.4	0.0994	0.0130
308-307	MH-308	MH-307	CONDUIT	120.0	0.1000	0.0130
309-308	MH-309	MH-308	CONDUIT	120.0	0.1000	0.0130
310-307	MH-310	MH-307	CONDUIT	73.5	0.1006	0.0130
311-310	MH-311	MH-310	CONDUIT	70.9	0.1002	0.0130
312-311	MH-312	MH-311	CONDUIT	114.4	0.0996	0.0130
313-312	MH-313	MH-312	CONDUIT	120.0	0.1000	0.0130
314-313	CBMH-314	MH-313	CONDUIT	17.2	0.5007	0.0130
401-PND3	MH-401	POND3	CONDUIT	30.6	0.0980	0.0130
402-401	MH-402	MH-401	CONDUIT	116.4	0.0997	0.0130
403-402	MH-403	MH-402	CONDUIT	120.0	0.2042	0.0130
44_(STM)	MH-305	MH-304	CONDUIT	96.8	0.1012	0.0130
501-160	MH-501	EX-MH160	CONDUIT	27.8	0.1509	0.0130
CAP-401	CAP	MH-401	CONDUIT	11.8	0.1020	0.0130
PND1_OVR	POND1	OF2	CONDUIT	42.4	0.3539	0.0150
PND2_OVR	POND2	OF3	CONDUIT	7.0	3.5737	0.0150
PND3_OVR	CBMH-303	OF4	CONDUIT	7.0	-3.5737	0.0130
OR1	POND1	HW-1001	ORIFICE			
OR2	POND2	HW-2001	ORIFICE			
OR3	POND3	HW-3001	ORIFICE			

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Cross Section Summary
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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
1001-139	CIRCULAR	0.60	0.28	0.15	0.60	1	439.00
101-PND1	CIRCULAR	0.75	0.44	0.19	0.75	1	622.85
102-101	CIRCULAR	0.68	0.36	0.17	0.68	1	461.15
103-102	CIRCULAR	0.60	0.28	0.15	0.60	1	337.36
104-103	CIRCULAR	0.53	0.22	0.13	0.53	1	291.14
105-104	CIRCULAR	0.45	0.16	0.11	0.45	1	283.32
2001-159	CIRCULAR	0.45	0.16	0.11	0.45	1	204.52
201-PND2	CIRCULAR	0.75	0.44	0.19	0.75	1	780.20
202-201	CIRCULAR	0.75	0.44	0.19	0.75	1	641.01
203-202	CIRCULAR	0.30	0.07	0.07	0.30	1	67.94
204-203	CIRCULAR	0.75	0.44	0.19	0.75	1	610.29
205-204	CIRCULAR	0.68	0.36	0.17	0.68	1	461.60
206-205	CIRCULAR	0.60	0.28	0.15	0.60	1	336.86
207-206	CIRCULAR	0.53	0.22	0.13	0.53	1	241.16
208-207	CIRCULAR	0.38	0.11	0.09	0.38	1	97.24
3001-501	CIRCULAR	1.05	0.87	0.26	1.05	1	1064.81
301-PND3	CIRCULAR	1.50	1.77	0.38	1.50	1	2307.59
302-301	CIRCULAR	1.50	1.77	0.38	1.50	1	2237.62
303-302	CIRCULAR	0.30	0.07	0.07	0.30	1	61.21
304-302	CIRCULAR	1.50	1.77	0.38	1.50	1	2307.86
306-305	CIRCULAR	0.60	0.28	0.15	0.60	1	273.54
307-304	CIRCULAR	1.35	1.43	0.34	1.35	1	1682.85
308-307	CIRCULAR	1.05	0.87	0.26	1.05	1	863.58
309-308	CIRCULAR	0.90	0.64	0.23	0.90	1	572.51
310-307	CIRCULAR	1.20	1.13	0.30	1.20	1	1236.83
311-310	CIRCULAR	1.20	1.13	0.30	1.20	1	1234.20
312-311	CIRCULAR	1.20	1.13	0.30	1.20	1	1230.74
313-312	CIRCULAR	1.05	0.87	0.26	1.05	1	863.73
314-313	CIRCULAR	0.38	0.11	0.09	0.38	1	124.07
401-PND3	CIRCULAR	1.50	1.77	0.38	1.50	1	2213.48
402-401	CIRCULAR	0.53	0.22	0.13	0.53	1	135.79
403-402	CIRCULAR	0.45	0.16	0.11	0.45	1	128.83
44_(STM)	CIRCULAR	0.82	0.53	0.21	0.82	1	456.74
501-160	CIRCULAR	1.05	0.87	0.26	1.05	1	1060.95
CAP-401	CIRCULAR	1.50	1.77	0.38	1.50	1	2258.20
PND1_OVR	RECT_OPEN	1.00	3.00	0.75	3.00	1	9822.22
PND2_OVR	RECT_OPEN	1.00	3.00	0.75	3.00	1	31212.12
PND3_OVR	RECT_OPEN	1.00	5.50	0.85	5.50	1	71554.66

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NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
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Analysis Options
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```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 03/18/2020 00:00:00
Ending Date .............. 03/19/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 2.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m
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Control Actions Taken
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Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	1.770	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.222	8.968
Surface Runoff	1.538	62.252

Final Storage	0.025	1.003
Continuity Error (%)	-0.777	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.538	15.376
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.553	15.533
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-1.018	

Highest Continuity Errors

Node MH-402 (2.94%)
Node MH-311 (-1.28%)

Time-Step Critical Elements

Link CAP-401 (1.08%)

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	1.99 sec
Maximum Time Step	:	2.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.01

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A-01	71.67	0.00	0.00	1.76	67.86	1.23	69.09	0.32	227.21	0.964
A-02	71.67	0.00	0.00	4.91	62.92	3.15	66.07	0.20	143.74	0.922
A-03	71.67	0.00	0.00	2.64	66.29	1.88	68.16	0.18	127.02	0.951
A-04	71.67	0.00	0.00	3.95	64.03	2.82	66.85	0.11	79.00	0.933
A-05	71.67	0.00	0.00	7.67	58.66	4.72	63.38	0.47	338.90	0.884
B-01	71.67	0.00	0.00	4.42	63.49	3.00	66.49	0.20	143.18	0.928
B-02	71.67	0.00	0.00	3.97	64.16	2.74	66.90	0.18	134.25	0.934
B-03	71.67	0.00	0.00	0.00	71.93	0.00	71.93	0.06	38.83	1.004
B-04	71.67	0.00	0.00	2.63	66.15	1.92	68.07	0.12	85.08	0.950
B-05	71.67	0.00	0.00	0.00	71.93	0.00	71.93	0.06	39.03	1.004
B-06	71.67	0.00	0.00	13.44	50.18	7.55	57.73	0.35	248.69	0.805
B-07	71.67	0.00	0.00	16.69	45.18	9.35	54.54	0.16	115.67	0.761
B-08	71.67	0.00	0.00	9.01	56.50	5.57	62.06	0.13	96.65	0.866
B-09	71.67	0.00	0.00	17.25	44.49	9.50	53.99	0.12	87.27	0.753
C-01	71.67	0.00	0.00	24.00	36.04	11.29	47.33	0.31	200.10	0.660
C-02	71.67	0.00	0.00	0.00	70.73	0.00	70.73	0.51	352.50	0.987
C-03	71.67	0.00	0.00	0.00	72.20	0.00	72.20	0.52	357.34	1.007
C-04	71.67	0.00	0.00	3.13	65.78	2.00	67.78	0.51	358.25	0.946
C-05	71.67	0.00	0.00	0.00	72.19	0.00	72.19	0.36	246.80	1.007
C-06	71.67	0.00	0.00	7.23	59.39	4.42	63.81	0.34	248.04	0.890
C-07	71.67	0.00	0.00	3.99	64.28	2.66	66.94	0.25	183.16	0.934
C-08	71.67	0.00	0.00	3.15	65.76	1.96	67.72	0.62	423.48	0.945
C-09	71.67	0.00	0.00	0.00	72.20	0.00	72.20	0.55	374.95	1.007
C-10	71.67	0.00	0.00	0.00	72.20	0.00	72.20	0.33	225.22	1.007
C-11	71.67	0.00	0.00	1.76	67.90	1.21	69.11	0.35	246.81	0.964
C-12	71.67	0.00	0.00	6.23	60.69	4.06	64.76	0.20	150.31	0.904
C-13	71.67	0.00	0.00	3.13	65.78	1.99	67.77	0.56	392.13	0.946
C-14	71.67	0.00	0.00	0.00	70.73	0.00	70.73	0.41	281.51	0.987
C-15	71.67	0.00	0.00	7.63	58.63	4.78	63.41	0.26	188.65	0.885
C-16	71.67	0.00	0.00	16.99	45.23	9.00	54.23	0.11	72.62	0.757
C-17	71.67	0.00	0.00	19.49	41.69	10.09	51.77	0.10	67.29	0.722
C-18	71.67	0.00	0.00	23.39	36.00	11.95	47.95	0.11	71.04	0.669

C-19	71.67	0.00	0.00	23.38	36.00	11.97	47.97	0.10	70.36	0.669
C-20	71.67	0.00	0.00	24.23	36.05	11.04	47.09	0.16	104.53	0.657
D-01	71.67	0.00	0.00	56.01	0.00	15.76	15.76	0.01	3.67	0.220
D-02	71.67	0.00	0.00	57.61	0.00	14.13	14.13	0.03	6.03	0.197
D-03	71.67	0.00	0.00	35.36	14.05	23.95	38.00	0.00	3.39	0.530
FUT-1	71.67	0.00	0.00	3.22	66.04	1.86	67.89	5.74	3587.52	0.947
PND1	71.67	0.00	0.00	50.23	0.00	21.70	21.70	0.04	16.92	0.303
PND2	71.67	0.00	0.00	49.58	0.00	22.39	22.39	0.08	31.93	0.312
PND3	71.67	0.00	0.00	55.26	0.00	16.52	16.52	0.18	49.39	0.230

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Node Depth Summary
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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	hr:min	Reported Max Depth Meters
CAP	JUNCTION	0.26	1.94	88.96	0	01:46	1.94
HW-1001	JUNCTION	0.03	0.25	87.95	0	01:28	0.25
HW-2001	JUNCTION	0.04	0.30	87.28	0	01:33	0.30
HW-3001	JUNCTION	0.15	0.65	86.98	0	01:48	0.65
MH-501	JUNCTION	0.43	0.87	86.76	0	01:48	0.87
EX-MH139	OUTFALL	0.00	0.00	87.17	0	00:00	0.00
EX-MH159	OUTFALL	0.00	0.00	86.10	0	00:00	0.00
EX-MH160	OUTFALL	0.00	0.00	85.82	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	90.65	0	00:00	0.00
OF2	OUTFALL	0.00	0.00	89.60	0	00:00	0.00
OF3	OUTFALL	0.00	0.00	89.50	0	00:00	0.00
OF4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF5	OUTFALL	0.00	0.00	89.70	0	00:00	0.00
CBMH-101	STORAGE	0.16	2.08	90.07	0	01:26	2.08
CBMH-102	STORAGE	0.14	1.90	90.08	0	01:26	1.90
CBMH-103	STORAGE	0.13	1.76	90.09	0	01:11	1.76
CBMH-104	STORAGE	0.10	1.76	90.34	0	01:10	1.75
CBMH-105	STORAGE	0.07	1.69	90.60	0	01:10	1.66
CBMH-202	STORAGE	0.16	1.88	89.23	0	01:31	1.88
CBMH-203	STORAGE	0.09	1.35	89.34	0	01:11	1.34
CBMH-204	STORAGE	0.12	1.72	89.39	0	01:12	1.72
CBMH-205	STORAGE	0.09	1.77	89.75	0	01:11	1.77
CBMH-206	STORAGE	0.08	1.74	89.90	0	01:11	1.74
CBMH-207	STORAGE	0.07	1.69	90.00	0	01:11	1.69
CBMH-208	STORAGE	0.05	1.75	90.33	0	01:10	1.74
CBMH-303	STORAGE	0.05	0.67	88.97	0	01:48	0.67
CBMH-314	STORAGE	0.03	1.22	89.89	0	01:10	1.21
MH-201	STORAGE	0.17	1.96	89.22	0	01:32	1.96
MH-301	STORAGE	0.31	2.23	88.96	0	01:47	2.23
MH-302	STORAGE	0.30	2.12	88.97	0	01:47	2.12
MH-304	STORAGE	0.28	2.03	88.99	0	01:12	2.03
MH-305	STORAGE	0.14	1.47	89.20	0	01:11	1.46
MH-306	STORAGE	0.08	1.38	89.56	0	01:10	1.37
MH-307	STORAGE	0.23	1.98	89.15	0	01:11	1.98
MH-308	STORAGE	0.16	1.84	89.43	0	01:11	1.84
MH-309	STORAGE	0.12	1.74	89.60	0	01:10	1.74
MH-310	STORAGE	0.20	1.89	89.28	0	01:11	1.88
MH-311	STORAGE	0.18	1.91	89.38	0	01:11	1.90
MH-312	STORAGE	0.16	1.94	89.58	0	01:11	1.94
MH-313	STORAGE	0.11	1.76	89.67	0	01:10	1.76
MH-401	STORAGE	0.27	1.98	88.96	0	01:47	1.98
MH-402	STORAGE	0.08	0.90	88.97	0	01:47	0.90
MH-403	STORAGE	0.04	0.58	88.97	0	01:47	0.58
POND1	STORAGE	0.19	2.37	90.07	0	01:28	2.37
POND2	STORAGE	0.20	2.22	89.22	0	01:32	2.22
POND3	STORAGE	0.41	2.61	88.96	0	01:48	2.61

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CAP	JUNCTION	3587.52	3587.52	0	01:10	5.74	5.74	-0.010
HW-1001	JUNCTION	0.00	163.24	0	01:28	0	1.31	-0.003
HW-2001	JUNCTION	0.00	163.43	0	01:32	0	1.46	-0.002
HW-3001	JUNCTION	0.00	849.13	0	01:48	0	12.7	0.003
MH-501	JUNCTION	0.00	849.13	0	01:48	0	12.7	0.019
EX-MH139	OUTFALL	0.00	163.25	0	01:28	0	1.31	0.000
EX-MH159	OUTFALL	0.00	163.43	0	01:33	0	1.46	0.000
EX-MH160	OUTFALL	0.00	849.13	0	01:48	0	12.7	0.000
OF1	OUTFALL	9.70	9.70	0	01:20	0.0396	0.0396	0.000
OF2	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
OF3	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
OF4	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
OF5	OUTFALL	3.39	3.39	0	01:10	0.00307	0.00307	0.000
CBMH-101	STORAGE	338.90	853.78	0	01:10	0.466	1.27	-0.044

CBMH-102	STORAGE	79.00	533.25	0	01:10	0.108	0.801	0.026
CBMH-103	STORAGE	127.02	471.58	0	01:10	0.176	0.693	-0.112
CBMH-104	STORAGE	143.74	362.24	0	01:10	0.199	0.517	0.173
CBMH-105	STORAGE	227.21	227.21	0	01:10	0.32	0.32	0.221
CBMH-202	STORAGE	96.65	823.97	0	01:10	0.131	1.38	-0.324
CBMH-203	STORAGE	87.27	87.27	0	01:10	0.124	0.124	1.027
CBMH-204	STORAGE	115.67	710.38	0	01:10	0.162	1.11	-0.955
CBMH-205	STORAGE	248.69	636.68	0	01:10	0.35	0.958	0.801
CBMH-206	STORAGE	124.11	409.88	0	01:10	0.174	0.609	0.108
CBMH-207	STORAGE	134.25	304.21	0	01:10	0.184	0.434	-0.155
CBMH-208	STORAGE	182.01	182.01	0	01:10	0.252	0.252	0.947
CBMH-303	STORAGE	72.62	72.62	0	01:10	0.105	0.105	1.980
CBMH-314	STORAGE	200.10	200.10	0	01:10	0.311	0.311	0.341
MH-201	STORAGE	0.00	787.90	0	01:10	0	1.38	-0.038
MH-301	STORAGE	0.00	3617.38	0	01:11	0	6.39	-0.268
MH-302	STORAGE	67.29	3649.88	0	01:11	0.0989	6.4	0.101
MH-304	STORAGE	188.65	3573.62	0	01:11	0.257	6.15	-0.756
MH-305	STORAGE	281.51	634.50	0	01:10	0.405	0.954	0.374
MH-306	STORAGE	392.13	392.13	0	01:10	0.559	0.559	1.836
MH-307	STORAGE	150.31	2887.15	0	01:10	0.204	4.9	-0.841
MH-308	STORAGE	472.04	1208.61	0	01:10	0.677	1.83	-0.328
MH-309	STORAGE	798.44	798.44	0	01:10	1.16	1.16	0.740
MH-310	STORAGE	183.16	1675.88	0	01:10	0.252	2.85	-0.492
MH-311	STORAGE	248.04	1581.78	0	01:10	0.343	2.56	-1.261
MH-312	STORAGE	605.05	1453.22	0	01:10	0.869	2.21	-0.521
MH-313	STORAGE	709.84	904.35	0	01:10	1.03	1.34	0.423
MH-401	STORAGE	71.04	3810.27	0	01:10	0.106	6.1	0.186
MH-402	STORAGE	70.36	171.48	0	01:10	0.105	0.268	3.028
MH-403	STORAGE	104.53	104.53	0	01:10	0.164	0.164	0.734
POND1	STORAGE	16.92	850.04	0	01:10	0.0426	1.31	-0.070
POND2	STORAGE	31.93	808.43	0	01:10	0.076	1.46	-0.030
POND3	STORAGE	49.39	7313.99	0	01:10	0.18	12.7	-0.322

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
CAP	JUNCTION	1.91	0.443	0.855

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CBMH-101	0.000	6	0	0	0.002	78	0 01:26	833.74
CBMH-102	0.000	5	0	0	0.002	74	0 01:26	522.55
CBMH-103	0.000	5	0	0	0.002	73	0 01:11	457.58
CBMH-104	0.000	4	0	0	0.002	75	0 01:10	346.18
CBMH-105	0.000	4	0	0	0.002	89	0 01:10	218.74
CBMH-202	0.000	6	0	0	0.002	67	0 01:31	787.90
CBMH-203	0.000	5	0	0	0.002	80	0 01:11	76.30
CBMH-204	0.000	5	0	0	0.002	71	0 01:12	661.70
CBMH-205	0.000	3	0	0	0.002	64	0 01:11	598.61
CBMH-206	0.000	3	0	0	0.002	66	0 01:11	389.84
CBMH-207	0.000	3	0	0	0.002	66	0 01:11	286.42
CBMH-208	0.000	2	0	0	0.002	76	0 01:10	170.17
CBMH-303	0.000	5	0	0	0.001	58	0 01:48	65.88
CBMH-314	0.000	2	0	0	0.001	82	0 01:10	195.00
MH-201	0.000	5	0	0	0.002	60	0 01:32	776.59
MH-301	0.000	10	0	0	0.003	70	0 01:47	3584.56
MH-302	0.000	10	0	0	0.002	73	0 01:47	3617.38
MH-304	0.000	10	0	0	0.002	71	0 01:12	3531.31
MH-305	0.000	6	0	0	0.002	62	0 01:11	585.87
MH-306	0.000	4	0	0	0.002	65	0 01:10	356.92
MH-307	0.000	8	0	0	0.002	66	0 01:11	2834.06
MH-308	0.000	6	0	0	0.002	67	0 01:11	1123.62
MH-309	0.000	5	0	0	0.002	70	0 01:10	744.15
MH-310	0.000	7	0	0	0.002	64	0 01:11	1642.45
MH-311	0.000	6	0	0	0.002	68	0 01:11	1509.80
MH-312	0.000	6	0	0	0.002	72	0 01:11	1344.96
MH-313	0.000	5	0	0	0.002	72	0 01:10	848.38
MH-401	0.000	9	0	0	0.002	70	0 01:47	3806.04
MH-402	0.000	4	0	0	0.001	44	0 01:47	166.52

MH-403	0.000	2	0	0	0.001	32	0	01:47	101.66
POND1	0.033	4	0	0	0.545	75	0	01:28	163.24
POND2	0.036	4	0	0	0.559	61	0	01:32	163.43
POND3	0.850	9	0	0	6.678	70	0	01:48	849.13

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
EX-MH139	29.19	53.21	163.25	1.311
EX-MH159	29.48	58.44	163.43	1.459
EX-MH160	96.90	153.30	849.13	12.720
OF1	10.83	4.40	9.70	0.040
OF2	0.00	0.00	0.00	0.000
OF3	0.00	0.00	0.00	0.000
OF4	0.00	0.00	0.00	0.000
OF5	9.40	0.43	3.39	0.003
System	21.97	269.78	3.39	15.533

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1001-139	CONDUIT	163.25	0 01:28	1.44	0.37	0.42
101-PND1	CONDUIT	833.74	0 01:10	1.89	1.34	1.00
102-101	CONDUIT	522.55	0 01:10	1.46	1.13	1.00
103-102	CONDUIT	457.58	0 01:10	1.62	1.36	1.00
104-103	CONDUIT	346.18	0 01:10	1.60	1.19	1.00
105-104	CONDUIT	218.74	0 01:10	1.38	0.77	1.00
2001-159	CONDUIT	163.43	0 01:33	1.50	0.80	0.65
201-PND2	CONDUIT	776.59	0 01:10	1.76	1.00	1.00
202-201	CONDUIT	787.90	0 01:10	1.78	1.23	1.00
203-202	CONDUIT	76.30	0 01:10	1.08	1.12	1.00
204-203	CONDUIT	661.70	0 01:11	1.50	1.08	1.00
205-204	CONDUIT	598.61	0 01:10	1.67	1.30	1.00
206-205	CONDUIT	389.84	0 01:10	1.38	1.16	1.00
207-206	CONDUIT	286.42	0 01:10	1.32	1.19	1.00
208-207	CONDUIT	170.17	0 01:10	1.54	1.75	1.00
3001-501	CONDUIT	849.13	0 01:48	1.64	0.80	0.58
301-PND3	CONDUIT	3584.56	0 01:11	2.57	1.55	1.00
302-301	CONDUIT	3617.38	0 01:11	2.11	1.62	1.00
303-302	CONDUIT	65.88	0 01:07	1.09	1.08	1.00
304-302	CONDUIT	3531.31	0 01:11	2.00	1.53	1.00
306-305	CONDUIT	356.92	0 01:10	1.26	1.30	1.00
307-304	CONDUIT	2834.06	0 01:11	1.98	1.68	1.00
308-307	CONDUIT	1123.62	0 01:10	1.30	1.30	1.00
309-308	CONDUIT	744.15	0 01:10	1.17	1.30	1.00
310-307	CONDUIT	1642.45	0 01:11	1.45	1.33	1.00
311-310	CONDUIT	1509.80	0 01:10	1.33	1.22	1.00
312-311	CONDUIT	1344.96	0 01:10	1.19	1.09	1.00
313-312	CONDUIT	848.38	0 01:10	1.06	0.98	1.00
314-313	CONDUIT	195.00	0 01:10	1.77	1.57	1.00
401-PND3	CONDUIT	3806.04	0 01:10	2.84	1.72	1.00
402-401	CONDUIT	166.52	0 01:12	1.03	1.23	1.00
403-402	CONDUIT	101.66	0 01:10	0.87	0.79	1.00
44_(STM)	CONDUIT	585.87	0 01:10	1.10	1.28	1.00
501-160	CONDUIT	849.13	0 01:48	1.87	0.80	0.52
CAP-401	CONDUIT	3587.35	0 01:10	2.52	1.59	1.00
PND1_OVR	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
PND2_OVR	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
PND3_OVR	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
OR1	ORIFICE	163.24	0 01:28			1.00
OR2	ORIFICE	163.43	0 01:32			1.00
OR3	ORIFICE	849.13	0 01:48			1.00

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
1001-139	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
101-PND1	1.00	0.01	0.00	0.00	0.12	0.00	0.00	0.86	0.00	0.00
102-101	1.00	0.02	0.00	0.00	0.11	0.00	0.00	0.87	0.00	0.00
103-102	1.00	0.02	0.00	0.00	0.10	0.00	0.00	0.88	0.00	0.00

104-103	1.00	0.01	0.00	0.00	0.10	0.00	0.00	0.89	0.01	0.00
105-104	1.00	0.01	0.00	0.00	0.09	0.00	0.00	0.89	0.01	0.00
2001-159	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
201-PND2	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.85	0.00	0.00
202-201	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.86	0.00	0.00
203-202	1.00	0.01	0.00	0.00	0.11	0.00	0.00	0.87	0.01	0.00
204-203	1.00	0.01	0.00	0.00	0.18	0.00	0.00	0.81	0.01	0.00
205-204	1.00	0.01	0.00	0.00	0.11	0.00	0.00	0.88	0.01	0.00
206-205	1.00	0.01	0.00	0.00	0.10	0.00	0.00	0.89	0.01	0.00
207-206	1.00	0.01	0.00	0.00	0.09	0.00	0.00	0.90	0.00	0.00
208-207	1.00	0.01	0.00	0.00	0.08	0.00	0.00	0.92	0.01	0.00
3001-501	1.00	0.01	0.00	0.00	0.78	0.00	0.00	0.21	0.10	0.00
301-PND3	1.00	0.01	0.00	0.00	0.23	0.00	0.00	0.76	0.00	0.00
302-301	1.00	0.01	0.00	0.00	0.23	0.00	0.00	0.77	0.01	0.00
303-302	1.00	0.02	0.00	0.00	0.12	0.00	0.00	0.86	0.02	0.00
304-302	1.00	0.01	0.00	0.00	0.23	0.00	0.00	0.76	0.00	0.00
306-305	1.00	0.02	0.00	0.00	0.13	0.00	0.00	0.85	0.02	0.00
307-304	1.00	0.01	0.00	0.00	0.21	0.00	0.00	0.79	0.01	0.00
308-307	1.00	0.01	0.00	0.00	0.17	0.00	0.00	0.82	0.01	0.00
309-308	1.00	0.01	0.00	0.00	0.16	0.00	0.00	0.84	0.01	0.00
310-307	1.00	0.01	0.00	0.00	0.19	0.00	0.00	0.80	0.01	0.00
311-310	1.00	0.01	0.00	0.00	0.43	0.00	0.00	0.56	0.16	0.00
312-311	1.00	0.01	0.00	0.00	0.18	0.00	0.00	0.81	0.01	0.00
313-312	1.00	0.01	0.00	0.00	0.16	0.00	0.00	0.84	0.01	0.00
314-313	1.00	0.02	0.00	0.00	0.08	0.00	0.00	0.91	0.01	0.00
401-PND3	1.00	0.01	0.00	0.00	0.20	0.00	0.00	0.79	0.00	0.00
402-401	1.00	0.02	0.00	0.00	0.13	0.00	0.00	0.86	0.01	0.00
403-402	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.86	0.03	0.00
44_(STM)	1.00	0.02	0.00	0.00	0.16	0.00	0.00	0.83	0.01	0.00
501-160	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
CAP-401	1.00	0.01	0.00	0.00	0.29	0.02	0.00	0.69	0.00	0.00
PND1_OVR	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PND2_OVR	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PND3_OVR	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
101-PND1	2.07	2.07	2.17	0.13	0.13
102-101	1.96	1.96	2.06	0.10	0.11
103-102	1.89	1.89	1.96	0.14	0.14
104-103	1.73	1.73	1.90	0.11	0.12
105-104	1.48	1.48	1.73	0.01	0.05
201-PND2	2.33	2.33	2.44	0.01	0.01
202-201	2.23	2.23	2.29	0.12	0.13
203-202	2.02	2.02	2.34	0.07	0.12
204-203	1.85	1.85	2.22	0.07	0.11
205-204	1.55	1.55	1.84	0.16	0.14
206-205	1.41	1.41	1.55	0.13	0.13
207-206	1.31	1.31	1.42	0.13	0.12
208-207	1.13	1.15	1.31	0.19	0.15
301-PND3	2.52	2.53	2.58	0.17	0.04
302-301	2.30	2.38	2.41	0.18	0.10
303-302	1.85	1.85	2.38	0.07	0.04
304-302	2.16	2.20	2.25	0.17	0.18
306-305	1.46	1.46	2.01	0.15	0.12
307-304	2.08	2.08	2.20	0.19	0.15
308-307	1.80	1.81	2.08	0.15	0.14
309-308	1.52	1.52	1.81	0.14	0.11
310-307	1.91	1.91	2.08	0.13	0.13
311-310	1.73	1.73	1.90	0.10	0.11
312-311	1.21	1.21	1.58	0.07	0.12
313-312	0.52	0.52	1.23	0.01	0.03
314-313	0.15	0.19	0.52	0.17	0.12
401-PND3	2.00	2.00	2.06	0.18	0.01
402-401	1.71	1.71	2.00	0.09	0.01
403-402	0.96	0.96	1.72	0.01	0.01
44_(STM)	1.99	2.00	2.20	0.14	0.14
CAP-401	1.91	1.91	1.93	0.17	0.02

Analysis begun on: Fri May 28 16:55:14 2021
Analysis ended on: Fri May 28 16:55:17 2021
Total elapsed time: 00:00:03

Sortation Facility
100-year HGL Elevations

MH ID	Pipe / MH / USF Information				HGL Information[1]		Surcharge Depth Above Pipe Obvert		Clearance from T/G	
	D/S Pipe Size (mm)	D/S Pipe Invert Elev. (m)	D/S Pipe Obvert Elev. (m)	MH T/G Elev. (m)	100-year (m)	100-year (+20%) (m)	100-year (m)	100-year (+20%) (m)	100-year (m)	100-year (+20%) (m)
CBMH-101	750	87.99	88.74	90.65	90.07	90.37	1.33	1.64	0.58	0.28
CBMH-102	675	88.18	88.86	90.75	90.08	90.37	1.22	1.51	0.67	0.38
CBMH-103	600	88.33	88.93	90.75	90.09	90.39	1.16	1.46	0.66	0.36
CBMH-104	525	88.58	89.11	90.91	90.34	90.63	1.24	1.52	0.57	0.28
CBMH-105	450	88.91	89.36	90.80	90.60	90.80	1.24	1.44	0.20	0.00
CBMH-202	750	87.35	88.10	90.15	89.23	89.54	1.13	1.44	0.92	0.61
CBMH-203	300	87.99	88.29	89.67	89.34	89.67	1.05	1.38	0.33	0.00
CBMH-204	750	87.67	88.42	90.10	89.39	89.84	0.97	1.42	0.71	0.26
CBMH-205	675	87.98	88.65	90.75	89.75	90.36	1.10	1.71	1.00	0.39
CBMH-206	600	88.16	88.76	90.80	89.90	90.55	1.14	1.79	0.90	0.25
CBMH-207	525	88.31	88.83	90.85	90.00	90.65	1.17	1.82	0.85	0.20
CBMH-208	375	88.58	88.95	90.90	90.33	90.90	1.38	1.95	0.57	0.00
CBMH-303	300	88.30	88.60	89.45	88.97	89.40	0.37	0.80	0.48	0.05
CBMH-314	375	88.67	89.05	90.15	89.89	90.15	0.84	1.10	0.26	0.00
MH-201	750	87.26	88.01	90.51	89.22	89.53	1.21	1.52	1.29	0.98
MH-301	1500	86.73	88.23	89.91	88.96	89.39	0.73	1.16	0.95	0.52
MH-302	1500	86.85	88.35	89.76	88.97	89.40	0.62	1.05	0.79	0.36
MH-304	1500	86.96	88.46	89.83	88.99	89.48	0.53	1.02	0.84	0.35
MH-305	825	87.73	88.56	90.08	89.20	89.77	0.64	1.21	0.88	0.31
MH-306	600	88.18	88.78	90.30	89.56	90.26	0.78	1.48	0.74	0.04
MH-307	1350	87.17	88.52	90.16	89.15	89.67	0.63	1.15	1.01	0.49
MH-308	1050	87.59	88.64	90.34	89.43	90.06	0.79	1.42	0.91	0.28
MH-309	900	87.86	88.76	90.35	89.60	90.31	0.84	1.55	0.75	0.04
MH-310	1200	87.39	88.59	90.35	89.28	89.79	0.69	1.20	1.07	0.56
MH-311	1200	87.47	88.67	90.29	89.38	89.89	0.71	1.22	0.91	0.40
MH-312	1200	87.64	88.84	90.34	89.58	90.11	0.74	1.27	0.76	0.23
MH-313	1050	87.91	88.96	90.35	89.67	90.18	0.71	1.22	0.68	0.17
MH-401	1500	86.98	88.48	89.83	88.96	89.39	0.48	0.91	0.87	0.44
MH-402	525	88.07	88.60	90.09	88.97	89.40	0.37	0.80	1.12	0.69
MH-403	450	88.39	88.84	90.22	88.97	89.40	0.13	0.56	1.25	0.82

(1) HGL information is for a 3-hour Chicago Storm Distribution; based on a fixed outfall elevation

Appendix E
Development Servicing Checklist

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- N/A ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- ☐ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- ☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

N/A ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

N/A ☐ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

N/A ☐ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

N/A ☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☒ Address reliability requirements such as appropriate location of shut-off valves

N/A ☐ Check on the necessity of a pressure zone boundary modification.

- [X] Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range
- [X] Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.
- N/A [ ] Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.
- [X] Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- [X] Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- [X] Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).
- [X] Confirm consistency with Master Servicing Study and/or justifications for deviations.
- N/A [ ] Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.
- [X] Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- [X] Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)
- [X] Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.
- [X] Description of proposed sewer network including sewers, pumping stations, and forcemains.

N/A ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).

N/A ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.

N/A ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.

N/A ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

☐ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

N/A ☐ Analysis of available capacity in existing public infrastructure.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

N/A ☐ Set-back from private sewage disposal systems.

N/A ☐ Watercourse and hazard lands setbacks.

N/A ☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

- [X] Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- [X] Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- [X] Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.
- N/A [ ] Any proposed diversion of drainage catchment areas from one outlet to another.
- [X] Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- N/A [ ] If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.
- [ ] Identification of potential impacts to receiving watercourses
- [ ] Identification of municipal drains and related approval requirements.
- [X] Descriptions of how the conveyance and storage capacity will be achieved for the development.
- [ ] 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.
- [X] Inclusion of hydraulic analysis including hydraulic grade line elevations.
- [X] Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- N/A [ ] Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
- N/A [ ] Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

- [X] Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.
- [ ] Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.
- N/A [ ] Changes to Municipal Drains.
- N/A [ ] Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

- [X] Clearly stated conclusions and recommendations
- N/A [ ] Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.
- [X] All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

Appendix F

Drawings