Van Gaal Lands - Claridge Development
1039 Terry Fox Drive & 5331 Fernbank Road

Site Serviceability and Stormwater Management Report

VAN GAAL LANDS – CLARIDGE DEVELOPMENT

1039 TERRY FOX DRIVE & 5331 FERNBANK ROAD

SITE SERVICEABILITY AND STORMWATER MANAGEMENT REPORT

Prepared for:

Claridge Homes

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

October 10, 2018

Novatech File: 117198
Report Ref: R-2018-116

NOVATECH
Engineers, Planners & Landscape Architects

October 10, 2018

City of Ottawa
Planning, Infrastructure and Economic Development Department
Planning Services Branch
110 Laurier Ave. West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Mr. Don Herweyer, Manager of Development Review South**

Reference: **Van Gaal Lands – 1039 Terry Fox Drive and 5331 Fernbank Road**
Site Serviceability and Stormwater Management Report
Novatech File No.: 117198

Novatech has prepared this Site Serviceability and Stormwater Management Report on behalf of Claridge Homes to support a Draft Plan of Subdivision application for 1039 Terry Fox Drive and 5331 Fernbank Road.

Claridge intends to develop a residential subdivision consisting of single-detached and street-oriented townhouses. All proposed uses conform to the current zoning.

It will address how the subject development will be serviced with sanitary sewer, watermain, storm sewers, and stormwater management.

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

Sincerely,

NOVATECH

Marc St. Pierre
Senior Project Manager

Encl.

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    - 100-year 24-hour SCS Storm (JFSA)

1.0 INTRODUCTION

Novatech has been retained by Claridge Homes to prepare a Site Serviceability and Stormwater Management Report as 1039 Terry Fox Drive and 5331 Fernbank Road in South Kanata, Ottawa.

The Plan of Subdivision applies to a portion of the larger property; specifically, the area south of the Monahan Drain, and north of Cope Drive (the 'Subject Site' or 'Van Gaal Lands'). An amendment to the Zoning By-law was approved by the City in July 2017 (City File No.: D02-02-15-0066) to permit residential uses on the Subject Site. The proposed development conforms to the current zoning.

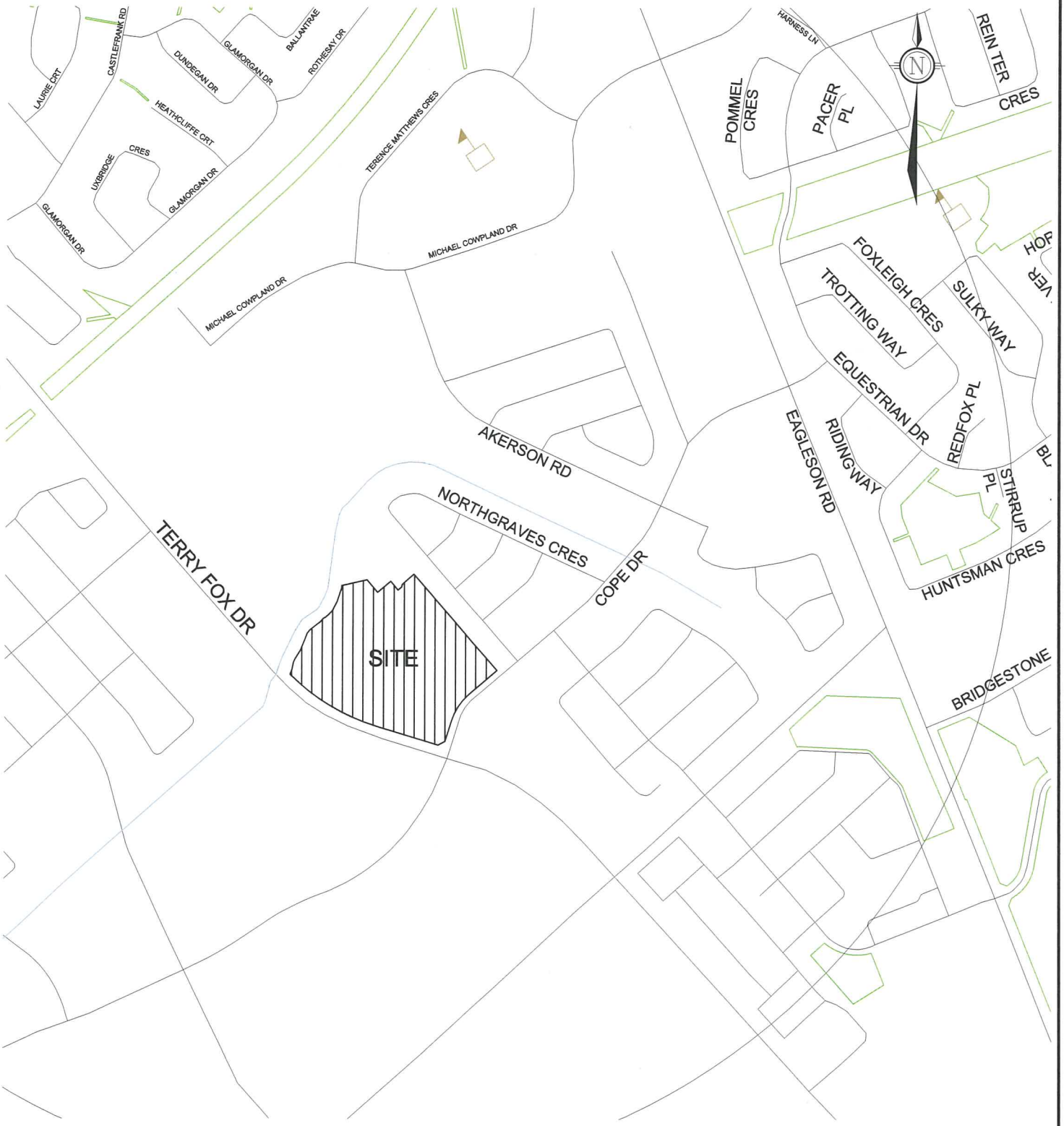
This report outlines the servicing and proposed storm drainage and stormwater management strategy for the site.

1.1 Background

The Draft Plan of Subdivision applies only to a portion of 1039 Terry Fox Drive and 5331 Fernbank Road; specifically, the area south of the Monahan Drain and north of Cope Drive (the 'Subject Site Boundary'), as shown in Figure 1.

Figure 1 – Site Location: 1039 Terry Fox and 5331 Fernbank Rd (Image Source: Google Maps, 2018)

The Subject Site is approximately 8.15 hectares in area. is bounded by Terry Fox Drive to the west, Cope Drive to the south, the Monahan Drain (a tributary to the Jock River) to the north, and an existing residential development known as Trailwest (formerly SOHO West) to the east. Refer to **Figure 1** – Site Location and **Figure 2** – Key Plan.



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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND 5331 FERNBANK ROAD

KEY PLAN

SCALE 1 : 10000 (0 100 200 300 400)

DATE OCT 2018 | JOB 117198 | FIGURE FIG2-KP

M:\2017\117198\CAD\Design\Figures\Design Brief\FIG2-Key Plan.dwg, KP, Oct 05, 2018 - 1:46pm, szorgel

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The Subject Site has approximately 146 metres of frontage along Cope Drive and approximately 325 metres of frontage along Terry Fox Drive. The topography is generally flat with a gentle slope from the south to the north, towards Cell 1 of the existing Monahan Drain.

1.2 Existing / Planned Adjacent Land Uses

The following describes the existing and planned land uses adjacent to the subject site:

North: The Van Gaal Lands currently extend north of the Monahan Drain to the Trans Canada Trail and are used for cattle grazing but are intended for future employment uses. A hydro corridor cuts through this northern portion in the east-west direction.

East: The lands east of the proposed subdivision are existing detached dwellings with frontage on Northgraves Crescent in the adjacent Trailwest Community.

South: Cope Drive, a two-lane collector road, bounds the Subject Site to the south. The Van Gaal Lands extend south of Cope Drive to Fernbank Road. An application for a shopping plaza is contemplated for this southern portion of the Van Gaal Lands by Smart centres.

West: Terry Fox Drive, a two-lane arterial road, bounds the Subject Site to the west. The Blackstone residential community is located on the west side of Terry Fox and is within the Fernbank Community Design Plan area. Additional future uses will include residential, local commercial, and a secondary school.

Southwest: A planned (by others) Smart Centres plaza (5357 Fernbank Road) is located at the southwest corner of Terry Fox Drive and Cope Drive.

The proposed development of the Subject Site is as a residential subdivision, as shown on **Figure 3** – Concept Plan. The proposed subdivision will consist of 129 townhouse units and 55 single units for a total of 184 units.

1.3 Additional Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing for the Van Gaal lands. This report should be read in conjunction with the following:

- *Van Gaal Lands: 1039 Terry Fox Drive and 5331 Fernbank Road, Ottawa, ON, Planning Rationale and Integrated Environmental Review Statement, completed by Novatech, Ref. No.: R-2018-106, dated October 10, 2018;*
- *Van Gaal Lands: 1039 Terry Fox Drive and 5331 Fernbank Road, Noise Impact Feasibility Study, completed by Novatech, Ref. No.: R-2018-118, dated October 10, 2018;*
- *5331 Fernbank Road and 1039 Terry Fox Drive, Traffic Impact Assessment, completed by Novatech, Ref. No.: R-2018-028, dated October 10, 2018;*
- *SOHO West- Rev. 3, Serviceability Report, Prepared by Stantec, dated October 31st, 2007;*
- *Van Gaal Lands: 5331 Fernbank Road and 1039 Terry Fox Drive, Ottawa, ON, Servicing & Stormwater Management Brief, completed by Novatech, Ref. No.: R-2015-123, dated September 1, 2015;*
- *Geotechnical Investigation, Proposed Residential Development, Terry Fox at Cope Drive – Ottawa, dated July 12, 2018 (Report No. PG4466-1).*

Northgraves Crescent

Cope Drive

(CLOSED BY BY-LAW 44-91, INST. NO. N599928)
PART 10 PLAN 5R-14317

PART 9 PLAN 5R-14317

ROAD ALLOWANCE BETWEEN LOTS 30 AND 31

Neighbourhood Park
0.96 ha

"Additional Lands Owned By Applicant"

Monahan Drain

STREET No. 1

STREET No. 2

STREET No. 3

STREET No. 4

BLOCK 57

BLOCK 58

BLOCK 59

BLOCK 60

BLOCK 61

BLOCK 62

BLOCK 63

BLOCK 64

BLOCK 65

BLOCK 66

BLOCK 67

PART 2 PLAN 4R-17373

PART 1 PLAN 4R-17373

Terry Fox Drive

BLOCK 298, PLAN 4M-1521

BLOCK 216, PLAN 4M-1491

LEGEND

PROPOSED DEVELOPMENT BOUNDARY

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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND 5331 FERNBANK ROAD

CONCEPT PLAN

SCALE 1 : 2000 (0 20 40 60 80)

DATE OCT 2018 | JOB 117198 | FIGURE FIG3-CP

SHT11X17.DWG - 279mmX432mm

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2.0 EXISTING CONDITIONS

2.1 Topography & Drainage

The proposed site is currently undeveloped and consists of agricultural lands. Access to the site is currently provided off Terry Fox Drive via a private gravel entrance. Refer to **Figure 4** – Existing Conditions Plan.

The site has a gentle slope from south to north, with most overland flow being directed to Cell 1 of the existing Monahan Drain along the north side of the site. A small amount of drainage is directed to the Terry fox ditch which is conveyed north to the Monahan Drain.

2.2 Subsurface Conditions

Paterson Group Inc. completed two (2) geotechnical investigations in support of the proposed development. The first geotechnical investigation was as follows:

- *Preliminary Geotechnical Investigation, 20 Acre Property, Terry Fox Drive at Fernbank Road, Ottawa Ontario, dated July 25, 2006 (Report No. PG0809-1).* The fieldwork for this investigation was carried out between April 26th and 27th, 2006.

A second geotechnical Investigation was conducted and incorporated the results from the first geotechnical investigation. Therefore, the second report supersedes the first report, and is as follows:

- *Geotechnical Investigation, Proposed Residential Development, Terry Fox at Cope Drive – Ottawa, dated July 12, 2018 (Report No. PG4466-1).* The fieldwork for this investigation was carried out on April 20th, 2018.

The principal findings of the Geotechnical Investigations are as follows:

- The work consisted of advancing six (6) boreholes to depths ranging from 6.4m to 35.8 m below ground surface.
- The existing soil profile consists of having a layer of topsoil ranging from 0.25m to 0.36m thick underlain by a thin layer of silty sand and stratified sand. Below this is a layer of silty clay layer that extends to more than 24m below the existing grade.
- Bedrock is expected to range from 25m-50m below grade.
- Groundwater is expected to range from 1.5m to 2.5m based on observations.
- There is an estimated permissible grade raise restriction of 1.8m for lot grading at the residential buildings and 2.2m for the proposed roadways.

The report provides engineering guidelines based on Paterson Group's interpretation of the borehole information and project requirements. Refer to the above-noted report for complete details.

LEGEND

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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND
5331 FERNBANK ROAD

EXISTING CONDITIONS PLAN

SCALE 1 : 2000 (0 20 40 60 80)

DATE	JOB	FIGURE
OCT 2018	117198	FIG4-EX

SHT11X17.DWG - 279mmX432mm

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3.0 SANITARY SERVICING

3.1 Previous Studies

The Claridge Van Gaal lands (subject site) is located upstream of Phase 1 of the Trailwest (formerly SOHO West) Subdivision. The SOHO West Serviceability Report, *SOHO West- Rev. 3, Serviceability Report, Prepared by Stantec, dated October 31st, 2007,* calculated sanitary flows to outlet to Cope Drive from the lands that make up 1039 Terry Fox Drive and 5331 Fernbank Road, which includes the subject lands and lands north of the Monahan Drain and well as lands south of Cope Drive. Sanitary flows in this report were calculated to be 45.95L/s to outlet to the sanitary sewers on Cope Drive, which ultimately outlet to the Hazeldean Pump Station. Refer to **Appendix B** for excerpts.

In 2015, a rezoning application was submitted for the lands located at 5331 Fernbank Road & 1039 Terry Fox Drive. The land north of the Monahan Drain was rezoned from IP4 to IP to allow for the development of office buildings. The subject lands was rezoned from IP4 to R3X [2410]-h to allow for residential development. And lastly, the land south of Cope drive to Fernbank Road was rezoned from IP4 to IP with exceptions to all for commercial development. The Exceptions would allow for retail store and retail food store to be permitted as secondary uses. As part of the submission a servicing and stormwater report was included titled, *Van Gaal Lands: 5331 Fernbank Road and 1039 Terry Fox Drive, Ottawa, ON, Servicing & Stormwater Management Brief, completed by Novatech, Ref. No.: R-2015-123, dated September 1, 2015.* The 2015 report comprised of two separate outlets for the sanitary flow from 1039 Terry Fox Drive and 5331 Fernbank Road.

The subject lands and the lands south of Cope Drive outlet to the sanitary sewers on Cope Drive. A sanitary flow of 16.23L/s was calculated for in the Cope Drive sanitary sewers.

The business park outlets to the existing 900mm sanitary sewer along Hazeldean Sideroad due to its close proximity to the Hazeldean Pump Station. A sanitary flow of 25.81L/s was calculated to outlet to the Hazeldean Sideroad sewer.

The total sanitary flows to the Hazeldean Pump Station was calculated to be 42.04L/s.

3.2 Existing Sanitary Sewer System for the Subject Lands

Currently, there is an existing 525mm sanitary trunk sewer along Cope Drive to the south and a 200mm sanitary sewer along Northgraves Crescent to the northeast. The sanitary trunk sewer along Cope Drive currently services the existing commercial plaza located at 5357 Fernbank Road and the existing Trailwest community. The Cope Drive trunk sewer ultimately outlets to the Hazeldean Pump Station via the sanitary pipe system in the Trailwest subdivision. Through pre-consultation with the City of Ottawa, underside of footing elevations (USFs) shall be a minimum of 95.30m, which is the emergency overflow elevation at the Pump Station. Please see **Appendix A** for correspondence.

3.3 Proposed Sanitary Sewer Outlet

It is proposed that the Van Gaal Lands development will outlet directly to the 525mm sanitary trunk sewer along Cope Drive. The proposed outlet is consistent with the approved SOHO West Serviceability Report (Stantec) and the approved Servicing & Stormwater Management Report (Novatech) as part of the rezoning application for the Van Gaal Lands. Refer to Section 1.3 for report details.

The proposed development can be serviced with a 200mm sanitary sewer system. The proposed sanitary layout can be seen on **Figure 5** – Sanitary Sewer Layout.

3.4 Design Criteria

Sanitary sewers, for the proposed development, are designed based on criteria established by the City of Ottawa in the following documents:

- Section 4.0 of the City of Ottawa Sewer Design Guidelines (October 2012).
- Technical Bulletin ISTB-2018-01 from the City of Ottawa regarding new sanitary design parameters. Design parameters from this technical bulletin will supersede values within the Sewer Design Guidelines (2012).

The resulting design parameters are summarized as follows:

Commercial/Institutional flows = 28,000 L/ha/day
Industrial flows = 35,000 L/ha/day
Population Flow = 280 L/capita/day
Infiltration = 0.33 L/s/ha
Single Family Home = 3.4 persons per unit
Townhouse = 2.7 persons per unit
Apartment = 1.8 persons per unit
Maximum Residential Peak Factor = 4.0
Harmon Correction Factor = 0.8
Industrial/Commercial/Institutional Peak Factor
= 1.0, if area is <20% of total contributing area
= 1.5, if area is >20% of total contributing area
Industrial Peaking Factor: As per Appendix 4-B of the City of Ottawa Sewer Design Guidelines
Minimum velocity = 0.6m/s
Manning's n = 0.013

3.5 Proposed Sanitary Sewer System

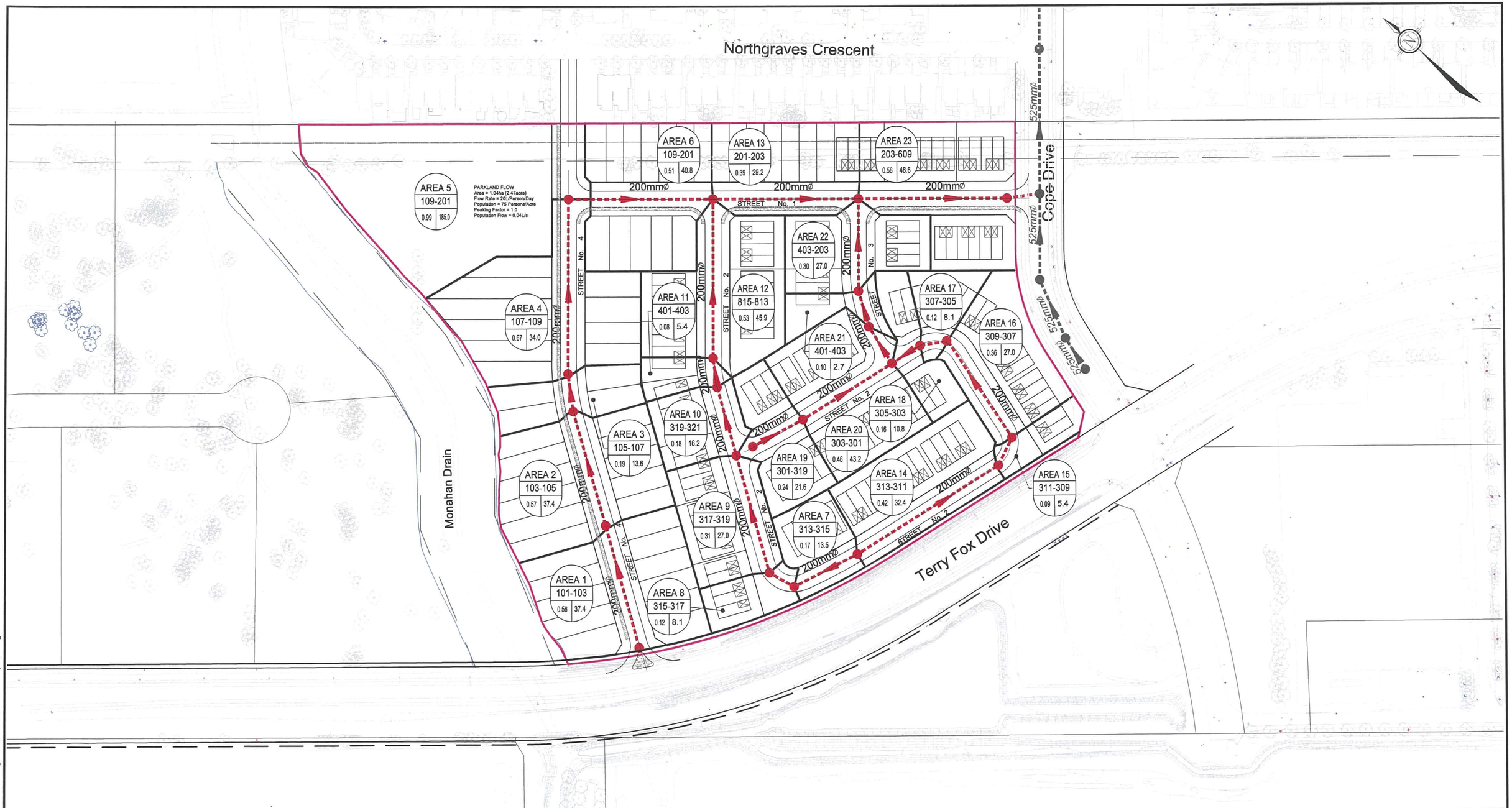
The calculated peak sanitary design flow for the development is 8.57 L/s. For detailed calculations refer to the Sanitary Sewer Design Sheet located in **Appendix B** and **Figure 5** – Sanitary Sewer Layout for sanitary drainage areas.

Sanitary flows from the subject lands were previously calculated in Stantec's Serviceability Report and the approved 2015 Servicing & Stormwater Management Report (Novatech) as part of the rezoning application for the Van Gaal Lands. As previously noted, sanitary flows from the lands north of the Monahan Drain will be directed to an existing 900mm diameter sanitary sewer on Hazeldean Side Road with the remaining two parcels outletting to the Cope Drive trunk sewer.

As a result, the proposed sanitary flows directed to the Cope Drive trunk sewer will be significantly less than previously calculated.

Outlet to Cope Drive Sewers

Proposed sanitary flows outletting to the Cope Drive trunk sewer versus the previously calculated sanitary flows from previous serviceability reports are listed in **Table 3.1**.



LEGEND

- PROPOSED DEVELOPMENT BOUNDARY
- SANITARY DRAINAGE AREA BOUNDARY
- PROPOSED SANITARY SEWER C/W FLOW DIRECTION
- EXISTING SANITARY SEWER C/W FLOW DIRECTION

AREA 1 / 815-813 / 0.81 | 89.1

- AREA ID
- MANHOLE TO MANHOLE
- POPULATION EQUIVALENT
- AREA IN HECTARES

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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND
5331 FERNBANK ROAD

SANITARY SEWER LAYOUT

SCALE 1 : 2000 (0 20 40 60 80)
DATE OCT 2018 | JOB 117198 | FIGURE FIG5-SAN

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Table 3.1: Sanitary Flow Summary to Cope Drive

Development Condition	Population	Area (ha)	Peak Flow (L/s)	Peak Ext. Flow (L/s)	Peak Design Flow (L/s)
Claridge Residential Development (Subject Site)	535	8.14	5.88	2.68	8.57
Commercial Area***		3.68	0.4	1.2	1.60
Total Flow* (Proposed)**					**10.17**
Stantec Serviceability Report	2811	23.14	39.47*	6.48	**45.95**
Novatech Approved Serviceability Report (rezoning)**		11.87	12.91	3.32	**16.23**

**Based on a peaking factor of 3.5, as per the Harmon Equation used in Stantec's Report.*
***Based on Table 4.1 of the rezoning report, Van Gaal Lands: 5331 Fernbank Road and 1039 Terry Fox Drive, Ottawa, ON, Servicing & Stormwater Management Brief, completed by Novatech, Ref. No.: R-2015-123,dated September 1, 2015.*
****Based on Site Servicing and Stormwater Management Report – Terry Fox Drive and Cope Drive Commercial Shopping Development, completed by Stantec, dated July 26, 2018.*

The total proposed sanitary flow from the subject lands and commercial area is 10.17 L/s, which represents a 77.9% decrease in sanitary flows compared to the calculated flows in the Stantec Serviceability Report (45.95 L/s) and a 37.3% decrease in sanitary flows compared to the calculated flows from Novatech's approved rezoning Servicing and Stormwater Management report (16.23L/s). This indicates there will be adequate capacity in the Cope Drive sewers to accommodate the proposed development.

For design sheet, drainage plans and design parameters from the Stantec Serviceability Report, refer to excerpts in **Appendix B**.

For excerpt from Novatech's approved rezoning Servicing and Stormwater Management report, refer to **Appendix B**.

For excerpt from the commercial lands Servicing and Stormwater Management report, refer to **Appendix B**.

As per the pre-consultation with the City of Ottawa, an HGL analysis of the sanitary system is required to confirm that the underside of footing elevations are acceptable as per the Ottawa Sewer Design Guidelines. An analysis of the sanitary HGL will be completed at the detailed design stage. The underside of footing elevations are governed by an emergency overflow elevation at the Hazeldean pump station of 95.30m. All USF elevations will have a minimum elevation of 95.30m. Correspondence can be found in **Appendix A**.

4.0 WATERMAIN

4.1 Proposed Watermain System

A preliminary hydraulic analysis was performed for the Van Gaal Lands. It is proposed to service the Van Gaal Lands site with a 200mm pipe with two connections to the existing watermain. The first connection will be made to the 300mm watermain on Cope Drive at the southern entrance. The second connection will be made to the 200mm watermain on Northgraves Crescent via a road connection near the northwest corner of the site. **Figure 6** – Watermain Layout highlights the proposed works and connection points. All existing watermain boundary conditions were provided by the City of Ottawa and are included in **Appendix C**.

4.2 Design Criteria

Fire flow demands have been calculated as per the Fire Underwriter's Survey (FUS) and are included in **Appendix C**. However as per the City of Ottawa's technical bulletin ISTB-2014-02 (Revisions to Ottawa Design Guidelines – Water), the majority of the townhouse fireflows have been capped at 10,000 L/min (167 L/s). Watermain analysis was completed based on the following criteria:

Demands:

- Townhouse Density 2.7 persons/unit
- Condo/Apartment Density 1.8 persons/unit
- Average Daily Demand 350 L/capita/day
- Max. Daily Demand 2.5 x Average Daily Demand
- Peak Hour Demand 2.2 x Maximum Daily Demand
- Fire Flow Demand Fire Underwriters Survey

System Requirements:

- Max. Pressure (Unoccupied Areas) 690 kPa (100 psi)
- Max. Pressure (Occupied Areas) 552 kPa (80 psi)
- Min. Pressure 276 kPa (40 psi) excluding fire flows
- Min. Pressure (Fire) 138 kPa (20 psi) including fire flows
- Max. Age (Quality) 192 hours (onsite)

Friction Factors:

Watermain Size	C-Factor
50mm	100
200-250 mm	110

Hydraulic modelling of the proposed Van Gaal Lands was completed using EPANET 2.0. EPANET is public domain software capable of modeling municipal water distribution systems by performing simulations of the water movement within a pressurized system. EPANET utilized the Hazen-Williams equation to predict the performance of the proposed watermain and considered

CONNECT TO EXISTING
200mmØ WATERMAIN

Northgraves Crescent

200mmØ

(CLOSED BY BY-LAW 44-91, INST. NO. N599928)
PART 10 PLAN 5R-14317

ROAD ALLOWANCE BETWEEN LOTS 30 AND 31

PART 9 PLAN 5R-14317

200mmØ 200mmØ 200mmØ

Cope Drive

CONNECT TO EXISTING
300mmØ WATERMAIN

PART 2 PLAN 4R-17373

PART 1 PLAN 4R-17373

STREET No. 1

STREET No. 4

STREET No. 2

STREET No. 3

200mmØ

STREET No. 2

STREET No. 4

STREET No. 2

Monahan Drain

Terry Fox Drive

BLOCK 298, PLAN 4M-1521

BLOCK 216, PLAN 4M-1491

LEGEND

PROPOSED DEVELOPMENT BOUNDARY

PROPOSED WATERMAIN

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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND
5331 FERNBANK ROAD

WATERMAIN LAYOUT

SCALE 1 : 2000 (0 20 40 60 80)

DATE OCT 2018 | JOB 117198 | FIGURE FIG6-WM

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the following input parameters: water demand, pipe length, pipe diameter, pipe roughness, and pipe elevation.

4.3 Hydraulic Analysis

Table 4.1 summarizes the watermain operating conditions during the high pressure, maximum daily demand and fire flow, and peak hour demands. Results of the hydraulic analysis are included in **Appendix C**. Refer to **Figure WM** – Proposed Watermain Node Network, provided in **Appendix C**, for details about the node and pipe network.

Table 4.1: Water Demand Summary

Condition	Demand (L/s)	Fire Flow (L/s)	Allowable Max/Min Pressure (kPa/psi)	Max/Min Pressure (kPa/psi)	Time (hours)
High Pressure	2.15	N/A	690/80 (Max)	635.7/92.2	17.5
Maximum Daily Demand	5.39	167	138/20 (Min)	141.1/20.5	N/A
Peak Hour	11.85	N/A	276/40 (Min)	576.5/83.6	N/A

The analysis confirms the proposed watermain can service the Van Gaal Lands under all operating conditions. It is noted that pressure in the main is greater than 552 kPa/80psi during the high pressure and peak hour condition for all the lots and blocks, therefore the use of pressure reducing values will be considered during detailed design.

A copy of the boundary conditions provided by the City of Ottawa, fire flow calculations, detailed hydraulic analysis results, and watermain layout figure are included in **Appendix C**.

There are no deviations from the City of Ottawa Design Guidelines – Water Distribution (2010).

5.0 STORM SEWER SYSTEM AND STORMWATER MANAGEMENT

The post-development storm sewer and stormwater management system has been designed in accordance with the Ottawa Sewer Design Guidelines and will adhere to previously established release rates for this area.

5.1 Previous Studies (Trailwest Subdivision / Monahan Drain Cell 1)

The Claridge Van Gaal lands (subject site) is located upstream of Phase 1 of the Trailwest (formerly SOHO West) Subdivision. Runoff from the majority of the site will be directed to the existing Cope Drive storm sewer, which runs through the Trailwest Subdivision and outlets into Cell 1 of the Monahan Drain. Storm runoff from the rearyards of lots adjacent to Cell 1 will flow overland directly into the Monahan Drain upstream of Cope Drive.

The storm drainage system for the Trailwest Subdivision was designed by Stantec. Refer to *Drawing OSD – Overall Storm Drainage Area Plan, SOHO – Kanata South (Rev. 7), Stantec* (February 25, 2009), provided in **Appendix D**.

In 2014, the City retained J.F. Sabourin & Associates (JFSA) to complete an assessment of flows and water levels through the Monahan Drain Constructed Wetlands. As part of this study, Stantec provided JFSA with post-development hydrographs for the Cope Drive storm sewer, which included future flow contributions from the Claridge Van Gaal lands.

As part of the overall storm drainage design, Stantec assigned the Van Gaal lands (catchment FUT-13A) a drainage area of 8.26 ha and a runoff coefficient of C=0.65. All storm runoff from the Claridge Van Gaal lands was assumed to outlet to Cope Drive (MH1013).

5.2 Allowable Release Rate

As indicated on JFSA Figure 3 (Table 2), provided in **Appendix D**, the total 100-year peak flow from the PH1-SOHO Lands (34.606 ha) to Cell 1 of the Monahan Drain is 5.38 m^3/s. This total flow includes the upstream Claridge Van Gaal lands and corresponds to a per hectare flow rate of 155.5 L/s/ha.

Based on the per hectare flow rate of 155.5 L/s/ha, and a contributing drainage area of 8.154 ha, the allowable 100-year release rate from the Claridge Van Gaal lands to Cope Drive (MH1013) is 1,268 L/s.

5.3 Existing Conditions

Under existing conditions, storm runoff from the site generally flows overland to Cell 1 of the Monahan Drain Constructed Wetlands SWM Facility along the north side of the site. A small amount of drainage is directed to the Terry Fox roadside ditch which also outlets to Cell 1.

5.4 Proposed Storm Infrastructure

The proposed development will be serviced by approximately 1,165m of storm sewers ranging from 250mm to 1050mm in diameter. The 1050mm dia. outlet pipe will connect to the existing 1200mm dia. storm sewer at MH1013 on Cope Drive.

Runoff from the rearyards and park block will discharge directly into Cell 1 of the Monahan Drain. Refer to **Figure 7** – Storm Sewer Layout.

Northgraves Crescent

Cope Drive

Terry Fox Drive

Monahan Drain

A4 0.24 ha 0.65

A11 0.48 ha 0.65

A18 0.75 ha 0.65

A17 0.07 ha 0.65

A10 0.32 ha 0.65

A16 0.25 ha 0.65

A5 0.33 ha 0.65

OFF1 1.38 ha 0.65

A3 0.62 ha 0.65

A9 0.31 ha 0.65

A13 0.80 ha 0.65

A14 0.12 ha 0.65

A2 0.78 ha 0.65

A15 0.25 ha 0.65

A8 0.14 ha 0.65

A1 0.43 ha 0.65

A7 0.46 ha 0.65

A12 0.27 ha 0.65

A6 0.11 ha 0.65

300mmø

750mmø

900mmø

1050mmø

STREET No. 1

STREET No. 4

STREET No. 2

STREET No. 3

675mmø

525mmø

600mmø

375mmø

250mmø

450mmø

1200mmx1800mmø

LEGEND

- PROPOSED DEVELOPMENT BOUNDARY
- STORM DRAINAGE AREA BOUNDARY
- PROPOSED STORM SEWER C/W FLOW DIRECTION
- EXISTING STORM SEWER C/W FLOW DIRECTION

NW-1 / 0.16 ha / 0.65

- AREA IDENTIFICATION
- DRAINAGE AREA (hectares)
- RUN-OFF COEFFICIENT

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND
5331 FERNBANK ROAD

STORM SEWER LAYOUT

SCALE 1 : 2000 (0 20 40 60 80)

DATE OCT 2018 | JOB 117198 | FIGURE FIG7-STM

SHT11X17.DWG - 279mmX432mm

M:\2017\117198\CAD\Design\Figures\Design Brief\FIG7-STM.dwg, STM, Oct 05, 2018 - 1:53pm, szorgel

5.4.1 Minor System (Storm Sewers)

Storm servicing for the proposed subdivision will be provided using a dual-drainage system. Runoff from frequent events (2-year return period) will be conveyed by the proposed storm sewers (minor system), while flows from large storm events that exceed the capacity of the minor system will be stored on the surface in road sages and/or conveyed overland along defined overland flow routes (major system).

Storm Sewer Design Criteria

The following is the storm sewer design criteria [Ottawa Sewer Design Guidelines (Oct. 2012)]:

- Rational Method (Q) = 2.78CIA, where
  - Q = peak flow (L/s)
  - C = runoff coefficient
    - C = (0.70 * %Imp.) + 0.20
  - I = rainfall intensity for a 2-year return period (mm/hr)
    - $I_{2yr} = 732.951 / [(Tc(min) + 6.199)]^{0.810}$
  - A = site area (ha)
- Minimum Pipe Size = 250 mm; Minimum / Maximum Full Flow Velocity = 0.8 m/s / 3.0 m/s

The on-site storm sewers will be sized to convey the peak flows corresponding to a 2-year return period storm event. Refer to the storm sewer design sheets provided in **Appendix D**.

Inlet Control Devices

Inlet control devices (ICDs) will be used to restrict inflows to the minor system. Rear yard catch basins will be connected in series with an ICD installed at the outlet of the most downstream structure. Road catch basins will have ICDs sized to not have surface ponding during a 2-year storm event, but provide surface storage / ponding for larger storm events (<2-year).

The rear yards and park block areas that drain directly to Cell 1 of the Monahan Drain will be uncontrolled.

Hydraulic Grade Line Criteria

The storm sewers will be designed to ensure the hydraulic grade line (HGL) elevation for a 100-year storm event will provide a minimum 0.30 m clearance from the underside of footing (USF) elevation. The HGL will be evaluated using a hydraulic model during detailed design.

5.4.2 Major System (Overland Flow)

Under post-development conditions, the site will be graded to provide an overland flow path to convey major system runoff towards Cope Drive, with the exception of the rearyards and park block that will outlet directly to Cell 1 of the Monahan Drain. Refer to the Grading Plan (Drawing 117198-GR).

Major System (Overland Flow) Criteria

Runoff from storms that exceed the minor system capacity are to be stored or conveyed overland within the right-of-way and/or defined drainage easements. The following overland flow criteria from the OSDG will be applied to the design:

- The roads are to be graded to ensure that the 100-year peak overland flows are confined within the right-of-way at a maximum depth of 0.35 m (static + dynamic flow).

- That the product of velocity x depth does not exceed 0.60 during the 100-year event.

During detailed design, the major system will be evaluated using a hydraulic model to ensure that the maximum total flow depth (static + dynamic) will be restricted to 0.35 m during the 100-year storm event; and water levels will not touch the building envelope / lowest opening during the Stress Test event (100-year +20%).

5.5 Proposed Stormwater Management Strategy

Stormwater Quality Control

The existing Vortechs unit immediately upstream the outlet to Cell 1 of the Monahan Drain Constructed Wetlands has been designed to provide water quality control for the Claridge Van Gaal Lands. The proposed development does not exceed the originally allocated drainage area and runoff coefficient for the subject site used to size the Vortechs unit.

Stormwater Quantity Control

Surface storage will be provided within the road sags. Stormwater will pond during infrequent (>2-year) storm events, with no surface ponding during the 2-year event.

The Monahan Drain Constructed Wetlands has been designed to accommodate post-development runoff from the subject site.

Best Management Practices and Low Impact Development

The proposed development will explore the use of best management practices (BMPs) and low impact development (LID) techniques to reduce the impacts of development on the hydrologic cycle and mitigate the reduction in groundwater infiltration / recharge resulting from the proposed development. The use and implementation of BMPs and LIDs will be reviewed during the detailed design process and may include measures such as the use of bioretention / infiltration systems within the rights-of-way.

5.6 Monahan Drain SWM Model Coordination

The impact on the Monahan Drain due to the proposed development of the Claridge Van Gaal Lands and neighbouring developments is being evaluated by JFSA.

A conceptual stormwater management model (PCSWMM) for the Claridge Van Gaal Lands was prepared to coordinate with the overall SWM model of the Monahan Drain being prepared by JFSA. The PCSWMM model for the Claridge Van Gaal Lands was provided to Stantec, who combined the model with their PCSWMM model for the remaining PH1-SOHO Lands and provided the resulting hydrographs to JFSA to confirm that the proposed developments will have no adverse impacts on water levels in the Monahan Drain.

5.6.1 PCSWMM Model Parameters

Design Storms

The model includes the following design storms based on the City of Ottawa IDF data presented in the City of Ottawa Sewer Design Guidelines (October 2012). The 24-hour SCS storm distribution was provided by JFSA and was used for the analysis of the Monahan Drain.

- 3-hour Chicago Storm Distribution (10-minute time step)
- 24-hour SCS Storm Distribution from JFSA (12-minute time step)

Each storm distribution includes the 2-year, 5-year, 100-year, and 100-year (+20%) return periods.

PCSWMM Model Schematics, Output Data and Modeling Files

PCSWMM model schematics and output data for the 100-year 3-hour Chicago and 100-year 24-hour SCS (JFSA) storm distributions are provided in **Appendix D**. The PCSWMM modeling files are provided on the enclosed CD.

Subcatchment Areas / Runoff Coefficients

- The conceptual PCSWMM model uses a semi-lumped approach, with catchment areas representing the total area to each storm sewer run (i.e. front and rearyard areas are combined). Refer to **Figure 7** – Storm Sewer Layout for drainage areas.
- The runoff coefficients are based on the proposed land use. The allocated runoff coefficient for each subcatchment land use is shown below:

  C = 0.25 – Parks
  C = 0.35 – Mixture of Single Family Homes (rearyards) & Parks
  C = 0.55 – Single Family Homes
  C = 0.60 – Mixture of Single Family Homes & Townhomes
  C = 0.65 – Townhomes

Depression Storage

- The default values for depression storage (1.57mm impervious / 4.67 mm pervious) have been applied to all catchments.
- The 'zero impervious' parameter (areas with no depression storage) for all catchments draining to Cope Drive is set to 60%.
- The 'zero impervious' parameter for areas draining directly to Cell 1 of the Monahan Drain (Catchment 'OFF01') is set to 90%.

Subarea Routing

- Subarea routing for all catchments draining to Cope Drive is 'pervious to impervious'.
- Subarea routing for catchment 'OFF1', is 'impervious to pervious'.

Equivalent Width

- The equivalent width parameter for all subcatchments is based on 225 m/ha.

Inlets / Orifices / Outlet Rating Curves

Each inlet to the minor system has been sized to provide the equivalent 155.5 L/s/ha flow rate (based on the subcatchment area):

- Inlets for catchbasins at low points are represented as orifices assuming a head of 1.6m plus the static ponding depth.
- Inlets for catchbasins on-grade are represented as outlets, with rating curves based on capture / bypass characteristics of standard CB grates and capped at 155.5 L/s/ha.

Minor System Conduits

- The minor system network was created in Civil3D and imported into PCSWMM.

Major System Conduits

- Major system conduits (road network) have been defined using an irregular transect representing an 18.5m right-of-way with a 3% crossfall from the centerline of the road to the bottom of curb.
- Junctions at high points have an invert elevation that represents either the bottom of curb or the road centerline, depending on the path of the overland flow route.

Downstream Boundary Condition (Minor System)

- The storm sewer outlet for the Claridge Val Gaal lands (OUT-Minor) is the existing maintenance hole on Cope Drive (MH1013).
- The HGL analysis provided by Stantec indicates that the 100-year HGL is below the pipe crown at MH1013.
- The boundary condition for the Claridge Van Gaal storm outlet was set at the obvert elevation of the outgoing sewer (94.91m).

5.6.2 Summary of Peak Flows (PCSWMM)

Table 5.1 provides a summary of the minor and major system flows from the Claridge Van Gaal lands to Cope Drive, and the direct flows to Cell 1 of the Monahan Drain. Outflow hydrographs for the 100-year 3-hour Chicago and 100-year 24-hour SCS storm distributions are provided in **Appendix D**.

Table 5.1: Summary of Peak Flows (PCSWMM)

Outfall	Drainage Area (ha)	Flow Rate based on 155.5 L/s/ha (L/s)	100-year Peak Flow (L/s)[2]	
			3-hour	24-hour SCS (JFSA)
To Cope Drive				
Minor System (to MH 1013)	6.721	1,045	1,080	1,052
Major System (to Cope Drive)	0.048	8	17	14
Direct to Monahan Drain (Cell 1)				
Rearyards / Park (Uncontrolled)	1.385	215	203	234
Overall				
TOTAL	**8.154**	**1,268**	**1,300**	**1,300**

[1]*Based on 155.5 L/s/ha x drainage area (ha).*
[2]*Based on PCSWMM model with fixed outfall set at 94.91m.*

6.0 TRAFFIC IMPACT BRIEF

An analysis of the effect from the proposed Van Gaal Lands development on the existing traffic patterns has been performed and detailed in the report, *5331 Fernbank Road and 1039 Terry Fox Drive, Traffic Impact Assessment, completed by Novatech, Ref. No.: R-2018-028, dated October 10, 2018;* and is submitted under a separate cover. Please refer to this report for more details.

7.0 NOISE CONTROL

The analysis of the roadway traffic along Terry Fox Drive and Cope Drive indicates that the City of Ottawa's criteria for residential noise will be exceeded, primarily for units in close proximity to the noise sources. Attenuation measures are required and they may include the installation of a noise barrier, central air conditioning, forced air ventilation and/or a notice may be placed on title with regards to the noise levels to be expected. The detailed results are included in the Noise Impact Feasibility Study and is submitted under a separate cover. Refer to *Van Gaal Lands, 1039 Terry Fox Drive and 5331 Fernbank Road, Noise Impact Feasibility Study, dated October 10, 2018 by Novatech, Report No.: R-2018-118* for more details.

8.0 UTILITIES

The development will be serviced by hydro, phone, gas and cable, which will be constructed in a three-party trench, as per the City and utility standard right-of-way cross-sections. All local roads will follow the City of Ottawa standard cross-section. During detailed design, the works will be coordinated with local utility companies. Canada Post will service the site with community mailboxes. Site lighting will be provided along roadways, sidewalks and walkways as per City standards.

9.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987). An Erosion and Sediment Control Plan will be prepared as part of the detailed design.

Typical erosion and sediment control measures recommended include, but are not limited to, the use of silt fences around perimeter of site (OPSD 219.110), catch basin inserts under catch basin/maintenance hole lids, heavy duty silt fence barrier (OPSD 219.130), straw bale check dams (OPSD 219.180), rock check dams (219.210 or OPSD 219.211), riprap (OPSS 511), mud mats, silt bags for dewatering operations, topsoil and sod to disturbed areas and natural grassed waterways. Dewatering and sediment control techniques will be developed for the individual situations based on the above guidelines and utilizing typical measures to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent Lands, water bodies or water treatment/conveyance facilities.

It will be the responsibility of the Contractor to submit a detailed construction schedule and appropriate staging, dewatering and erosion and sediment control plans to the Contract Administrator for review and approval prior to the commencement of work. A copy of the City of Ottawa Special Provision F-1005 is included in **Appendix E** which will become part of any contract and which outlines the contractual requirements which includes preparation of a detailed erosion and sediment control plan.

General Erosion and Sediment Control Measures

- All erosion and sediment control measures are to be installed to the satisfaction of the engineer, the municipality and the conservation authority prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and remain present during all phases of site preparation and construction.
- A qualified inspector, provided by the owner, should conduct daily visits during construction to ensure that the contractor is working in accordance with the design drawings and that mitigation measures are being implemented as specified.
    - A light duty silt fence barrier is to be installed in the locations shown on the Erosion and Sediment Control Plan.
    - Rock check dams and/or straw bales are to be installed in drainage ditches.
    - Catch basin inserts are to be placed under the grates of all proposed and existing catchbasins and structures.
    - After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.
- The contractor shall ensure that proper dust control is provided with the application of water (and if required, calcium chloride) during dry periods.
- The contractor shall immediately report to the engineer or inspector any accidental discharges of sediment material into any ditch or sewer system. Appropriate response measures shall be carried out by the contractor without delay.

The contractor acknowledges that failure to implement erosion and sediment control measures may result in penalties imposed by any applicable regulatory agency.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Sanitary Servicing

The analysis of the proposed sanitary servicing confirms the following:

- It is proposed that the proposed development will outlet directly to the 525mm sanitary trunk sewer along Cope Drive. The proposed outlet is consistent with the approved SOHO West Serviceability Report (Stantec) and the approved Servicing & Stormwater Management Report (Novatech) as part of the rezoning application for the Van Gaal Lands.
- The proposed development can be serviced with a 200mm sanitary sewer system.
- The total proposed sanitary flow from the subject lands and commercial area is 10.17 L/s, which represents a 77.9% decrease in sanitary flows compared to the calculated flows in the Stantec Serviceability Report (45.95 L/s) and a 37.3% decrease in sanitary flows compared to the calculated flows from Novatech's approved rezoning Servicing and Stormwater Management report (16.23L/s).
- The proposed sanitary sewers have adequate capacity to accommodate the peak sanitary flow.
- Through pre-consultation with the City of Ottawa, underside of footing elevations (USFs) shall be a minimum of 95.30m, which is the emergency overflow elevation at the Pump Station.

Watermain

The analysis of the proposed watermain network confirms the following:

- It is proposed to service the Van Gaal Lands site with a 200mm pipe with two connections to the existing watermain. The first connection will be made to the 300mm watermain on Cope Drive at the southern entrance. The second connection will be made to the 200mm watermain on Northgraves Crescent via a road connection near the northwest corner of the site.
- The analysis confirms the proposed watermain can service the Van Gaal Lands under all operating conditions.
- It is noted that pressure in the main is greater than 552 kPa/80psi during the high pressure and peak hour condition for all the lots and blocks, therefore the use of pressure reducing values will be considered during detailed design.

Stormwater Management

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

- Allowable release rate for the site is 1,268 L/s; based on a 155.5 L/s/ha flow rate.
- Proposed storm sewer system will convey stormwater to existing MH1013 on Cope Drive.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 2-year peak flow using the Rational Method.
    - Inflows to the minor system will be controlled using inlet control devices (ICDs).
    - A minimum clearance of 0.30m will be provided between the 100-year hydraulic grade line (HGL) and the designed underside of footing elevations.

- Roads graded in a saw-toothed pattern to provide surface stormwater storage during infrequent (>2-year) storm events. No surface ponding during a 2-year storm event.
    - The major overland flow oute for the site is Cope Drive / Monahan Drain.
    - Ponding depths will not exceed 0.35m for all storms up to and including the 100-year event.
- Direct uncontrolled flows from rearyards and park block to Cell 1 of the Monahan Drain.
- PCSWMM model developed for coordination / review of impact to Monahan Drain.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.
- An Erosion and Sediment Control Plan will be prepared during detailed design to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent lands, water bodies or water treatment/conveyance facilities.

11.0 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:

Steve Zorgel, P.Eng.
Project Coordinator, Engineering

Conrad Stang, M.A.Sc., P.Eng.
Project Manager, Water Resources

Reviewed by:

Marc St. Pierre
Senior Project Manager, Engineering

Michael Petepiece, P.Eng.
Senior Project Manager, Water Resources

Appendix A
Correspondence

Steve Zorgel

From: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Sent: Tuesday, February 13, 2018 4:02 PM
To: Greg Winters
Cc: Eric Bays; Marc St.Pierre; jim.burghout@claridgehomes.com; John Riddell
Subject: Pre-Consultation Follow-Up: 1039 Terry Fox & 5331 Fernbank
Attachments: Plan & Study List.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Greg,

Please refer to the below regarding our Pre-Consultation Meeting on Tuesday February 6th, 2018 on 1039 Terry Fox Drive and 5331 Fernbank Road. I have also attached the Plans & Study List.

General

- Subdivision development for 72 walk-up apartment units with a height of 3-storeys, consisting of 4 units on each storey and 182 townhouses
- Right-in / Right-out onto Terry Fox, as per the Councillor's request
- Idea of conveying Monahan Drain corridor as a block to the City, thereby creating a natural severance
    - Create an R-Plan to convey block to the City
- Zoning already in place for subdivision
- Holding can be lifted after draft approval
- Addressing and Signs has confirmed that 1039 Terry Fox and 5331 Fernbank will be used with the application

Planning/Urban Design

- The Official Plan designation is now General Urban
    - An increased product diversity can be attained with the designation change as singles and semi detached units are now permitted
- Please consider increasing the amount of park land with the land allocated to large deep lots in the Northwest corner abutting the Monahan Drain

Engineering

- Please establish the residential underside of footings to carry out a hydraulic grade line analysis of the sanitary sewer system. Please use the emergency overflow elevation for the Hazeldean Pumping Station of 95.30m to establish USF elevations in accordance with the Ottawa Sewer Design Guidelines. Please account for grade raise restrictions when completing the analysis.
- The geotechnical report is to look at grade raise restrictions and all current trees in sensitive clay soils. Geotechnical guideline requirements must be implemented. Refer to the Tree Planting in Sensitive Marine Clay Soils 2017 Guidelines.
- The applicant will be required to assess the hydraulic impact on the Monahan Drain against the controlling 100 year elevation of 95.30 metres at the Hazeldean Pump Station overflow outlet location into the Didsbury ditch. Please include all post-development Van Gaal Lands in the hydraulic assessment.
- The applicant is responsible to provide any required stormwater mitigation measures for this specific development. Mitigation measures will need to be handled via on-site stormwater management, which may affect the proposed layout.

- The Stormwater Management solution for all lands south of the Monahan Drain should be addressed with one common approach.
- The applicant is required to address quality and quantity requirements as set through the RCVA and the Monahan Stormwater facility.
- Please show the 100 year high water level elevations along the Monahan Drain on plans. No development within the 100 year HWLs nor within the 40 metre Monahan Drain Corridor.
- No structures nor controls are to be located within the Park block.
- The MOECC are in the final stages of updating their Stormwater Management guidelines. Please follow these new guidelines in anticipation of the expected 2018 change found below:

  Runoff Volume Control Targets for Ontario

  The proposed RVCt and recommended approach to implementation can be summarized as:
  i) Control of 90% of the annual average rainfall, commonly determined through the use of the 90th percentile storm. For the City of Ottawa, this has been identified as 26-28mm (depending on location).
  ii) the RCVt is to be applied to new development, redevelopment, re-urbanization and residential intensification, as well as "linear projects" that include all right-of-way (ROW) project (new roads, widenings , reconstruction and resurfacing) as well as trails, sidewalks, rail lines and transit infrastructure.
  iii) A mandatory control hierarchy, which requires that the RVCt be met:
  - First via **retention:** runoff volume is to be reduced via infiltration, evapotranspiration, and/or re-use, with this volume being define by the existing condition water balance on this site;
  - Second via **detention and release:** runoff volume not eliminated is to be treated via filtration approaches, e.g., filtering through bio retention (LID) features with slowed release to the storm sewer system
  - third via "**other detention and release:"** remaining proportion of the RVCt volume to be detained and treated, e.g., storage of runoff for sedimentation in end-of-pipe facilities.
- For questions related to engineering, please contact Gabrielle Schaeffer

Transportation

- Please follow the new Transportation Impact Assessment (TIA) guidelines for this development
- Right of way protection is required on Terry Fox (44.5m) and on Cope (24m)
- Discussion regarding a pork chop approach to allow for a right in/ right out connection to Terry Fox
  - Is this the best solution?
  - How can the access be controlled?
- It is advised that the applicant contacts OC Transpo about their future plans for the proposed development
  - Bus stops on Cope
- A Noise Feasibility Study will be required
  - Noise walls required in several locations
- Discussion around placement of sidewalks and their associated connections
  - Intersection near park
    - Pedestrian destination
    - "T" with no pedestrian control, suggested PXO
    - Look at internal design
  - Look at connections into the existing neighbourhood
- For questions related to engineering, please contact Rosanna Baggs

Environmental

- Tree Conservation Report
  - What is possible to retain along the drain, back property line and near the park block
- Be vigilant for Butternut Trees on the property as they are a protected endangered species under the *Endangered Species Act*

- Please submit the IER with the Planning Rationale
- It is the owner's responsibility for maintenance to the Monahan Drain if the land is not owned by the City

Parks

- Please take care of vegetation observed on stockpile
- Maintain culvert for park connection crossing purposes
- Facility Fit Plan will be required for registration

Rideau Valley Conservation Authority

- The RCVA requires 80% TSS removal
- No building encroachment is permitted within the 30 metre setback from the Monahan Drain
- Rear yard fencing is required along properties that back onto the Monahan Drain to maintain protection of the Drain
- Any overland flows are not to exceed 0.3 metres during major events

Please do not hesitate to contact me if you have any questions.

Regards,
Laurel

Laurel McCreight MCIP, RPP
Planner
Development Review West
Urbaniste
Examen des demandes d'aménagement ouest

City of Ottawa | Ville d'Ottawa
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ottawa.ca/planning / ottawa.ca/urbanisme

Appendix B

Sanitary Design Sheets &
Excerpts from Relevant Reports

SANITARY SEWER DESIGN SHEET
Van Gaal Lands - Claridge Development - 1039 Terry Fox Drive & 5331 Fernbank Road
Developer: Claridge Homes

NOVATECH
Engineers, Planners & Landscape Architects

PROJECT # : 117198
DESIGNED BY : SAZ
CHECKED BY : DDB
DATE PREPARED : 7-Sep-18

LOCATION				RESIDENTIAL								PARK			INFILTRATION			FLOW	PROPOSED SEWER							
				INDIVIDUAL				CUMULATIVE				PARK														
STREET	FROM MH	TO MH	Area ID	Single Units	Town Units	Population (in 1000's)	AREA (ha.)	Population (in 1000's)	AREA (ha.)	PEAK FACTOR M	POPULATION FLOW Qr(p) (L/s)	AREA (ha.)	Accu. AREA (ha.)	PARK FLOW Qc(p) (L/s)	Total Area (ha.)	Accu. Total AREA (ha.)	PEAK EXTRAN. FLOW Q(I) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	PIPE ID (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	Qpeak/ Qcap
Street 4	401	403	1	11		0.037	0.56	0.037	0.56	3.7	0.44		0.00	0.00	0.56	0.56	0.18	0.63	63.9	200	203.20	DR 35	0.36	20.5	0.63	3.1%
Street 4	403	405	2	11		0.037	0.57	0.075	1.13	3.6	0.88		0.00	0.00	0.57	1.13	0.37	1.25	67.2	200	203.20	DR 35	0.36	20.5	0.63	6.1%
Street 4	405	407	3	4		0.014	0.19	0.088	1.32	3.6	1.03		0.00	0.00	0.19	1.32	0.44	1.47	17.7	200	203.20	DR 35	0.45	23.0	0.71	6.4%
Street 4	407	109	4	10		0.034	0.67	0.122	1.99	3.6	1.42		0.00	0.00	0.67	1.99	0.66	2.07	95.7	200	203.20	DR 35	0.36	20.5	0.63	10.1%
Parkland	101	103	5			0.000		0.122	1.99	3.6	1.42	1.04	1.04	0.04	1.04	3.03	1.00	2.46	78.0	200	203.20	DR 35	0.36	20.5	0.00	15.0%
Street 1			6	12		0.041	0.51	0.163	2.50	3.5	1.87		1.04	0.04	0.51	3.54	1.17	3.09								
Street 2	215	317	7		5	0.014	0.17	0.014	0.17	3.7	0.16		0.00	0.00	0.17	0.17	0.06	0.22	38.2	200	203.20	DR 35	0.65	27.6	0.85	0.8%
Street 2	217	319	8		3	0.008	0.12	0.022	0.29	3.7	0.26		0.00	0.00	0.12	0.29	0.10	0.35	15.3	200	203.20	DR 35	0.52	24.7	0.76	1.4%
Street 2	219	321	9		10	0.027	0.31	0.049	0.60	3.7	0.58		0.00	0.00	0.31	0.60	0.20	0.77	65.8	200	203.20	DR 35	0.36	20.5	0.63	3.8%
Street 2	221	323	10		6	0.016	0.18	0.065	0.78	3.6	0.76		0.00	0.00	0.18	0.78	0.26	1.02	38.3	200	203.20	DR 35	0.36	20.5	0.63	5.0%
Street 2	223	325	11		2	0.005	0.08	0.070	0.86	3.6	0.82		0.00	0.00	0.08	0.86	0.28	1.11	15.8	200	203.20	DR 35	0.51	24.4	0.75	4.5%
Street 2	225	103	12		17	0.046	0.53	0.116	1.39	3.6	1.35		0.00	0.00	0.53	1.39	0.46	1.81	85.9	200	203.20	DR 35	0.36	20.5	0.63	8.8%
Street 1	103	105	13	7	2	0.029	0.39	0.309	4.28	3.5	3.46		1.04	0.04	0.39	5.32	1.76	5.26	78.5	200	203.20	DR 35	0.36	20.5	0.63	25.6%
Street 2	215	213	14		12	0.032	0.42	0.032	0.42	3.7	0.39		0.00	0.00	0.42	0.42	0.14	0.52	95.4	200	203.20	DR 35	0.36	20.5	0.63	2.6%
Street 2	213	211	15		2	0.005	0.09	0.038	0.51	3.7	0.45		0.00	0.00	0.09	0.51	0.17	0.62	12.4	200	203.20	DR 35	0.48	23.7	0.73	2.6%
Street 2	211	209	16		10	0.027	0.36	0.065	0.87	3.6	0.76		0.00	0.00	0.36	0.87	0.29	1.05	59.7	200	203.20	DR 35	0.36	20.5	0.63	5.1%
Street 2	209	207	17		3	0.008	0.12	0.073	0.99	3.6	0.86		0.00	0.00	0.12	0.99	0.33	1.18	12.4	200	203.20	DR 35	0.48	23.7	0.73	5.0%
Street 2	207	205	18		4	0.011	0.16	0.084	1.15	3.6	0.98		0.00	0.00	0.16	1.15	0.38	1.36	24.7	200	203.20	DR 35	0.45	23.0	0.71	5.9%
Street 2	201	203	19		8	0.022	0.24	0.022	0.24	3.7	0.26		0.00	0.00	0.24	0.24	0.08	0.34	30.8	200	203.20	DR 37	0.65	27.6	0.85	1.2%
Street 2	203	205	20		16	0.043	0.46	0.065	0.70	3.6	0.76		0.00	0.00	0.46	0.70	0.23	0.99	56.6	200	203.20	DR 38	0.36	20.5	0.63	4.8%
Street 3	205	301				0.000		0.149	1.85	3.6	1.71		0.00	0.00	0.00	1.85	0.61	2.32	23.4	200	203.20	DR 40	0.36	20.5	0.63	11.3%
Street 3	301	303	21		1	0.003	0.10	0.151	1.95	3.6	1.74		0.00	0.00	0.10	1.95	0.64	2.38	20.0	200	203.20	DR 41	0.45	23.0	0.71	10.4%
Street 3	303	105	22		10	0.027	0.30	0.178	2.25	3.5	2.04		0.00	0.00	0.30	2.25	0.74	2.78	49.8	200	203.20	DR 42	0.36	20.5	0.63	13.6%
Street 1	105	107	23		18	0.049	0.56	0.535	7.09	3.4	5.84		1.04	0.04	0.56	8.13	2.68	8.57	80.4	200	203.20	DR 44	0.36	20.5	0.63	41.7%
Street 1	107	EX145				0.000		0.535	7.09	3.4	5.84		1.04	0.04	0.00	8.13	2.68	8.57	17.9	200	203.20	DR 45	0.45	23.0	0.71	37.3%
Total Flows											**5.84**			**0.04**			**2.68**	**8.57**								

Notes:
1. Q(d) = Qr(p) + Q(I) + Qc(p)
2. Q(I) = 0.33 L/sec/ha
3. Qr(p) = (PxqxM/86,400)
3. Qc(p) = (A*q*Pf)/86,400

Definitions:
Q(d) = Design Flow (L/sec)
Qr(p) = Population Flow (L/sec), Residential
Q(I) = Extraneous Flow (L/sec)
Qc(p) = Population Flow (L/sec), Commercial/Institutional/Park

P = Population (3.4 persons per single unit, 2.7 persons per townhouse unit)
q = Average per capita flow = 280 L/cap/day - Residential
q = Average per gross ha. flow = 35000 L/gross ha/day - Light industrial
q = Average per gross ha. flow = 28000 L/gross ha/day - Commercial/Institutional
q = Average per gross ha. flow = 3700 L/gross ha/day - Park (20L/day/person, 185 persons/ha - as per Appendix 4-A of the City of Ottawa Sewer Design Guidelines)
M = Harmon Formula (maximum of 4.0), K = Correction Factor = 0.8
Min pipe size 200mm @ min. slope 0.32%
Mannings n = 0.013
Pf = Peak factor (Commercial/Institional/Park) = 1.0 (less than 20% of total contributing areas), 1.5 (if area is 20% or greater of total contributing area)

Serviceability Report

Cavanagh Construction Ltd. / Karam

SOHO West – Rev 3

Project #604-00502

Urban Land
1505 Laperriere Avenue
Ottawa, Ontario
K1Z 7T1
(613) 722-4420

October 31, 2007

Stantec

Stantec

Cavanagh Construction

SOHO Development Phase 1 and 2

DATE: April 2007
REVISION: October 2007
DESIGNED BY: MJS
CHECKED BY: KK

SANITARY SEWER DESIGN SHEET

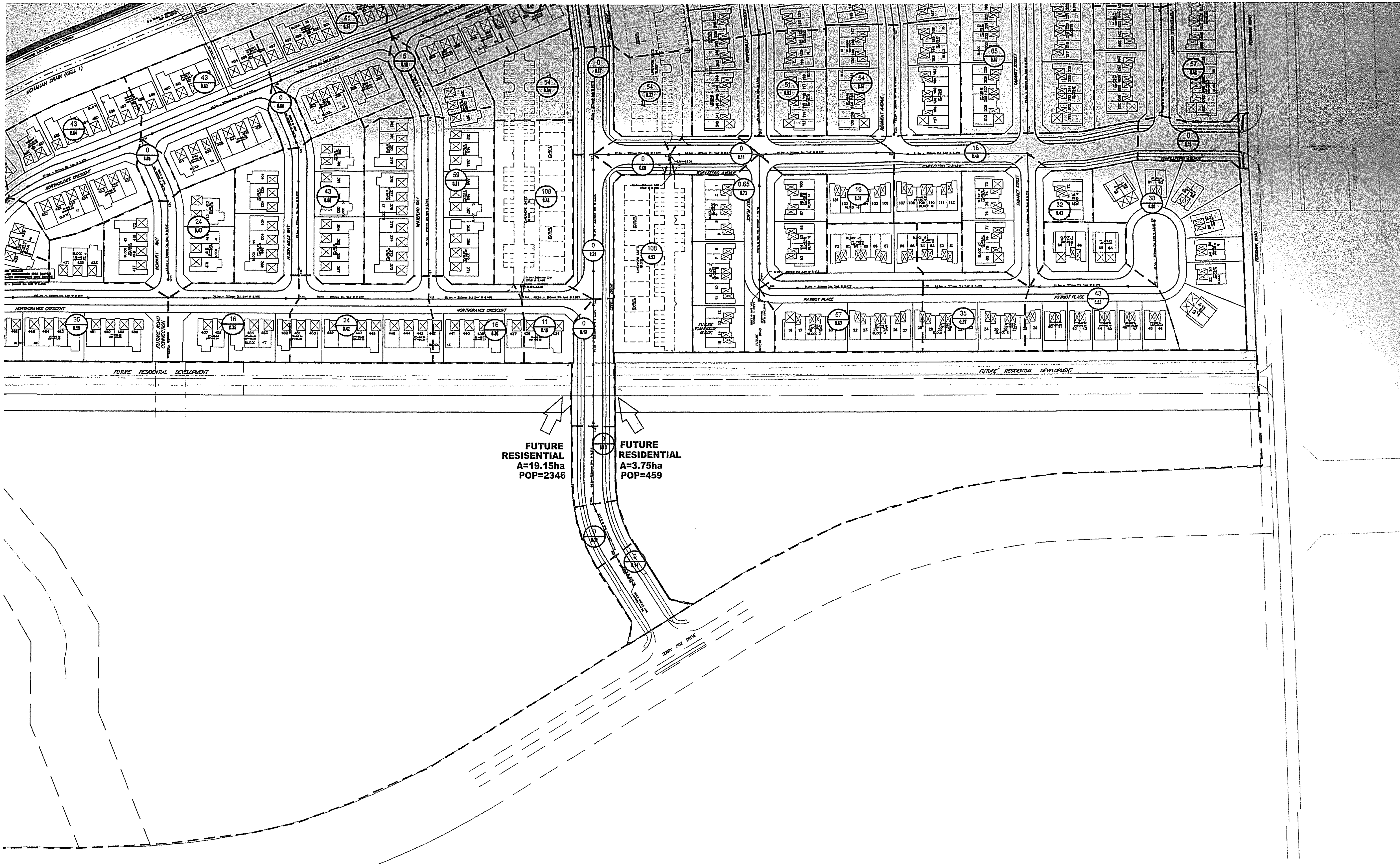
(City of Ottawa)

FILE NUMBER: 1604-00502

DESIGN PARAMETERS

AVG. DAILY FLOW / PERSON =	350	l/p/day	COMMERCIAL	50,000.00	l/Ha/day
MINIMUM VELOCITY =	0.60	m/s	LIGHT INDUSTRIAL	35,000.00	l/Ha/day
n =	0.013		INSTITUTIONAL	0.60	l/s/Ha
MAX PEAK FACTOR =	4.0		INFILTRATION	0.28	l/s/Ha
MIN PEAK FACTOR =	2.4		RESIDENTIAL HARMON PEAKING FACTOR PERSONS/UNIT =		4.0
			KANATA WEST REPORT PERSONS/UNIT =		3.0
Peaking Factor Industrial:	1.5		POPULATION DENSITY PER UNIT =	Single Family =	3.4
Peaking Factor Comm. / Inst.:	1.5			Townhouse =	2.7

LOCATION			RESIDENTIAL AREA AND POPULATION								COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS Singles	UNITS Towns	UNITS* (KWR)	POP	CUMULATIVE AREA (ha)	CUMULATIVE POP	PEAK FACT	PEAK FLOW (l/s)	AREA (ha)	ACCU AREA (ha)	AREA (ha)	ACCU AREA (ha)	AREA (ha)	ACCU AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU AREA (ha)	INFILT FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP (FULL) (l/s)	(FULL) (m/s)	VEL (ACT.) (m/s)
Phase 1																												
PATRIOT PLACE	101	102	0.80	14	0	38		0.80	38	4.00	0.62							0.00	0.80	0.80	0.224	0.84	40.5	200	0.65	26.88	0.84	0.34
PATRIOT PLACE	102	104	0.55	16	0	43		1.35	81	4.00	1.31							0.00	0.55	1.35	0.378	1.69	76.9	200	0.45	22.40	0.70	0.36
PATRIOT PLACE	104	105	0.37	13	0	35		1.72	116	4.00	1.83							0.00	0.37	1.72	0.482	2.36	64.0	200	0.45	22.40	0.70	0.43
PATRIOT PLACE	105	106	0.60	21	0	57		2.32	173	4.00	2.80							0.00	0.60	2.32	0.650	3.45	98.0	200	0.45	22.40	0.70	0.48
PATRIOT PLACE	106	109	0.73	24	0	65		3.05	238	4.00	3.85							0.00	0.73	3.05	0.854	4.71	81.0	200	0.45	22.40	0.70	0.53
TABARET STREET	104	107	0.43	12	0	32		0.43	32	4.00	0.52							0.00	0.43	0.43	0.120	0.64	83.8	200	0.70	27.84	0.87	0.35
TEMPLEFORD AVENUE	107	108	0.48	6	0	16		0.91	48	4.00	0.78							0.00	0.48	0.91	0.255	1.04	81.0	200	0.45	22.40	0.70	0.33
TEMPLEFORD AVENUE	108	109	0.31	6	0	16		1.22	64	4.00	1.04							0.00	0.31	1.22	0.342	1.38	81.0	200	0.45	22.40	0.70	0.36
TEMPLEFORD AVENUE	109	110	0.11	0	0	0		4.38	302	4.00	4.89							0.00	0.11	4.38	1.225	6.12	53.6	200	0.84	30.72	0.96	0.71
BLOCK 1	110B	110	0.52	40	0	108		0.52	108	4.00	1.75							0.00	0.52	0.52	0.146	1.90	111.5	200	0.75	29.12	0.91	0.47
TEMPLEFORD AVENUE	110	147	0.08	0	0	0		4.98	410	4.00	6.64							0.00	0.08	4.98	1.394	8.03	46.5	200	1.18	36.48	1.14	0.89
NORTHGRAVES	129	130	0.20	3	0	8		0.20	8	4.00	0.13							0.00	0.20	0.20	0.056	0.19	13.0	200	0.65	26.88	0.84	0.00
NORTHGRAVES	130	131	0.59	13	0	35		0.79	43	4.00	0.70							0.00	0.59	0.79	0.221	0.92	105.2	200	0.45	22.40	0.70	0.33
NORTHGRAVES	131	132	0.35	6	0	16		1.14	59	4.00	0.96							0.00	0.35	1.14	0.319	1.28	78.0	200	0.45	22.40	0.70	0.33
NORTHGRAVES	132	133	0.42	9	0	24		1.56	83	4.00	1.34							0.00	0.42	1.56	0.437	1.78	78.0	200	0.45	22.40	0.70	0.36
NORTHGRAVES	133	133A	0.26	6	0	16		1.82	99	4.00	1.60							0.00	0.26	1.82	0.510	2.11	55.4	200	0.45	22.40	0.70	0.41
BLOCK 34 ****	133C	133B	0.24	20	0	54		0.24	54	4.00	0.88							0.00	0.24	0.24	0.067	0.95	42.5	200	0.65	26.88	0.84	0.34
BLOCK 34 ****	133B	133A	0.48	40	0	108		0.72	162	4.00	2.63							0.00	0.48	0.72	0.202	2.83	113.0	200	0.40	21.12	0.66	0.44
NORTHGRAVES	133A	146	0.16	4	0	11		2.70	272	4.00	4.31							0.00	0.16	2.70	0.756	5.17	43.2	200	1.09	34.88	1.09	0.75
COPE DR ***	STUB	145B	125.14	0	0	8075		125.14	8075	3.05	99.77			28.72	28.72			17.45	153.86	153.86	43.081	160.30	20.4	525	0.25	223.00	1.00	1.09
COPE DR	145B	145A	0.09	0	0	0		125.23	8075	3.05	99.77				28.72			17.45	0.09	153.95	43.105	160.33	34.4	525	0.25	223.00	1.00	1.09
COPE DR	145A	145	0.12	0	0	0		125.35	8075	3.05	99.77				28.72			17.45	0.12	154.07	43.140	160.36	46.4	525	0.25	223.00	1.00	1.09
COPE DR	145	146	23.14	0	0	2811		148.49	10886	2.92	128.773				28.72			17.45	23.14	177.21	49.619	195.84	78.0	525	0.25	223.00	1.00	1.14
HENBURY WAY	134A	134	0.43	9	0	24		0.43	24	4.00	0.39							0.00	0.43	0.43	0.120	0.51	58.3	200	0.65	26.88	0.84	0.00
HENBURY WAY	134	141	0.06	0	0	0		0.49	24	4.00	0.39							0.00	0.06	0.49	0.137	0.53	42.6	200	0.65	26.88	0.84	0.00
ALSON MILLS WAY	135	136	0.68	16	0	43		0.68	43	4.00	0.70							0.00	0.68	0.68	0.190	0.89	79.9	200	0.65	26.88	0.84	0.34
ALSON MILLS WAY	136	142	0.06	0	0	0		0.74	43	4.00	0.70							0.00	0.06	0.74	0.207	0.91	41.6	200	0.82	30.40	0.95	0.38
WHITEFORD WAY	137	138	0.81	22	0	59		0.81	59	4.00	0.96							0.00	0.81	0.81	0.227	1.19	101.1	200	0.78	29.44	0.92	0.43
WHITEFORD WAY	138	143	0.18	2	0	5		0.99	64	4.00	1.04							0.00	0.18	0.99	0.277	1.32	54.4	200	0.78	29.44	0.92	0.43
NORTHGRAVES	129	139	0.22	4	0	11		0.22	11	4.00	0.18							0.00	0.22	0.22	0.062	0.24	26.7	200	0.65	26.88	0.84	0.00
NORTHGRAVES	139	140	0.29	7	0	19		0.51	30	4.00	0.49							0.00	0.29	0.51	0.143	0.63	31.2	200	0.45	22.40	0.70	0.28
NORTHGRAVES	140	141	0.64	16	0	43		1.15	73	4.00	1.18							0.00	0.64	8.00	2.240	3.42	87.6	200	0.65	26.88	0.84	0.55
NORTHGRAVES	141	142	0.60	16	0	43		2.24	140	4.00	2.27							0.00	0.60	9.09	2.545	4.82	85.7	200	0.35	19.84	0.62	0.50
NORTHGRAVES	142	143	0.57	15	0	41		3.55	224	4.00	3.63							0.00	0.57	10.40	2.912	6.54	79.8	200	0.55	24.96	0.78	0.64
NORTHGRAVES	143	144	0.44	11	0	30		4.98	318	4.00	5.16							0.00	0.44	11.83	3.312	8.46	60.0	200	0.69	27.84	0.87	0.76
NORTHGRAVES	144	149	0.42	10	0	27		5.40	345	4.00	5.59							0.00	0.42	12.25	3.430	9.02	64.5	200	0.69	27.84	0.87	0.77


FUTURE
RESISENTIAL
A=19.15ha
POP=2346
FUTURE
RESIDENTIAL
A=3.75ha
POP=459
FUTURE RESIDENTIAL DEVELOPMENT
FUTURE RESIDENTIAL DEVELOPMENT

day and maximum day demands. At a residual pressure of 20 psi, the available fire flow in the adjacent distribution systems was greater than 10,000 L/min.

4.0 SANITARY SEWER

4.1 Design Flows

The design criteria used to determine the sanitary flows produced by the proposed development is as follows;

Design Residential Domestic Flow per capita	350 L/cap/day
Capita per dwelling	2.7 persons per townhouse
Residential Peak Factor	Where P is population in 1000s; $P.F. = 1 + \frac{14}{\sqrt{4 + P^{0.5}}}$
Commercial Flow	50,000 L/ha/day
Commercial Peak Factor	1.5
Light Industrial Flow	35,000 L/ha/day
Light Industrial (Business Park) Peak Factor	4 (Appendix 4-B Ottawa Sewer Design Guidelines)
Infiltration	0.28 L/ha/day
Minimum Velocity	0.60 m/s
Minimum Pipe Size	250 mm dia. (0.432 % slope)

Table 4.1 - Sanitary Design Flows under Proposed Land Use and Zoning

	Proposed Zoning	Area (ha)	Pop. (1000's)	Peak Popul. Flow Q(p) (L/s)	Peak Busi. Flow Q(i) (L/s)	Peak Comm. Flow Q(c) (L/s)	Peak Extran. Flow Q(e) (L/s)	Peak Design Flow Q(d) (L/s)
Business Park (Light Industrial)	IP	13.58			22.00		3.80	25.81
Residential	R4	8.14	0.608	9.67			2.28	11.95
Commercial	IP	3.73				3.24	1.04	4.28
Total		25.45	0.608	9.67	22.00	3.24	7.13	42.04

Stantec

SUBDIVISION:

Terry Fox Drive and Cope Drive Commercial Shopping Development

DATE: 7/23/2018
REVISION: 1
DESIGNED BY: TKR
CHECKED BY: -

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

FILE NUMBER: 160401397

DESIGN PARAMETERS

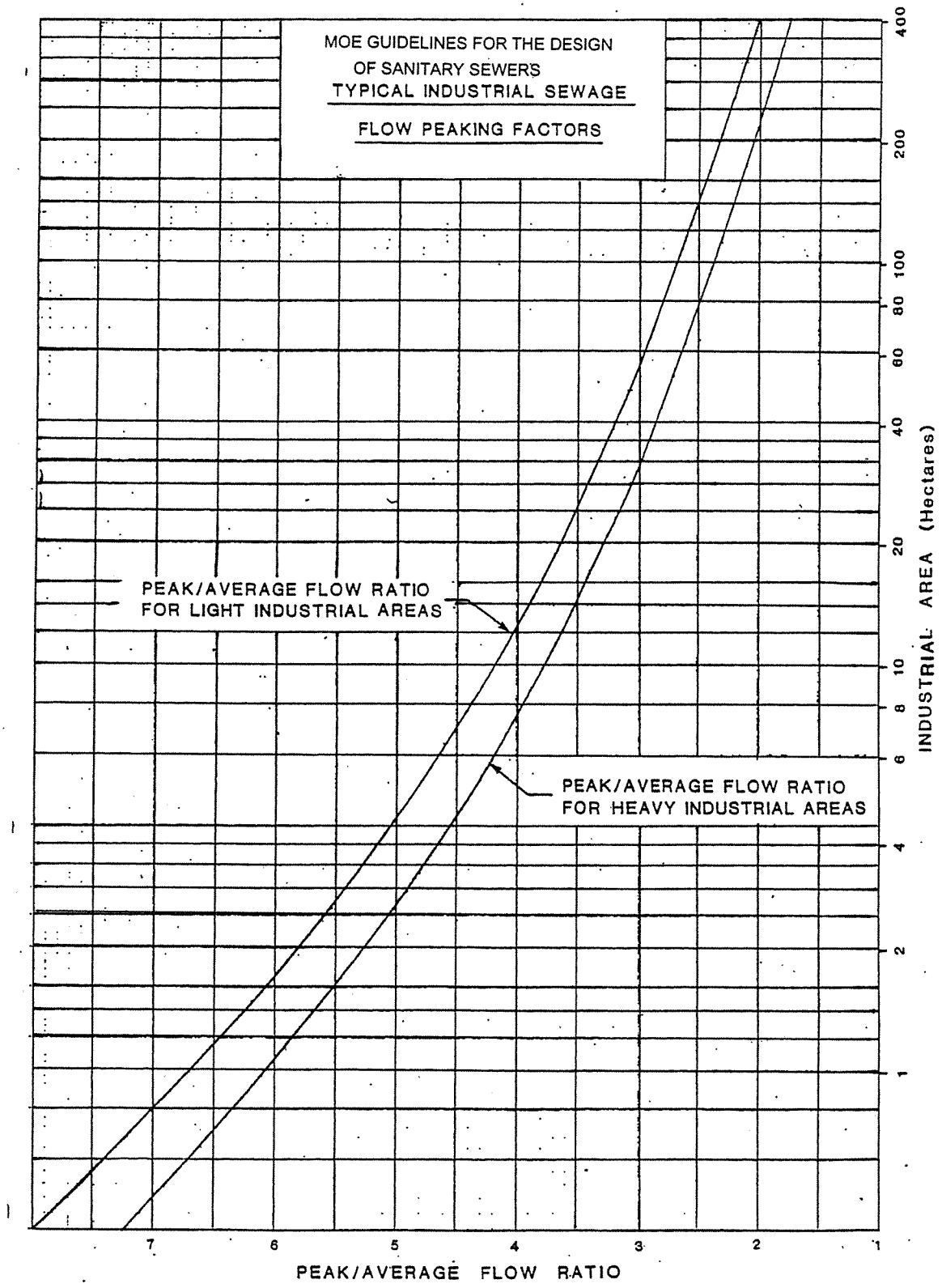
MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	SINGLE	UNITS TOWN	APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
C106B	38	106	0.00	0	0	0	0	0.00	0	4.00	0.0	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.03	0.03	0.0	0.0	14.6	100	PVC	DR 28	1.00	5.3	0.43%	0.67	0.14
C106A	39	106	0.00	0	0	0	0	0.00	0	4.00	0.0	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.01	0.01	0.0	0.0	6.2	150	PVC	DR 28	1.00	15.3	0.05%	0.86	0.07
G106A, G106B	106	105	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.65	0.0	0.65	0.69	0.2	0.2	23.4	250	PVC	SDR 35	0.50	42.9	0.57%	0.86	0.19
C105B	41	105	0.00	0	0	0	0	0.00	0	4.00	0.0	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.06	0.0	0.0	5.8	150	PVC	DR 28	1.00	15.3	0.31%	0.86	0.16
G105A	105	104	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.56	1.21	0.0	0.56	1.31	0.4	0.5	94.8	250	PVC	SDR 35	0.50	42.9	1.11%	0.86	0.25
C105A	42	104	0.00	0	0	0	0	0.00	0	4.00	0.0	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.14	0.14	0.0	0.1	5.8	150	PVC	DR 28	1.00	15.3	0.75%	0.86	0.21
G104A	104	103	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.27	1.48	0.1	0.27	1.71	0.6	0.7	40.6	250	PVC	SDR 35	0.50	42.9	1.59%	0.86	0.27
C103A	43	103	0.00	0	0	0	0	0.00	0	4.00	0.0	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.11	0.11	0.0	0.1	19.0	150	PVC	DR 28	1.00	15.3	0.60%	0.86	0.21
C103B	44	103	0.00	0	0	0	0	0.00	0	4.00	0.0	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.04	0.04	0.0	0.0	25.0	150	PVC	DR 28	1.00	15.3	0.20%	0.86	0.14
G103A	103	100	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.98	2.46	0.2	0.98	2.84	0.9	1.1	105.3	250	PVC	SDR 35	0.50	42.9	2.62%	0.86	0.31
	46	102	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	7.2	150	PVC	DR 28	1.00	15.3	0.00%	0.86	0.00
C102A	102	100	0.00	0	0	0	0	0.00	0	4.00	0.0	0.32	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	0.32	0.32	0.1	0.3	23.8	250	PVC	SDR 35	7.45	165.5	0.16%	3.33	0.53
C101A	48	101	0.00	0	0	0	0	0.00	0	4.00	0.0	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.06	0.0	0.0	20.6	150	PVC	DR 28	1.00	15.3	0.30%	0.86	0.16
C101B	49	101	0.00	0	0	0	0	0.00	0	4.00	0.0	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	0.08	0.0	0.1	28.1	150	PVC	DR 28	1.00	15.3	0.44%	0.86	0.19
	101	100	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.14	0.0	0.0	13.5	250	PVC	SDR 35	0.50	42.9	0.11%	0.86	0.11
G100A	100	33	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.38	2.83	0.4	0.38	3.68	1.2	1.6	58.3	250 250	PVC	SDR 35	0.50	42.9	3.80%	0.86	0.34

APPENDIX 4-B

PEAKING FACTOR FOR INDUSTRIAL AREAS

APPENDIX 4-B PEAKING FACTOR FOR INDUSTRIAL AREAS



Appendix C

Watermain Boundary Conditions,
FUS Calculations, &
Modelling Results

Steve Zorgel

From: Schaeffer, Gabrielle <gabrielle.schaeffer@Ottawa.ca>
Sent: Thursday, April 26, 2018 11:22 AM
To: Steve Zorgel
Cc: Marc St.Pierre
Subject: RE: Boundary Condition Request - Van Gaal
Attachments: 1039 Terry Fox Dr_.docx

Hi Steve,

Attached are the revised drinking water boundary conditions. There was an error in the model that has now been rectified.

Please note there is a new Technical Bulletin ISDTB 2018-02 dated March 21, 2018 that has information about hydrants and FUS calculations.

Regards,
Gabrielle

From: Steve Zorgel <s.zorgel@novatech-eng.com>
Sent: Wednesday, April 11, 2018 3:13 PM
To: Schaeffer, Gabrielle <gabrielle.schaeffer@Ottawa.ca>
Cc: Marc St.Pierre <m.stpierre@novatech-eng.com>
Subject: Boundary Condition Request - Van Gaal

Hi Gabrielle,

We would like to request boundary conditions for the Van Gaal lands, located at 1039 Terry Fox Drive. This is subsequent to the pre-consultation held on February 6, 2018. As part of draft plan approval, we are required to complete a hydraulic assessment and will require boundary conditions for the analysis of the watermain network. The proposed development will consist of 54 single units and 129 townhouse units.

There will be two connection points to the existing watermain. The first connection will be to the existing 300mm watermain located at Cope Drive, approximately 150m north of the Cope Drive/Terry Fox intersection. The second connection will be to the existing 200mm watermain on Northgraves Crescent at the Northgraves Crescent/Henbury Way intersection, refer to attached Figure-BC for details.

The watermain demand, figure and calculated fireflows are attached. Please note the governing fireflow for the site is **167L/s**, which is less than the calculated values for the townhouse blocks as per the FUS. The fireflow value of 167L/s represents the maximum fireflow as per Technical Bulletin ISDTB-2014-02.

If you have any questions or concerns please don't hesitate to ask, thank you.

Regards,

Steve Zorgel, **P.Eng.**, Project Coordinator | Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x298 | Fax: 613.254.5867

'

'

BOUNDARY CONDITIONS

Boundary Conditions For: 1039 Terry Fox Drive

Date of Boundary Conditions: 2018-Apr-26

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	130.0	2.2
Maximum Daily Demand	324.0	5.4
Peak Hour	712.8	11.9
Fire Flow #1 Demand	10,000	167

Connection Location:

BOUNDARY CONDITIONS

Results:

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.8	91.8
Peak Hour	156.7	84.7
Max Day Plus Fire (10000) L/min	146.9	70.7

[1]Elevation: 97.3 m

Connection #: 2

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.8	91.6
Peak Hour	156.7	84.5
Max Day Plus Fire (10000) L/min	151.2	76.6

[1]Elevation: 97.2

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

2) It is expected the water network will be looped with a 200 mm diameter watermain between the two proposed connections as demonstrated by the Connection Locations image in this BC.

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.

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117198
Project Name: Van Gaal Lands - Claridge Development 1039 Terry Fox Drive & 5331 Fernbank Road
Date: 9/7/2018
Input By: Steve Zorgel
Reviewed By: Marc St. Pierre

Legend: Input by User; No Information or Input Required

Building Description: Townhouses - 6 Units
Wood frame

Step			Input	Multiplier Options	Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**					
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	660			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**1,320**	
	F	**Base fire flow without reductions**				**12,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**10,200**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**					
	(3)	North Side	20.1 - 30 m		10%	**7,650**
		East Side	0 - 3 m		25%	
		South Side	10.1 - 20 m		15%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**75%**	
Results						
6	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			L/min	**18,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**300**
				or	USGPM	4,756
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	4
		Required Volume of Fire Flow (m^3)			m^3	4320

**** Fireflow to be capped at 167L/s as per Technical Bulletin ISTB-2014-02***

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117198
Project Name: Van Gaal Lands - Claridge Development 1039 Terry Fox Drive & 5331 Fernbank Road
Date: 9/7/2018
Input By: Steve Zorgel
Reviewed By: Marc St. Pierre

Legend: Input by User; No Information or Input Required

Building Description: Townhouses - 6 Units - Required Firebreak based on Area
Wood frame

Step			Input	Multiplier Options	Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**					
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	330			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**660**	
	F	**Base fire flow without reductions**				**8,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**6,800**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**					
	(3)	North Side	20.1 - 30 m		10%	**5,100**
		East Side	0 - 3 m		25%	
		South Side	10.1 - 20 m		15%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**75%**	
Results						
6	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			L/min	**12,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**200**
				or	USGPM	3,170
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2.5
		Required Volume of Fire Flow (m^3)			m^3	1800

**** Fireflow to be capped at 167L/s as per Technical Bulletin ISTB-2014-02***

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117198
Project Name: Van Gaal Lands - Claridge Development 1039 Terry Fox Drive & 5331 Fernbank Road
Date: 9/7/2018
Input By: Steve Zorgel
Reviewed By: Marc St. Pierre

Legend: Input by User; No Information or Input Required

Building Description: Townhouses- 5 Units
Wood frame

Step			Input	Multiplier Options	Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**					
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	550			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**1,100**	
	F	**Base fire flow without reductions**				**11,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	-15%	**9,350**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**					
	(3)	North Side	10.1 - 20 m		15%	**7,013**
		East Side	0 - 3 m		25%	
		South Side	20.1 - 30 m		10%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**75%**	
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

**** Fireflow to be capped at 167L/s as per Technical Bulletin ISTB-2014-02***

Population and Consumption Rate Calculations

Node	Number of Single Units	Number of Townhouse Units	Residential Population	Consumption Rates (L/s)		
				Average Daily	Maximum Daily	Maximum Hourly
R1						
R2						
N1	7		24	0.10	0.24	0.53
N2	14		48	0.19	0.48	1.06
N3	15		51	0.21	0.52	1.14
N4			0	0.00	0.00	0.00
N5	6		20	0.08	0.21	0.45
N6			0	0.00	0.00	0.00
N7	13	4	55	0.22	0.56	1.23
N8		21	57	0.23	0.57	1.26
N9			0	0.00	0.00	0.00
N10		13	35	0.14	0.36	0.78
N11		13	35	0.14	0.36	0.78
N12		16	43	0.18	0.44	0.96
N13			0	0.00	0.00	0.00
N14		22	59	0.24	0.60	1.32
N15		20	54	0.22	0.55	1.20
N16			0	0.00	0.00	0.00
N17		20	54	0.22	0.55	1.20
TOTAL ONSITE	**55**	**129**	**535**	**2.17**	**5.42**	**11.93**

Water Demand Parameters - As per City of Ottawa Guidelines

Single Residential Units	3.4	persons/unit
Townhouse Residential Units	2.7	persons/unit

Water Demand Parameters (Local Demand as per City of Ottawa Guidelines - Water Distribution Systems)

Residential Demand - Single (low density)	350.0	L/c/day
Residential Demand - Street Town (med. density)	350.0	L/c/day
Residential Max Day	2.5	x Avg Day
Residential Peak Hour	2.2	x Max Day
Residential Fire Flow Cap (Typical)	167	L/s

Notes:

1) Fireflows of 167L/s have been applied as per City of Ottawa Technical Bulletin ISDTB-2014-02.
2) Fireflow values have been distributed over several hydrants as per Technical Bulletin ISTB-2018-02.

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi	Age hours
Resvr R1	161.80	-1.06	161.80	0.00	0.00	0.00	0.0
Resvr R2	161.80	-1.10	161.80	0.00	0.00	0.00	0.0
Junc N1	97.90	0.10	161.80	63.90	626.86	90.92	10.9
Junc N2	97.75	0.18	161.80	64.05	628.33	91.13	4.6
Junc N3	97.65	0.21	161.80	64.15	629.31	91.27	2.2
Junc N4	97.60	0.00	161.80	64.20	629.80	91.35	0.7
Junc N5	97.46	0.08	161.80	64.34	631.18	91.54	0.5
Junc N6	97.50	0.00	161.80	64.30	630.78	91.49	2.3
Junc N7	97.42	0.22	161.80	64.38	631.57	91.60	3.2
Junc N8	97.48	0.23	161.80	64.32	630.98	91.52	3.8
Junc N9	97.70	0.00	161.80	64.10	628.82	91.20	5.3
Junc N10	97.43	0.14	161.80	64.37	631.47	91.59	6.7
Junc N11	97.10	0.14	161.80	64.70	634.71	92.06	17.5
Junc N12	97.60	0.18	161.80	64.20	629.80	91.35	4.8
Junc N13	97.55	0.00	161.80	64.25	630.29	91.42	2.3
Junc N14	97.77	0.24	161.80	64.03	628.13	91.10	7.6
Junc N15	97.40	0.22	161.80	64.40	631.76	91.63	1.8
Junc N16	97.25	0.00	161.80	64.55	633.24	91.84	0.9
Junc N17	97.00	0.22	161.80	64.80	635.69	92.20	0.5

Maximum Pressure Offsite
Maximum Age

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.10	0.00	0.00	0.000
Pipe P2	79.00	200	110	-0.28	0.01	0.00	0.058
Pipe P3	85.00	200	110	-0.49	0.02	0.00	0.057
Pipe P4	15.00	200	110	-0.98	0.03	0.01	0.045
Pipe P5	65.00	200	110	-1.06	0.03	0.01	0.048
Pipe P6	78.00	200	110	0.49	0.02	0.00	0.054
Pipe P7	12.00	200	110	-0.03	0.00	0.00	0.000
Pipe P8	87.00	200	110	0.52	0.02	0.00	0.056
Pipe P9	51.00	200	110	0.29	0.01	0.00	0.051
Pipe P10	35.00	200	110	0.22	0.01	0.00	0.043
Pipe P11	81.00	200	110	0.08	0.00	0.00	0.142
Pipe P12	105.00	200	110	-0.06	0.00	0.00	0.185
Pipe P13	69.00	200	110	-0.24	0.01	0.00	0.054
Pipe P14	78.00	200	110	0.17	0.01	0.00	0.062
Pipe P15	45.00	200	110	-0.07	0.00	0.00	0.000
Pipe P16	24.00	200	110	-0.41	0.01	0.00	0.053
Pipe P17	66.00	200	110	-0.63	0.02	0.01	0.052
Pipe P18	66.00	200	110	0.25	0.01	0.00	0.054
Pipe P19	34.00	200	110	-0.88	0.03	0.01	0.049
Pipe P20	64.00	200	110	-1.1	0.03	0.01	0.048

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	156.70	-5.81	156.70	0.00	0.00	0.00
Resvr R2	156.70	-6.02	156.70	0.00	0.00	0.00
Junc N1	97.90	0.53	156.67	58.77	576.53	83.62
Junc N2	97.75	0.98	156.67	58.92	578.01	83.83
Junc N3	97.65	1.14	156.67	59.02	578.99	83.97
Junc N4	97.60	0.00	156.67	59.07	579.48	84.05
Junc N5	97.46	0.45	156.68	59.22	580.95	84.26
Junc N6	97.50	0.00	156.67	59.17	580.46	84.19
Junc N7	97.42	1.23	156.67	59.25	581.24	84.30
Junc N8	97.48	1.26	156.66	59.18	580.56	84.20
Junc N9	97.70	0.00	156.66	58.96	578.40	83.89
Junc N10	97.43	0.78	156.66	59.23	581.05	84.27
Junc N11	97.10	0.78	156.66	59.56	584.28	84.74
Junc N12	97.60	0.96	156.66	59.06	579.38	84.03
Junc N13	97.55	0.00	156.66	59.11	579.87	84.10
Junc N14	97.77	1.32	156.66	58.89	577.71	83.79
Junc N15	97.40	1.20	156.66	59.26	581.34	84.32
Junc N16	97.25	0.00	156.67	59.42	582.91	84.54
Junc N17	97.00	1.20	156.68	59.68	585.46	84.91

Minimum Pressure

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.53	0.02	0.00	0.053
Pipe P2	79.00	200	110	-1.51	0.05	0.03	0.045
Pipe P3	85.00	200	110	-2.65	0.08	0.08	0.042
Pipe P4	15.00	200	110	-5.36	0.17	0.28	0.038
Pipe P5	65.00	200	110	-5.81	0.18	0.32	0.037
Pipe P6	78.00	200	110	2.71	0.09	0.08	0.042
Pipe P7	12.00	200	110	-0.12	0.00	0.00	0.000
Pipe P8	87.00	200	110	2.83	0.09	0.09	0.041
Pipe P9	51.00	200	110	1.57	0.05	0.03	0.045
Pipe P10	35.00	200	110	1.20	0.04	0.02	0.047
Pipe P11	81.00	200	110	0.42	0.01	0.00	0.054
Pipe P12	105.00	200	110	-0.36	0.01	0.00	0.054
Pipe P13	69.00	200	110	-1.32	0.04	0.02	0.047
Pipe P14	78.00	200	110	0.95	0.03	0.01	0.049
Pipe P15	45.00	200	110	-0.37	0.01	0.00	0.059
Pipe P16	24.00	200	110	-2.27	0.07	0.06	0.043
Pipe P17	66.00	200	110	-3.47	0.11	0.12	0.040
Pipe P18	66.00	200	110	1.35	0.04	0.02	0.046
Pipe P19	34.00	200	110	-4.82	0.15	0.23	0.038
Pipe P20	64.00	200	110	-6.02	0.19	0.35	0.037

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-91.82	146.90	0.00	0.00	0.00
Resvr R2	151.20	-80.59	151.20	0.00	0.00	0.00
Junc N1	97.90	83.74	112.28	14.38	141.07	20.46
Junc N2	97.75	83.95	115.56	17.81	174.72	25.34
Junc N3	97.65	0.52	128.54	30.89	303.03	43.95
Junc N4	97.60	0.00	142.59	44.99	441.35	64.01
Junc N5	97.46	0.21	143.40	45.94	450.67	65.36
Junc N6	97.50	0.00	145.60	48.10	471.86	68.44
Junc N7	97.42	0.56	145.82	48.40	474.80	68.86
Junc N8	97.48	0.57	146.02	48.54	476.18	69.06
Junc N9	97.70	0.00	146.27	48.57	476.47	69.11
Junc N10	97.43	0.36	146.30	48.87	479.41	69.53
Junc N11	97.10	0.36	146.38	49.28	483.44	70.12
Junc N12	97.60	0.44	146.47	48.87	479.41	69.53
Junc N13	97.55	0.00	146.54	48.99	480.59	69.70
Junc N14	97.77	0.60	146.37	48.60	476.77	69.15
Junc N15	97.40	0.55	146.68	49.28	483.44	70.12
Junc N16	97.25	0.00	147.07	49.82	488.73	70.88
Junc N17	97.00	0.55	148.49	51.49	505.12	73.26

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-83.74	2.67	45.43	0.025
Pipe P2	79.00	200	110	-167.69	5.34	164.38	0.023
Pipe P3	85.00	200	110	-168.21	5.35	165.32	0.023
Pipe P4	15.00	200	110	-91.61	2.92	53.65	0.025
Pipe P5	65.00	200	110	-91.82	2.92	53.87	0.025
Pipe P6	78.00	200	110	-76.60	2.44	38.52	0.025
Pipe P7	12.00	200	110	-51.65	1.64	18.56	0.027
Pipe P8	87.00	200	110	-24.95	0.79	4.83	0.030
Pipe P9	51.00	200	110	-25.52	0.81	5.03	0.030
Pipe P10	35.00	200	110	-9.61	0.31	0.82	0.035
Pipe P11	81.00	200	110	-9.97	0.32	0.88	0.034
Pipe P12	105.00	200	110	-10.33	0.33	0.94	0.034
Pipe P13	69.00	200	110	-10.77	0.34	1.02	0.034
Pipe P14	78.00	200	110	16.51	0.53	2.25	0.032
Pipe P15	45.00	200	110	15.91	0.51	2.10	0.032
Pipe P16	24.00	200	110	-27.28	0.87	5.69	0.030
Pipe P17	66.00	200	110	-27.83	0.89	5.91	0.030
Pipe P18	66.00	200	110	52.21	1.66	18.94	0.027
Pipe P19	34.00	200	110	-80.04	2.55	41.79	0.025
Pipe P20	64.00	200	110	-80.59	2.57	42.32	0.025

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-91.82	146.90	0.00	0.00	0.00
Resvr R2	151.20	-80.59	151.20	0.00	0.00	0.00
Junc N1	97.90	36.24	119.55	21.65	212.39	30.80
Junc N2	97.75	95.45	120.24	22.49	220.63	32.00
Junc N3	97.65	36.52	128.54	30.89	303.03	43.95
Junc N4	97.60	0.00	142.59	44.99	441.35	64.01
Junc N5	97.46	0.21	143.40	45.94	450.67	65.36
Junc N6	97.50	0.00	145.60	48.10	471.86	68.44
Junc N7	97.42	0.56	145.82	48.40	474.80	68.86
Junc N8	97.48	0.57	146.02	48.54	476.18	69.06
Junc N9	97.70	0.00	146.27	48.57	476.47	69.11
Junc N10	97.43	0.36	146.30	48.87	479.41	69.53
Junc N11	97.10	0.36	146.38	49.28	483.44	70.12
Junc N12	97.60	0.44	146.47	48.87	479.41	69.53
Junc N13	97.55	0.00	146.54	48.99	480.59	69.70
Junc N14	97.77	0.60	146.37	48.60	476.77	69.15
Junc N15	97.40	0.55	146.68	49.28	483.44	70.12
Junc N16	97.25	0.00	147.07	49.82	488.73	70.88
Junc N17	97.00	0.55	148.49	51.49	505.12	73.26

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-36.24	1.15	9.63	0.028
Pipe P2	79.00	200	110	-131.69	4.19	105.07	0.023
Pipe P3	85.00	200	110	-168.21	5.35	165.32	0.023
Pipe P4	15.00	200	110	-91.61	2.92	53.65	0.025
Pipe P5	65.00	200	110	-91.82	2.92	53.87	0.025
Pipe P6	78.00	200	110	-76.60	2.44	38.52	0.025
Pipe P7	12.00	200	110	-51.65	1.64	18.56	0.027
Pipe P8	87.00	200	110	-24.95	0.79	4.83	0.030
Pipe P9	51.00	200	110	-25.52	0.81	5.03	0.030
Pipe P10	35.00	200	110	-9.61	0.31	0.82	0.035
Pipe P11	81.00	200	110	-9.97	0.32	0.88	0.034
Pipe P12	105.00	200	110	-10.33	0.33	0.94	0.034
Pipe P13	69.00	200	110	-10.77	0.34	1.02	0.034
Pipe P14	78.00	200	110	16.51	0.53	2.25	0.032
Pipe P15	45.00	200	110	15.91	0.51	2.10	0.032
Pipe P16	24.00	200	110	-27.28	0.87	5.69	0.030
Pipe P17	66.00	200	110	-27.83	0.89	5.91	0.030
Pipe P18	66.00	200	110	52.21	1.66	18.94	0.027
Pipe P19	34.00	200	110	-80.04	2.55	41.79	0.025
Pipe P20	64.00	200	110	-80.59	2.57	42.32	0.025

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-93.53	146.90	0.00	0.00	0.00
Resvr R2	151.20	-78.88	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	133.16	35.26	345.90	50.17
Junc N2	97.75	36.45	133.16	35.41	347.37	50.38
Junc N3	97.65	95.52	133.94	36.29	356.00	51.63
Junc N4	97.60	0.00	142.94	45.34	444.79	64.51
Junc N5	97.46	36.21	143.28	45.82	449.49	65.19
Junc N6	97.50	0.00	145.82	48.32	474.02	68.75
Junc N7	97.42	0.56	146.03	48.61	476.86	69.16
Junc N8	97.48	0.57	146.22	48.74	478.14	69.35
Junc N9	97.70	0.00	146.47	48.77	478.43	69.39
Junc N10	97.43	0.36	146.50	49.07	481.38	69.82
Junc N11	97.10	0.36	146.56	49.46	485.20	70.37
Junc N12	97.60	0.44	146.66	49.06	481.28	69.80
Junc N13	97.55	0.00	146.73	49.18	482.46	69.97
Junc N14	97.77	0.60	146.56	48.79	478.63	69.42
Junc N15	97.40	0.55	146.86	49.46	485.20	70.37
Junc N16	97.25	0.00	147.23	49.98	490.30	71.11
Junc N17	97.00	0.55	148.60	51.60	506.20	73.42

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-36.69	1.17	9.85	0.028
Pipe P3	85.00	200	110	-132.21	4.21	105.84	0.023
Pipe P4	15.00	200	110	-57.32	1.82	22.52	0.027
Pipe P5	65.00	200	110	-93.53	2.98	55.75	0.025
Pipe P6	78.00	200	110	-74.89	2.38	36.94	0.026
Pipe P7	12.00	200	110	-50.51	1.61	17.81	0.027
Pipe P8	87.00	200	110	-24.38	0.78	4.62	0.030
Pipe P9	51.00	200	110	-24.95	0.79	4.82	0.030
Pipe P10	35.00	200	110	-9.39	0.30	0.79	0.035
Pipe P11	81.00	200	110	-9.75	0.31	0.85	0.035
Pipe P12	105.00	200	110	-10.11	0.32	0.91	0.034
Pipe P13	69.00	200	110	-10.55	0.34	0.98	0.034
Pipe P14	78.00	200	110	16.16	0.51	2.16	0.032
Pipe P15	45.00	200	110	15.56	0.50	2.01	0.032
Pipe P16	24.00	200	110	-26.71	0.85	5.47	0.030
Pipe P17	66.00	200	110	-27.26	0.87	5.68	0.030
Pipe P18	66.00	200	110	51.07	1.63	18.18	0.027
Pipe P19	34.00	200	110	-78.33	2.49	40.14	0.025
Pipe P20	64.00	200	110	-78.88	2.51	40.66	0.025

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-86.12	146.90	0.00	0.00	0.00
Resvr R2	151.20	-86.29	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	142.94	45.04	441.84	64.08
Junc N2	97.75	0.45	142.94	45.19	443.31	64.30
Junc N3	97.65	36.52	142.94	45.29	444.29	64.44
Junc N4	97.60	0.00	143.80	46.20	453.22	65.73
Junc N5	97.46	95.21	143.79	46.33	454.50	65.92
Junc N6	97.50	0.00	144.98	47.48	465.78	67.56
Junc N7	97.42	36.56	145.02	47.60	466.96	67.73
Junc N8	97.48	0.57	145.42	47.94	470.29	68.21
Junc N9	97.70	0.00	145.69	47.99	470.78	68.28
Junc N10	97.43	0.36	145.72	48.29	473.72	68.71
Junc N11	97.10	0.36	145.79	48.69	477.65	69.28
Junc N12	97.60	0.44	145.89	48.29	473.72	68.71
Junc N13	97.55	0.00	145.97	48.42	475.00	68.89
Junc N14	97.77	0.60	145.79	48.02	471.08	68.32
Junc N15	97.40	0.55	146.11	48.71	477.85	69.31
Junc N16	97.25	0.00	146.51	49.26	483.24	70.09
Junc N17	97.00	0.55	148.13	51.13	501.59	72.75

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.052
Pipe P3	85.00	200	110	-37.21	1.18	10.11	0.028
Pipe P4	15.00	200	110	9.09	0.29	0.74	0.035
Pipe P5	65.00	200	110	-86.12	2.74	47.85	0.025
Pipe P6	78.00	200	110	-46.30	1.47	15.16	0.027
Pipe P7	12.00	200	110	-20.80	0.66	3.45	0.031
Pipe P8	87.00	200	110	-25.50	0.81	5.02	0.030
Pipe P9	51.00	200	110	-26.07	0.83	5.23	0.030
Pipe P10	35.00	200	110	-9.82	0.31	0.86	0.034
Pipe P11	81.00	200	110	-10.18	0.32	0.92	0.034
Pipe P12	105.00	200	110	-10.54	0.34	0.98	0.034
Pipe P13	69.00	200	110	-10.98	0.35	1.06	0.034
Pipe P14	78.00	200	110	16.84	0.54	2.33	0.032
Pipe P15	45.00	200	110	16.24	0.52	2.18	0.032
Pipe P16	24.00	200	110	-27.83	0.89	5.90	0.030
Pipe P17	66.00	200	110	-28.38	0.90	6.12	0.029
Pipe P18	66.00	200	110	57.36	1.83	22.55	0.027
Pipe P19	34.00	200	110	-85.74	2.73	47.46	0.025
Pipe P20	64.00	200	110	-86.29	2.75	48.02	0.025

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-74.24	146.90	0.00	0.00	0.00
Resvr R2	151.20	-98.17	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	144.38	46.48	455.97	66.13
Junc N2	97.75	0.45	144.38	46.63	457.44	66.35
Junc N3	97.65	0.52	144.38	46.73	458.42	66.49
Junc N4	97.60	0.00	144.38	46.78	458.91	66.56
Junc N5	97.46	36.21	144.54	47.08	461.85	66.99
Junc N6	97.50	0.00	143.61	46.11	452.34	65.61
Junc N7	97.42	95.56	143.51	46.09	452.14	65.58
Junc N8	97.48	36.57	143.59	46.11	452.34	65.61
Junc N9	97.70	0.00	144.00	46.30	454.20	65.88
Junc N10	97.43	0.36	144.05	46.62	457.34	66.33
Junc N11	97.10	0.36	144.17	47.07	461.76	66.97
Junc N12	97.60	0.44	144.32	46.72	458.32	66.47
Junc N13	97.55	0.00	144.43	46.88	459.89	66.70
Junc N14	97.77	0.60	144.15	46.38	454.99	65.99
Junc N15	97.40	0.55	144.64	47.24	463.42	67.21
Junc N16	97.25	0.00	145.25	48.00	470.88	68.30
Junc N17	97.00	0.55	147.30	50.30	493.44	71.57

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.051
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-38.03	1.21	10.53	0.028
Pipe P5	65.00	200	110	-74.24	2.36	36.35	0.026
Pipe P6	78.00	200	110	36.82	1.17	9.92	0.028
Pipe P7	12.00	200	110	33.17	1.06	8.18	0.029
Pipe P8	87.00	200	110	3.65	0.12	0.14	0.040
Pipe P9	51.00	200	110	-32.92	1.05	8.06	0.029
Pipe P10	35.00	200	110	-12.47	0.40	1.33	0.033
Pipe P11	81.00	200	110	-12.83	0.41	1.41	0.033
Pipe P12	105.00	200	110	-13.19	0.42	1.48	0.033
Pipe P13	69.00	200	110	-13.63	0.43	1.57	0.033
Pipe P14	78.00	200	110	21.05	0.67	3.52	0.031
Pipe P15	45.00	200	110	20.45	0.65	3.34	0.031
Pipe P16	24.00	200	110	-34.68	1.10	8.88	0.029
Pipe P17	66.00	200	110	-35.23	1.12	9.14	0.029
Pipe P18	66.00	200	110	62.39	1.99	26.34	0.026
Pipe P19	34.00	200	110	-97.62	3.11	60.35	0.025
Pipe P20	64.00	200	110	-98.17	3.12	60.98	0.025

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-60.66	146.90	0.00	0.00	0.00
Resvr R2	151.20	-111.75	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	144.90	47.00	461.07	66.87
Junc N2	97.75	0.45	144.90	47.15	462.54	67.09
Junc N3	97.65	0.52	144.90	47.25	463.52	67.23
Junc N4	97.60	0.00	144.90	47.30	464.01	67.30
Junc N5	97.46	0.21	145.27	47.81	469.02	68.03
Junc N6	97.50	0.00	143.04	45.54	446.75	64.80
Junc N7	97.42	0.56	143.12	45.70	448.32	65.02
Junc N8	97.48	95.57	138.46	40.98	402.01	58.31
Junc N9	97.70	0.00	138.48	40.78	400.05	58.02
Junc N10	97.43	36.36	138.45	41.02	402.41	58.36
Junc N11	97.10	0.36	138.91	41.81	410.16	59.49
Junc N12	97.60	0.44	139.53	41.93	411.33	59.66
Junc N13	97.55	0.00	139.94	42.39	415.85	60.31
Junc N14	97.77	36.60	138.55	40.78	400.05	58.02
Junc N15	97.40	0.55	140.92	43.52	426.93	61.92
Junc N16	97.25	0.00	143.63	46.38	454.99	65.99
Junc N17	97.00	0.55	146.24	49.24	483.04	70.06

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.051
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-60.45	1.92	24.84	0.026
Pipe P5	65.00	200	110	-60.66	1.93	25.00	0.026
Pipe P6	78.00	200	110	59.24	1.89	23.93	0.026
Pipe P7	12.00	200	110	-31.36	1.00	7.37	0.029
Pipe P8	87.00	200	110	90.59	2.88	52.55	0.025
Pipe P9	51.00	200	110	-4.98	0.16	0.24	0.038
Pipe P10	35.00	200	110	9.02	0.29	0.73	0.035
Pipe P11	81.00	200	110	-27.34	0.87	5.72	0.030
Pipe P12	105.00	200	110	-27.70	0.88	5.86	0.030
Pipe P13	69.00	200	110	-28.14	0.90	6.03	0.029
Pipe P14	78.00	200	110	50.60	1.61	17.87	0.027
Pipe P15	45.00	200	110	14.00	0.45	1.65	0.033
Pipe P16	24.00	200	110	-78.74	2.51	40.53	0.025
Pipe P17	66.00	200	110	-79.29	2.52	41.06	0.025
Pipe P18	66.00	200	110	31.92	1.02	7.61	0.029
Pipe P19	34.00	200	110	-111.20	3.54	76.82	0.024
Pipe P20	64.00	200	110	-111.75	3.56	77.52	0.024

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-59.39	146.90	0.00	0.00	0.00
Resvr R2	151.20	-113.02	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	144.98	47.08	461.85	66.99
Junc N2	97.75	0.45	144.98	47.23	463.33	67.20
Junc N3	97.65	0.52	144.98	47.33	464.31	67.34
Junc N4	97.60	0.00	144.98	47.38	464.80	67.41
Junc N5	97.46	0.21	145.34	47.88	469.70	68.12
Junc N6	97.50	0.00	143.19	45.69	448.22	65.01
Junc N7	97.42	0.56	143.23	45.81	449.40	65.18
Junc N8	97.48	0.57	139.66	42.18	413.79	60.01
Junc N9	97.70	0.00	137.62	39.92	391.62	56.80
Junc N10	97.43	95.36	135.97	38.54	378.08	54.84
Junc N11	97.10	36.36	136.04	38.94	382.00	55.40
Junc N12	97.60	0.44	137.63	40.03	392.69	56.96
Junc N13	97.55	0.00	138.70	41.15	403.68	58.55
Junc N14	97.77	36.60	137.64	39.87	391.12	56.73
Junc N15	97.40	0.55	139.96	42.56	417.51	60.56
Junc N16	97.25	0.00	143.47	46.22	453.42	65.76
Junc N17	97.00	0.55	146.13	49.13	481.97	69.90

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.051
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-59.18	1.88	23.88	0.026
Pipe P5	65.00	200	110	-59.39	1.89	24.04	0.026
Pipe P6	78.00	200	110	57.97	1.85	22.99	0.027
Pipe P7	12.00	200	110	-20.81	0.66	3.45	0.031
Pipe P8	87.00	200	110	78.78	2.51	40.57	0.025
Pipe P9	51.00	200	110	78.21	2.49	40.03	0.025
Pipe P10	35.00	200	110	85.36	2.72	47.07	0.025
Pipe P11	81.00	200	110	-10.00	0.32	0.89	0.034
Pipe P12	105.00	200	110	-46.36	1.48	15.19	0.027
Pipe P13	69.00	200	110	-46.80	1.49	15.46	0.027
Pipe P14	78.00	200	110	43.76	1.39	13.65	0.028
Pipe P15	45.00	200	110	7.16	0.23	0.48	0.036
Pipe P16	24.00	200	110	-90.55	2.88	52.51	0.025
Pipe P17	66.00	200	110	-91.10	2.90	53.10	0.025
Pipe P18	66.00	200	110	21.37	0.68	3.62	0.031
Pipe P19	34.00	200	110	-112.47	3.58	78.45	0.024
Pipe P20	64.00	200	110	-113.02	3.60	79.16	0.024

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-59.11	146.90	0.00	0.00	0.00
Resvr R2	151.20	-113.30	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	144.99	47.09	461.95	67.00
Junc N2	97.75	0.45	144.99	47.24	463.42	67.21
Junc N3	97.65	0.52	144.99	47.34	464.41	67.36
Junc N4	97.60	0.00	145.00	47.40	464.99	67.44
Junc N5	97.46	0.21	145.35	47.89	469.80	68.14
Junc N6	97.50	0.00	143.22	45.72	448.51	65.05
Junc N7	97.42	0.56	143.25	45.83	449.59	65.21
Junc N8	97.48	0.57	139.95	42.47	416.63	60.43
Junc N9	97.70	0.00	138.06	40.36	395.93	57.43
Junc N10	97.43	36.36	136.18	38.75	380.14	55.13
Junc N11	97.10	95.36	134.48	37.38	366.70	53.19
Junc N12	97.60	36.44	135.70	38.10	373.76	54.21
Junc N13	97.55	0.00	138.35	40.80	400.25	58.05
Junc N14	97.77	0.60	138.16	40.39	396.23	57.47
Junc N15	97.40	0.55	139.70	42.30	414.96	60.19
Junc N16	97.25	0.00	143.43	46.18	453.03	65.71
Junc N17	97.00	0.55	146.11	49.11	481.77	69.87

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.052
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-58.90	1.87	23.68	0.026
Pipe P5	65.00	200	110	-59.11	1.88	23.83	0.026
Pipe P6	78.00	200	110	57.69	1.84	22.79	0.027
Pipe P7	12.00	200	110	-17.89	0.57	2.60	0.032
Pipe P8	87.00	200	110	75.58	2.41	37.57	0.025
Pipe P9	51.00	200	110	75.01	2.39	37.05	0.026
Pipe P10	35.00	200	110	91.62	2.92	53.66	0.025
Pipe P11	81.00	200	110	55.26	1.76	21.04	0.027
Pipe P12	105.00	200	110	-40.10	1.28	11.62	0.028
Pipe P13	69.00	200	110	-76.54	2.44	38.46	0.025
Pipe P14	78.00	200	110	17.21	0.55	2.43	0.032
Pipe P15	45.00	200	110	16.61	0.53	2.27	0.032
Pipe P16	24.00	200	110	-93.75	2.98	56.00	0.025
Pipe P17	66.00	200	110	-94.30	3.00	56.61	0.025
Pipe P18	66.00	200	110	18.45	0.59	2.76	0.031
Pipe P19	34.00	200	110	-112.75	3.59	78.80	0.024
Pipe P20	64.00	200	110	-113.30	3.61	79.52	0.024

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-58.72	146.90	0.00	0.00	0.00
Resvr R2	151.20	-113.69	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	145.02	47.12	462.25	67.04
Junc N2	97.75	0.45	145.02	47.27	463.72	67.26
Junc N3	97.65	0.52	145.02	47.37	464.70	67.40
Junc N4	97.60	0.00	145.02	47.42	465.19	67.47
Junc N5	97.46	0.21	145.37	47.91	470.00	68.17
Junc N6	97.50	0.00	143.26	45.76	448.91	65.11
Junc N7	97.42	0.56	143.28	45.86	449.89	65.25
Junc N8	97.48	0.57	140.42	42.94	421.24	61.10
Junc N9	97.70	0.00	138.77	41.07	402.90	58.44
Junc N10	97.43	0.36	138.01	40.58	398.09	57.74
Junc N11	97.10	36.36	136.28	39.18	384.36	55.75
Junc N12	97.60	95.44	135.97	38.37	376.41	54.59
Junc N13	97.55	0.00	138.59	41.04	402.60	58.39
Junc N14	97.77	0.60	138.70	40.93	401.52	58.24
Junc N15	97.40	36.55	139.24	41.84	410.45	59.53
Junc N16	97.25	0.00	143.38	46.13	452.54	65.63
Junc N17	97.00	0.55	146.08	49.08	481.47	69.83

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.051
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-58.51	1.86	23.39	0.026
Pipe P5	65.00	200	110	-58.72	1.87	23.54	0.026
Pipe P6	78.00	200	110	57.30	1.82	22.50	0.027
Pipe P7	12.00	200	110	-12.85	0.41	1.41	0.033
Pipe P8	87.00	200	110	70.16	2.23	32.73	0.026
Pipe P9	51.00	200	110	69.59	2.22	32.24	0.026
Pipe P10	35.00	200	110	56.09	1.79	21.62	0.027
Pipe P11	81.00	200	110	55.73	1.77	21.37	0.027
Pipe P12	105.00	200	110	19.37	0.62	3.02	0.031
Pipe P13	69.00	200	110	-76.07	2.42	38.03	0.025
Pipe P14	78.00	200	110	-12.90	0.41	1.42	0.033
Pipe P15	45.00	200	110	-13.50	0.43	1.55	0.033
Pipe P16	24.00	200	110	-63.17	2.01	26.95	0.026
Pipe P17	66.00	200	110	-99.72	3.17	62.78	0.024
Pipe P18	66.00	200	110	13.41	0.43	1.53	0.033
Pipe P19	34.00	200	110	-113.14	3.60	79.31	0.024
Pipe P20	64.00	200	110	-113.69	3.62	80.03	0.024

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-60.07	146.90	0.00	0.00	0.00
Resvr R2	151.20	-112.34	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	144.94	47.04	461.46	66.93
Junc N2	97.75	0.45	144.94	47.19	462.93	67.14
Junc N3	97.65	0.52	144.94	47.29	463.91	67.29
Junc N4	97.60	0.00	144.94	47.34	464.41	67.36
Junc N5	97.46	0.21	145.30	47.84	469.31	68.07
Junc N6	97.50	0.00	143.11	45.61	447.43	64.89
Junc N7	97.42	0.56	143.17	45.75	448.81	65.09
Junc N8	97.48	36.57	139.00	41.52	407.31	59.08
Junc N9	97.70	0.00	138.14	40.44	396.72	57.54
Junc N10	97.43	36.36	138.10	40.67	398.97	57.87
Junc N11	97.10	0.36	138.51	41.41	406.23	58.92
Junc N12	97.60	0.44	139.05	41.45	406.62	58.98
Junc N13	97.55	0.00	139.42	41.87	410.74	59.57
Junc N14	97.77	95.60	137.66	39.89	391.32	56.76
Junc N15	97.40	0.55	140.51	43.11	422.91	61.34
Junc N16	97.25	0.00	143.55	46.30	454.20	65.88
Junc N17	97.00	0.55	146.19	49.19	482.55	69.99

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.051
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-59.86	1.91	24.39	0.026
Pipe P5	65.00	200	110	-60.07	1.91	24.55	0.026
Pipe P6	78.00	200	110	58.65	1.87	23.49	0.026
Pipe P7	12.00	200	110	-26.89	0.86	5.54	0.030
Pipe P8	87.00	200	110	85.54	2.72	47.25	0.025
Pipe P9	51.00	200	110	48.97	1.56	16.82	0.027
Pipe P10	35.00	200	110	10.80	0.34	1.02	0.034
Pipe P11	81.00	200	110	-25.56	0.81	5.05	0.030
Pipe P12	105.00	200	110	-25.92	0.83	5.18	0.030
Pipe P13	69.00	200	110	-26.36	0.84	5.34	0.030
Pipe P14	78.00	200	110	57.43	1.83	22.59	0.027
Pipe P15	45.00	200	110	-38.17	1.21	10.60	0.028
Pipe P16	24.00	200	110	-83.79	2.67	45.48	0.025
Pipe P17	66.00	200	110	-84.34	2.68	46.04	0.025
Pipe P18	66.00	200	110	27.45	0.87	5.76	0.030
Pipe P19	34.00	200	110	-111.79	3.56	77.57	0.024
Pipe P20	64.00	200	110	-112.34	3.58	78.28	0.024

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-58.44	146.90	0.00	0.00	0.00
Resvr R2	151.20	-113.97	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	145.03	47.13	462.35	67.06
Junc N2	97.75	0.45	145.03	47.28	463.82	67.27
Junc N3	97.65	0.52	145.03	47.38	464.80	67.41
Junc N4	97.60	0.00	145.04	47.44	465.39	67.50
Junc N5	97.46	0.21	145.38	47.92	470.10	68.18
Junc N6	97.50	0.00	143.30	45.80	449.30	65.17
Junc N7	97.42	0.56	143.30	45.88	450.08	65.28
Junc N8	97.48	0.57	140.83	43.35	425.26	61.68
Junc N9	97.70	0.00	139.40	41.70	409.08	59.33
Junc N10	97.43	0.36	139.27	41.84	410.45	59.53
Junc N11	97.10	0.36	138.99	41.89	410.94	59.60
Junc N12	97.60	36.44	138.63	41.03	402.50	58.38
Junc N13	97.55	0.00	138.78	41.23	404.47	58.66
Junc N14	97.77	36.60	138.81	41.04	402.60	58.39
Junc N15	97.40	95.55	138.79	41.39	406.04	58.89
Junc N16	97.25	0.00	143.35	46.10	452.24	65.59
Junc N17	97.00	0.55	146.06	49.06	481.28	69.80

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.052
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.052
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-58.23	1.85	23.18	0.026
Pipe P5	65.00	200	110	-58.44	1.86	23.34	0.026
Pipe P6	78.00	200	110	57.02	1.82	22.30	0.027
Pipe P7	12.00	200	110	-7.94	0.25	0.58	0.036
Pipe P8	87.00	200	110	64.97	2.07	28.39	0.026
Pipe P9	51.00	200	110	64.40	2.05	27.93	0.026
Pipe P10	35.00	200	110	21.38	0.68	3.62	0.031
Pipe P11	81.00	200	110	21.02	0.67	3.51	0.031
Pipe P12	105.00	200	110	20.66	0.66	3.40	0.031
Pipe P13	69.00	200	110	-15.78	0.50	2.07	0.032
Pipe P14	78.00	200	110	-6.42	0.20	0.39	0.037
Pipe P15	45.00	200	110	-43.02	1.37	13.23	0.028
Pipe P16	24.00	200	110	-9.36	0.30	0.79	0.035
Pipe P17	66.00	200	110	-104.91	3.34	68.97	0.024
Pipe P18	66.00	200	110	8.50	0.27	0.66	0.035
Pipe P19	34.00	200	110	-113.42	3.61	79.67	0.024
Pipe P20	64.00	200	110	-113.97	3.63	80.39	0.024

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
Resvr R1	146.90	-45.17	146.90	0.00	0.00	0.00
Resvr R2	151.20	-127.24	151.20	0.00	0.00	0.00
Junc N1	97.90	0.24	145.74	47.84	469.31	68.07
Junc N2	97.75	0.45	145.74	47.99	470.78	68.28
Junc N3	97.65	0.52	145.74	48.09	471.76	68.42
Junc N4	97.60	0.00	145.74	48.14	472.25	68.49
Junc N5	97.46	0.21	145.96	48.50	475.79	69.01
Junc N6	97.50	0.00	144.68	47.18	462.84	67.13
Junc N7	97.42	36.56	144.60	47.18	462.84	67.13
Junc N8	97.48	0.57	144.52	47.04	461.46	66.93
Junc N9	97.70	0.00	144.44	46.74	458.52	66.50
Junc N10	97.43	0.36	144.43	47.00	461.07	66.87
Junc N11	97.10	0.36	144.40	47.30	464.01	67.30
Junc N12	97.60	0.44	144.38	46.78	458.91	66.56
Junc N13	97.55	0.00	144.36	46.81	459.21	66.60
Junc N14	97.77	0.60	144.41	46.64	457.54	66.36
Junc N15	97.40	36.55	144.33	46.93	460.38	66.77
Junc N16	97.25	0.00	144.64	47.39	464.90	67.43
Junc N17	97.00	95.55	144.89	47.89	469.80	68.14

Minimum Pressure
Applied Fireflow (sum)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	72.00	200	110	-0.24	0.01	0.00	0.061
Pipe P2	79.00	200	110	-0.69	0.02	0.01	0.051
Pipe P3	85.00	200	110	-1.21	0.04	0.02	0.047
Pipe P4	15.00	200	110	-44.96	1.43	14.36	0.028
Pipe P5	65.00	200	110	-45.17	1.44	14.48	0.028
Pipe P6	78.00	200	110	43.75	1.39	13.65	0.028
Pipe P7	12.00	200	110	29.12	0.93	6.42	0.029
Pipe P8	87.00	200	110	14.63	0.47	1.80	0.032
Pipe P9	51.00	200	110	14.06	0.45	1.67	0.033
Pipe P10	35.00	200	110	5.67	0.18	0.31	0.037
Pipe P11	81.00	200	110	5.31	0.17	0.27	0.038
Pipe P12	105.00	200	110	4.95	0.16	0.24	0.038
Pipe P13	69.00	200	110	4.51	0.14	0.20	0.039
Pipe P14	78.00	200	110	-7.79	0.25	0.56	0.036
Pipe P15	45.00	200	110	-8.39	0.27	0.64	0.035
Pipe P16	24.00	200	110	12.30	0.39	1.30	0.033
Pipe P17	66.00	200	110	-24.25	0.77	4.57	0.030
Pipe P18	66.00	200	110	7.44	0.24	0.51	0.036
Pipe P19	34.00	200	110	-31.69	1.01	7.51	0.029
Pipe P20	64.00	200	110	-127.24	4.05	98.58	0.024

Maximum day plus fire flow demand was modeled for each node.
The following is a summary of the minimum pressures that occurred for each operating condition.

	Demand (L/s)			Minimum Pressure			
Fire at Junction	Maximum Daily	Fire Flow	Max Day + Fire	(m)	kPa	psi	Node
N1	0.24	167.00	167.24	14.38	141.07	20.46	N1
N2	0.45	167.00	167.45	21.65	212.39	30.80	N1
N3	0.52	167.00	167.52	35.26	345.90	50.17	N1
N5	0.21	167.00	167.21	45.04	441.84	64.08	N1
N7	0.56	167.00	167.56	46.09	452.14	65.58	N7
N8	0.57	167.00	167.57	40.78	400.05	58.02	N9/N14
N10	0.36	167.00	167.36	38.54	378.08	54.84	N10
N11	0.36	167.00	167.36	37.38	366.70	53.19	N11
N12	0.44	167.00	167.44	38.37	376.41	54.59	N12
N14	0.60	167.00	167.60	39.89	391.32	56.76	N14
N15	0.55	167.00	167.55	41.03	402.50	58.38	N12
N17	0.55	167.00	167.55	46.64	457.54	66.36	N14

Note:
1) Fireflows of 167L/s have been applied based on City of Ottawa Technical Bulletin ISDTB-2014-02.
2) Fireflow values have been distributed over several hydrants as per Technical Bulletin ISTB-2018-02.

CONNECTION TO EXISTING 200mmØ WATERMAIN

R1

Northgraves Crescent

Cope Drive

CONNECTION TO EXISTING 300mmØ WATERMAIN

R2

Monahan Drain

Terry Fox Drive

LEGEND

- PROPERTY LINE
- P5 — PROPOSED WATERMAIN
- 1 — PROPOSED NODE AND ID NUMBER
- R1 — EXISTING RESERVOIR AND ID NUMBER

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P20

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

200mmØ WM

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VAN GAAL LANDS - CLARIDGE
1039 TERRY FOX DRIVE AND
5331 FERNBANK ROAD

WATERMAIN LAYOUT AND NODES

SCALE 1 : 1500 (0 15 30 45 60)

DATE OCT 2018 | JOB 117198 | FIGURE FIG-WM

SHT11X17.DWG - 279mmX432mm

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Appendix D

STM Design Sheets, SWM Excerpts &
PCSWMM Modelling Info

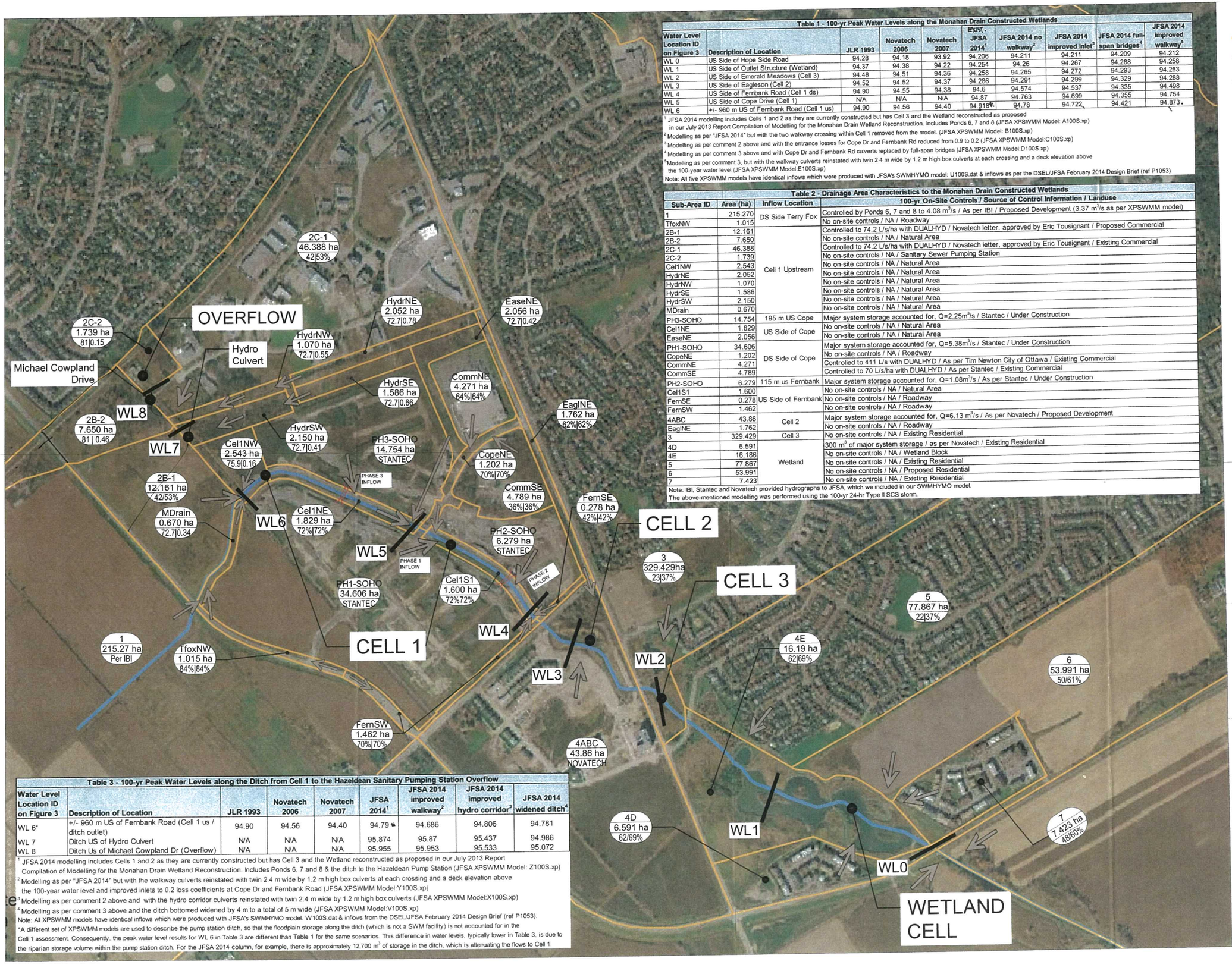

Table 1 - 100-yr Peak Water Levels along the Monahan Drain Constructed Wetlands

Water Level Location ID on Figure 3	Description of Location	JLR 1993	Novatech 2006	Novatech 2007	DSEL/ JFSA 2014[1]	JFSA 2014 no walkway[2]	JFSA 2014 improved inlet[3]	JFSA 2014 full-span bridges[4]	JFSA 2014 improved walkway[5]
WL 0	US Side of Hope Side Road	94.28	94.18	93.92	94.206	94.211	94.211	94.209	94.212
WL 1	US Side of Outlet Structure (Wetland)	94.37	94.38	94.22	94.254	94.26	94.267	94.288	94.258
WL 2	US Side of Emerald Meadows (Cell 3)	94.48	94.51	94.36	94.258	94.265	94.272	94.293	94.263
WL 3	US Side of Eagleson (Cell 2)	94.52	94.52	94.37	94.286	94.291	94.299	94.329	94.288
WL 4	US Side of Fernbank Road (Cell 1 ds)	94.90	94.55	94.38	94.6	94.574	94.537	94.335	94.498
WL 5	US Side of Cope Drive (Cell 1)	N/A	N/A	N/A	94.87	94.763	94.699	94.355	94.754
WL 6	+/- 960 m US of Fernbank Road (Cell 1 us)	94.90	94.56	94.40	94.918*	94.78	94.722	94.421	94.873*

[1] JFSA 2014 modelling includes Cells 1 and 2 as they are currently constructed but has Cell 3 and the Wetland reconstructed as proposed in our July 2013 Report Compilation of Modelling for the Monahan Drain Wetland Reconstruction. Includes Ponds 6, 7 and 8 (JFSA XPSWMM Model: A100S.xp)
[2] Modelling as per "JFSA 2014" but with the two walkway crossing within Cell 1 removed from the model. (JFSA XPSWMM Model: B100S.xp)
[3] Modelling as per comment 2 above and with the entrance losses for Cope Dr and Fernbank Rd reduced from 0.9 to 0.2 (JFSA XPSWMM Model:C100S.xp)
[4] Modelling as per comment 3 above and with Cope Dr and Fernbank Rd culverts replaced by full-span bridges (JFSA XPSWMM Model:D100S xp)
[5] Modelling as per comment 3, but with the walkway culverts reinstated with twin 2.4 m wide by 1.2 m high box culverts at each crossing and a deck elevation above the 100-year water level (JFSA XPSWMM Model:E100S.xp)
Note: All five XPSWMM models have identical inflows which were produced with JFSA's SWMHYMO model: U100S.dat & inflows as per the DSEL/JFSA February 2014 Design Brief (ref P1053)

Table 2 - Drainage Area Characteristics to the Monahan Drain Constructed Wetlands

Sub-Area ID	Area (ha)	Inflow Location	100-yr On-Site Controls / Source of Control Information / Landuse
1	215.270	DS Side Terry Fox	Controlled by Ponds 6, 7 and 8 to 4.08 m^3/s / As per IBI / Proposed Development (3.37 m^3/s as per XPSWMM model)
TfoxNW	1.015		No on-site controls / NA / Roadway
2B-1	12.161	Cell 1 Upstream	Controlled to 74.2 L/s/ha with DUALHYD / Novatech letter, approved by Eric Tousignant / Proposed Commercial
2B-2	7.650		No on-site controls / NA / Natural Area
2C-1	46.388		Controlled to 74.2 L/s/ha with DUALHYD / Novatech letter, approved by Eric Tousignant / Existing Commercial
2C-2	1.739		No on-site controls / NA / Sanitary Sewer Pumping Station
Cel1NW	2.543		No on-site controls / NA / Natural Area
HydrNE	2.052		No on-site controls / NA / Natural Area
HydrNW	1.070		No on-site controls / NA / Natural Area
HydrSE	1.586		No on-site controls / NA / Natural Area
HydrSW	2.150		No on-site controls / NA / Natural Area
MDrain	0.670		No on-site controls / NA / Natural Area
PH3-SOHO	14.754	195 m US Cope	Major system storage accounted for, Q=2.25m^3/s / Stantec / Under Construction
Cel1NE	1.829	US Side of Cope	No on-site controls / NA / Natural Area
EaseNE	2.056		No on-site controls / NA / Natural Area
PH1-SOHO	34.606	DS Side of Cope	Major system storage accounted for, Q=5.38m^3/s / Stantec / Under Construction
CopeNE	1.202		No on-site controls / NA / Roadway
CommNE	4.271		Controlled to 411 L/s with DUALHYD / As per Tim Newton City of Ottawa / Existing Commercial
CommSE	4.789		Controlled to 70 L/s/ha with DUALHYD / As per Stantec / Existing Commercial
PH2-SOHO	6.279	115 m us Fernbank	Major system storage accounted for, Q=1.08m^3/s / As per Stantec / Under Construction
Cel1S1	1.600	US Side of Fernbank	No on-site controls / NA / Natural Area
FernSE	0.278		No on-site controls / NA / Roadway
FernSW	1.462		No on-site controls / NA / Roadway
4ABC	43.86	Cell 2	Major system storage accounted for, Q=6.13 m^3/s / As per Novatech / Proposed Development
EagINE	1.762		No on-site controls / NA / Roadway
3	329.429	Cell 3	No on-site controls / NA / Existing Residential
4D	6.591	Wetland	300 m^3 of major system storage / as per Novatech / Existing Residential
4E	16.186		No on-site controls / NA / Wetland Block
5	77.867		No on-site controls / NA / Existing Residential
6	53.991		No on-site controls / NA / Proposed Residential
7	7.423		No on-site controls / NA / Existing Residential

Note: IBI, Stantec and Novatech provided hydrographs to JFSA, which we included in our SWMHYMO model.
The above-mentioned modelling was performed using the 100-yr 24-hr Type II SCS storm.

Table 3 - 100-yr Peak Water Levels along the Ditch from Cell 1 to the Hazeldean Sanitary Pumping Station Overflow

Water Level Location ID on Figure 3	Description of Location	JLR 1993	Novatech 2006	Novatech 2007	JFSA 2014[1]	JFSA 2014 improved walkway[2]	JFSA 2014 improved hydro corridor[3]	JFSA 2014 widened ditch[4]
WL 6*	+/- 960 m US of Fernbank Road (Cell 1 us / ditch outlet)	94.90	94.56	94.40	94.79*	94.686	94.806	94.781
WL 7	Ditch US of Hydro Culvert	N/A	N/A	N/A	95.874	95.87	95.437	94.986
WL 8	Ditch Us of Michael Cowpland Dr (Overflow)	N/A	N/A	N/A	95.955	95.953	95.533	95.072

[1] JFSA 2014 modelling includes Cells 1 and 2 as they are currently constructed but has Cell 3 and the Wetland reconstructed as proposed in our July 2013 Report Compilation of Modelling for the Monahan Drain Wetland Reconstruction. Includes Ponds 6, 7 and 8 & the ditch to the Hazeldean Pump Station (JFSA XPSWMM Model: Z100S.xp)
[2] Modelling as per "JFSA 2014" but with the walkway culverts reinstated with twin 2.4 m wide by 1.2 m high box culverts at each crossing and a deck elevation above the 100-year water level and improved inlets to 0.2 loss coefficients at Cope Dr and Fernbank Road (JFSA XPSWMM Model:Y100S.xp)
[3] Modelling as per comment 2 above and with the hydro corridor culverts reinstated with twin 2.4 m wide by 1.2 m high box culverts (JFSA XPSWMM Model:X100S.xp)
[4] Modelling as per comment 3 above and the ditch bottomed widened by 4 m to a total of 5 m wide (JFSA XPSWMM Model:V100S xp)
Note: All XPSWMM models have identical inflows which were produced with JFSA's SWMHYMO model. W100S.dat & inflows from the DSEL/JFSA February 2014 Design Brief (ref P1053).
*A different set of XPSWMM models are used to describe the pump station ditch, so that the floodplain storage along the ditch (which is not a SWM facility) is not accounted for in the Cell 1 assessment. Consequently, the peak water level results for WL 6 in Table 3 are different than Table 1 for the same scenarios. This difference in water levels, typically lower in Table 3, is due to the riparian storage volume within the pump station ditch. For the JFSA 2014 column, for example, there is approximately 12,700 m^3 of storage in the ditch, which is attenuating the flows to Cell 1.

WL1

Ottawa

EXISTING COMMERCIAL

LOBLAWS

EXISTING COMMERCIAL

FUTURE PHASE

FUTURE PHASE

FOREBAY

ORIGINAL SHEET - ISO A1

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2009-02-26 09:05AM By: gulak

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Stantec

Legend

- DRAINAGE AREA NO.
- RUNOFF COEFFICIENT
- STORM DRAINAGE AREA (ha)
- DRAINAGE AREA BOUNDARY
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED CATCH BASIN (ALL ROAD CB'S TO INCLUDE PERFORATED STUB DRAINS EXTENDING OUT FROM THE CB IN TWO DIRECTIONS PARALLEL TO THE ROADWAY. THESE DRAINS ARE TO BE INSTALLED AT THE BOTTOM OF THE SUBBASE LAYER.)
- PROPOSED SUBDRAIN CATCH BASIN
- PROPOSED 250ø PERFORATED PIPE
- STREET CATCHBASINS TO BE INTERCONNECTED WITH ONLY ONE CONNECTION TO STORM SEWER PER PAIR WHERE NOTED.
- IPEX TYPE 'A' TO BE INSTALLED IN STREET AND REAR YARD CATCHBASINS WHERE NOTED.
- PROPOSED CATCH BASIN / MANHOLE c/w IPEX INLET-CONTROL DEVICE TYPE 'A' OR APPROVED EQUIVALENT
- PONDING AREA LIMITS
- DEPTH=0.20m MAXIMUM PONDING DEPTH
- DIRECTION OF OVERLAND FLOW
- FUTURE PHASE OF STORM DRAINAGE WORKS

Notes

1. IPEX TYPE 'A' TO RESTRICT FLOWS TO THE STORM SEWER TO 22L/s AT 1.8m HEAD.

7	REVISED DRIVEWAY & SIDEWALK LOCATIONS, ISSUED FOR FINAL APPROVAL	KJK	JBL	09.02.25
5	REVISED LOT GRADING AND SERVICING	KJK	JBL	08.11.03
4	ISSUED FOR CONSTRUCTION	KJK	JBL	08.01.21
3	REVISED AS PER CITY COMMENTS AND FINAL APPROVAL	KJK	JBL	07.10.29
2	REVISED AS PER CITY COMMENTS	KJK	JBL	07.08.17
1	ISSUED FOR CITY COMMENTS	KJK	JBL	07.07.12
Revision		By	Appd.	YY.MM.DD
File Name: 160400502C-SD		KJK	JBL	KJK 07.03.14
		Dwn.	Chkd.	Dsgn YY.MM.DD

Permit-Seal

Client/Project

CAVANAGH CONSTRUCTION LTD.

SOHO - KANATA SOUTH

Ottawa ON Canada

Title

OVERALL
STORM DRAINAGE PLAN

Project No. 160400502C	Scale 1:2000 (0, 20, 60, 100m)	
Drawing No. OSD	Sheet 49 of 58	Revision 7

Van Gaal Lands - Claridge Development - 1039 Terry Fox Drive & 5331 Fernabnk Road
Claridge Homes
Project No.: 117198

STORM SEWER DESIGN SHEET
(Claridge Homes)
FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA								
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	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
Street 4	A1	400	102	0.43	0.55	0.24	0.657	0.657	10.00	76.81			50.5	50.5	0.381	375	PVC	0.30	68.7	100.1	0.88	1.30	50%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
Street 4	A2	402	104	0.78	0.60	0.47	1.301	1.959	11.30	72.14			141.3	141.3	0.533	525	Conc	0.22	64.1	210.3	0.94	1.14	67%
						0.00	0.000	0.000	11.30														
						0.00	0.000	0.000	11.30														
Street 4		404	106			0.00	0.000	1.959	12.44	68.56			134.3	134.3	0.533	525	Conc	0.24	20.7	219.6	0.98	0.35	61%
						0.00	0.000	0.000	12.44														
						0.00	0.000	0.000	12.44														
Street 4	A3	406	100	0.62	0.60	0.37	1.034	2.993	12.79	67.53			202.1	202.1	0.686	675	Conc	0.15	95.9	339.4	0.92	1.74	60%
						0.00	0.000	0.000	12.79														
						0.00	0.000	0.000	12.79														
									14.53														
Street 4	A4	408	100	0.24	0.55	0.13	0.367	0.367	10.00	76.81			28.2	28.2	0.305	300	PVC	0.55	18.3	74.8	1.02	0.30	38%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
									10.30														
Street 1	A5	100	102	0.33	0.55	0.18	0.505	3.864	14.53	62.90			243.1	243.1	0.762	750	Conc	0.12	78.0	402.1	0.88	1.47	60%
						0.00	0.000	0.000	14.53														
						0.00	0.000	0.000	14.53														
									16.00														
Street 2	A6	214	216	0.11	0.65	0.07	0.199	0.199	10.00	76.81			15.3	15.3	0.457	450	Conc	0.25	37.6	148.6	0.91	0.69	10%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
Street 2		216	218			0.00	0.000	0.199	10.69	74.25			14.8	14.8	0.457	450	Conc	0.28	17.6	157.3	0.96	0.31	9%
						0.00	0.000	0.000	10.69														
						0.00	0.000	0.000	10.69														
Street 2	A7	218	220	0.46	0.65	0.30	0.831	1.030	11.00	73.17			75.4	75.4	0.457	450	Conc	0.25	67.0	148.6	0.91	1.23	51%
						0.00	0.000	0.000	11.00														
						0.00	0.000	0.000	11.00														
Street 2		220	222			0.00	0.000	1.030	12.23	69.18			71.3	71.3	0.457	450	Conc	0.25	35.8	148.6	0.91	0.66	48%
						0.00	0.000	0.000	12.23														
						0.00	0.000	0.000	12.23														
Street 2	A9	222	224	0.31	0.65	0.20	0.560	1.590	12.89	67.24			106.9	106.9	0.533	525	Conc	0.20	18.8	200.5	0.90	0.35	53%
						0.00	0.000	0.000	12.89														
						0.00	0.000	0.000	12.89														
Street 2	A10	224	102	0.32	0.65	0.21	0.578	2.168	13.24	66.26			143.7	143.7	0.533	525	Conc	0.20	86.1	200.5	0.90	1.60	72%
						0.00	0.000	0.000	13.24														
						0.00	0.000	0.000	13.24														
									14.84														

Van Gaal Lands - Claridge Development - 1039 Terry Fox Drive & 5331 Fernabnk Road
Claridge Homes
Project No.: 117198

STORM SEWER DESIGN SHEET
(Claridge Homes)
FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA							
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	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
Street 1	**A11**	102	104	0.50	0.60	0.30	0.834	6.867	16.00	59.50			408.5	408.5	0.914	900	Conc	0.12	78.5	653.9	1.00	1.31	62%
						0.00	0.000	0.000	16.00														
						0.00	0.000	0.000	16.00														
									17.32														
Street 2	**A12**	214	212	0.27	0.65	0.18	0.488	0.488	10.00	76.81			37.5	37.5	0.457	450	Conc	0.25	96.9	148.6	0.91	1.78	25%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
Street 2		212	210			0.00	0.000	0.488	11.78	70.57			34.4	34.4	0.457	450	Conc	0.32	15.4	168.1	1.02	0.25	20%
						0.00	0.000	0.000	11.78														
						0.00	0.000	0.000	11.78														
Street 2	**A13**	210	208	0.80	0.65	0.52	1.446	1.933	12.03	69.79			134.9	134.9	0.533	525	Conc	0.20	59.7	200.5	0.90	1.11	67%
						0.00	0.000	0.000	12.03														
						0.00	0.000	0.000	12.03														
Street 2		208	206			0.00	0.000	1.933	13.14	66.53			128.6	128.6	0.533	525	Conc	0.20	15.5	200.5	0.90	0.29	64%
						0.00	0.000	0.000	13.14														
						0.00	0.000	0.000	13.14														
Street 2	**A14**	206	204	0.12	0.65	0.08	0.217	2.150	13.43	65.74			141.4	141.4	0.533	525	Conc	0.20	26.2	200.5	0.90	0.49	70%
						0.00	0.000	0.000	13.43														
						0.00	0.000	0.000	13.43														
									13.92														
Street 2	**A8**	200	202	0.14	0.65	0.09	0.253	0.253	10.00	76.81			19.4	19.4	0.254	250	PVC	0.50	30.3	43.8	0.86	0.58	44%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
Street 2	**A15**	202	204	0.25	0.65	0.16	0.452	0.705	10.58	74.63			52.6	52.6	0.381	375	PVC	0.30	56.5	100.1	0.88	1.07	53%
						0.00	0.000	0.000	10.58														
						0.00	0.000	0.000	10.58														
									11.66														
Street 3		204	300			0.00	0.000	2.855	13.92	64.44			184.0	184.0	0.610	600	Conc	0.24	20.9	313.6	1.07	0.32	59%
						0.00	0.000	0.000	13.92														
						0.00	0.000	0.000	13.92														
Street 3	**A16**	300	302	0.25	0.65	0.16	0.452	3.307	14.24	63.62			210.4	210.4	0.610	600	Conc	0.22	23.0	300.3	1.03	0.37	70%
						0.00	0.000	0.000	14.24														
						0.00	0.000	0.000	14.24														
Street 3	**A17**	302	104	0.07	0.65	0.05	0.126	3.433	14.61	62.69			215.2	215.2	0.610	600	Conc	0.18	50.3	271.6	0.93	0.90	79%
						0.00	0.000	0.000	14.61														
						0.00	0.000	0.000	14.61														
									15.52														

Van Gaal Lands - Claridge Development - 1039 Terry Fox Drive & 5331 Fernabnk Road
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Project No.: 117198

STORM SEWER DESIGN SHEET
(Claridge Homes)
FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA								
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	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
Street 1	**A18**	104	106	0.67	0.65	0.44	1.211	11.511	17.32	56.79			653.7	653.7	1.067	1050	Conc	0.12	83.9	986.4	1.10	1.27	66%
						0.00	0.000	0.000	17.32														
						0.00	0.000	0.000	17.32														
Street 1	**COPE DRIVE**	106	EX 604			0.00	0.000	11.511	18.58	54.42			626.5	626.5	1.067	1050	Conc	0.15	13.6	1,102.8	1.23	0.18	57%
						0.00	0.000	0.000	18.58														
						0.00	0.000	0.000	18.58														
									18.77														

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:	September 7, 2018
Design By:	Steve Zorgel
Client:	**Dwg. Reference:** / **Checked By:**
Claridge Homes	Figure 7 - Storm Sewer Layout (Design Brief) / DDB

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

Van Gaal Lands (117198)
Conceptual PCSWMM Model

NOVATECH
Engineers, Planners & Landscape Architects

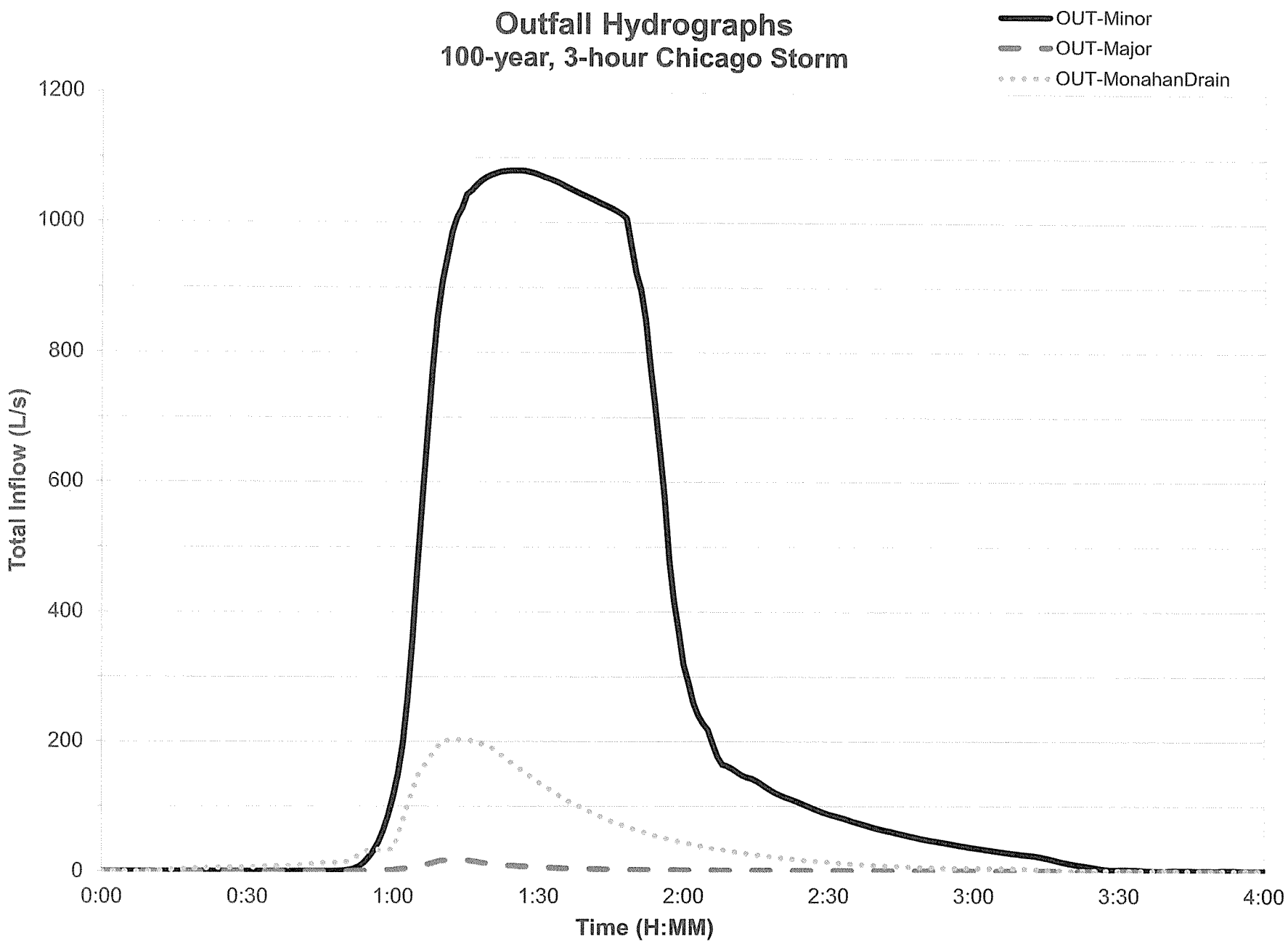
Equivalent Orifice Sizing and Distribution of 155.5 L/s/ha Flow Rate for each Subcatchment

Name	Inlet / Outlet Node	Area ID	Drainage Area (ha)	Static Ponding Depth (m)	155.5 L/s/ha Flow Rate[1] (L/s)	Artificial Orific Dia.[2] (m)
Orifices (CB's In-Sag)						
O-CB01-02	CB01-02	A01	0.434	0.30	67.5	0.157
O-CB03-04	CB03-04	A02	0.777	0.30	120.8	0.210
O-CB05-06	CB05-06	A03	0.618	0.30	96.1	0.188
O-CB07-08	CB07-08	A04	0.238	0.20	37.0	0.116
O-CB09-10	CB09-10	A05	0.331	0.25	51.5	0.137
O-CB11-12	CB11-12	A11	0.504	0.25	78.4	0.169
O-CB13-14	CB13-14	A18	0.671	0.35	104.3	0.196
O-CB17-18	CB17-18	A08	0.143	0.20	22.2	0.090
O-CB19-20	CB19-20	A15	0.248	0.13	38.6	0.119
O-CB23-24	CB23-24	A13	0.804	0.30	125.0	0.214
O-CB25-26	CB25-26	A12	0.269	0.25	41.8	0.124
O-CB29-30	CB29-30	A07	0.461	0.30	71.7	0.162
O-CB31-32	CB31-32	A09	0.306	0.20	47.6	0.132
O-CB33-34	CB33-34	A10	0.317	0.30	49.3	0.134
O-CB35-36	CB35-36	A16	0.303	0.25	47.1	0.131
Outlets (CB's On-Grade)						
O-CB21-22	CB21-22	A14	0.121	-	18.8	-
O-CB27-28	CB27-28	A06	0.108	-	16.8	-
O-CB37-38	CB37-38	A17	0.068	-	10.6	-
Uncontroled Areas to Monahan Drain & Cope Drive						
OFF01	OUT-MonahanDrain	OFF01	1.385	-	215.4	-
OFF02	OUT-Major	OFF02	0.048	-	7.5	-
TOTAL	**-**	**-**	**8.154**	**-**	**1267.9**	**-**

[1] *Flow rate = drainage area (ha) x 155.5 L/s/ha.*

[2] *Equivalent orifice diameter corresponding to 155.5 L/s/ha flow rate; based on 1.60m of head (CB T/G - CB Inv.)*

Van Gaal Lands (117198)
PCSWMM Outfall Hydrographs



Date: 22/08/18
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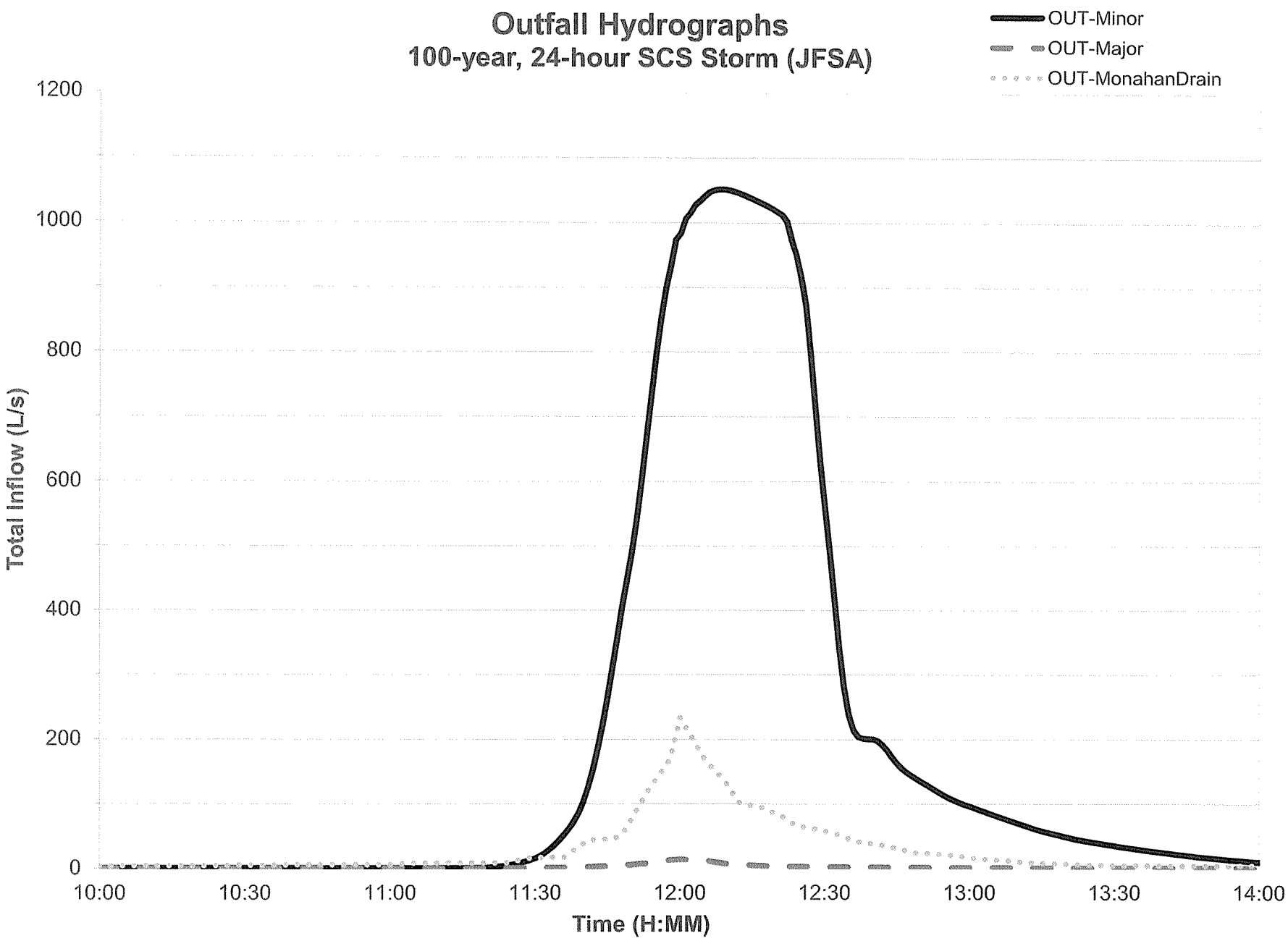
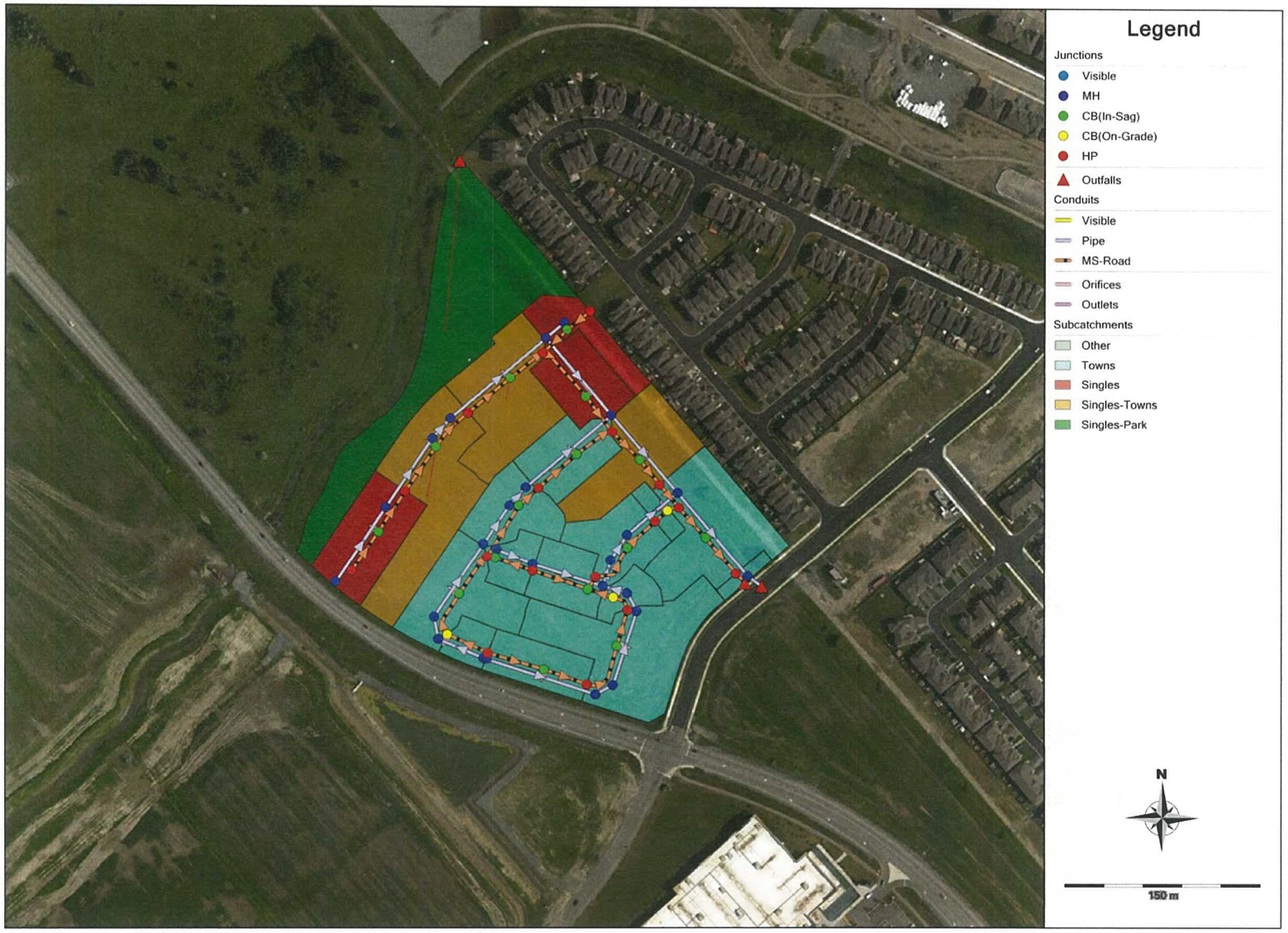

Outfall Hydrographs
100-year, 24-hour SCS Storm (JFSA)
OUT-Minor
OUT-Major
OUT-MonahanDrain
1200
1000
800
600
400
200
0
Total Inflow (L/s)
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
Time (H:MM)

Van Gaal Lands (117198)
PCSWMM Model Schematics

NOVATECH
Engineers, Planners & Landscape Architects

Overall Model Schematic



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Van Gaal Lands (117198)
PCSWMM Model Schematics

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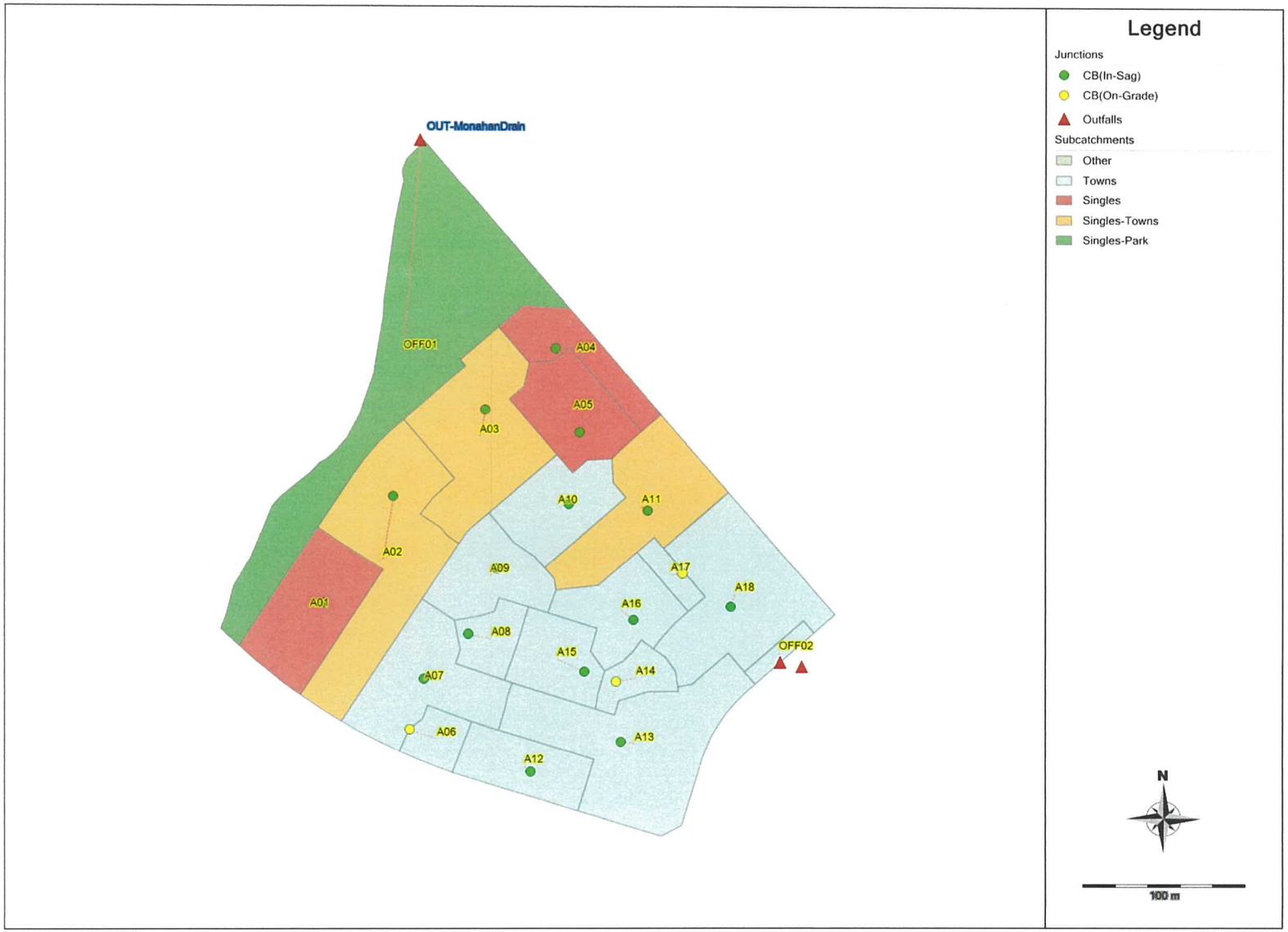
Subcatchments and Outfalls



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Van Gaal Lands (117198)
PCSWMM Model Schematics

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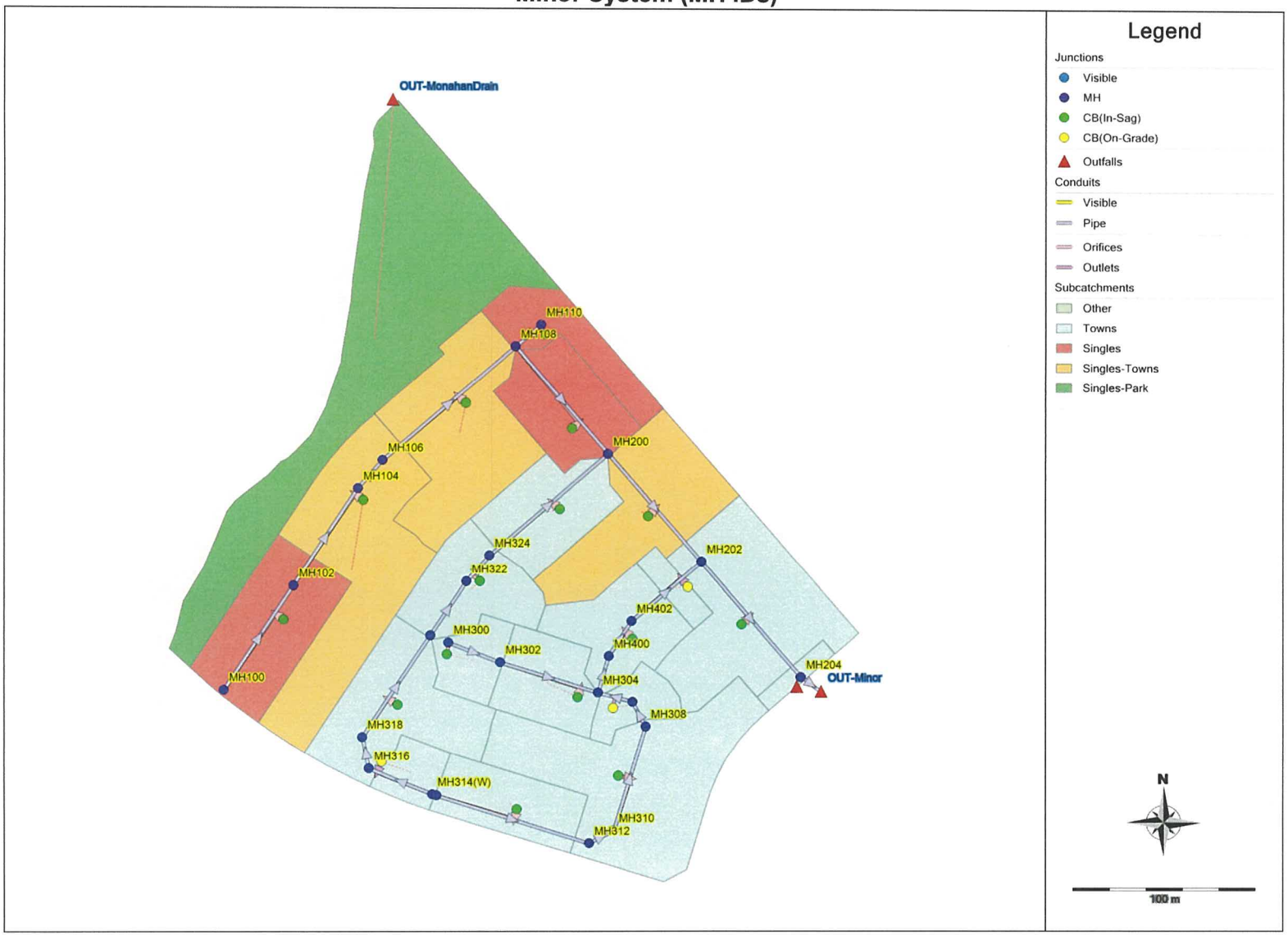
Minor System (MH IDs)



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Van Gaal Lands (117198)
PCSWMM Model Schematics

NOVATECH
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Major System (CB IDs)

Date: 01/08/2018
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```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
---------------------------------------------------------------

WARNING 02: maximum depth increased for Node CB01-02
WARNING 02: maximum depth increased for Node CB03-04
WARNING 02: maximum depth increased for Node CB09-10
WARNING 02: maximum depth increased for Node CB11-12
WARNING 02: maximum depth increased for Node CB17-18
WARNING 02: maximum depth increased for Node CB23-24

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 20
Number of nodes ........... 63
Number of links ........... 80
Number of pollutants ...... 0
Number of land uses ....... 0


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


*********************
Subcatchment Summary
*********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
A01                         0.43     97.60     50.00    0.5000 RG                   CB01-02
A02                         0.78    174.80     57.10    0.5000 RG                   CB03-04
A03                         0.62    138.90     57.10    0.5000 RG                   CB05-06
A04                         0.24     53.60     50.00    0.5000 RG                   CB07-08
A05                         0.33     74.40     50.00    0.5000 RG                   CB09-10
A06                         0.11     24.30     64.30    0.5000 RG                   CB27-28
A07                         0.46    103.70     64.30    0.5000 RG                   CB29-30
A08                         0.14     32.10     64.30    0.5000 RG                   CB17-18
A09                         0.31     68.80     64.30    0.5000 RG                   CB31-32
A10                         0.32     71.30     64.30    0.5000 RG                   CB33-34
A11                         0.50    113.30     57.10    0.5000 RG                   CB11-12
A12                         0.27     60.40     64.30    0.5000 RG                   CB25-26
A13                         0.80    180.90     64.30    0.5000 RG                   CB23-24
A14                         0.12     27.20     64.30    0.5000 RG                   CB21-22
A15                         0.25     55.80     64.30    0.5000 RG                   CB19-20
A16                         0.30     68.20     64.30    0.5000 RG                   CB35-36
A17                         0.07     15.30     64.30    0.5000 RG                   CB37-38
A18                         0.67    151.10     64.30    0.5000 RG                   CB13-14
OFF01                       1.39    311.60     21.40    0.5000 RG                   OUT-MonahanDrain
OFF02                       0.05     10.90     64.30    0.5000 RG                   OUT-Major


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
CB01-02              JUNCTION        95.77      2.60       0.0
CB03-04              JUNCTION        95.67      2.61       0.0
CB05-06              JUNCTION        95.57      2.60       0.0
CB07-08              JUNCTION        95.67      2.60       0.0
CB09-10              JUNCTION        95.52      2.60       0.0
CB11-12              JUNCTION        95.52      2.60       0.0
CB13-14              JUNCTION        95.17      2.60       0.0
CB17-18              JUNCTION        95.77      2.60       0.0
CB19-20              JUNCTION        95.72      2.60       0.0
CB21-22              JUNCTION        97.48      1.00       0.0
CB23-24              JUNCTION        95.77      2.60       0.0
CB25-26              JUNCTION        95.92      2.60       0.0
CB27-28              JUNCTION        97.63      1.00       0.0
CB29-30              JUNCTION        95.67      2.60       0.0
CB31-32              JUNCTION        95.67      2.60       0.0
CB33-34              JUNCTION        95.47      2.60       0.0
CB35-36              JUNCTION        95.47      2.60       0.0
CB37-38              JUNCTION        97.22      1.00       0.0
HP01                 JUNCTION        97.77      1.00       0.0
HP02                 JUNCTION        97.67      1.00       0.0
HP03                 JUNCTION        97.57      1.00       0.0
HP04                 JUNCTION        97.47      1.00       0.0
HP05                 JUNCTION        97.47      1.00       0.0
HP06                 JUNCTION        97.37      1.00       0.0
HP07                 JUNCTION        97.37      1.00       0.0
HP08                 JUNCTION        97.12      1.00       0.0
HP09                 JUNCTION        97.12      1.00       0.0
HP10                 JUNCTION        97.47      1.00       0.0
```

HP11	JUNCTION	97.57	1.00	0.0
HP12	JUNCTION	97.92	1.00	0.0
HP13	JUNCTION	97.77	1.00	0.0
HP14	JUNCTION	97.67	1.00	0.0
HP16	JUNCTION	97.45	1.00	0.0
HP17	JUNCTION	97.67	1.00	0.0
HP18	JUNCTION	97.32	1.00	0.0
MH100	JUNCTION	95.38	2.02	0.0
MH102	JUNCTION	95.02	2.58	0.0
MH104	JUNCTION	94.88	2.49	0.0
MH106	JUNCTION	94.68	2.86	0.0
MH108	JUNCTION	94.46	3.08	0.0
MH110	JUNCTION	95.01	2.36	0.0
MH200	JUNCTION	94.22	3.22	0.0
MH202	JUNCTION	93.98	3.24	0.0
MH204	JUNCTION	93.88	3.05	0.0
MH300	JUNCTION	95.37	2.09	0.0
MH302	JUNCTION	95.09	2.65	0.0
MH304	JUNCTION	94.69	2.80	0.0
MH306	JUNCTION	94.81	2.76	0.0
MH308	JUNCTION	94.87	2.79	0.0
MH310	JUNCTION	95.02	2.62	0.0
MH312	JUNCTION	95.15	2.59	0.0
MH314(E)	JUNCTION	95.41	2.58	0.0
MH314(W)	JUNCTION	95.36	2.63	0.0
MH316	JUNCTION	95.24	2.40	0.0
MH318	JUNCTION	95.16	2.36	0.0
MH320	JUNCTION	94.99	2.65	0.0
MH322	JUNCTION	94.82	2.56	0.0
MH324	JUNCTION	94.77	2.73	0.0
MH400	JUNCTION	94.63	2.64	0.0
MH402	JUNCTION	94.57	2.62	0.0
OUT-Major	OUTFALL	96.87	1.00	0.0
OUT-Minor	OUTFALL	93.86	1.05	0.0
OUT-MonahanDrain	OUTFALL	96.00	0.00	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
MH100-102	MH100	MH102	CONDUIT	68.7	0.3055	0.0130
MH102-104	MH102	MH104	CONDUIT	64.1	0.2183	0.0130
MH104-106	MH104	MH106	CONDUIT	20.7	0.2418	0.0130
MH106-108	MH106	MH108	CONDUIT	95.9	0.1460	0.0130
MH108-200	MH108	MH200	CONDUIT	78.0	0.1154	0.0130
MH110-108	MH110	MH108	CONDUIT	18.3	0.5453	0.0130
MH200-202	MH200	MH202	CONDUIT	78.5	0.1146	0.0130
MH202-204	MH202	MH204	CONDUIT	83.9	0.1192	0.0130
MH204-1013	MH204	OUT-Minor	CONDUIT	13.6	0.1473	0.0130
MH300-302	MH300	MH302	CONDUIT	30.3	0.4951	0.0130
MH302-304	MH302	MH304	CONDUIT	56.5	0.3012	0.0130
MH304-400	MH304	MH400	CONDUIT	20.9	0.2390	0.0130
MH306-304	MH306	MH304	CONDUIT	19.5	0.2053	0.0130
MH308-306	MH308	MH306	CONDUIT	15.4	0.1942	0.0130
MH310-308	MH310	MH308	CONDUIT	59.7	0.2011	0.0130
MH312-310	MH312	MH310	CONDUIT	15.4	0.3245	0.0130
MH314-312	MH314(E)	MH312	CONDUIT	90.2	0.2549	0.0130
MH314-316	MH314(W)	MH316	CONDUIT	37.6	0.2393	0.0130
MH316-318	MH316	MH318	CONDUIT	17.6	0.2834	0.0130
MH318-320	MH318	MH320	CONDUIT	67.0	0.2538	0.0130
MH320-322	MH320	MH322	CONDUIT	35.8	0.2513	0.0130
MH322-324	MH322	MH324	CONDUIT	18.8	0.2124	0.0130
MH324-200	MH324	MH200	CONDUIT	86.1	0.1975	0.0130
MH400-402	MH400	MH402	CONDUIT	23.0	0.2173	0.0130
MH402-202	MH402	MH202	CONDUIT	50.3	0.1790	0.0130
MS01	HP01	CB01-02	CONDUIT	36.2	1.1050	0.0150
MS02	CB01-02	HP02	CONDUIT	37.2	-0.8065	0.0150
MS03	HP02	CB03-04	CONDUIT	41.8	0.9331	0.0150
MS04	CB03-04	HP03	CONDUIT	35.9	-0.8357	0.0150
MS05	HP03	CB05-06	CONDUIT	42.2	0.9479	0.0150
MS06	CB05-06	HP04	CONDUIT	31.8	-0.9434	0.0150
MS07	HP05	CB07-08	CONDUIT	22.6	0.8850	0.0150
MS08	CB07-08	HP04	CONDUIT	25.7	-0.7782	0.0150
MS09	HP04	CB09-10	CONDUIT	48.2	0.7262	0.0150
MS10	CB09-10	HP06	CONDUIT	33.6	-0.7441	0.0150
MS11	HP06	CB11-12	CONDUIT	30.5	0.8197	0.0150
MS12	CB11-12	HP07	CONDUIT	24.6	-1.0163	0.0150
MS13	HP07	HP08	CONDUIT	23.1	1.0823	0.0150
MS14	HP08	CB13-14	CONDUIT	30.9	1.1328	0.0150
MS16	CB13-14	HP09	CONDUIT	35.9	-0.9750	0.0150
MS17	HP09	OUT-Major	CONDUIT	10.1	2.4760	0.0150
MS18	CB33-34	HP06	CONDUIT	32.7	-0.9175	0.0150
MS19	HP10	CB33-34	CONDUIT	39.2	1.0205	0.0150
MS20	CB31-32	HP10	CONDUIT	20.2	-0.9901	0.0150
MS21	HP11	CB31-32	CONDUIT	46.1	0.6508	0.0150
MS22	CB29-30	HP11	CONDUIT	35.7	-0.8404	0.0150
MS23	CB27-28	CB29-30	CONDUIT	36.6	0.9837	0.0150
MS24	HP12	CB27-28	CONDUIT	33.8	0.8580	0.0150
MS25	HP12	CB25-26	CONDUIT	45.0	0.8889	0.0150
MS26	CB25-26	HP13	CONDUIT	35.0	-0.7143	0.0150

MS27	HP13	CB23-24	CONDUIT	43.8	0.9133	0.0150
MS28	CB23-24	HP14	CONDUIT	28.8	-1.0417	0.0150
MS29	HP14	CB21-22	CONDUIT	15.9	1.1951	0.0150
MS30	CB21-22	CB19-20	CONDUIT	8.3	1.9281	0.0150
MS31	CB19-20	HP16	CONDUIT	11.2	-1.1608	0.0150
MS32	HP17	CB19-20	CONDUIT	44.7	0.7830	0.0150
MS33	HP17	CB17-18	CONDUIT	30.6	0.9804	0.0150
MS34	CB17-18	HP11	CONDUIT	6.3	-3.1762	0.0150
MS35	HP16	CB35-36	CONDUIT	37.3	1.0188	0.0150
MS36	CB35-36	HP18	CONDUIT	28.8	-0.8681	0.0150
MS37	HP18	CB37-38	CONDUIT	13.0	0.7693	0.0150
MS38	CB37-38	HP08	CONDUIT	9.2	1.0870	0.0150
O-CB01-02	CB01-02	MH100	ORIFICE			
O-CB03-04	CB03-04	MH102	ORIFICE			
O-CB05-06	CB05-06	MH106	ORIFICE			
O-CB07-08	CB07-08	MH110	ORIFICE			
O-CB09-10	CB09-10	MH108	ORIFICE			
O-CB11-12	CB11-12	MH200	ORIFICE			
O-CB13-14	CB13-14	MH202	ORIFICE			
O-CB17-18	CB17-18	MH300	ORIFICE			
O-CB19-20	CB19-20	MH302	ORIFICE			
O-CB23-24	CB23-24	MH310	ORIFICE			
O-CB25-26	CB25-26	MH314(E)	ORIFICE			
O-CB29-30	CB29-30	MH318	ORIFICE			
O-CB31-32	CB31-32	MH322	ORIFICE			
O-CB33-34	CB33-34	MH324	ORIFICE			
O-CB35-36	CB35-36	MH400	ORIFICE			
O-CB21-22	CB21-22	MH306	OUTLET			
O-CB27-28	CB27-28	MH314(W)	OUTLET			
O-CB37-38	CB37-38	MH402	OUTLET			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
MH100-102	CIRCULAR	0.38	0.11	0.09	0.38	1	96.92
MH102-104	CIRCULAR	0.53	0.22	0.13	0.53	1	200.97
MH104-106	CIRCULAR	0.53	0.22	0.13	0.53	1	211.48
MH106-108	CIRCULAR	0.68	0.36	0.17	0.68	1	321.24
MH108-200	CIRCULAR	0.75	0.44	0.19	0.75	1	378.18
MH110-108	CIRCULAR	0.30	0.07	0.07	0.30	1	71.41
MH200-202	CIRCULAR	0.90	0.64	0.23	0.90	1	612.89
MH202-204	CIRCULAR	1.05	0.87	0.26	1.05	1	942.92
MH204-1013	CIRCULAR	1.05	0.87	0.26	1.05	1	1048.02
MH300-302	CIRCULAR	0.25	0.05	0.06	0.25	1	41.84
MH302-304	CIRCULAR	0.38	0.11	0.09	0.38	1	96.22
MH304-400	CIRCULAR	0.60	0.28	0.15	0.60	1	300.20
MH306-304	CIRCULAR	0.53	0.22	0.13	0.53	1	194.89
MH308-306	CIRCULAR	0.53	0.22	0.13	0.53	1	189.52
MH310-308	CIRCULAR	0.53	0.22	0.13	0.53	1	192.87
MH312-310	CIRCULAR	0.45	0.16	0.11	0.45	1	162.41
MH314-312	CIRCULAR	0.45	0.16	0.11	0.45	1	143.95
MH314-316	CIRCULAR	0.45	0.16	0.11	0.45	1	139.48
MH316-318	CIRCULAR	0.45	0.16	0.11	0.45	1	151.80
MH318-320	CIRCULAR	0.45	0.16	0.11	0.45	1	143.64
MH320-322	CIRCULAR	0.45	0.16	0.11	0.45	1	142.94
MH322-324	CIRCULAR	0.53	0.22	0.13	0.53	1	198.23
MH324-200	CIRCULAR	0.53	0.22	0.13	0.53	1	191.14
MH400-402	CIRCULAR	0.60	0.28	0.15	0.60	1	286.24
MH402-202	CIRCULAR	0.60	0.28	0.15	0.60	1	259.79
MS01	18.5mROW	1.00	15.07	0.37	18.00	1	54341.78
MS02	18.5mROW	1.00	15.07	0.37	18.00	1	46423.85
MS03	18.5mROW	1.00	15.07	0.37	18.00	1	49934.25
MS04	18.5mROW	1.00	15.07	0.37	18.00	1	47256.97
MS05	18.5mROW	1.00	15.07	0.37	18.00	1	50330.18
MS06	18.5mROW	1.00	15.07	0.37	18.00	1	50211.32
MS07	18.5mROW	1.00	15.07	0.37	18.00	1	48631.11
MS08	18.5mROW	1.00	15.07	0.37	18.00	1	45603.69
MS09	18.5mROW	1.00	15.07	0.37	18.00	1	44051.55
MS10	18.5mROW	1.00	15.07	0.37	18.00	1	44591.42
MS11	18.5mROW	1.00	15.07	0.37	18.00	1	46802.85
MS12	18.5mROW	1.00	15.07	0.37	18.00	1	52114.50
MS13	18.5mROW	1.00	15.07	0.37	18.00	1	53780.11
MS14	18.5mROW	1.00	15.07	0.37	18.00	1	55019.12
MS16	18.5mROW	1.00	15.07	0.37	18.00	1	51043.69
MS17	18.5mROW	1.00	15.07	0.37	18.00	1	81343.11
MS18	18.5mROW	1.00	15.07	0.37	18.00	1	49515.46
MS19	18.5mROW	1.00	15.07	0.37	18.00	1	52220.76
MS20	18.5mROW	1.00	15.07	0.37	18.00	1	51439.28
MS21	18.5mROW	1.00	15.07	0.37	18.00	1	41702.27
MS22	18.5mROW	1.00	15.07	0.37	18.00	1	47389.17
MS23	18.5mROW	1.00	15.07	0.37	18.00	1	51270.33
MS24	18.5mROW	1.00	15.07	0.37	18.00	1	47884.35
MS25	18.5mROW	1.00	15.07	0.37	18.00	1	48739.07
MS26	18.5mROW	1.00	15.07	0.37	18.00	1	43690.44
MS27	18.5mROW	1.00	15.07	0.37	18.00	1	49402.27
MS28	18.5mROW	1.00	15.07	0.37	18.00	1	52761.98
MS29	18.5mROW	1.00	15.07	0.37	18.00	1	56511.74
MS30	18.5mROW	1.00	15.07	0.37	18.00	1	71780.46

MS31	18.5mROW	1.00	15.07	0.37	18.00	1 55695.77
MS32	18.5mROW	1.00	15.07	0.37	18.00	1 45743.76
MS33	18.5mROW	1.00	15.07	0.37	18.00	1 51186.48
MS34	18.5mROW	1.00	15.07	0.37	18.00	1 92129.59
MS35	18.5mROW	1.00	15.07	0.37	18.00	1 52178.74
MS36	18.5mROW	1.00	15.07	0.37	18.00	1 48164.48
MS37	18.5mROW	1.00	15.07	0.37	18.00	1 45339.81
MS38	18.5mROW	1.00	15.07	0.37	18.00	1 53896.91

****
Transect Summary
****

Transect 18.5mROW
Area:

0.0009	0.0035	0.0078	0.0139	0.0217
0.0313	0.0424	0.0539	0.0664	0.0802
0.0953	0.1117	0.1292	0.1481	0.1682
0.1895	0.2121	0.2359	0.2597	0.2836
0.3075	0.3313	0.3552	0.3791	0.4029
0.4268	0.4507	0.4746	0.4984	0.5223
0.5462	0.5701	0.5939	0.6178	0.6417
0.6656	0.6895	0.7133	0.7372	0.7611
0.7850	0.8089	0.8328	0.8567	0.8805
0.9044	0.9283	0.9522	0.9761	1.0000

Hrad:

0.0262	0.0524	0.0787	0.1049	0.1311
0.1573	0.1962	0.2469	0.2908	0.3274
0.3577	0.3829	0.4038	0.4212	0.4357
0.4478	0.4579	0.4670	0.4779	0.4901
0.5034	0.5175	0.5323	0.5476	0.5632
0.5793	0.5956	0.6121	0.6289	0.6458
0.6629	0.6801	0.6974	0.7148	0.7323
0.7498	0.7674	0.7851	0.8029	0.8206
0.8384	0.8563	0.8742	0.8921	0.9100
0.9280	0.9460	0.9640	0.9820	1.0000

Width:

0.0728	0.1456	0.2184	0.2912	0.3640
0.4368	0.4733	0.4996	0.5522	0.6047
0.6573	0.7098	0.7624	0.8149	0.8675
0.9201	0.9726	0.9989	0.9989	0.9990
0.9990	0.9990	0.9991	0.9991	0.9991
0.9992	0.9992	0.9992	0.9993	0.9993
0.9994	0.9994	0.9994	0.9995	0.9995

0.9995	0.9996	0.9996	0.9996	0.9997
0.9997	0.9997	0.9998	0.9998	0.9998
0.9999	0.9999	0.9999	1.0000	1.0000

****
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.
****

****
Analysis Options
****
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
Starting Date 06/18/2018 00:00:00
Ending Date 06/19/2018 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

********** Runoff Quantity Continuity **********	Volume hectare-m	Depth mm
Initial LID Storage	0.003	0.320
Total Precipitation	0.584	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.173	21.241
Surface Runoff	0.417	51.131

```
Final Storage ............          0.003          0.320
Continuity Error (%) .....         -0.980

**************************        Volume         Volume
Flow Routing Continuity       hectare-m      10^6 ltr
**************************    ---------      ---------
Dry Weather Inflow .......          0.000          0.000
Wet Weather Inflow .......          0.417          4.170
Groundwater Inflow .......          0.000          0.000
RDII Inflow ..............          0.000          0.000
External Inflow ..........          0.000          0.000
External Outflow .........          0.417          4.173
Flooding Loss ............          0.000          0.000
Evaporation Loss .........          0.000          0.000
Exfiltration Loss ........          0.000          0.000
Initial Stored Volume ....          0.019          0.190
Final Stored Volume ......          0.020          0.196
Continuity Error (%) .....         -0.214


*************************
Highest Continuity Errors
*************************
Node HP08 (-2.93%)
Node CB27-28 (-1.86%)


***************************
Time-Step Critical Elements
***************************
Link MH204-1013 (5.84%)


*********************************
Highest Flow Instability Indexes
*********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.95 sec
Maximum Time Step           :     2.00 sec
```

```
Percent in Steady State     :     0.00
Average Iterations per Step :     2.01
Percent Not Converging      :     0.09


***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A01	71.67	0.00	0.00	23.09	49.25	0.21	124.70	0.687
A02	71.67	0.00	0.00	20.11	52.30	0.41	248.05	0.730
A03	71.67	0.00	0.00	20.11	52.30	0.32	197.25	0.730
A04	71.67	0.00	0.00	23.08	49.25	0.12	68.42	0.687
A05	71.67	0.00	0.00	23.09	49.25	0.16	95.09	0.687
A06	71.67	0.00	0.00	17.10	55.39	0.06	37.95	0.773
A07	71.67	0.00	0.00	17.10	55.39	0.26	161.97	0.773
A08	71.67	0.00	0.00	17.11	55.38	0.08	50.22	0.773
A09	71.67	0.00	0.00	17.10	55.39	0.17	107.50	0.773
A10	71.67	0.00	0.00	17.10	55.39	0.18	111.37	0.773
A11	71.67	0.00	0.00	20.11	52.30	0.26	160.87	0.730
A12	71.67	0.00	0.00	17.11	55.38	0.15	94.48	0.773
A13	71.67	0.00	0.00	17.10	55.39	0.45	282.49	0.773
A14	71.67	0.00	0.00	17.10	55.39	0.07	42.51	0.773
A15	71.67	0.00	0.00	17.10	55.39	0.14	87.14	0.773
A16	71.67	0.00	0.00	17.10	55.39	0.17	106.47	0.773
A17	71.67	0.00	0.00	17.10	55.39	0.04	23.89	0.773
A18	71.67	0.00	0.00	17.10	55.39	0.37	235.79	0.773
OFF01	71.67	0.00	0.00	33.01	39.00	0.54	202.81	0.544
OFF02	71.67	0.00	0.00	17.05	55.42	0.03	16.95	0.773

```
******************
Node Depth Summary
******************
```

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB01-02	JUNCTION	0.06	1.81	97.58	0 01:25	1.81

CB03-04	JUNCTION	0.07	1.91	97.58	0	01:25	1.91
CB05-06	JUNCTION	0.07	1.88	97.45	0	01:25	1.88
CB07-08	JUNCTION	0.06	1.79	97.46	0	01:25	1.79
CB09-10	JUNCTION	0.06	1.77	97.29	0	01:26	1.77
CB11-12	JUNCTION	0.06	1.87	97.39	0	01:23	1.87
CB13-14	JUNCTION	0.08	1.96	97.13	0	01:27	1.96
CB17-18	JUNCTION	0.07	1.80	97.57	0	01:25	1.80
CB19-20	JUNCTION	0.07	1.78	97.50	0	01:19	1.78
CB21-22	JUNCTION	0.00	0.04	97.52	0	01:22	0.04
CB23-24	JUNCTION	0.07	1.94	97.71	0	01:22	1.94
CB25-26	JUNCTION	0.07	1.79	97.71	0	01:25	1.79
CB27-28	JUNCTION	0.00	0.04	97.67	0	01:15	0.04
CB29-30	JUNCTION	0.08	1.90	97.57	0	01:26	1.90
CB31-32	JUNCTION	0.07	1.82	97.49	0	01:24	1.82
CB33-34	JUNCTION	0.07	1.83	97.30	0	01:26	1.83
CB35-36	JUNCTION	0.09	1.89	97.36	0	01:27	1.89
CB37-38	JUNCTION	0.00	0.04	97.26	0	01:26	0.04
HP01	JUNCTION	0.00	0.00	97.77	0	00:00	0.00
HP02	JUNCTION	0.00	0.00	97.67	0	00:00	0.00
HP03	JUNCTION	0.00	0.01	97.58	0	01:24	0.01
HP04	JUNCTION	0.00	0.00	97.47	0	00:00	0.00
HP05	JUNCTION	0.00	0.00	97.47	0	00:00	0.00
HP06	JUNCTION	0.00	0.02	97.39	0	01:24	0.02
HP07	JUNCTION	0.00	0.02	97.39	0	01:23	0.02
HP08	JUNCTION	0.00	0.04	97.16	0	01:28	0.04
HP09	JUNCTION	0.00	0.01	97.13	0	01:27	0.01
HP10	JUNCTION	0.00	0.02	97.49	0	01:23	0.02
HP11	JUNCTION	0.00	0.00	97.57	0	01:24	0.00
HP12	JUNCTION	0.00	0.00	97.92	0	00:00	0.00
HP13	JUNCTION	0.00	0.00	97.77	0	00:00	0.00
HP14	JUNCTION	0.00	0.04	97.71	0	01:22	0.04
HP16	JUNCTION	0.00	0.05	97.50	0	01:19	0.05
HP17	JUNCTION	0.00	0.00	97.67	0	00:00	0.00
HP18	JUNCTION	0.00	0.04	97.36	0	01:27	0.04
MH100	JUNCTION	0.02	0.45	95.83	0	01:15	0.44
MH102	JUNCTION	0.03	0.75	95.77	0	01:11	0.69
MH104	JUNCTION	0.06	0.70	95.58	0	01:11	0.69
MH106	JUNCTION	0.25	0.85	95.53	0	01:11	0.84
MH108	JUNCTION	0.46	0.89	95.35	0	01:24	0.89
MH110	JUNCTION	0.02	0.40	95.41	0	01:11	0.39
MH200	JUNCTION	0.70	1.04	95.26	0	01:24	1.04
MH202	JUNCTION	0.94	1.18	95.16	0	01:24	1.18
MH204	JUNCTION	1.03	1.13	95.01	0	01:25	1.13
MH300	JUNCTION	0.01	0.26	95.63	0	01:25	0.26
MH302	JUNCTION	0.02	0.49	95.58	0	01:24	0.49
MH304	JUNCTION	0.24	0.80	95.49	0	01:25	0.80
MH306	JUNCTION	0.12	0.77	95.58	0	01:25	0.77
MH308	JUNCTION	0.07	0.76	95.63	0	01:25	0.76
MH310	JUNCTION	0.03	0.73	95.75	0	01:25	0.73
MH312	JUNCTION	0.02	0.60	95.75	0	01:25	0.60
MH314(E)	JUNCTION	0.02	0.36	95.77	0	01:25	0.36
MH314(W)	JUNCTION	0.01	0.24	95.60	0	01:23	0.24
MH316	JUNCTION	0.01	0.36	95.60	0	01:24	0.36
MH318	JUNCTION	0.02	0.44	95.60	0	01:24	0.44
MH320	JUNCTION	0.03	0.55	95.54	0	01:24	0.55
MH322	JUNCTION	0.11	0.68	95.50	0	01:24	0.68
MH324	JUNCTION	0.16	0.71	95.48	0	01:24	0.71
MH400	JUNCTION	0.30	0.81	95.44	0	01:25	0.81
MH402	JUNCTION	0.36	0.80	95.37	0	01:25	0.80
OUT-Major	OUTFALL	0.00	0.01	96.88	0	01:27	0.01
OUT-Minor	OUTFALL	1.05	1.05	94.91	0	00:00	1.05
OUT-MonahanDrain	OUTFALL	0.00	0.00	96.00	0	00:00	0.00

****
Node Inflow Summary
****

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
CB01-02	JUNCTION	124.70	124.70	0 01:15	0.214	0.214	-0.093
CB03-04	JUNCTION	248.05	248.05	0 01:15	0.406	0.407	-0.050
CB05-06	JUNCTION	197.25	197.25	0 01:15	0.323	0.324	-0.221
CB07-08	JUNCTION	68.42	68.42	0 01:15	0.117	0.117	-0.009
CB09-10	JUNCTION	95.09	95.09	0 01:15	0.163	0.165	-0.052
CB11-12	JUNCTION	160.87	160.87	0 01:15	0.264	0.265	-0.129
CB13-14	JUNCTION	235.79	248.44	0 01:15	0.372	0.395	0.140
CB17-18	JUNCTION	50.22	50.22	0 01:15	0.0792	0.0793	-0.123
CB19-20	JUNCTION	87.14	110.72	0 01:15	0.137	0.174	0.034
CB21-22	JUNCTION	42.51	50.40	0 01:20	0.067	0.0805	-0.159
CB23-24	JUNCTION	282.49	282.49	0 01:15	0.445	0.446	-0.117
CB25-26	JUNCTION	94.48	94.48	0 01:15	0.149	0.149	-0.164
CB27-28	JUNCTION	37.95	37.95	0 01:15	0.0598	0.0598	-1.831
CB29-30	JUNCTION	161.97	182.52	0 01:15	0.255	0.277	0.394
CB31-32	JUNCTION	107.50	107.50	0 01:15	0.169	0.17	-0.191
CB33-34	JUNCTION	111.37	111.37	0 01:15	0.176	0.18	-0.321
CB35-36	JUNCTION	106.47	137.31	0 01:16	0.168	0.208	0.300
CB37-38	JUNCTION	23.89	29.26	0 01:26	0.0377	0.0491	-0.041

HP01	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP02	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP03	JUNCTION	0.00	22.88	0	01:21	0	0.00237	46.303	
HP04	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP05	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP06	JUNCTION	0.00	28.99	0	01:18	0	0.00588	7.804	
HP07	JUNCTION	0.00	19.13	0	01:17	0	0.00284	5.108	
HP08	JUNCTION	0.00	21.20	0	01:26	0	0.0226	-2.846	
HP09	JUNCTION	0.00	11.02	0	01:22	0	0.00103	37.662	
HP10	JUNCTION	0.00	17.34	0	01:18	0	0.00291	10.247	
HP11	JUNCTION	0.00	5.01	0	01:22	0	0.000294	188.743	
HP12	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP13	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP14	JUNCTION	0.00	37.42	0	01:16	0	0.0145	1.708	
HP16	JUNCTION	0.00	48.65	0	01:17	0	0.0391	-2.548	
HP17	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP18	JUNCTION	0.00	22.59	0	01:25	0	0.0123	1.512	
MH100	JUNCTION	0.00	68.80	0	01:25	0	0.214	0.195	
MH102	JUNCTION	0.00	194.58	0	01:25	0	0.619	-0.112	
MH104	JUNCTION	0.00	194.58	0	01:25	0	0.62	-0.061	
MH106	JUNCTION	0.00	294.86	0	01:25	0	0.949	0.030	
MH108	JUNCTION	0.00	384.42	0	01:25	0	1.24	-0.018	
MH110	JUNCTION	0.00	37.55	0	01:25	0	0.117	0.059	
MH200	JUNCTION	0.00	653.88	0	01:25	0	2.16	0.029	
MH202	JUNCTION	0.00	1080.09	0	01:25	0	3.63	-0.004	
MH204	JUNCTION	0.00	1080.10	0	01:25	0	3.63	-0.003	
MH300	JUNCTION	0.00	22.79	0	01:25	0	0.0791	-0.001	
MH302	JUNCTION	0.00	62.43	0	01:29	0	0.214	0.273	
MH304	JUNCTION	0.00	255.28	0	01:25	0	0.843	-0.075	
MH306	JUNCTION	0.00	193.11	0	01:26	0	0.629	0.020	
MH308	JUNCTION	0.00	175.65	0	01:30	0	0.582	-0.178	
MH310	JUNCTION	0.00	175.62	0	01:30	0	0.582	0.045	
MH312	JUNCTION	0.00	56.32	0	01:50	0	0.149	-0.221	
MH314(E)	JUNCTION	0.00	42.91	0	01:25	0	0.149	0.064	
MH314(W)	JUNCTION	0.00	16.80	0	01:09	0	0.0396	-0.012	
MH316	JUNCTION	0.00	16.80	0	01:11	0	0.0396	-0.091	
MH318	JUNCTION	0.00	90.37	0	01:20	0	0.315	-0.032	
MH320	JUNCTION	0.00	89.02	0	01:24	0	0.315	-0.104	
MH322	JUNCTION	0.00	139.14	0	01:51	0	0.484	0.086	
MH324	JUNCTION	0.00	192.63	0	01:51	0	0.666	-0.065	
MH400	JUNCTION	0.00	304.46	0	01:25	0	1.04	-0.002	
MH402	JUNCTION	0.00	315.06	0	01:25	0	1.07	-0.005	
OUT-Major	OUTFALL	16.95	16.95	0	01:15	0.0266	0.0271	0.000	
OUT-Minor	OUTFALL	0.00	1080.11	0	01:25	0	3.63	0.000	
OUT-MonahanDrain	OUTFALL	202.81	202.81	0	01:15	0.54	0.54	0.000	

****
Node Surcharge Summary
****

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
MH100	JUNCTION	0.46	0.076	1.569
MH102	JUNCTION	0.63	0.226	1.829
MH104	JUNCTION	0.65	0.170	1.795
MH106	JUNCTION	0.66	0.180	2.005
MH108	JUNCTION	0.68	0.138	2.187
MH110	JUNCTION	0.62	0.095	1.965
MH200	JUNCTION	0.72	0.135	2.180
MH202	JUNCTION	0.69	0.078	2.062
MH204	JUNCTION	0.86	0.077	1.923
MH300	JUNCTION	0.13	0.007	1.833
MH302	JUNCTION	0.60	0.113	2.157
MH304	JUNCTION	0.70	0.195	2.000
MH306	JUNCTION	0.69	0.218	1.987
MH308	JUNCTION	0.66	0.205	2.030
MH310	JUNCTION	0.63	0.199	1.891
MH312	JUNCTION	0.55	0.125	1.985
MH320	JUNCTION	0.60	0.100	2.100
MH322	JUNCTION	0.69	0.151	1.879
MH324	JUNCTION	0.70	0.172	2.023
MH400	JUNCTION	0.72	0.204	1.826
MH402	JUNCTION	0.73	0.193	1.817

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OUT-Major	13.23	2.68	16.95	0.027
OUT-Minor	96.70	48.79	1080.11	3.629
OUT-MonahanDrain	18.39	39.36	202.81	0.540
System	42.78	90.82	1275.06	4.196

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
MH100-102	CONDUIT	68.81	0 01:25	0.91	0.71	1.00
MH102-104	CONDUIT	194.58	0 01:25	1.01	0.97	1.00
MH104-106	CONDUIT	194.58	0 01:25	0.90	0.92	1.00
MH106-108	CONDUIT	294.87	0 01:25	0.82	0.92	1.00
MH108-200	CONDUIT	384.42	0 01:25	0.87	1.02	1.00
MH110-108	CONDUIT	37.55	0 01:25	0.75	0.53	1.00
MH200-202	CONDUIT	653.88	0 01:24	1.03	1.07	1.00
MH202-204	CONDUIT	1080.10	0 01:25	1.25	1.15	1.00
MH204-1013	CONDUIT	1080.11	0 01:25	1.25	1.03	1.00
MH300-302	CONDUIT	23.33	0 01:49	0.90	0.56	1.00
MH302-304	CONDUIT	64.14	0 01:50	0.80	0.67	1.00
MH304-400	CONDUIT	255.29	0 01:25	0.90	0.85	1.00
MH306-304	CONDUIT	193.11	0 01:25	0.89	0.99	1.00
MH308-306	CONDUIT	175.68	0 01:30	0.81	0.93	1.00
MH310-308	CONDUIT	175.65	0 01:30	0.89	0.91	1.00
MH312-310	CONDUIT	92.81	0 01:50	0.70	0.57	1.00
MH314-312	CONDUIT	56.32	0 01:50	0.71	0.39	0.90
MH314-316	CONDUIT	16.80	0 01:11	0.46	0.12	0.64
MH316-318	CONDUIT	16.21	0 01:10	0.37	0.11	0.86
MH318-320	CONDUIT	89.02	0 01:24	0.92	0.62	0.99
MH320-322	CONDUIT	102.27	0 01:53	0.98	0.72	1.00
MH322-324	CONDUIT	144.19	0 01:51	0.73	0.73	1.00
MH324-200	CONDUIT	196.72	0 01:52	0.93	1.03	1.00
MH400-402	CONDUIT	304.46	0 01:25	1.08	1.06	1.00
MH402-202	CONDUIT	315.06	0 01:25	1.11	1.21	1.00
MS01	CHANNEL	0.00	0 00:00	0.00	0.00	0.10
MS02	CHANNEL	0.00	0 00:00	0.00	0.00	0.10
MS03	CHANNEL	0.00	0 00:00	0.00	0.00	0.15
MS04	CHANNEL	22.88	0 01:21	0.15	0.00	0.16
MS05	CHANNEL	0.91	0 01:24	0.15	0.00	0.15
MS06	CHANNEL	0.00	0 00:00	0.00	0.00	0.14
MS07	CHANNEL	0.00	0 00:00	0.00	0.00	0.09
MS08	CHANNEL	0.00	0 00:00	0.00	0.00	0.09
MS09	CHANNEL	0.00	0 00:00	0.00	0.00	0.09
MS10	CHANNEL	3.35	0 01:24	0.14	0.00	0.10
MS11	CHANNEL	28.99	0 01:18	0.15	0.00	0.14
MS12	CHANNEL	19.13	0 01:17	0.11	0.00	0.15
MS13	CHANNEL	4.36	0 01:23	0.23	0.00	0.03
MS14	CHANNEL	19.60	0 01:28	0.27	0.00	0.20
MS16	CHANNEL	11.02	0 01:22	0.09	0.00	0.18
MS17	CHANNEL	0.55	0 01:27	0.35	0.00	0.01
MS18	CHANNEL	3.72	0 01:24	0.13	0.00	0.12
MS19	CHANNEL	2.84	0 01:23	0.13	0.00	0.12
MS20	CHANNEL	17.34	0 01:18	0.14	0.00	0.12
MS21	CHANNEL	0.00	0 01:24	0.01	0.00	0.11
MS22	CHANNEL	0.00	0 01:24	0.01	0.00	0.15
MS23	CHANNEL	20.61	0 01:15	0.31	0.00	0.16
MS24	CHANNEL	0.00	0 00:00	0.00	0.00	0.02
MS25	CHANNEL	0.00	0 00:00	0.00	0.00	0.10
MS26	CHANNEL	0.00	0 00:00	0.00	0.00	0.10
MS27	CHANNEL	0.00	0 00:00	0.00	0.00	0.17
MS28	CHANNEL	37.42	0 01:16	0.13	0.00	0.19
MS29	CHANNEL	26.33	0 01:22	0.53	0.00	0.04
MS30	CHANNEL	31.38	0 01:22	0.49	0.00	0.11
MS31	CHANNEL	48.65	0 01:17	0.19	0.00	0.12
MS32	CHANNEL	0.00	0 00:00	0.00	0.00	0.09
MS33	CHANNEL	0.00	0 00:00	0.00	0.00	0.10
MS34	CHANNEL	5.01	0 01:22	0.02	0.00	0.10
MS35	CHANNEL	47.67	0 01:19	0.11	0.00	0.17
MS36	CHANNEL	22.59	0 01:25	0.09	0.00	0.16
MS37	CHANNEL	19.73	0 01:27	0.44	0.00	0.04
MS38	CHANNEL	18.58	0 01:26	0.48	0.00	0.04
O-CB01-02	ORIFICE	68.80	0 01:25			1.00
O-CB03-04	ORIFICE	125.78	0 01:25			1.00
O-CB05-06	ORIFICE	100.28	0 01:25			1.00
O-CB07-08	ORIFICE	37.55	0 01:25			1.00
O-CB09-10	ORIFICE	52.01	0 01:26			1.00
O-CB11-12	ORIFICE	81.00	0 01:23			1.00
O-CB13-14	ORIFICE	111.22	0 01:27			1.00
O-CB17-18	ORIFICE	22.79	0 01:25			1.00
O-CB19-20	ORIFICE	39.47	0 01:19			1.00
O-CB23-24	ORIFICE	131.58	0 01:22			1.00

O-CB25-26	ORIFICE	42.91	0	01:25	1.00
O-CB29-30	ORIFICE	75.13	0	01:26	1.00
O-CB31-32	ORIFICE	48.95	0	01:24	1.00
O-CB33-34	ORIFICE	50.57	0	01:26	1.00
O-CB35-36	ORIFICE	49.19	0	01:27	1.00
O-CB21-22	DUMMY	18.80	0	01:09	
O-CB27-28	DUMMY	16.80	0	01:09	
O-CB37-38	DUMMY	10.60	0	01:07	

****
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 ----------								
MH100-102	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
MH102-104	1.00	0.00	0.34	0.00	0.66	0.00	0.00	0.00	0.87	0.00
MH104-106	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.02	0.00
MH106-108	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH108-200	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH110-108	1.00	0.00	0.00	0.00	0.42	0.00	0.00	0.58	0.00	0.00
MH200-202	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH202-204	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH204-1013	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH300-302	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
MH302-304	1.00	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.00	0.00
MH304-400	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH306-304	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH308-306	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH310-308	1.00	0.00	0.53	0.00	0.41	0.00	0.00	0.06	0.84	0.00
MH312-310	1.00	0.00	0.00	0.00	0.07	0.00	0.00	0.93	0.00	0.00
MH314-312	1.00	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.01	0.00
MH314-316	1.00	0.00	0.00	0.00	0.05	0.00	0.00	0.95	0.01	0.00
MH316-318	1.00	0.00	0.00	0.00	0.12	0.00	0.00	0.88	0.04	0.00
MH318-320	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.23	0.00
MH320-322	1.00	0.00	0.68	0.00	0.23	0.00	0.00	0.09	0.85	0.00
MH322-324	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH324-200	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH400-402	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH402-202	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MS01	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS02	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS03	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS04	1.00	0.05	0.01	0.00	0.02	0.00	0.00	0.92	0.02	0.00
MS05	1.00	0.05	0.01	0.00	0.02	0.00	0.00	0.92	0.02	0.00
MS06	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS07	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS08	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS09	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS10	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
MS11	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.02	0.00
MS12	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.02	0.00
MS13	1.00	0.00	0.00	0.00	0.34	0.66	0.00	0.00	1.00	0.00
MS14	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
MS16	1.00	0.05	0.01	0.00	0.02	0.00	0.00	0.92	0.02	0.00
MS17	1.00	0.06	0.00	0.00	0.64	0.30	0.00	0.00	0.03	0.00
MS18	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
MS19	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03	0.00
MS20	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.02	0.00
MS21	1.00	0.05	0.01	0.00	0.02	0.00	0.00	0.92	0.02	0.00
MS22	1.00	0.05	0.01	0.00	0.03	0.00	0.00	0.91	0.02	0.00
MS23	1.00	0.85	0.00	0.00	0.04	0.00	0.00	0.11	0.04	0.00
MS24	1.00	0.85	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS25	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS26	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS27	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS28	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.02	0.00
MS29	1.00	0.00	0.00	0.00	0.93	0.07	0.00	0.00	0.10	0.00
MS30	1.00	0.84	0.00	0.00	0.03	0.00	0.00	0.13	0.03	0.00
MS31	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01	0.00
MS32	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS33	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS34	1.00	0.05	0.01	0.00	0.02	0.00	0.00	0.92	0.02	0.00
MS35	1.00	0.00	0.00	0.00	0.05	0.00	0.00	0.95	0.04	0.00
MS36	1.00	0.00	0.00	0.00	0.05	0.00	0.00	0.95	0.03	0.00
MS37	1.00	0.00	0.00	0.00	0.88	0.12	0.00	0.00	0.08	0.00
MS38	1.00	0.00	0.84	0.00	0.13	0.03	0.00	0.00	0.95	0.00

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Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
	--------- Hours Full --------			Hours	Hours

MH100-102	0.46	0.46	0.63	0.01	0.01
MH102-104	0.63	0.63	0.65	0.01	0.20
MH104-106	0.65	0.65	0.66	0.01	0.41
MH106-108	0.66	0.66	0.68	0.01	0.63
MH108-200	0.68	0.68	0.72	0.38	0.38
MH110-108	0.62	0.62	0.68	0.01	0.01
MH200-202	0.72	0.72	0.76	0.59	0.59
MH202-204	0.76	0.76	0.86	0.64	0.70
MH204-1013	0.86	0.86	24.00	0.36	0.86
MH300-302	0.13	0.13	0.60	0.01	0.01
MH302-304	0.61	0.61	0.70	0.01	0.01
MH304-400	0.70	0.70	0.72	0.01	0.01
MH306-304	0.70	0.71	0.70	0.01	0.70
MH308-306	0.68	0.68	0.69	0.01	0.66
MH310-308	0.64	0.64	0.66	0.01	0.09
MH312-310	0.62	0.62	0.63	0.01	0.01
MH314-312	0.01	0.01	0.55	0.01	0.01
MH318-320	0.01	0.01	0.60	0.01	0.01
MH320-322	0.60	0.60	0.69	0.01	0.01
MH322-324	0.69	0.69	0.70	0.01	0.01
MH324-200	0.69	0.71	0.72	0.02	0.65
MH400-402	0.72	0.72	0.73	0.46	0.67
MH402-202	0.69	0.74	0.69	0.69	0.69

Analysis begun on: Wed Aug 01 11:55:55 2018
Analysis ended on: Wed Aug 01 11:55:59 2018
Total elapsed time: 00:00:04

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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
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WARNING 02: maximum depth increased for Node CB01-02
WARNING 02: maximum depth increased for Node CB03-04
WARNING 02: maximum depth increased for Node CB09-10
WARNING 02: maximum depth increased for Node CB11-12
WARNING 02: maximum depth increased for Node CB17-18
WARNING 02: maximum depth increased for Node CB23-24

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 20
Number of nodes ........... 63
Number of links ........... 80
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
Name                 Data Source                    Data       Recording
                                                    Type       Interval
------------------------------------------------------------------------
RG                   S24hr-100yr_JFSA               INTENSITY   12 min.


*********************
Subcatchment Summary
*********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
A01                         0.43     97.60     50.00    0.5000 RG                   CB01-02
A02                         0.78    174.80     57.10    0.5000 RG                   CB03-04
A03                         0.62    138.90     57.10    0.5000 RG                   CB05-06
A04                         0.24     53.60     50.00    0.5000 RG                   CB07-08
A05                         0.33     74.40     50.00    0.5000 RG                   CB09-10
A06                         0.11     24.30     64.30    0.5000 RG                   CB27-28
A07                         0.46    103.70     64.30    0.5000 RG                   CB29-30
A08                         0.14     32.10     64.30    0.5000 RG                   CB17-18
A09                         0.31     68.80     64.30    0.5000 RG                   CB31-32
A10                         0.32     71.30     64.30    0.5000 RG                   CB33-34
A11                         0.50    113.30     57.10    0.5000 RG                   CB11-12
A12                         0.27     60.40     64.30    0.5000 RG                   CB25-26
A13                         0.80    180.90     64.30    0.5000 RG                   CB23-24
A14                         0.12     27.20     64.30    0.5000 RG                   CB21-22
A15                         0.25     55.80     64.30    0.5000 RG                   CB19-20
A16                         0.30     68.20     64.30    0.5000 RG                   CB35-36
A17                         0.07     15.30     64.30    0.5000 RG                   CB37-38
A18                         0.67    151.10     64.30    0.5000 RG                   CB13-14
OFF01                       1.39    311.60     21.40    0.5000 RG                   OUT-MonahanDrain
OFF02                       0.05     10.90     64.30    0.5000 RG                   OUT-Major


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
CB01-02              JUNCTION        95.77      2.60       0.0
CB03-04              JUNCTION        95.67      2.61       0.0
CB05-06              JUNCTION        95.57      2.60       0.0
CB07-08              JUNCTION        95.67      2.60       0.0
CB09-10              JUNCTION        95.52      2.60       0.0
CB11-12              JUNCTION        95.52      2.60       0.0
CB13-14              JUNCTION        95.17      2.60       0.0
CB17-18              JUNCTION        95.77      2.60       0.0
CB19-20              JUNCTION        95.72      2.60       0.0
CB21-22              JUNCTION        97.48      1.00       0.0
CB23-24              JUNCTION        95.77      2.60       0.0
CB25-26              JUNCTION        95.92      2.60       0.0
CB27-28              JUNCTION        97.63      1.00       0.0
CB29-30              JUNCTION        95.67      2.60       0.0
CB31-32              JUNCTION        95.67      2.60       0.0
CB33-34              JUNCTION        95.47      2.60       0.0
CB35-36              JUNCTION        95.47      2.60       0.0
CB37-38              JUNCTION        97.22      1.00       0.0
HP01                 JUNCTION        97.77      1.00       0.0
HP02                 JUNCTION        97.67      1.00       0.0
HP03                 JUNCTION        97.57      1.00       0.0
HP04                 JUNCTION        97.47      1.00       0.0
HP05                 JUNCTION        97.47      1.00       0.0
HP06                 JUNCTION        97.37      1.00       0.0
HP07                 JUNCTION        97.37      1.00       0.0
HP08                 JUNCTION        97.12      1.00       0.0
HP09                 JUNCTION        97.12      1.00       0.0
HP10                 JUNCTION        97.47      1.00       0.0
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HP11	JUNCTION	97.57	1.00	0.0
HP12	JUNCTION	97.92	1.00	0.0
HP13	JUNCTION	97.77	1.00	0.0
HP14	JUNCTION	97.67	1.00	0.0
HP16	JUNCTION	97.45	1.00	0.0
HP17	JUNCTION	97.67	1.00	0.0
HP18	JUNCTION	97.32	1.00	0.0
MH100	JUNCTION	95.38	2.02	0.0
MH102	JUNCTION	95.02	2.58	0.0
MH104	JUNCTION	94.88	2.49	0.0
MH106	JUNCTION	94.68	2.86	0.0
MH108	JUNCTION	94.46	3.08	0.0
MH110	JUNCTION	95.01	2.36	0.0
MH200	JUNCTION	94.22	3.22	0.0
MH202	JUNCTION	93.98	3.24	0.0
MH204	JUNCTION	93.88	3.05	0.0
MH300	JUNCTION	95.37	2.09	0.0
MH302	JUNCTION	95.09	2.65	0.0
MH304	JUNCTION	94.69	2.80	0.0
MH306	JUNCTION	94.81	2.76	0.0
MH308	JUNCTION	94.87	2.79	0.0
MH310	JUNCTION	95.02	2.62	0.0
MH312	JUNCTION	95.15	2.59	0.0
MH314(E)	JUNCTION	95.41	2.58	0.0
MH314(W)	JUNCTION	95.36	2.63	0.0
MH316	JUNCTION	95.24	2.40	0.0
MH318	JUNCTION	95.16	2.36	0.0
MH320	JUNCTION	94.99	2.65	0.0
MH322	JUNCTION	94.82	2.56	0.0
MH324	JUNCTION	94.77	2.73	0.0
MH400	JUNCTION	94.63	2.64	0.0
MH402	JUNCTION	94.57	2.62	0.0
OUT-Major	OUTFALL	96.87	1.00	0.0
OUT-Minor	OUTFALL	93.86	1.05	0.0
OUT-MonahanDrain	OUTFALL	96.00	0.00	0.0

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
MH100-102	MH100	MH102	CONDUIT	68.7	0.3055	0.0130
MH102-104	MH102	MH104	CONDUIT	64.1	0.2183	0.0130
MH104-106	MH104	MH106	CONDUIT	20.7	0.2418	0.0130
MH106-108	MH106	MH108	CONDUIT	95.9	0.1460	0.0130
MH108-200	MH108	MH200	CONDUIT	78.0	0.1154	0.0130
MH110-108	MH110	MH108	CONDUIT	18.3	0.5453	0.0130
MH200-202	MH200	MH202	CONDUIT	78.5	0.1146	0.0130
MH202-204	MH202	MH204	CONDUIT	83.9	0.1192	0.0130
MH204-1013	MH204	OUT-Minor	CONDUIT	13.6	0.1473	0.0130
MH300-302	MH300	MH302	CONDUIT	30.3	0.4951	0.0130
MH302-304	MH302	MH304	CONDUIT	56.5	0.3012	0.0130
MH304-400	MH304	MH400	CONDUIT	20.9	0.2390	0.0130
MH306-304	MH306	MH304	CONDUIT	19.5	0.2053	0.0130
MH308-306	MH308	MH306	CONDUIT	15.4	0.1942	0.0130
MH310-308	MH310	MH308	CONDUIT	59.7	0.2011	0.0130
MH312-310	MH312	MH310	CONDUIT	15.4	0.3245	0.0130
MH314-312	MH314(E)	MH312	CONDUIT	90.2	0.2549	0.0130
MH314-316	MH314(W)	MH316	CONDUIT	37.6	0.2393	0.0130
MH316-318	MH316	MH318	CONDUIT	17.6	0.2834	0.0130
MH318-320	MH318	MH320	CONDUIT	67.0	0.2538	0.0130
MH320-322	MH320	MH322	CONDUIT	35.8	0.2513	0.0130
MH322-324	MH322	MH324	CONDUIT	18.8	0.2124	0.0130
MH324-200	MH324	MH200	CONDUIT	86.1	0.1975	0.0130
MH400-402	MH400	MH402	CONDUIT	23.0	0.2173	0.0130
MH402-202	MH402	MH202	CONDUIT	50.3	0.1790	0.0130
MS01	HP01	CB01-02	CONDUIT	36.2	1.1050	0.0150
MS02	CB01-02	HP02	CONDUIT	37.2	-0.8065	0.0150
MS03	HP02	CB03-04	CONDUIT	41.8	0.9331	0.0150
MS04	CB03-04	HP03	CONDUIT	35.9	-0.8357	0.0150
MS05	HP03	CB05-06	CONDUIT	42.2	0.9479	0.0150
MS06	CB05-06	HP04	CONDUIT	31.8	-0.9434	0.0150
MS07	HP05	CB07-08	CONDUIT	22.6	0.8850	0.0150
MS08	CB07-08	HP04	CONDUIT	25.7	-0.7782	0.0150
MS09	HP04	CB09-10	CONDUIT	48.2	0.7262	0.0150
MS10	CB09-10	HP06	CONDUIT	33.6	-0.7441	0.0150
MS11	HP06	CB11-12	CONDUIT	30.5	0.8197	0.0150
MS12	CB11-12	HP07	CONDUIT	24.6	-1.0163	0.0150
MS13	HP07	HP08	CONDUIT	23.1	1.0823	0.0150
MS14	HP08	CB13-14	CONDUIT	30.9	1.1328	0.0150
MS16	CB13-14	HP09	CONDUIT	35.9	-0.9750	0.0150
MS17	HP09	OUT-Major	CONDUIT	10.1	2.4760	0.0150
MS18	CB33-34	HP06	CONDUIT	32.7	-0.9175	0.0150
MS19	HP10	CB33-34	CONDUIT	39.2	1.0205	0.0150
MS20	CB31-32	HP10	CONDUIT	20.2	-0.9901	0.0150
MS21	HP11	CB31-32	CONDUIT	46.1	0.6508	0.0150
MS22	CB29-30	HP11	CONDUIT	35.7	-0.8404	0.0150
MS23	CB27-28	CB29-30	CONDUIT	36.6	0.9837	0.0150
MS24	HP12	CB27-28	CONDUIT	33.8	0.8580	0.0150
MS25	HP12	CB25-26	CONDUIT	45.0	0.8889	0.0150
MS26	CB25-26	HP13	CONDUIT	35.0	-0.7143	0.0150

MS27	HP13	CB23-24	CONDUIT	43.8	0.9133	0.0150
MS28	CB23-24	HP14	CONDUIT	28.8	-1.0417	0.0150
MS29	HP14	CB21-22	CONDUIT	15.9	1.1951	0.0150
MS30	CB21-22	CB19-20	CONDUIT	8.3	1.9281	0.0150
MS31	CB19-20	HP16	CONDUIT	11.2	-1.1608	0.0150
MS32	HP17	CB19-20	CONDUIT	44.7	0.7830	0.0150
MS33	HP17	CB17-18	CONDUIT	30.6	0.9804	0.0150
MS34	CB17-18	HP11	CONDUIT	6.3	-3.1762	0.0150
MS35	HP16	CB35-36	CONDUIT	37.3	1.0188	0.0150
MS36	CB35-36	HP18	CONDUIT	28.8	-0.8681	0.0150
MS37	HP18	CB37-38	CONDUIT	13.0	0.7693	0.0150
MS38	CB37-38	HP08	CONDUIT	9.2	1.0870	0.0150
O-CB01-02	CB01-02	MH100	ORIFICE			
O-CB03-04	CB03-04	MH102	ORIFICE			
O-CB05-06	CB05-06	MH106	ORIFICE			
O-CB07-08	CB07-08	MH110	ORIFICE			
O-CB09-10	CB09-10	MH108	ORIFICE			
O-CB11-12	CB11-12	MH200	ORIFICE			
O-CB13-14	CB13-14	MH202	ORIFICE			
O-CB17-18	CB17-18	MH300	ORIFICE			
O-CB19-20	CB19-20	MH302	ORIFICE			
O-CB23-24	CB23-24	MH310	ORIFICE			
O-CB25-26	CB25-26	MH314(E)	ORIFICE			
O-CB29-30	CB29-30	MH318	ORIFICE			
O-CB31-32	CB31-32	MH322	ORIFICE			
O-CB33-34	CB33-34	MH324	ORIFICE			
O-CB35-36	CB35-36	MH400	ORIFICE			
O-CB21-22	CB21-22	MH306	OUTLET			
O-CB27-28	CB27-28	MH314(W)	OUTLET			
O-CB37-38	CB37-38	MH402	OUTLET			

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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
MH100-102	CIRCULAR	0.38	0.11	0.09	0.38	1	96.92
MH102-104	CIRCULAR	0.53	0.22	0.13	0.53	1	200.97
MH104-106	CIRCULAR	0.53	0.22	0.13	0.53	1	211.48
MH106-108	CIRCULAR	0.68	0.36	0.17	0.68	1	321.24
MH108-200	CIRCULAR	0.75	0.44	0.19	0.75	1	378.18
MH110-108	CIRCULAR	0.30	0.07	0.07	0.30	1	71.41
MH200-202	CIRCULAR	0.90	0.64	0.23	0.90	1	612.89
MH202-204	CIRCULAR	1.05	0.87	0.26	1.05	1	942.92
MH204-1013	CIRCULAR	1.05	0.87	0.26	1.05	1	1048.02
MH300-302	CIRCULAR	0.25	0.05	0.06	0.25	1	41.84
MH302-304	CIRCULAR	0.38	0.11	0.09	0.38	1	96.22
MH304-400	CIRCULAR	0.60	0.28	0.15	0.60	1	300.20
MH306-304	CIRCULAR	0.53	0.22	0.13	0.53	1	194.89
MH308-306	CIRCULAR	0.53	0.22	0.13	0.53	1	189.52
MH310-308	CIRCULAR	0.53	0.22	0.13	0.53	1	192.87
MH312-310	CIRCULAR	0.45	0.16	0.11	0.45	1	162.41
MH314-312	CIRCULAR	0.45	0.16	0.11	0.45	1	143.95
MH314-316	CIRCULAR	0.45	0.16	0.11	0.45	1	139.48
MH316-318	CIRCULAR	0.45	0.16	0.11	0.45	1	151.80
MH318-320	CIRCULAR	0.45	0.16	0.11	0.45	1	143.64
MH320-322	CIRCULAR	0.45	0.16	0.11	0.45	1	142.94
MH322-324	CIRCULAR	0.53	0.22	0.13	0.53	1	198.23
MH324-200	CIRCULAR	0.53	0.22	0.13	0.53	1	191.14
MH400-402	CIRCULAR	0.60	0.28	0.15	0.60	1	286.24
MH402-202	CIRCULAR	0.60	0.28	0.15	0.60	1	259.79
MS01	18.5mROW	1.00	15.07	0.37	18.00	1	54341.78
MS02	18.5mROW	1.00	15.07	0.37	18.00	1	46423.85
MS03	18.5mROW	1.00	15.07	0.37	18.00	1	49934.25
MS04	18.5mROW	1.00	15.07	0.37	18.00	1	47256.97
MS05	18.5mROW	1.00	15.07	0.37	18.00	1	50330.18
MS06	18.5mROW	1.00	15.07	0.37	18.00	1	50211.32
MS07	18.5mROW	1.00	15.07	0.37	18.00	1	48631.11
MS08	18.5mROW	1.00	15.07	0.37	18.00	1	45603.69
MS09	18.5mROW	1.00	15.07	0.37	18.00	1	44051.55
MS10	18.5mROW	1.00	15.07	0.37	18.00	1	44591.42
MS11	18.5mROW	1.00	15.07	0.37	18.00	1	46802.85
MS12	18.5mROW	1.00	15.07	0.37	18.00	1	52114.50
MS13	18.5mROW	1.00	15.07	0.37	18.00	1	53780.11
MS14	18.5mROW	1.00	15.07	0.37	18.00	1	55019.12
MS16	18.5mROW	1.00	15.07	0.37	18.00	1	51043.69
MS17	18.5mROW	1.00	15.07	0.37	18.00	1	81343.11
MS18	18.5mROW	1.00	15.07	0.37	18.00	1	49515.46
MS19	18.5mROW	1.00	15.07	0.37	18.00	1	52220.76
MS20	18.5mROW	1.00	15.07	0.37	18.00	1	51439.28
MS21	18.5mROW	1.00	15.07	0.37	18.00	1	41702.27
MS22	18.5mROW	1.00	15.07	0.37	18.00	1	47389.17
MS23	18.5mROW	1.00	15.07	0.37	18.00	1	51270.33
MS24	18.5mROW	1.00	15.07	0.37	18.00	1	47884.35
MS25	18.5mROW	1.00	15.07	0.37	18.00	1	48739.07
MS26	18.5mROW	1.00	15.07	0.37	18.00	1	43690.44
MS27	18.5mROW	1.00	15.07	0.37	18.00	1	49402.27
MS28	18.5mROW	1.00	15.07	0.37	18.00	1	52761.98
MS29	18.5mROW	1.00	15.07	0.37	18.00	1	56511.74
MS30	18.5mROW	1.00	15.07	0.37	18.00	1	71780.46

MS31	18.5mROW	1.00	15.07	0.37	18.00	1	55695.77
MS32	18.5mROW	1.00	15.07	0.37	18.00	1	45743.76
MS33	18.5mROW	1.00	15.07	0.37	18.00	1	51186.48
MS34	18.5mROW	1.00	15.07	0.37	18.00	1	92129.59
MS35	18.5mROW	1.00	15.07	0.37	18.00	1	52178.74
MS36	18.5mROW	1.00	15.07	0.37	18.00	1	48164.48
MS37	18.5mROW	1.00	15.07	0.37	18.00	1	45339.81
MS38	18.5mROW	1.00	15.07	0.37	18.00	1	53896.91

****
Transect Summary
****

Transect 18.5mROW
Area:

0.0009	0.0035	0.0078	0.0139	0.0217
0.0313	0.0424	0.0539	0.0664	0.0802
0.0953	0.1117	0.1292	0.1481	0.1682
0.1895	0.2121	0.2359	0.2597	0.2836
0.3075	0.3313	0.3552	0.3791	0.4029
0.4268	0.4507	0.4746	0.4984	0.5223
0.5462	0.5701	0.5939	0.6178	0.6417
0.6656	0.6895	0.7133	0.7372	0.7611
0.7850	0.8089	0.8328	0.8567	0.8805
0.9044	0.9283	0.9522	0.9761	1.0000

Hrad:

0.0262	0.0524	0.0787	0.1049	0.1311
0.1573	0.1962	0.2469	0.2908	0.3274
0.3577	0.3829	0.4038	0.4212	0.4357
0.4478	0.4579	0.4670	0.4779	0.4901
0.5034	0.5175	0.5323	0.5476	0.5632
0.5793	0.5956	0.6121	0.6289	0.6458
0.6629	0.6801	0.6974	0.7148	0.7323
0.7498	0.7674	0.7851	0.8029	0.8206
0.8384	0.8563	0.8742	0.8921	0.9100
0.9280	0.9460	0.9640	0.9820	1.0000

Width:

0.0728	0.1456	0.2184	0.2912	0.3640
0.4368	0.4733	0.4996	0.5522	0.6047
0.6573	0.7098	0.7624	0.8149	0.8675
0.9201	0.9726	0.9989	0.9989	0.9990
0.9990	0.9990	0.9991	0.9991	0.9991
0.9992	0.9992	0.9992	0.9993	0.9993
0.9994	0.9994	0.9994	0.9995	0.9995

0.9995	0.9996	0.9996	0.9996	0.9997
0.9997	0.9997	0.9998	0.9998	0.9998
0.9999	0.9999	0.9999	1.0000	1.0000

****
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.
****

****
Analysis Options
****
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
Starting Date 06/18/2018 00:00:00
Ending Date 06/20/2018 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

********** Runoff Quantity Continuity **********	Volume hectare-m	Depth mm
Initial LID Storage	0.003	0.320
Total Precipitation	0.842	103.232
Evaporation Loss	0.000	0.000
Infiltration Loss	0.496	60.862
Surface Runoff	0.349	42.803

```
Final Storage ............          0.003          0.320
Continuity Error (%) .....         -0.419


**************************        Volume         Volume
Flow Routing Continuity       hectare-m      10^6 ltr
**************************    ---------      ---------
Dry Weather Inflow .......          0.000          0.000
Wet Weather Inflow .......          0.350          3.497
Groundwater Inflow .......          0.000          0.000
RDII Inflow ..............          0.000          0.000
External Inflow ..........          0.000          0.000
External Outflow .........          0.350          3.498
Flooding Loss ............          0.000          0.000
Evaporation Loss .........          0.000          0.000
Exfiltration Loss ........          0.000          0.000
Initial Stored Volume ....          0.019          0.190
Final Stored Volume ......          0.020          0.196
Continuity Error (%) .....         -0.188


*************************
Highest Continuity Errors
*************************
Node HP08 (-4.83%)
Node CB27-28 (-1.30%)


***************************
Time-Step Critical Elements
***************************
Link MH204-1013 (3.19%)


*********************************
Highest Flow Instability Indexes
*********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.97 sec
Maximum Time Step           :     2.00 sec
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Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.02


***************************
Subcatchment Runoff Summary
***************************
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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A01	103.23	0.00	0.00	64.94	38.65	0.17	104.43	0.374
A02	103.23	0.00	0.00	61.86	41.78	0.32	203.71	0.405
A03	103.23	0.00	0.00	61.86	42.06	0.26	164.27	0.407
A04	103.23	0.00	0.00	64.94	38.65	0.09	57.30	0.374
A05	103.23	0.00	0.00	64.94	38.65	0.13	79.63	0.374
A06	103.23	0.00	0.00	58.33	45.35	0.05	30.52	0.439
A07	103.23	0.00	0.00	58.33	45.35	0.21	130.27	0.439
A08	103.23	0.00	0.00	58.33	45.35	0.06	40.39	0.439
A09	103.23	0.00	0.00	58.33	45.35	0.14	86.46	0.439
A10	103.23	0.00	0.00	58.33	45.35	0.14	89.58	0.439
A11	103.23	0.00	0.00	61.86	42.06	0.21	133.98	0.407
A12	103.23	0.00	0.00	58.33	45.35	0.12	75.98	0.439
A13	103.23	0.00	0.00	58.33	45.35	0.36	227.21	0.439
A14	103.23	0.00	0.00	58.33	45.35	0.05	34.19	0.439
A15	103.23	0.00	0.00	58.33	45.35	0.11	70.08	0.439
A16	103.23	0.00	0.00	58.33	45.35	0.14	85.64	0.439
A17	103.23	0.00	0.00	58.33	45.35	0.03	19.22	0.439
A18	103.23	0.00	0.00	58.33	45.35	0.30	189.66	0.439
OFF01	103.23	0.00	0.00	63.63	39.88	0.55	233.60	0.386
OFF02	103.23	0.00	0.00	58.32	45.36	0.02	13.66	0.439

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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
CB01-02	JUNCTION	0.02	1.74	97.51	0 12:08	1.74

CB03-04	JUNCTION	0.03	1.83	97.50	0	12:08	1.83
CB05-06	JUNCTION	0.03	1.80	97.37	0	12:08	1.80
CB07-08	JUNCTION	0.02	1.73	97.40	0	12:08	1.73
CB09-10	JUNCTION	0.02	1.71	97.23	0	12:08	1.71
CB11-12	JUNCTION	0.03	1.81	97.33	0	12:08	1.81
CB13-14	JUNCTION	0.03	1.86	97.03	0	12:09	1.86
CB17-18	JUNCTION	0.03	1.75	97.52	0	12:09	1.75
CB19-20	JUNCTION	0.03	1.77	97.49	0	12:07	1.77
CB21-22	JUNCTION	0.00	0.03	97.51	0	12:00	0.03
CB23-24	JUNCTION	0.03	1.86	97.63	0	12:08	1.86
CB25-26	JUNCTION	0.03	1.74	97.66	0	12:09	1.74
CB27-28	JUNCTION	0.00	0.03	97.66	0	12:01	0.03
CB29-30	JUNCTION	0.03	1.82	97.49	0	12:09	1.82
CB31-32	JUNCTION	0.03	1.76	97.43	0	12:09	1.76
CB33-34	JUNCTION	0.03	1.76	97.23	0	12:09	1.76
CB35-36	JUNCTION	0.03	1.79	97.26	0	12:11	1.79
CB37-38	JUNCTION	0.00	0.03	97.25	0	12:00	0.03
HP01	JUNCTION	0.00	0.00	97.77	0	00:00	0.00
HP02	JUNCTION	0.00	0.00	97.67	0	00:00	0.00
HP03	JUNCTION	0.00	0.00	97.57	0	00:00	0.00
HP04	JUNCTION	0.00	0.00	97.47	0	00:00	0.00
HP05	JUNCTION	0.00	0.00	97.47	0	00:00	0.00
HP06	JUNCTION	0.00	0.00	97.37	0	00:00	0.00
HP07	JUNCTION	0.00	0.00	97.37	0	00:00	0.00
HP08	JUNCTION	0.00	0.02	97.14	0	12:02	0.02
HP09	JUNCTION	0.00	0.00	97.12	0	00:00	0.00
HP10	JUNCTION	0.00	0.00	97.47	0	00:00	0.00
HP11	JUNCTION	0.00	0.00	97.57	0	00:00	0.00
HP12	JUNCTION	0.00	0.00	97.92	0	00:00	0.00
HP13	JUNCTION	0.00	0.00	97.77	0	00:00	0.00
HP14	JUNCTION	0.00	0.00	97.67	0	00:00	0.00
HP16	JUNCTION	0.00	0.03	97.48	0	12:07	0.03
HP17	JUNCTION	0.00	0.00	97.67	0	00:00	0.00
HP18	JUNCTION	0.00	0.00	97.32	0	00:00	0.00
MH100	JUNCTION	0.01	0.40	95.78	0	12:08	0.40
MH102	JUNCTION	0.01	0.65	95.67	0	12:08	0.65
MH104	JUNCTION	0.04	0.66	95.54	0	12:08	0.66
MH106	JUNCTION	0.24	0.81	95.49	0	11:58	0.81
MH108	JUNCTION	0.46	0.87	95.33	0	11:58	0.87
MH110	JUNCTION	0.01	0.37	95.38	0	11:58	0.37
MH200	JUNCTION	0.69	1.02	95.24	0	12:08	1.02
MH202	JUNCTION	0.93	1.16	95.14	0	12:07	1.16
MH204	JUNCTION	1.03	1.12	95.00	0	12:08	1.12
MH300	JUNCTION	0.01	0.21	95.58	0	12:07	0.21
MH302	JUNCTION	0.01	0.45	95.54	0	12:07	0.45
MH304	JUNCTION	0.23	0.76	95.45	0	12:07	0.76
MH306	JUNCTION	0.11	0.73	95.54	0	12:07	0.73
MH308	JUNCTION	0.05	0.71	95.58	0	12:07	0.71
MH310	JUNCTION	0.01	0.68	95.70	0	12:08	0.68
MH312	JUNCTION	0.01	0.55	95.70	0	12:08	0.55
MH314(E)	JUNCTION	0.01	0.31	95.72	0	12:08	0.31
MH314(W)	JUNCTION	0.00	0.21	95.57	0	12:09	0.21
MH316	JUNCTION	0.01	0.32	95.56	0	12:09	0.32
MH318	JUNCTION	0.01	0.40	95.56	0	12:09	0.40
MH320	JUNCTION	0.01	0.52	95.51	0	12:09	0.52
MH322	JUNCTION	0.10	0.65	95.47	0	12:09	0.65
MH324	JUNCTION	0.15	0.68	95.45	0	12:09	0.68
MH400	JUNCTION	0.29	0.78	95.41	0	12:07	0.78
MH402	JUNCTION	0.35	0.77	95.34	0	12:06	0.77
OUT-Major	OUTFALL	0.00	0.00	96.87	0	00:00	0.00
OUT-Minor	OUTFALL	1.05	1.05	94.91	0	00:00	1.05
OUT-MonahanDrain	OUTFALL	0.00	0.00	96.00	0	00:00	0.00

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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
CB01-02	JUNCTION	104.43	104.43	0 12:00	0.168	0.168	-0.016
CB03-04	JUNCTION	203.71	203.71	0 12:00	0.325	0.325	0.010
CB05-06	JUNCTION	164.27	164.27	0 12:00	0.26	0.26	-0.039
CB07-08	JUNCTION	57.30	57.30	0 12:00	0.0922	0.0922	0.044
CB09-10	JUNCTION	79.63	79.63	0 12:00	0.128	0.128	0.039
CB11-12	JUNCTION	133.98	133.98	0 12:00	0.212	0.212	-0.014
CB13-14	JUNCTION	189.66	196.08	0 12:00	0.305	0.314	0.141
CB17-18	JUNCTION	40.39	40.39	0 12:00	0.065	0.065	0.016
CB19-20	JUNCTION	70.08	85.55	0 12:00	0.113	0.132	0.016
CB21-22	JUNCTION	34.19	34.19	0 12:00	0.055	0.055	-0.134
CB23-24	JUNCTION	227.21	227.21	0 12:00	0.365	0.365	0.012
CB25-26	JUNCTION	75.98	75.98	0 12:00	0.122	0.122	0.012
CB27-28	JUNCTION	30.52	30.52	0 12:00	0.0491	0.0491	-1.281
CB29-30	JUNCTION	130.27	142.31	0 12:00	0.209	0.224	0.284
CB31-32	JUNCTION	86.46	86.46	0 12:00	0.139	0.139	-0.024
CB33-34	JUNCTION	89.58	89.58	0 12:00	0.144	0.144	0.049
CB35-36	JUNCTION	85.64	86.45	0 12:05	0.138	0.147	0.123
CB37-38	JUNCTION	19.22	19.22	0 12:00	0.0309	0.0309	-0.002

HP01	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP02	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP03	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP04	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP05	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP06	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP07	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP08	JUNCTION	0.00	8.49	0	12:00	0	0.00832	-4.611	
HP09	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP10	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP11	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP12	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP13	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP14	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP16	JUNCTION	0.00	19.57	0	12:05	0	0.00936	-2.225	
HP17	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
HP18	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	ltr
MH100	JUNCTION	0.00	67.45	0	12:08	0	0.168	0.193	
MH102	JUNCTION	0.00	190.30	0	12:09	0	0.493	-0.109	
MH104	JUNCTION	0.00	190.31	0	12:09	0	0.495	-0.087	
MH106	JUNCTION	0.00	288.41	0	12:09	0	0.758	0.006	
MH108	JUNCTION	0.00	376.43	0	12:09	0	0.983	-0.020	
MH110	JUNCTION	0.00	36.89	0	12:08	0	0.0922	0.046	
MH200	JUNCTION	0.00	640.97	0	12:09	0	1.75	0.002	
MH202	JUNCTION	0.00	1051.52	0	12:08	0	2.95	0.017	
MH204	JUNCTION	0.00	1051.51	0	12:08	0	2.94	-0.002	
MH300	JUNCTION	0.00	22.43	0	12:09	0	0.065	0.301	
MH302	JUNCTION	0.00	61.92	0	12:10	0	0.187	0.185	
MH304	JUNCTION	0.00	246.40	0	12:08	0	0.716	-0.050	
MH306	JUNCTION	0.00	184.65	0	12:07	0	0.527	0.010	
MH308	JUNCTION	0.00	172.44	0	12:11	0	0.488	-0.142	
MH310	JUNCTION	0.00	172.41	0	12:11	0	0.487	0.044	
MH312	JUNCTION	0.00	49.31	0	12:26	0	0.122	-0.318	
MH314(E)	JUNCTION	0.00	42.26	0	12:09	0	0.122	0.253	
MH314(W)	JUNCTION	0.00	16.80	0	11:59	0	0.0353	0.100	
MH316	JUNCTION	0.00	16.31	0	11:59	0	0.0353	-0.154	
MH318	JUNCTION	0.00	87.63	0	12:08	0	0.259	-0.029	
MH320	JUNCTION	0.00	88.11	0	12:27	0	0.259	-0.010	
MH322	JUNCTION	0.00	138.88	0	12:25	0	0.399	0.065	
MH324	JUNCTION	0.00	186.69	0	12:25	0	0.546	-0.039	
MH400	JUNCTION	0.00	294.09	0	12:08	0	0.865	-0.001	
MH402	JUNCTION	0.00	303.49	0	12:07	0	0.89	-0.010	
OUT-Major	OUTFALL	13.66	13.66	0	12:00	0.0218	0.0218	0.000	
OUT-Minor	OUTFALL	0.00	1051.52	0	12:08	0	2.94	0.000	
OUT-MonahanDrain	OUTFALL	233.60	233.60	0	12:00	0.554	0.554	0.000	

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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
MH100	JUNCTION	0.18	0.021	1.624
MH102	JUNCTION	0.40	0.129	1.926
MH104	JUNCTION	0.43	0.134	1.831
MH106	JUNCTION	0.44	0.138	2.047
MH108	JUNCTION	0.47	0.117	2.208
MH110	JUNCTION	0.39	0.070	1.990
MH200	JUNCTION	0.50	0.118	2.197
MH202	JUNCTION	0.48	0.065	2.075
MH204	JUNCTION	0.68	0.072	1.928
MH302	JUNCTION	0.39	0.074	2.196
MH304	JUNCTION	0.50	0.159	2.036
MH306	JUNCTION	0.49	0.173	2.032
MH308	JUNCTION	0.47	0.158	2.077
MH310	JUNCTION	0.44	0.148	1.942
MH312	JUNCTION	0.34	0.073	2.037
MH320	JUNCTION	0.37	0.071	2.129
MH322	JUNCTION	0.47	0.124	1.906
MH324	JUNCTION	0.49	0.146	2.049
MH400	JUNCTION	0.52	0.171	1.859
MH402	JUNCTION	0.53	0.165	1.845

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Node Flooding Summary
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No nodes were flooded.

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Outfall Loading Summary
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	Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OUT-Major	7.42	2.10	13.66	0.022
OUT-Minor	91.28	22.60	1051.52	2.943
OUT-MonahanDrain	52.33	7.19	233.60	0.554
System	50.34	31.89	1240.74	3.519

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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
MH100-102	CONDUIT	67.68	0	12:17	0.88	0.70	1.00
MH102-104	CONDUIT	190.31	0	12:09	0.98	0.95	1.00
MH104-106	CONDUIT	190.31	0	12:09	0.90	0.90	1.00
MH106-108	CONDUIT	288.42	0	12:09	0.81	0.90	1.00
MH108-200	CONDUIT	376.45	0	12:08	0.85	1.00	1.00
MH110-108	CONDUIT	36.89	0	12:08	0.75	0.52	1.00
MH200-202	CONDUIT	641.02	0	12:09	1.01	1.05	1.00
MH202-204	CONDUIT	1051.51	0	12:08	1.21	1.12	1.00
MH204-1013	CONDUIT	1051.52	0	12:08	1.21	1.00	1.00
MH300-302	CONDUIT	22.79	0	12:22	0.90	0.54	0.92
MH302-304	CONDUIT	66.39	0	12:26	0.81	0.69	1.00
MH304-400	CONDUIT	246.41	0	12:08	0.87	0.82	1.00
MH306-304	CONDUIT	184.68	0	12:08	0.85	0.95	1.00
MH308-306	CONDUIT	172.47	0	12:11	0.80	0.91	1.00
MH310-308	CONDUIT	172.44	0	12:11	0.87	0.89	1.00
MH312-310	CONDUIT	91.19	0	12:26	0.66	0.56	1.00
MH314-312	CONDUIT	49.31	0	12:26	0.66	0.34	0.85
MH314-316	CONDUIT	16.31	0	11:59	0.45	0.12	0.56
MH316-318	CONDUIT	14.63	0	12:29	0.36	0.10	0.78
MH318-320	CONDUIT	88.11	0	12:27	0.90	0.61	0.95
MH320-322	CONDUIT	106.90	0	12:27	0.91	0.75	1.00
MH322-324	CONDUIT	142.11	0	12:26	0.71	0.72	1.00
MH324-200	CONDUIT	188.82	0	12:26	0.88	0.99	1.00
MH400-402	CONDUIT	294.10	0	12:08	1.04	1.03	1.00
MH402-202	CONDUIT	303.50	0	12:07	1.07	1.17	1.00
MS01	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
MS02	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
MS03	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
MS04	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
MS05	CHANNEL	0.00	0	00:00	0.00	0.00	0.10
MS06	CHANNEL	0.00	0	00:00	0.00	0.00	0.10
MS07	CHANNEL	0.00	0	00:00	0.00	0.00	0.06
MS08	CHANNEL	0.00	0	00:00	0.00	0.00	0.06
MS09	CHANNEL	0.00	0	00:00	0.00	0.00	0.06
MS10	CHANNEL	0.00	0	00:00	0.00	0.00	0.06
MS11	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
MS12	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
MS13	CHANNEL	0.00	0	00:00	0.00	0.00	0.01
MS14	CHANNEL	7.66	0	12:02	0.29	0.00	0.14
MS16	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
MS17	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
MS18	CHANNEL	0.00	0	00:00	0.00	0.00	0.08
MS19	CHANNEL	0.00	0	00:00	0.00	0.00	0.08
MS20	CHANNEL	0.00	0	00:00	0.00	0.00	0.08
MS21	CHANNEL	0.00	0	00:00	0.00	0.00	0.08
MS22	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
MS23	CHANNEL	12.70	0	12:01	0.31	0.00	0.12
MS24	CHANNEL	0.00	0	00:00	0.00	0.00	0.02
MS25	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
MS26	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
MS27	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
MS28	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
MS29	CHANNEL	0.00	0	00:00	0.00	0.00	0.01
MS30	CHANNEL	15.57	0	12:00	0.46	0.00	0.10
MS31	CHANNEL	19.57	0	12:05	0.16	0.00	0.10
MS32	CHANNEL	0.00	0	00:00	0.00	0.00	0.08
MS33	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
MS34	CHANNEL	0.00	0	00:00	0.00	0.00	0.07
MS35	CHANNEL	17.77	0	12:07	0.14	0.00	0.11
MS36	CHANNEL	0.00	0	00:00	0.00	0.00	0.09
MS37	CHANNEL	0.00	0	00:00	0.00	0.00	0.01
MS38	CHANNEL	8.49	0	12:00	0.41	0.00	0.03
O-CB01-02	ORIFICE	67.45	0	12:08			1.00
O-CB03-04	ORIFICE	122.83	0	12:08			1.00
O-CB05-06	ORIFICE	98.10	0	12:08			1.00
O-CB07-08	ORIFICE	36.89	0	12:08			1.00
O-CB09-10	ORIFICE	51.12	0	12:08			1.00
O-CB11-12	ORIFICE	79.74	0	12:08			1.00
O-CB13-14	ORIFICE	108.25	0	12:09			1.00
O-CB17-18	ORIFICE	22.43	0	12:09			1.00
O-CB19-20	ORIFICE	39.27	0	12:07			1.00
O-CB23-24	ORIFICE	128.86	0	12:09			1.00
O-CB25-26	ORIFICE	42.26	0	12:09			1.00

O-CB29-30	ORIFICE	73.48	0	12:09	1.00
O-CB31-32	ORIFICE	48.21	0	12:09	1.00
O-CB33-34	ORIFICE	49.62	0	12:09	1.00
O-CB35-36	ORIFICE	47.78	0	12:11	1.00
O-CB21-22	DUMMY	18.44	0	12:00	
O-CB27-28	DUMMY	16.80	0	11:59	
O-CB37-38	DUMMY	10.60	0	11:56	

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Flow Classification Summary
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	Adjusted	---------- Fraction of Time in Flow Class ----------								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
MH100-102	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
MH102-104	1.00	0.00	0.87	0.00	0.13	0.00	0.00	0.00	0.72	0.00
MH104-106	1.00	0.00	0.00	0.00	0.98	0.00	0.00	0.02	0.01	0.00
MH106-108	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH108-200	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH110-108	1.00	0.00	0.00	0.00	0.35	0.00	0.00	0.65	0.00	0.00
MH200-202	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH202-204	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH204-1013	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH300-302	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
MH302-304	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
MH304-400	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH306-304	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH308-306	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH310-308	1.00	0.00	0.85	0.00	0.11	0.00	0.00	0.04	0.70	0.00
MH312-310	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
MH314-312	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
MH314-316	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
MH316-318	1.00	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.02	0.00
MH318-320	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.74	0.00
MH320-322	1.00	0.00	0.87	0.00	0.08	0.00	0.00	0.05	0.70	0.00
MH322-324	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH324-200	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH400-402	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH402-202	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MS01	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS02	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS03	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS04	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS05	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS06	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS07	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS08	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS09	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS10	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS11	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS12	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS13	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS14	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
MS16	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS17	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS18	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS19	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS20	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS21	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS22	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS23	1.00	0.92	0.00	0.00	0.01	0.00	0.00	0.07	0.01	0.00
MS24	1.00	0.92	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS25	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS26	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS27	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS28	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS29	1.00	0.92	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS30	1.00	0.92	0.00	0.00	0.01	0.00	0.00	0.07	0.01	0.00
MS31	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
MS32	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS33	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS34	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS35	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.01	0.00
MS36	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS37	1.00	0.92	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS38	1.00	0.00	0.92	0.00	0.06	0.02	0.00	0.00	0.75	0.00

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Conduit Surcharge Summary
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	--------- Hours Full --------			Hours Above Full	Hours Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
MH100-102	0.18	0.18	0.40	0.01	0.01

MH102-104	0.40	0.40	0.43	0.01	0.01
MH104-106	0.43	0.43	0.44	0.01	0.01
MH106-108	0.44	0.44	0.47	0.01	0.39
MH108-200	0.47	0.47	0.51	0.01	0.01
MH110-108	0.39	0.39	0.47	0.01	0.01
MH200-202	0.51	0.51	0.55	0.35	0.36
MH202-204	0.55	0.55	0.68	0.43	0.49
MH204-1013	0.68	0.68	48.00	0.08	0.68
MH300-302	0.01	0.01	0.39	0.01	0.01
MH302-304	0.40	0.40	0.50	0.01	0.01
MH304-400	0.51	0.51	0.52	0.01	0.01
MH306-304	0.50	0.51	0.50	0.01	0.50
MH308-306	0.49	0.49	0.49	0.01	0.47
MH310-308	0.44	0.44	0.47	0.01	0.01
MH312-310	0.40	0.40	0.44	0.01	0.01
MH314-312	0.01	0.01	0.34	0.01	0.01
MH318-320	0.01	0.01	0.37	0.01	0.01
MH320-322	0.37	0.37	0.47	0.01	0.01
MH322-324	0.47	0.47	0.49	0.01	0.01
MH324-200	0.47	0.49	0.50	0.01	0.43
MH400-402	0.53	0.53	0.53	0.23	0.48
MH402-202	0.48	0.54	0.48	0.51	0.48

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Analysis begun on:  Wed Aug 01 12:00:00 2018
Analysis ended on:  Wed Aug 01 12:00:07 2018
Total elapsed time: 00:00:07
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Appendix E

Erosion and Sediment Control, F-1004

EROSION AND SEDIMENT CONTROL

General

The Contractor acknowledges that surface erosion and sediment runoff resulting from his construction operations has potential to cause a detrimental impact to any downstream watercourse or sewer, and that all construction operations that may impact upon water quality shall be carried out in a manner that strictly meets the requirements of all applicable legislation and regulations.

As such, the Contractor shall be responsible for carrying out his operations, and supplying and installing any appropriate control measures, so as to prevent sediment laden runoff from entering any sewer or watercourse within or downstream of the Working Area.

The Contractor acknowledges that no one measure is likely to be 100% effective for erosion protection and controlling sediment runoff and discharges from the site. Therefore, where necessary the Contractor shall implement sequential measures arranged in such a manner as to mitigate sediment release from the construction operations and achieve specific maximum permitted criteria where applicable. Suggested on-site measures may include, but shall not be limited to, the following methods: sediment ponds, filter bags, pump filters, settling tanks, silt fences, straw bales, filter cloths, catch basin filters, check dams and/or berms, or other recognized technologies and methods available at the time of construction. Specific measures shall be installed in accordance with the requirements of OPSS 805 where appropriate, or in accordance with manufacturer's recommendations.

Where, in the opinion of the Contract Administrator or Regulatory Agency, the installed control measures fail to perform adequately, the Contractor shall supply and install additional or alternative measures as directed by the Contract Administrator or Regulatory Agency. As such, the Contractor shall have additional control materials on site at all times which are easily accessible and may be implemented by him at a moment's notice.

Before commencing the Work, the Contractor shall submit to the Contract Administrator six copies of a detailed Erosion and Sediment Control Plan (ESCP). The ESCP will consist of a written description and detailed drawings indicating the on-site activities and measures to be used to control erosion and sediment movement for each step of the Work.

Contractor's Responsibilities

The Contractor shall ensure that all workers, including sub-contractors, in the Working Area are aware of the importance of the erosion and sediment control measures and informed of the consequences of the failure to comply with the requirements of all Regulatory Agencies and the specifications detailed herein.

The Contractor shall periodically, and when requested by the Contract Administrator, clean out accumulated sediment deposits as required at the sediment control devices, including those deposits that may originate from outside the construction area. Accumulated sediment shall be removed in such a manner that prevents the deposition of this material into any sewer or watercourse and avoids damage to the control measure. The sediment shall be removed from the site at the Contractor's expense and managed in compliance with the requirements for excess earth material, as specified elsewhere in the Contract.

The Contractor shall immediately report to the Contract Administrator any accidental discharges of sediment material into either the watercourse or the storm sewer system. Failure to report will be constitute a breach of this specification and the Contractor may also be subject to the penalties imposed

EROSION AND SEDIMENT CONTROL

by any applicable Regulatory Agency. Appropriate response measures, including any repairs to existing control measures or the implementation of additional control measures, shall be carried out by the Contractor without delay.

The sediment control measures shall only be removed when, in the opinion of the Contract Administrator, the measure or measures, is no longer required. No control measure may be permanently removed without prior authorization from the Contract Administrator. All sediment and erosion control measures shall be removed in a manner that avoids the entry of any equipment, other than hand-held equipment, into any watercourse, and prevents the release of any sediment or debris into any sewer or watercourse within or downstream of the Working Area. All accumulated sediment shall be removed from the Working Area at the Contractor's expense and managed in compliance with the requirements for excess earth material, as specified elsewhere in the Contract.

Where, in the opinion of either the Contract Administrator or a Regulatory Agency, any of the terms specified herein have not been complied with or performed in a suitable manner, or at all, the Contract Administrator or Regulatory Agency has the right to immediately withdraw its permission to continue the work but may renew its permission upon being satisfied that the defaults or deficiencies in the performance of this specification by the Contractor have been remedied. No compensation will be owed or paid to the Contractor for the withdrawal of permission to do the work resulting from non-compliance with the requirements of this specification or the Regulatory Agencies.

In addition to any other remedy and/or penalty provided by law, where there has been default or non-compliance with any of the terms specified herein and the Contractor refuses to perform or rectify same within forty-eight (48) hours of the receipt of the written demand of the Contract Administrator to do so, the Owner is hereby entitled to enter upon the Working Area and either complete the work in conformity with the Contract or have the work done that it considers necessary to complete the Work to its intended condition, whichever, in the Owner's sole opinion, is the most reasonable course of action. The Contractor and the Owner further agree that the costs incurred for any such work shall be retained by the Owner from monies otherwise due to the Contractor, should any such monies be available.

Basis of Payment

Payment at the contract Lump Sum price for the item "Erosion and Sediment Control" shall be full compensation for the plan preparation and implementation of the erosion and sediment control requirements for the site, and shall include all labour, equipment and materials to supply, construct, monitor and maintain all erosion and sediment control measures.

Payment shall be based upon the following schedule:

a) 25% upon satisfactory submission of the ESC Plan and installation of the control measures;
b) 50% pro-rated into equal payments over the term of the contract; and,
c) 25% upon successful completion and removal of the ESC Plan protection measures.

This payment schedule may only be modified as agreed upon in writing between the Contractor and the Contract Administrator.

Warrant: For work which is not in close proximity to watercourses or environmentally sensitive areas